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The Candidate's Guide to (CFA) Chartered Financial Analyst 2006 Level 1

Learning Outcome Statements

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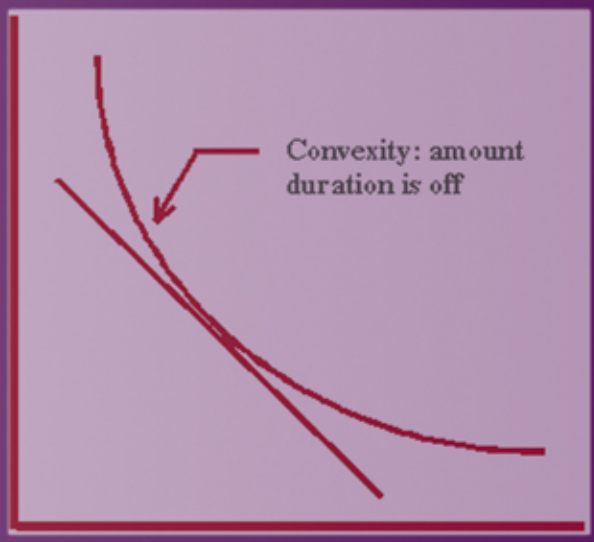

Jane Vessey, CFA
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David Stewart

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ExamInsight
For CFA 2006 Level I Certification:
The Candidate's Guide to
Chartered Financial Analyst
Learning Outcome Statements

www.financialexams.com

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The sponsoring editor for this book is Bruce Moran and the production supervisor is Corby R. Tate.

This book is dedicated to our fantastic children Adam and Julia who we love very much.

Jane Vessey & M. Afdal Pamilih

This Study Guide is dedicated to the widow(er)s and orphans of the "Silent Spring". Those who have sacrificed loved ones to the obscurity of quiet study and endured weekend sacrifice above and beyond the call of continuing education. On the alter of a profession's highest accreditation these unsung heroes have sacrificed time with their spouse, shopping with Mom, and pitch and catch with Dad. These patient supporters have endured tense attitudes, unfinished chores, extra duties, and received the respect and appreciation of all who have studied throughout the "Silent Spring".

In particular, never ending thanks to:

Carol Lee, Mary Elizabeth, Sophia Victoria, David Todd II

David Stewart

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BY

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Jane Vessey

Jane Vessey manages a training company in the United Kingdom specializing in financial analysis and investment. She is a visiting lecturer at Cass Business School teaching classes in asset management and valuation. She also teaches a CFA® revision course at ISMA (the business school at Reading University) and is an associate at a leading London financial training company where she teaches courses covering investment management and related topics. She has developed online training programs for students taking the CFA examinations and teaches CFA courses for UKSIP (the UK Society of Investment Professionals).

Jane graduated in Mathematics from Oxford University, United Kingdom, and is a CFA charter holder. She has some eighteen years experience working in the investment industry, starting out as an equity analyst before becoming an investment manager. She was based in London and Tokyo and took responsibility for managing equity portfolios invested in the Japanese and other Asian markets. In 1990, Jane moved to Indonesia and established and ran an investment management operation on behalf of Mees Pierson. She took responsibility for all areas of the business, including investment, operations, marketing and administration. While in Asia, Jane was involved in providing training to capital market participants and state officials and teaching in courses provided by local universities.

M. Afdal Pamilih

Afdal has 18 years' experience working in the finance industry. He started his career with J.P. Morgan, and then with County NatWest Government Securities, in New York specializing in the development of quantitative products for foreign exchange and fixed income markets. After returning to Indonesia in 1989 he was responsible for the development of investment services and subsequently treasury management for leading banks in Jakarta.

Afdal has developed web-based training programs for the CFA examinations and has wide teaching experience, including instructing at the School of Management, University of Surrey, United Kingdom.

He obtained a MSc in Mathematics from the University of Texas at Arlington and holds the Chartered Financial Analyst ("CFA") qualification.

David Stewart:

David Stewart has extensive experience in venture capital and business structural reorganizations. As president of a private client broker dealer firm, he has business valuation and project valuation experience on the venture capital side and portfolio management on the asset management side. His analysis, commentary, books, and study guides have appeared in the financial management, securities, and exam prep industries.

David has collaborated with experts in the field to produce the 2001 through 2006 editions of this study guide. His extensive research into the CFA exam program and past exam histories, field work, and consistent review of CFA Institute information allows him and his co-authors to deliver high quality and up to date information.

About the Book:

ExamInsight to CFA Level I Certification is designed to help you master the Learning Outcome Statements as quickly and as effectively as possible so you can pass the CFA Level I exam *your first time.* This compact study guide and download test engine with 1250+ practice questions will give you the information, practice exams, and test-taking tips that you need to reach a passing level and feel confident that you are ready for the real exam

You can also feel confident that your are getting some of the best advice and coaching available, since our authors are not only CFA charter holders and successful investment professionals, but also teach CFA exam preparation courses in college, online, and in seminars. You get the benefit of their combined international experience.

This book is divided into Study Sessions (1 – 18) that cover the Learning Outcome Statements and the associated Assigned Readings. Appendix A (Exhibits 1 – 3), is a collection of exhibits and flow charts for condensed reference and review, including examples of accounting statements, puts and calls, PE breakdown, and financial ratios.

The 18 2006 CFA Level I Study Sessions breakout is as follows:

Ethical and Professional Standards

Study Session 1: Ethical and Professional Standards

Investment Tools

Study Session 2. Quantitative Methods: Basic Concepts
Study Session 3. Quantitative Methods: Application
Study Session 4. Economics: Macroeconomic Analysis
Study Session 5. Economics: Microeconomic Analysis
Study Session 6. Economics: Global Economic Analysis
Study Session 7. Financial Statement Analysis: Basic Concepts
Study Session 8. Financial Statement Analysis: Financial Ratios and Earnings Per Share
Study Session 9. Financial Statement Analysis: Assets
Study Session 10. Financial Statement Analysis: Liabilities
Study Session 11. Corporate Finance: Corporate Investing & Financing Decisions

Asset Valuation

Study Session 12. Equity Investments: Securities Markets
Study Session 13. Equity Investments: Industry and Company Analysis
Study Session 14. Fixed Income Investments: Basic Concepts
Study Session 15. Fixed Income Investments: Analysis and Valuation
Study Session 16. Derivative Investments
Study Session 17. Alternative Investments

Portfolio Management

Study Session 18. Portfolio Management

Download Supplemental Information: Obtain printable content from this links.

http://snipurl.com/ConceptQ

Preliminary Reading Assignments Supplement and Concept Check Questions Workbook

Online Information:

1. CFA Program:
   http://www.cfainstitute.org/cfaprogram/
2. The Code of Ethics (Full Text)
   http://www.cfainstitute.org/standards/ethics/code/
3. International Code Of Ethics And Standards Of Professional Conduct
   http://www.cfainstitute.org/cfacentre/ethics/codeandstandards.html
4. Interpretations of CFA Institute's Code of Ethics and Standards of Professional Conduct
   http://www.cfainstitute.org/standards/pps/gips_library.html
5. The Standards of Professional Conduct
   Standard I: Fundamental Responsibilities
   Standard II: Relationships with and Responsibilities to the Profession
   Standard III: Relationships with and Responsibilities to the Employer
   Standard IV: Relationships with and Responsibilities to Clients and Prospects
   Standard V: Relationships with and Responsibilities to the Public
   http://www.cfainstitute.org/standards/ethics/conduct/index.html
   http://www.cfapubs.org/ap/issues/v2003n4/toc.html
   http://www.cfainstitute.org/cfacentre/ips/
   http://www.cfainstitute.org/cfacentre/pdf/English2006CodeandStandards.pdf
6. CFA Institute-PPSTM AIMR Performance Presentation Standards
   http://www.cfainstitute.org/standards/pps/ppsstand.html
7. Global Investment Performance Standards
   http://www.cfainstitute.org/standards/pps/gips_standards.html
8. Soft Dollar Learning Module
   http://www.cfainstitute.org/standards/ethics/soft_dollar/index.html

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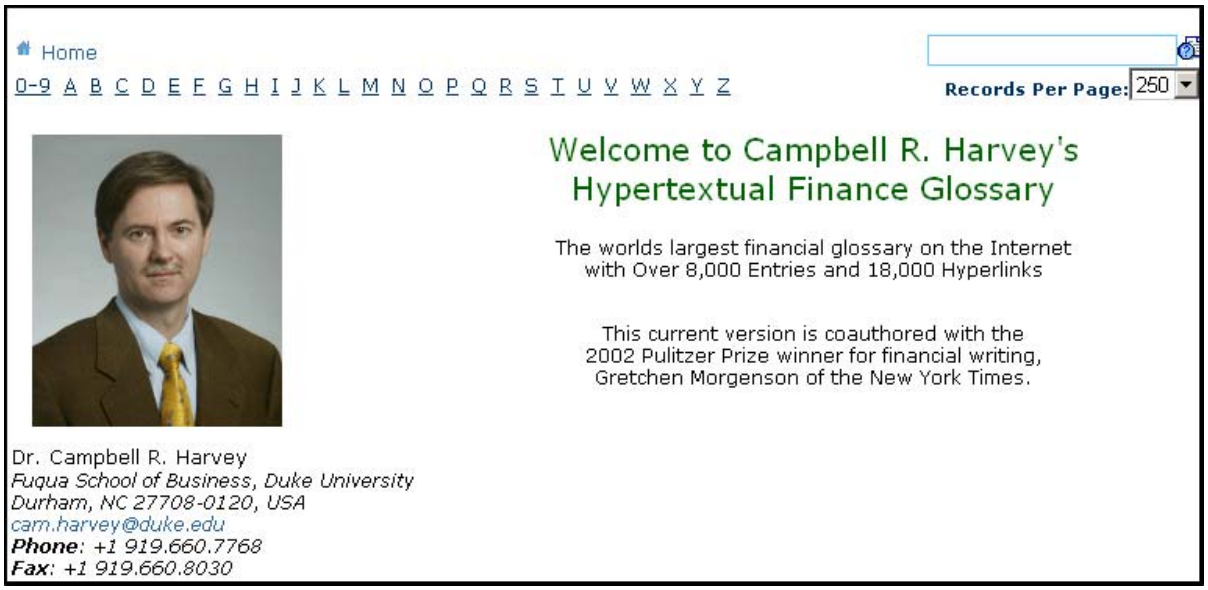


Thank You,

Bruce Moran

Publisher

2006 CFA Level I Study and Examination Program Textbooks:

2006 Level I Program Curriculum, $395.00

Self-contained volumes that offer everything you need for your study program. Includes all required materials, learning outcome statements, and solutions. (CFA Institute)

Preliminary Readings (Not Required) $152.00

Economics: Private and Public Choice, 10th ed., $80.00

Financial Accounting, 8th ed. , $72.00

2006 CFA Level I Study Guide Outline

2006 Examination Guideline Topic Area Weights

Topic	Survey Results	Level I	Level II	Level III
Ethical and Professional Standards	10%	15%	10%	10%
Investment Tools: • Economics* • Quantitative Analysis • Financial Statement Analysis**	10 10 20	10 12 28	0–10 0–10 25–35	0 0–10 0
Asset Valuation***	35	30	35–45	30–40
Portfolio Management***	15	5	5–15	40–60
TOTAL	100%	100%	100%	100%

*Economics is part of Portfolio Management at Level III.

**Corporate Finance is part of Financial Statement Analysis at Level I and Level II.

***Derivatives is a part of Asset Valuation at Level I and Level II and Portfolio Management at Level III.

Dates Regarding the June 2006 CFA Examination

15 July 2005 Study Guides available

15 July 2005 Textbooks available for purchase from book distributor

15 September 2005 Initial deadline for new registrations and enrolments to be received by CFA Institute

November 2005 Past years' constructed response essay examination questions and guideline answers for Level III available from book distributor

February 2006 Online sample examinations available for a fee from the CFA Institute website

15 February 2006 Second deadline for new registrations and enrolments to be received by CFA Institute

15 March 2006 Final deadline for new registrations and enrolments to be received by CFA Institute

20 March 2006 Final deadline for special test center requests, disability accommodation requests and requests for religious alternative dates to be received by CFA Institute

3 April 2006 All test center change requests must be received by CFA Institute

Late April 2006 Examination Admission tickets available online

3 June 2006 Examination Day

4 June 2006 Examination Day in Eastern Asia and Oceania

June - July 2006 Examination papers graded

Late July 2006 Examination results available online for Level I and II candidates

Mid-August Examination results available online for Level III candidates

September 2006 CFA Charter Holders announced for year 2006

Note: Fee schedules including registration deadlines can be found on the CFA Institute website at www.cfainstitute.org/cfaprogram/feeschedule.html

Preface

The purpose of this CFA Candidate's Guide is to give you the information and practice required to pass the CFA Level I exam. It is the first in a series of three exams, in addition to industry experience, needed to obtain the CFA designation. Once you have passed the CFA Level I exam, you are considered to have mastered the basics and the general breadth, but not the depth, of the information necessary to function as an analyst in today's global economy.

The Candidate's Guide Tutorials provides two main sections for each Study Session:

1. Book / eBook CFA Curriculum, including Concept Checks
2. Self Help and Interactive Exam Study Aids

You begin your studies with the CFA Curriculum on Page 1. Continue your studies page-by-page; the learning outcome statements (LOS) have been re-ordered, where necessary, to make learning more intuitive than in the CFA Institute's Study Guide. Our concise writing style minimizes learning time, and there are numerous Examples to help you master every LOS. Study Guide command words are boldface in the LOS title; the examiners expect that your knowledge reflects the command word.

It is suggested that you first read the 18 Study Sessions, which cover all 79 Learning Outcome Statements and their associated CFA Assigned Readings. Then download the accompanying test engine with 1250+ questions to help you identify your strengths and weaknesses so you will know where best to allocate your future study time. Each Study Session question database consists of 70+ multiple choice questions with a level of difficulty and design similar to those on the CFA examination itself.

Your comments are welcome at anytime at support@financialexams.com :

Publishing high-quality learning tools is our business, but errors can slip through. If you think you have found one, please use the Error Reporting Form at www.financialexams.com or www.cfaexams.com. Errors with their corrections will be posted on our website. We will send an e-mail message to you whenever new corrections are posted.

Practice Questions and Answers

After reviewing more intensely the Learning Outcome Statements, use the FinancialExams Quizzer testing engine to solidify what you have learned and to prepare you for rigors of taking and passing the exam.

In the early 1990's we pioneered computer certification test engines for the IT industry, which were later incorporated into the exam prep manuals of major computer book publishers such as McGraw-Hill and Wiley. We also developed the adaptive testing software now used in preparing for the GMAT, LSAT and other exams. We have taken that same proven, user-friendly software and applied it to helping you practice, practice, practice to pass the CFA exam your first time.

Our **Practice Exams** are designed to save you precious time by quickly identifying your weakest knowledge areas so you can allocate your available study time to getting those areas up to a passing level.

Our **Simulated Exams**—lasting the same number of hours and including the same number of questions as the real CFA exam—are designed to give you the confidence and endurance for the real thing.

The FinancialExams Quizzer generates randomized practice exams and simulated exams drawn from a database of 1250+ questions. It **offers you four helpful testing formats:**

1) Adaptive Exams generates 44-55 questions in 1-hour sessions to help you identify your strengths and weaknesses in each exam category. You save hours by then focusing your available study time on bringing your weakest knowledge areas up to a passing level.

We recommend that you start by taking three adaptive exams, which include questions from all exam categories and different levels of difficulty. Our software keeps track of how you perform and develops a Historical Analysis, which visually shows you exactly how you are scoring in each exam category. When you reach a passing level in a particular topic or LOS, then you can allocate your study time to those areas you need to strengthen. The Historical Analysis keeps track of all of your practice tests and lets you see your progress on a day-by-day basis. It offers visual proof throughout your study process that you are retaining what you are learning.

2) Study Sessions help strengthen your weakest knowledge areas by generating up to 250 questions per exam category until you can answer each correctly. We go beyond simple answers by giving you thorough explanations that are linked to a page number reference to the relevant CFA Institute assigned reading and to specific chapters in an accompanying eBook study manual. We help you develop a complete understanding of *why* an answer is correct. We also help you solve all of the questions pertaining to mathematical formulas by walking you through them step by step. By focusing primarily on your rough spots, we guarantee to get you certified fast—*guaranteed* or get money back on your purchase.

3) Simulated Exams are timed 6-hour exams with a 1.5-hour break and comprised of 240 questions about all of the exam categories—just like the real CFA exam. As you finish each automatically ending exam, the software displays for comparison your score in each category and the passing score required by CFA. You may review each question that you answered incorrectly, display the correct answer, identify a learning resource, link to a specific chapter in an accompanying eBook for further explanation. Note: You can limit your time to 3 hours if you wish and get a Mock Exam of 120 questions.

Our simulated exams are designed to look and feel just like the real CFA exam. You have the same number of questions from the same exam categories that you will cover on the real exam. Each question is timed, with a clock ticking in the corner of your monitor, putting pressure on you just like the real exam. After each exam, you can monitor your performance by comparing your score to the required CFA exam passing score. You can then check your Historical Analysis to see exactly where you might need to go back and spend more time on a specific exam category.

The software continuously randomizes all questions so you will never take the same exam twice. Our software also automatically tosses out questions that you have answered correctly, and continues to feed you the types of questions your have missed until you get them right. Again, we help you focus on what you need to learn rather than what you already know.

4) Flash Card Drills present questions to answer mentally and then allow you to click F4 to display the correct answer. You can also create your own portable flash card questions by printing directly from the test engine software.

CFA Program

The CFA Program is an exhaustive self-study curriculum for developing the fundamentals of financial analysis and portfolio management. It is designed to broaden and deepen your knowledge of the entire field of investment valuation and portfolio management. The program assumes the candidate has mastered undergraduate finance and accounting and seeks to build a platform for individual and sector analysis, equity and fixed income valuation, and asset management emphasizing competence and integrity within the profession of investment management.

Requirements

There are no prerequisites to begin this area of study. This can, however, be considered a fairly comprehensive study if these concepts are totally new to you. CFA Institute assumes you have mastered undergraduate finance and accounting. Although every effort is made to cover all the material you may encounter at exam time, this book does not go into detail in areas that most financial professionals should already know.

http://www.cfainstitute.org/cfaprogram/exam/exam_details.html

Before the Exam

1. Read the CFA Institute Study Guide, since the rules are very strict on what you can or cannot take into the exam room. Don't forget your exam admission ticket and passport, or other form of permitted identification.
2. Remember that the only calculators you can use are the TI BAII plus and HP 12C 11. We strongly recommend you take two calculators or at the very least a spare battery.
3. Ensure you know the location of the exam and how to get there. It is the CFA Institute's policy to close the doors 30 minutes before the exam starts.
4. Read CFA Institute Candidate Bulletins to check for changes to the exam procedures.

Study Program

It is critical that you design a study program. There are no short cuts to passing the CFA exam, and pass rates have been falling. It is a tough exam and you will need to both learn the underlying material as well as do plenty of practice questions to test your knowledge and to get used to the CFA style of questions. Although the Candidate's Guide Tutorials are designed to cover the entire CFA curriculum and give a concise summary of the material you need to know for the exam, we encourage candidates to also refer to the source text books, particularly for subjects with which they are not so familiar.

The CFA Institute recommends approximately 10 to 15 hours study per study session plus extra time for final revision. That means if you plan to cover one study session per week you will need to start studying in January for the June exam or July for the December exam. The CFA curriculum sets out very clearly what you need to know to pass the exam. Focus on the Learning Outcome Statements (LOS) and the command words. Questions on the exam will relate to the LOS not to other parts of the text.

In addition to doing all the questions in The Candidate's guide Tutorials we recommend you try the sample exam provided by the CFA Institute.

CFA Institute Exam Rules

IMPORTANT:
Use no. 2 or hb pencils for multiple choice answer sheet! Do not use mechanical pencils with synthetic non-graphite (non electrical conducting) compounds which will not be compatible with the electronic scan grading.

CALCULATORS Allowed:

Hewlett Packard 12c

Texas Instruments Baii Plus

TESTING REGULATIONS:

No beepers or cell phones allowed in test area

No removing exam materials from the test room

No writing after the proctor says "stop."

This is very much part of your test:

CFA Institute is quite serious about their exam rules, follow them.

Taking the Exam

Many people do not test well on exams. Often, the student knows the material, but does not know how to take exams. The CFA Level I exam is based upon the multiple-choice format. You receive points for each question answered correctly. No points are subtracted for a wrong or unanswered question. Since the wrong answer is no worse than an unanswered question, never leave an exam with an unanswered question. Any guess is better than a blank. Example: Answering letter "B" throughout the exam will give you approximately a grade of 25. In the last minute finish the exam by selecting a single letter and marking it as the correct answer on all unanswered questions.

The exams have time limits that provide adequate time for you to read and think about the question. You should be able to reach the end of the exam before the time runs out. You should also have time to return to the unanswered questions to provide an answer. You will not have time for to continuously search the answered questions trying to find the ones you later felt you marked wrong. With this thought in mind, be careful to make sure that when you answer a question it is the last time you will read that question. The answer you give is the one you will keep. The following is a blueprint for taking an exam to insure you have answered to the maximum of your knowledge and capability:

Note: Keep in mind that this is a timed test!

A. Starting with the first question, begin to answer the multiple choice questions that you know to be correct.

B. Remember there may not be enough time to go back so Mark an answer before going on. For the unknown answers Select a letter before you go into the exam and use the same letter through out the test. You should get 25%of these unknown answers correct.

C. If you do not know the exact answer or if it is a choice between two or more answers, Pick an Answer, Mark the question for review, and go on. Often later questions will trigger the correct answer to this question for you.

D. Skip all the long scenario questions; they are time consuming, and often you will be better prepared to answer them later in the test session.

E. You should answer at least 50% of the questions with certainty.

F. Return to the beginning and start again on the unanswered questions. Do not take time with the questions you have already answered. If you can narrow a question to two possible answers, pick the best one.

G. Now that you have finished all the questions go back to the ones you have marked for review.

You must always finish your test before time runs out! In the last minute quickly answer all remaining questions with your favorite letter!

On the Exam Day

The CFA Level I exam is 100% multiple choice questions, the morning and afternoon paper will each contain 120 questions.

You will be under time pressure in the exam and need to answer on average one question every 1½ minutes so you must keep moving through the questions. We recommend the following strategies:

1. There is a strong argument for working methodically through the questions in the order they are set but you might wish to start with a subject where you feel confident and which you can work through fairly quickly. But avoid hopping from one subject to another, this will waste time and you may end up missing one section of questions out.
2. Don't panic if you hit some difficult questions, you can probably get as many as 30 or 40 questions incorrect on each paper and still pass the exam.
3. Ethics in study session 1 is an important topic, if you are a marginal candidate your ethics score could be the deciding factor whether you pass the exam.
4. There is no penalty for getting an answer incorrect, so if you don't know the answer eliminate any obviously wrong answers and guess which one is correct.
5. Mark questions in the exam booklet when you are not sure of the answer or where the calculation needs checking and come back to them when you have finished all the other questions.
6. Do not get distracted by a question that does not make sense, if the question turns out to be ambiguous then it will be excluded when it comes to grading the paper.
7. Read the questions carefully, particularly when there is a negative statement in the question.
8. Leave time to check your answers on the answer sheet, be careful you don't miss answering a question and mark subsequent answers against the wrong question number on the answer sheet.

***** Make sure that ALL Questions contain an answer *****

STUDY SESSION 1

Ethical and Professional Standards

Overview

Questions on Ethical and Professional Standards have a guideline weighting of 15 percent of the total Level I exam questions, and the score for this section will probably be the deciding factor in marginal pass/fail papers. This is a very important Study Session to master and much of the material will be covered again at Levels II and III. The material is straightforward, but it needs to be memorized. Don't underestimate the amount of time you need to spend on this Session. Care needs to be taken in answering the exam questions – they are not always as easy as you might expect and you will often need to focus on identifying the best answer.

Our study notes summarize the Standards of Professional Conduct, and we recommend that you also read the required pages of the Standards of Practice Handbook (SOPH). Ensure that you have the new ninth edition, not the old eighth edition of SOPH. Given the high number of questions on the Standards, you will need to know each Standard and how it is applied in a variety of situations. The third and fourth Reading Assignments cover standards for reporting investment performance, or GIPS®, and you will need to master the main requirements and recommendation of the GIPS standards. The final Reading considers corporate governance issues for companies and how investors can identify companies which practice high standards of corporate governance. This is a new Reading to Level I for 2006.

The June 2006 examinations for all three Levels will be the first time that the new SOPH will be tested. Even if you excelled at Ethics in prior study years, ensure that you study the latest SOPH and take note of the changes to the previous edition, for example CFA Institute has dropped the requirement that members and candidates need to provide a copy of the Code and Standards to their direct supervisor.

Reading Assignments

1. "Code of Ethics and Standards of Professional Conduct ," Standards of Practice Handbook, 9th edition (CFA Institute, 2005)
2. "Guidance," for Standards I – VII, Standards of Practice Handbook, 9th edition (CFA Institute, 2005)
3. Introduction to the Global Investment Performance Standards (GIPS®)
4. Global Investment Performance Standards (GIPS®), pp. i-iii and 1-9, (CFA Institute, 2005)
   A. Preface: Background of the GIPS Standards
   B. I. Introduction
   C. II.0. Provisions of the Global Investment Performance Standards – Fundamentals of Compliance
5. The Corporate Governance of Listed Companies: A Manual for Investors (CFA Institute, 2005)

1 Code of Ethics and Standards of Professional Conduct

Learning Outcome Statements (LOS)

1	The Code of Ethics establishes the framework for ethical decision-making in the investment profession. The candidate should be able to **state** the six components of the Code of Ethics. The Standards of Professional Conduct are organized into seven standards: I. Professionalism. II. Integrity of Capital Markets. III. Duties to Clients and Prospective Clients. IV. Duties to Employers. V. Investment Analysis, Recommendations and Action. VI. Conflicts of Interest. VII. Responsibilities as a CFA Institute Member or CFA Candidate. Each standard contains multiple provisions for which the candidate is responsible. The candidate should be able to **identify** the ethical responsibilities required by the Code and Standards.

Introduction

The CFA Institute sees one of its main roles as promoting high standards of ethical conduct which involves educating its members on ethical standards and bringing disciplinary action against members who violate the Code and Standards. It also sees its role as providing leadership in the development of global standards and promoting the increasing awareness of ethics and use of the Code and Standards within the investment profession.

The Code of Ethics sets out the ethical standards that all CFA Institute Members ('members') and CFA Candidates ('candidates') must follow.

LOS 1

The candidate should be able to **state** the six components of the Code of Ethics.

Candidates should memorize the six components of the Code of Ethics. Members and candidates must:

- Act with integrity, competence, diligence, respect and in an ethical manner with the public, clients, prospective clients, employers, employees, colleagues in the investment profession, and other participants in the global capital markets.
- Place the integrity of the investment profession and the interests of clients above their own personal interests.
- Use reasonable care and exercise independent professional judgment when conducting investment analysis, making investment recommendations, taking investment actions, and engaging in other professional activities.
- Practice and encourage others to practice in a professional and ethical manner that will reflect credit on themselves and the profession.
- Promote the integrity of, and uphold the rules governing, capital markets.
- Maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals.

LOS 1 continued

The candidate should be able to **identify** the ethical responsibilities required by the Code and Standards.

The Code of Ethics is the underlying philosophy of the Standards of Professional Conduct. The Standards are organized into seven broad categories:

1. Professionalism.
2. Integrity of Capital Markets.
3. Duties to Clients and Prospective Clients.
4. Duties to Employers.
5. Investment Analysis, Recommendations and Action.
6. Conflicts of Interest.
7. Responsibilities as a CFA Institute Member or CFA Candidate.

The following is a summary of each major section and subsection of the Standards. On the exam, you do **not** need to know the section number and subsection letter for each Standard.

Standard I: Professionalism

A. Knowledge of the Law

Members and candidates must understand and comply with all applicable laws, rules, and regulations (including the CFA Institute Code of Ethics and Standards of Professional Conduct) of any government, regulatory organization, licensing agency, or professional association governing their professional activities. In the event of conflict, members and candidates must comply with the more strict law, rule, or regulation. Members and candidates must not knowingly participate or assist in and must dissociate from any violation of such laws, rules, or regulations.

B. Independence and Objectivity

Members and candidates must use reasonable care and judgment to achieve and maintain independence and objectivity in their professional activities. Members and candidates must not offer, solicit, or accept any gift, benefit, compensation, or consideration that reasonably could be expected to compromise their own or another's independence and objectivity.

C. Misrepresentation

Members and candidates must not knowingly make any misrepresentation relating to investment analysis, recommendations, actions, or other professional activities.

D. Misconduct

Members and candidates must not engage in any professional conduct involving dishonesty, fraud, or deceit or commit any act that reflects adversely on their professional reputation, integrity, or competence.

Standard II: Integrity of Capital Markets

A. Material Nonpublic Information

Members and candidates who possess material nonpublic information that could affect the value of an investment must not act or cause others to act on the information.

B. Market Manipulation

Members and candidates must not engage in practices that distort prices or artificially inflate trading volume with the intent to mislead market participants.

Standard III: Duties to Clients and Prospective Clients

A. Loyalty, Prudence, and Care

Members and candidates have a duty of loyalty to their clients and must act with reasonable care and exercise prudent judgment. Members and candidates must act for the benefit of their clients and place their clients' interests before their employer's or their own interests.

In relationships with clients, members and candidates must determine applicable fiduciary duty and must comply with such duty to persons and interests to whom it is owed.

B. Fair Dealing

Members and candidates must deal fairly and objectively with all clients when providing investment analysis, making investment recommendations, taking investment action, or engaging in other professional activities.

C. Suitability

1. When members and candidates are in an advisory relationship with a client, they must:
   a. Make a reasonable inquiry into a client's or prospective clients' investment experience, risk and return objectives, and financial constraints prior to making any investment recommendation or taking investment action and must reassess and update this information regularly.
   b. Determine that an investment is suitable to the client's financial situation and consistent with the client's written objectives, mandates, and constraints before making an investment recommendation or taking investment action.
   c. Judge the suitability of investments in the context of the client's total portfolio.
2. When members and candidates are responsible for managing a portfolio to a specific mandate, strategy, or style, they must only make investment recommendations or take investment actions that are consistent with the stated objectives and constraints of the portfolio.

D. Performance Presentation

When communicating investment performance information, members or candidates must make reasonable efforts to ensure that it is fair, accurate, and complete.

E. Preservation of Confidentiality

Members and candidates must keep information about current, former, and prospective clients confidential unless:

1. The information concerns illegal activities on the part of the client or prospective client,
2. Disclosure is required by law, or
3. The client or prospective client permits disclosure of the information.

Standard IV: Duties to Employers

A. Loyalty

In matters related to their employment, members and candidates must act for the benefit of their employer and not deprive their employer of the advantage of their skills and abilities, divulge confidential information, or otherwise cause harm to their employer.

B. Additional Compensation Arrangements

Members and candidates must not accept gifts, benefits, compensation, or consideration that competes with, or might reasonably be expected to create a conflict of interest with, their employer's interest unless they obtain written consent from all parties involved.

C. Responsibilities of Supervisors

Members and candidates must make reasonable efforts to detect and prevent violations of applicable laws, rules, regulations, and the Code and Standards by anyone subject to their supervision or authority.

Standard V: Investment Analysis, Recommendations, and Actions

A. Diligence and Reasonable Basis

Members and candidates must:

1. Exercise diligence, independence, and thoroughness in analyzing investments, making investment recommendations, and taking investment actions.
2. Have a reasonable and adequate basis, supported by appropriate research and investigation, for any investment analysis, recommendation, or action.

B. Communication with Clients and Prospective Clients

Members and candidates must:

1. Disclose to clients and prospective clients the basic format and general principles of the investment processes used to analyze investments, select securities, and construct portfolios and must promptly disclose any changes that might materially affect those processes.
2. Use reasonable judgment in identifying which factors are important to their investment analyses, recommendations, or actions and include those factors in communications with clients and prospective clients.
3. Distinguish between fact and opinion in the presentation of investment analysis and recommendations.

C. Record Retention

Members and candidates must develop and maintain appropriate records to support their investment analysis, recommendations, actions, and other investment-related communications with clients and prospective clients.

Standard VI: Conflicts of Interest

A. Disclosure of Conflicts

Members and candidates must make full and fair disclosure of all matters that could reasonably be expected to impair their independence and objectivity or interfere with respective duties to their clients, prospective clients, and employer. Members and candidates must ensure that such disclosures are prominent, are delivered in plain language, and communicate the relevant information effectively.

B. Priority of Transactions

Investment transactions for clients and employers must have priority over investment transactions in which a member or candidate is the beneficial owner.

C. Referral Fees

Members and candidates must disclose to their employer, clients, and prospective clients, as appropriate, any compensation, consideration, or benefit received from, or paid to, others for the recommendation of products or services.

Standard VII: Responsibilities as a CFA Institute Member or CFA Candidate

A. Conduct as Members and Candidates in the CFA Program

Members and candidates must not engage in any conduct that compromises the reputation or integrity of CFA Institute or the CFA designation or the integrity, validity, or security of the CFA examinations

B. Reference to CFA Institute, the CFA designation, and the CFA Program

When referring to CFA Institute, CFA Institute membership, the CFA designation, or candidacy in the CFA Program, members and candidates must not misrepresent or exaggerate the meaning or implications of membership in CFA Institute, holding the CFA designation, or candidacy in the CFA Program.

2 Guidance for Standards I - VII

Learning Outcome Statements (LOS)

2	The guidance in the Standards of Practice Handbook addresses the application of the Standards of Professional Conduct. For each standard, the Handbook offers guidance for the standard, presents recommended procedures for compliance, and provides examples of the standard in practice. The candidate should be able to:
2-a	**demonstrate** a thorough knowledge of the Standards of Professional Conduct by recognizing and applying the standards to specific situations;
2-b	**distinguish** between conduct that conforms to the Code and Standards and conduct that violates the Code and the Standards.

Introduction

Candidates need to understand (1) the purpose and scope of each Standard, (2) the application of each Standard and (3) procedures for compliance with each Standard. Candidates can expect to be given a number of situations in which members of the CFA Institute or candidates are faced with making a decision on the best course of action to take to comply with the Standards. We re-emphasize that candidates should purchase their own copy of the Standards of Practice Handbook and work through the numerous examples of applications of each Standard that are provided in the handbook, and study the sample exam questions at the end. The sample exam is essential because the questions most likely conform to the style and level of difficulty used by CFA Institute Council of Examiners (COE).

LOS 2-a

Demonstrate a thorough knowledge of the Standards of Professional Conduct by recognizing and applying the Standards to specific situations.

LOS 2-b

Distinguish between conduct that conforms to the Code and Standards and conduct that violates the Code and the Standards.

Standard I: Professionalism

A. Knowledge of the Law

Members and candidates must understand and comply with all applicable laws, rules, and regulations (including the CFA Institute Code of Ethics and Standards of Professional Conduct) of any government, regulatory organization, licensing agency, or professional association governing their professional activities. In the event of conflict, members and candidates must comply with the more strict law, rule, or regulation. Members and candidates must not knowingly participate or assist in and must dissociate from any violation of such laws, rules, or regulations.

Members practicing across many countries must follow the applicable laws, whether they are their own country's laws or the foreign country's laws. When there is a conflict between applicable laws and the Code and Standards they must follow whichever is the strictest. For example, if a member lives in a country with weak (or non-existent) laws but has clients in countries with stricter rules than the Code and Standards, then the member must adhere to the Code and Standards. On the exam, watch for wording that indicates which country's rules govern the member's (or candidate's) professional conduct: it could be where the member lives; where the member does business; or where the client resides. The exam will tell you – you need not judge for yourself. Members should ensure that they have appropriate knowledge of the laws and regulations of the countries where they do business. Members are responsible for violations that they knowingly participate in or assist.

If the member suspects that a Standard or law has been violated he/she should report it to his/her supervisor or compliance department (he/she is not automatically required to inform the government or any regulatory organizations). If the situation is not remedied he/she should disassociate him/herself from the illegal or unethical activity.

Example 2-1 Fundamental responsibilities

Situation: Marilyn Monteaux, CFA, lives in Mombuta, a country where the securities laws and regulations are less strict than the Code and Standards. Monteaux conducts business with clients who reside in Singaratu, a country where very few securities laws and regulations exist. Mombuta's laws state that the law of the locality where business is conducted applies.

Comment: Monteaux must adhere to the Code and Standards although the Mombuta laws state that the securities laws and regulations of Singaratu are applicable. The rule of thumb is that a member must adhere to the stricter of the applicable law and the Code and Standards.

B. Independence and Objectivity

Members and candidates must use reasonable care and judgment to achieve and maintain independence and objectivity in their professional activities. Members and candidates must not offer, solicit, or accept any gift, benefit, compensation, or consideration that reasonably could be expected to compromise their own or another's independence and objectivity.

Members and candidates may come under pressure from their employers or be given free trips or gifts by corporations that may influence their recommendations or research. Members should avoid these situations which would cause, or be perceived as causing, a loss of independence.

When a member or candidate visits a company or issuer, the member or candidate should wherever possible pay his/her own transport and accommodation costs. Members should avoid the issuer regularly acting as host. Members should only receive modest gifts or entertainment, rather than lavish ones, that will not pose a threat to their independence and objectivity.

However gift or benefits from clients are treated separately and may be accepted if they are disclosed to the member's or candidate's employers.

Members should ensure corporate relationships, between colleagues or their employer, are disclosed. If a brokerage company is unwilling to publish a negative report on a company that is also a client of a related investment banking operation then the company should be put on a restricted list and only factual information should be released.

Example 2-2 Independence and objectivity

Situation: Conrad Hillon, CFA, is an equity analyst with Faith Securities. After in-depth analysis he decides that the stock in Wireworld is overpriced at the current level. He is about to publish an unfavorable report on the company when he receives a copy of the proposal that the investment banking division of his firm has made to Wireworld to underwrite a debt offering. Hillon decides to change his 'sell' recommendation to 'buy' so that the investment banking division can win Wireworld's debt underwriting business.

Comment: To comply with Standard I(B) Independence and Objectivity, Hillon's analysis must be objective and based solely on the company fundamentals. Any pressure from other divisions is inappropriate. This conflict could have been avoided if, in anticipation of the debt offering, Faith Securities placed Wireworld on a restricted list.

C. Misrepresentation

Members and candidates must not knowingly make any misrepresentation relating to investment analysis, recommendations, actions, or other professional activities.

A misrepresentation is any untrue statement, omission of a fact, or any other statement that is false or misleading. The Standard is considering misrepresentations in any form, including oral communication, advertisements, e-mails or written materials. Members and candidates should not misrepresent any aspect of their practice including, but not limited to:

- Their own or their firm's qualifications.
- Services provided by their firm.
- Their own or their firm's performance record.
- Guaranteeing returns on a risky investment or risky investment product (unless the product is specifically structured with a built-in guarantee).

This Standard also covers plagiarism. Members shall not copy or use, in substantially the same form as the original, material prepared by another without acknowledging and identifying the name of the author, publisher, or source of such material.

Examples of plagiarism include basing a report on another analyst's report, using excerpts from an article, using charts, graphs or proprietary computerized spreadsheets without giving the original source of the report (or gaining permission, if required). The standard not only covers plagiarism in written materials but also in oral communications, such as in client meetings or presentations. Plagiarism can also take place outside the member/client relationship, such as a member presenting the work of somebody else to colleagues within their own firm.

When preparing research reports analysts should keep copies of sources of information used, acknowledge quotations, and cite sources of statistics.

Example 2-3 Investment guarantees

Situation: Bill Marcus, CFA, sells mortgage-backed derivatives called interest-only strips (IOs) to his public pension clients and describes them as 'guaranteed by the U.S. government'. The regulations stipulate that public pension clients can only invest in securities guaranteed by the U.S. government. The reality is that IO investors are entitled to the interest stream only, not the principal. The underlying mortgage pool is guaranteed by the U.S. government, but not the interest stream, which can fluctuate depending on many factors.

Comment: Marcus misrepresented the terms and character of the investment and therefore violated Standard I(C) Misrepresentation.

Example 2-4 Plagiarism

Situation: After a few years of employment as a portfolio manager with Truthful Advisors, Bryan Matthews, CFA, starts his own investment business. Prior to his departure from Truthful, Matthews took certain steps to begin his new business, including taking with him a new, proprietary and confidential stock picking methodology. In creating marketing materials for his new firm, Matthews copies the methodology but makes a few minor changes to it.

Comment: Matthews violated Standard I(C) Misrepresentation by copying another company's proprietary materials without permission and without proper credit. Matthews may have also violated Standard IV(A), Duties to Employers by misappropriating his previous employer's property.

D. Misconduct

Members and candidates must not engage in any professional conduct involving dishonesty, fraud, or deceit or commit any act that reflects adversely on their professional reputation, integrity, or competence.

This standard addresses compliance with regulations and the upholding of professional integrity. Dishonest personal behavior reflects badly on the profession. For example, excessive drinking in business hours, multiple minor convictions, and fiddling of expense accounts suggest poor judgment. Members should encourage employers to adopt a code of ethics that all employees must follow, to make clear that dishonest personal behavior reflects badly on the profession, and to check potential employees' backgrounds.

This Standard addresses professional rather than personal conduct outside of work.

Standard II: Integrity of Capital Markets

A. Material Nonpublic Information

Members and candidates who possess material nonpublic information that could affect the value of an investment must not act or cause others to act on the information.

'Material' means disclosure is likely to have an impact on the price of a security or reasonable investors would want to know the information before making an investment decision. The reliability of the source of the information is also a factor in determining whether it is material, the less reliable the source, the less likely it is to be material.

'Non-public' means that the information has not been disseminated in the market place and investors have not had a chance to react to the information. In the situation that a group of analysts is given information by a company, until it has been disseminated to other investors in the market, it is still non-public information. In the case that a member or candidate is given material non-public information by a company, they should encourage the company to make efforts to achieve public dissemination of the information.

However it is acceptable for an analyst to piece together and analyze public information and non-material non-public information to predict events, which would lead to the same conclusion as receiving material non-public information. This is called mosaic theory.

Example 2-5 Material non-public information

Situation: James Welch, CFA, is a portfolio manager of Churners Securities who was at his son's school party when he overheard another parent saying that she looked at an opened file marked 'CONFIDENTIAL' in her husband's briefcase and found out that Woking Corporation is planning to make a bid to purchase a competitor, Guildford Corporation. "The company will pay up to three times the current market price for Guildford Corporation stock!" Welch returned home and immediately purchased Guildford Corporation shares for his clients.

Comment: Welch has taken an investment action based on material non-public information, which is a violation of Standard II(A) Material Non-public Information.

Most investment banking firms with combined brokerage services will set up an information barrier, a 'fire wall' to prevent communication of nonpublic information from one department of a firm to another. For example the corporate finance department should be separated from the sales and research departments. Additionally clear procedures need to be in place to ensure that employees can recognize material nonpublic information and report to a supervisor or compliance officer if they receive such information.

B. Market Manipulation

Members and candidates must not engage in practices that distort prices or artificially inflate trading volume with the intent to mislead market participants.

- Market manipulation is often related to:
- Transactions that artificially distort prices or volumes of securities traded.
- Taking a dominant position in a security in order to manipulate the price of a related derivative.
- The dissemination of false or misleading information in order to artificially inflate or decrease a security price.
- Short-term transactions are usually prohibited, but those conducted in the scope of tax minimization strategies are permitted.

Standard III: Duties to Clients

B. Loyalty, Prudence, and Care

Members and candidates have a duty of loyalty to their clients and must act with reasonable care and exercise prudent judgment. Members and candidates must act for the benefit of their clients and place their clients' interests before their employer's or their own interests. In relationships with clients, members and candidates must determine applicable fiduciary duty and must comply with such duty to persons and interests to whom it is owed.

This Standard confirms that clients' interests must always come first and the member or candidate has a duty of loyalty, prudence and care to clients.

A fiduciary is an individual or institution charged with the duty of acting for the benefit of another party in matters coming within the scope of the relationship between them. This means that the fiduciary is in a position of trust. Fiduciary duties are defined by law to protect clients because they are assumed to have less investment knowledge than members. A fiduciary duty can only exist when there is a client.

In many cases, the Standard is looking at the case where members or their employers have discretionary authority managing clients' assets.

The Standard distinguishes between client types and degrees of fiduciary duty: for example for individuals the manager is responsible for ensuring the client's objectives are realistic and the risks are understood. In most cases recommended investment strategies should relate to the long-term objectives of the client. Sometimes the fiduciary duty is not owed to the person who has hired the investment manager; in the case of a U.S. corporate pension plan, the fiduciary duty is owed to beneficiaries

A specific example of the importance of loyalty to clients is directed brokerage or soft commissions. This is when a client's brokerage is used to purchase research for the benefit of the client's portfolios. It is important to remember that brokerage belongs to the client and should be directed for their benefit, not the manager's. The manager should ensure they get best price and execution for trades and that any goods or services purchased benefit the client. The voting of proxies is yet another important fiduciary duty. Unless the client instructs otherwise, the investment manager must always vote on a proxy issue – it cannot be ignored.

Example 2-6 Loyalty, prudence and care

Situation 1: Louise Brunn, CFA, is an analyst with Provincial Advisors covering South East Asian equities. She directs most of her trading activities to SEA Securities. SEA Securities has been paying for her travel to the markets that she covers. The commission rates are higher than average but SEA's contacts in the South East Asian region are excellent. SEA has arranged meetings for Brunn with central bank officials, senior officials of the ministries, local economists, and senior executives of local corporations during her recent trip. At the end of the trip Brunn stayed in Bali for five days of vacation that was paid for by soft-dollar commissions.

Comment 1: Brunn has violated Standard III(A) if she has not determined whether the trip provides value in relation to making investment decisions and whether the quality of research and execution of SEA Securities justifies the higher commission rates. The five-day vacation is also a violation of Standard I(B) Independence and Objectivity.

Situation 2: Dominique Rhynes, CFA, is a portfolio manager at Dark Cloud Advisors, managing a number of pension fund accounts. She directs most of her trades to JNI Brokerage, despite the higher commission rates, because of the close relationship between the executives of the two firms. The quality of research of JNI is considered average but JNI absorbs overhead expenses of Dark Cloud Advisors such as online information services and magazine subscriptions.

Comment 2: Rhynes and Dark Cloud Advisors breached Standard III(A) by not seeking the best value brokerage services to benefit the pension funds and their beneficiaries. Soft dollars cannot be used to pay for the firm's operating expenses.

B. Fair Dealing

Members and candidates must deal fairly and objectively with all clients when providing investment analysis, making investment recommendations, taking investment action, or engaging in other professional activities.

Fair dealing means that the member does not favor one client above any other when disseminating recommendations or taking investment action. This means that material changes to recommendations must be communicated to all clients known to hold the security or to have placed orders contrary to the recommendation. Material changes must be announced, as far as it is practical, to all clients at the same time.

Discretionary and non-discretionary clients must be treated equally. New issues should be offered to all clients for whom the issue is an appropriate investment, and if an issue is over subscribed, it should be distributed on a pro-rata basis.

It is important that members encourage their employers to develop written allocation procedures, particularly for block trades and new issues.

Example 2-7 Fair dealing

Situation: Monica Abidin, CFA, works in the investment management department of a private client firm. She learns that the research department has just issued a "buy" recommendation for ABC Ketchup Inc. She buys a large block of ABC Ketchup stock and allocates it to the mutual finds that are managed internally since these accounts are particularly performance sensitive. She then reviews the firm's other clients and purchases additional shares where appropriate.

Comments: Abidin's activities clearly violate Standard III(B) Fair Dealing by giving the mutual funds preferential treatment over other clients.

C. Suitability

1. When members and candidates are in an advisory relationship with a client, they must::
   a Make a reasonable inquiry into a client's or prospective clients' investment experience, risk and return objectives, and financial constraints prior to making any investment recommendation or taking investment action and must reassess and update this information regularly.
   b. Determine that an investment is suitable to the client's financial situation and consistent with the client's written objectives, mandates, and constraints before making an investment recommendation or taking investment action.
   c. Judge the suitability of investments in the context of the client's total portfolio.
2. When members and candidates are responsible for managing a portfolio to a specific mandate, strategy, or style, they must only make investment recommendations or take investment actions that are consistent with the stated objectives and constraints of the portfolio.

This list of requirements means that advisors must know their clients prior to giving them advice. In order to comply with the Standard, a member should write an investment policy statement (IPS) for each client. The IPS should include:

- the roles and responsibilities of the parties in the advisory relationship; and
- the type and nature of the client and the client's aversion to risk; and
- investor objectives in terms of risk and return; and
- investment constraints, such as liquidity, legal requirements, time horizon, tax position, and unique circumstances; and
- performance measurement benchmarks.

Example 2-8 Portfolio investment recommendations

Situation: Pierre Dauphinais, CFA, an investment advisor, has been advising Delia Moynihan, a risk-averse client, on the use of put options in her equity portfolio. The purpose is to protect the portfolio against stock market declines. Dauphinais educates Moynihan regarding the possible outcomes, including the risks involved and tax implications. He also explained the possible disastrous scenario if stock prices drop precipitously without Moynihan holding put options.

Comment: When determining the suitability of investments, the primary issue is the characteristics of the client's entire portfolio, not looking on an issue-by-issue basis. In this case Dauphinais appears to have properly considered the investment in the context of the entire portfolio and thoroughly explained the investment to the client making him comply with Standard III(C).

D. Performance Presentation

When communicating investment performance information, members or candidates must make reasonable efforts to ensure that it is fair, accurate, and complete.

CFA Institute has developed the Global Investment Performance Standards (GIPS) as a common, accepted set of standards for the investment management industry. Although compliance is voluntary, members and their firms are encouraged to adopt the standards, and they are becoming increasingly widely used. (GIPS are covered in more detail in the next two Readings).

All performance statements must be fair, accurate, and complete.

Example 2-9 Performance presentation

Situation: Terry Arbuckle, CFA, is a senior partner of Provincial Advisors and circulates a performance sheet of the firm's Technology Funds for the years 1999 through 2005. During a client meeting, Arbuckle states: "All returns are in compliance with Global Investment Performance Standards." In fact, returns are calculated in compliance with GIPS, except that the calculation of the rate of return is a money-weighted, not time-weighted return.

Comment: Arbuckle is in violation of Standard III(D) Performance Presentation because the performance measurement does not fully comply with GIPS. Provincial Advisors must meet all requirements (in contrast with recommendations) to be able to claim full compliance.

E. Preservation of Confidentiality

Members and candidates must keep information about current, former, and prospective clients confidential unless:

1. The information concerns illegal activities on the part of the client or prospective client,.
2. Disclosure is required by law, or
3. The client or prospective client permits disclosure of the information.

In general, avoid disclosing any information about a client except to authorized fellow employees who are working for the benefit of the client. However, a member may want to disclose information of a non-confidential nature in which case they should check if the information is relevant to the work being performed for the client and whether disclosure enables the member to provide a better service to the client. Confidential information can be provided to CFA Institute to cooperate with an investigation of any member's or candidate's professional conduct because the proceedings themselves are confidential.

Example 2-10 Confidentiality

Situation: Roger Warner, CFA, is a portfolio manager. He manages an endowment plan of a university. The university has given Warner a confidential review of the future plans for expansion so he can manage the fund, taking into account projected capital expenditure and cash flow requirements. Geronimo, a friend of Warner, is a local construction businessman who is interested in making a tax-deductible contribution to the endowment plan with the understanding that his company would be favorably considered when bidding for construction work on the future expansion plan. Before speaking to the trustees of the endowment fund, Geronimo insists on meeting with Warner to find out about the future plans of the university.

Comment: Warner owes confidentiality to the endowment fund and its trustees and therefore should refuse to divulge any information to Geronimo. Any confidential information entrusted to a member must be treated as such according to Standard III (E) Preservation of Confidentiality.

Standard IV: Duties to Employers

A. Loyalty

In matters related to their employment, members and candidates must act for the benefit of their employer and not deprive their employer of the advantage of their skills and abilities, divulge confidential information, or otherwise cause harm to their employer.

The employer's interests must come above the employee's own interest in matters relating to employment. Members and candidate must follow their employer's policies and procedures as long as they do not conflict with applicable laws or the Code and Standards.

This covers issues such as independent practice – members and candidates should not enter into independent practice if it is in conflict with their employers' interests. However independent practice is not explicitly prohibited, but members and candidates need to obtain prior permission from their employer and any other party. Members and candidates can make preparations to undertake independent practice prior to leaving their employer, but care must be taken to ensure that the employer's interests are maintained. The member needs to include details of the types of service to be performed, duration and compensation.

Example 2-11 Duties to employers

Situation: Joanne Reilly, CFA, is an independent registered investment advisor, and she runs her own advisory business advising five high net-worth clients. She specializes in the emerging markets. With a renewed interest in the emerging markets, a local stockbroker asks Reilly to join him as a research analyst. She accepts the offer but keeps her five clients.

Comment: Reilly must seek written consent from her new employer, the local stockbroker, to comply with Standard IV(A).

When members plan to leave their current employers, there is scope for conflicts to arise, but they still have a duty to act in their employer's best interests until their resignation becomes effective. For example, the member must be careful not to misappropriate trade secrets or misuse confidential information, solicit the employer's clients or misappropriate client lists.

Example 2-12 Duties to employers

Situation: Prior to his departure from Truthful Advisors, Bryan Matthews, CFA, took certain steps to begin his new business, including talking confidentially with the clients of Truthful regarding his intention to start his own advisory firm. He also mentioned his planned fee structure, which would be more competitive than that of Truthful.

Comment: Matthews violated Standard IV(A) by soliciting his employer's clients while still employed by them.

B. Additional Compensation Arrangements

Members and candidates must not accept gifts, benefits, compensation, or consideration that competes with, or might reasonably be expected to create a conflict of interest with, their employer's interest unless they obtain written consent from all parties involved.

Employers have a right to know that their employees remain faithful to the firm; outside commitments could erode the employee's dedication to the firm. Additional compensation includes payments from clients or from third parties.

Example 2-13 Additional compensation arrangements

Situation: Theodore Spencer, CFA, is a manager in a small securities company. He also sits on the board of a publicly listed large resort chain. In addition to receiving an annual stipend as a member of the board, he is also given membership privileges for his family at all the resort facilities. Although Spencer discloses his annual stipend, he does not disclose receiving the membership privileges because he believes that he is only obliged to report monetary compensation, not benefits-in-kind.

Comment: Spencer violated Standard IV (B) Additional Compensation Arrangements by failing to disclose the total compensation as a member of the board of directors. When dealing with the securities of the resort chain, he may be obligated to disclose this arrangement to clients and prospective clients under Standard VI(A) Disclosure of Conflicts.

C. Responsibilities of Supervisors

Members and candidates must make reasonable efforts to detect and prevent violations of applicable laws, rules, regulations, and the Code and Standards by anyone subject to their supervision or authority.

Supervisors are responsible for their subordinates' ethical behavior, even if the employee is not a CFA Institute member. Supervisors can rely on reasonable compliance procedures designed to avoid and detect any wrongdoing. Moreover, if a compliance system is not in place, then the member should not accept the supervisory responsibility until reasonable procedures are in place.

Example 2-14 Responsibilities of supervisors

Situation: Fred Smith is a trainee salesman at Churners Securities, but he is not a member of the CFA Institute. Smith recently acquired a sizable private client account and has done an unusually high volume of trades for the account. Anthony Mason, CFA, Smith's supervisor, finds out that the high volume has been derived from trades in a single security, and Smith insists that the trades are performed at the client's request. Mason praises Smith for the large business volume that he generates.

Comment: As a trainee, Smith may lack the necessary judgment as to whether the high volume of trade is appropriate. Mason's failure to adequately review and investigate the unusual high volume of trading violates Standard IV(C) Responsibilities of Supervisors. Supervisors should be aware of the actual or potential conflicts between their own self-interest and their supervisory responsibilities.

Ideally, compliance procedures should:

- Be contained in a clearly written and accessible manual that is easy to understand;
- Outline permissible conduct;
- Be clearly written and accessible;
- Outline the scope of the procedures;
- Implement a system of checks and balances;
- Designate a compliance officer and specify his authority;
- Outline procedures for reporting violations and sanctions;
- Outline procedures to document and test compliance procedures; and
- Describe the hierarchy of supervision and assign duties to supervisors.

Compliance rules should be communicated to all employees and updated periodically. Employees should be partially evaluated on their standards of professional conduct. If a violation occurs then a supervisor must respond promptly, conduct a thorough investigation and put limits on the relevant employee(s)' activities until the investigation is complete.

Standard V: Investment Analysis, Recommendations, and Actions

A. Diligence and Reasonable Basis

Members and candidates must:

1. Exercise diligence, independence, and thoroughness in analyzing investments, making investment recommendations, and taking investment actions.
2. Have a reasonable and adequate basis, supported by appropriate research and investigation, for any investment analysis, recommendation, or action.

This applies to primary research, secondary (research conducted by someone else in the same firm) or third party research. Members and candidates must make reasonable and diligent efforts to ensure that the research is sound. If any information is suspected of being inaccurate, then it cannot be used.

Example 2-15 Reasonable basis for recommendations

Situation: Gary Seller, CFA, follows Widget Corporation as a research analyst. All the information he has accumulated and documented suggests that the outlook for the company's existing products is poor. The launch of new products has been delayed. Seller overhears a financial analyst during lunch say that Widget's new products will be superior to those of its competitors. Upon returning to his office, Seller immediately changes his recommendation from "sell" to "buy".

Comment: Seller violated Standard V(A) Diligence and Reasonable Basis as he should have conducted his own thorough research as an adequate and reasonable basis for his recommendation.

B. Communication with Clients and Prospective Clients

Members and candidates must:

1. Disclose to clients and prospective clients the basic format and general principles of the investment processes used to analyze investments, select securities, and construct portfolios and must promptly disclose any changes that might materially affect those processes.
2. Use reasonable judgment in identifying which factors are important to their investment analyses, recommendations, or actions and include those factors in communications with clients and prospective clients.
3. Distinguish between fact and opinion in the presentation of investment analysis and recommendations.

This is a very important standard, it establishes the importance of clients understanding the information sent to them (via any means of communication) allowing them to make informed decisions. Analysts must provide information on the basic characteristics of an investment, which are the key factors supporting a recommendation, and differentiate between opinion (often on the investment's future prospects) and fact. Not all information is required to be included in a research report, only information that is deemed to be the most relevant to the intended audience.

Example 2-16 Research reports

Situation: Judy Wiencek, CFA, is a mining analyst and has written a research report on Noisy Bay Minerals. Included in her report is her own assessment of the extent of mineral reserves likely to be found on the company's land. Based on preliminary core sample results from the company's latest drilling and her own calculations, Wiencek writes, "based on the fact that the company has in excess of 200,000 ounces of gold, we rate Noisy Bay a 'buy'". She omitted to state that a potentially serious environmental litigation case has just been filed by local residents living adjacent to the mining sites.

Comment: Wiencek violated Standard V(B) as her calculation of the total reserves is an opinion not a fact, and her omission of the relevant legal case is not reasonable.

C. Record Retention

Members and candidates must develop and maintain appropriate records to support their investment analysis, recommendations, actions, and other investment-related communications with clients and prospective clients.

Members and candidates should maintain files to support their work including sources of information and methodology by which recommendations or conclusions were made. Generally these will remain the property of the firm, not the employee. Records can be maintained either in hard copy or electronically. The Standard does not stipulate a minimum holding period, but local regulatory requirements must be upheld.

Standard VI: Conflicts of Interest

A. Disclosure of Conflicts

Members and candidates must make full and fair disclosure of all matters that could reasonably be expected to impair their independence and objectivity or interfere with respective duties to their clients, prospective clients, and employer. Members and candidates must ensure that such disclosures are prominent, are delivered in plain language, and communicate the relevant information effectively.

Conflicts of interest looks at potential conflicts between members and candidates, their employer, clients and prospective clients. The emphasis is on full disclosure of conflicts so all the parties can evaluate the objectivity of advice or investment actions being taken.

The member or candidate cannot decide for themselves whether an actual or potential conflict exists – only clients and employers can make this decision.

Investment advice to clients could be biased due to a number of factors, including if the member or candidate has beneficial ownership (a direct of indirect personal interest) of a security. Other issues causing a conflict of interest include a member or the member's firm providing directors or acting as consultant to an issuer, acting as underwriter or broker-dealer relationships.

Example 2-17 Disclosure of conflicts

Martin Bolle, CFA, is an analyst and partner in his firm. He sits on the board of a publicly listed company, and he writes research reports recommending the securities of the publicly listed company.

Comment: Standard VI(A) Disclosure of Conflicts requires Bolle to disclose his service on the company's board of directors to his clients and prospects.

Members should report any beneficial ownership that they have in securities and any corporate directorships or similar positions that could reasonably be considered to produce a conflict of interest to their employer. If in doubt whether any action could provide a conflict of interest, they should discuss the issue with a compliance officer or supervisor.

Example 2-18 Disclosure of conflicts

Situation: Jason Woodsmith, CFA, covers South East Asian equities for Alpha Beta Investments, which specializes in emerging markets. While on a business trip to Malaysia, Woodsmith learns that index-linked notes that replicate the performance of the Malaysian composite index can be purchased in Singapore. During the Asian financial crisis, Alpha Beta reduces its exposure to Malaysia. Unknown to Alpha Beta, Woodsmith purchases in Singapore the Malaysian index-linked notes for his own account. Later, Alpha Beta increases its exposure to Malaysia, and Woodsmith then purchases the index-linked notes for his pension fund clients. Woodsmith did not sell his own portfolio to his clients, but he has enjoyed an unrealized profit of 30 percent since he purchased them.

Comment: Woodsmith violated Standard VI(A) Disclosure of Conflicts for not disclosing to his employer his ownership of the index-linked notes. Owning the notes in his personal portfolio may have impaired his professional judgment.

B. Priority of Transactions

Investment transactions for clients and employers must have priority over investment transactions in which a member or candidate is the beneficial owner.

A beneficial owner means the member or candidate owns the shares directly or has an indirect interest in the security. Note, however, that family accounts that are also client accounts should be treated equally with other clients.

In many cases conflicts arise in IPOs where there is a shortage of stock available and a rise in price is anticipated when the stock is listed. Conflicts can be avoided if members and candidates do not participate in IPOs. Similar conflicts arise with private placements; members should not be involved in these transactions if they could influence their judgment.

All individuals involved in investment decision-making should observe a blackout or restricted period prior to trading for clients so they cannot front-run client trades.

Supervisors should establish clear reporting procedures for relevant employees' personal trades.

Example 2-19 Priority of transactions

Situation: Baillie Trafford, CFA, is a portfolio manager at a local investment firm. His parents opened a retirement account with the firm. Whenever appropriate IPOs become available he firstly allocates the shares to his other clients and then places any remaining portion into his parents' account. He has adopted this procedure to avoid the accusation that he gives favorable treatment to his parents.

Comment: Trafford is in violation of his fiduciary duties to his parents, as stated in Standard VI(B) Priority of Transactions, by treating them differently to other clients. His parents are entitled to the same treatment as any other fee-paying client of the firm. If Trafford has beneficial ownership to the account, then a pre-clearance for personal transactions is required.

C. Referral Fees

Members and candidates must disclose to their employer, clients, and prospective clients, as appropriate, any compensation, consideration, or benefit received from, or paid to, others for the recommendation of products or services.

The disclosure should be before any arrangement is entered into and include the nature of the benefit together with an estimate of the dollar value. Members should consult a supervisor and legal counsel concerning any such prospective arrangements. Referral arrangements need not be paid in cash. Referral arrangements between a broker and an investment manager could come in the form of soft dollars, for example.

Example 2-20 Referral fees

Situation: Jerry Weiss, CFA, is a discretionary portfolio manager with Advent Investment Management, responsible for the management of pension fund investments. He is often requested by his contacts to recommend mutual funds for their personal investments. As his firm does not offer retail products, Weiss refers the requests to the portfolio manager of a mutual fund, in a competing firm, whom he has known since his school days. He receives compensation for the occasional sales made. The mutual fund's performance is in the top quartile.

Comment: Although they are not clients of his firm, Weiss is obliged to disclose any such arrangement to personal contacts in order to comply with Standard VI (C) Referral Fees. Weiss needs to disclose the arrangements to his clients if they purchase any of the mutual funds. The disclosure enables clients to determine if there was any partiality in the referral and the true cost of the referred services.

Standard VII: Responsibilities as a CFA Institute Member or CFA Candidate

A. Conduct as Members and Candidates in the CFA Program

Members and candidates must not engage in any conduct that compromises the reputation or integrity of CFA Institute or the CFA designation or the integrity, validity, or security of the CFA examinations.

This Standard is concerned with members or candidates not taking any action that would undermine the standing of the CFA Program or CFA charter.

Example 2-21 Professional misconduct

Situation: Melissa White, CFA, runs her own investment advisory firm, and she serves as a proctor for the administration of the CFA examination in her city. She receives copies of the Level II CFA examination many days before the exam day. On the evening prior to the exam, she provides information concerning the examination questions to two stressed candidates whom are also her best-performing advisors.

Comment: White and the two candidates violated Standard VII(A) Professional Misconduct. Although it does not involve clients' money or an investment recommendation, White and the two members undermined the integrity and validity of the examination.

B. Reference to CFA Institute, the CFA designation, and the CFA Program

When referring to CFA Institute, CFA Institute membership, the CFA designation, or candidacy in the CFA Program, members and candidates must not misrepresent or exaggerate the meaning or implications of membership in CFA Institute, holding the CFA designation, or candidacy in the CFA Program.

Members or candidates must not use references to the CFA designation to exaggerate their competency or their ability to achieve investment returns.

Once accepted as a member of the CFA Institute, in order to maintain his/her status a member must continue to:

- Maintain active membership of CFA Institute and pay annual membership dues; and
- Make an ongoing commitment to abide by the requirements of CFA Institute's Professional Conduct Program.

Those who have earned the right to use the Chartered Financial Analyst designation may use the marks "Chartered Financial Analyst" or "CFA" and are encouraged to do so, but only in a manner that does not exaggerate or misrepresent the meaning of the designation.

The acronym 'CFA' must be used as an adjective not as a stand-alone noun. For example, you should refer to someone as a CFA charterholder rather than as a 'CFA'. On business cards 'CFA' should be in capitals following the charterholder's name and 'CFA' must not be in larger font than the charterholder's name.

Candidates in the CFA Program may make reference to their participation in the CFA Program, but the reference must clearly state that an individual is a candidate in the CFA Program and cannot imply that the candidate has achieved any type of partial designation. There is no partial designation for someone who has passed the exams but has not received their charter. Candidates part-way through the program may only state that they are a candidate for the CFA designation, in which case they must be enrolled for the next exam. Candidates may also state that they have completed one or more Levels, but they may not give an expected award date of their CFA charter after successfully completing Level III.

Example 2-22 Use of CFA designation

Situation: Enesco Fermi has recently passed Level II of the CFA examination. Looking for a new job, he circulates a resumé stating that he has "completed Chartered Financial Analyst II" and he holds the designation "CFA II".

Comment: Fermi has violated Standard VII (B). The CFA Institute does not award partial designation. However he may say that he passed Level II of the CFA exam or that he is a Level III candidate of the CFA program. Claiming to be a candidate would mean that he is enrolled to take the next examination; otherwise his statement would not be valid, violating the Standard.

28 Readings: 3 Introduction to the Global Investment Performance Standards (GIPS®)
and Reading: 4 Global Investment Performance Standards

3 Introduction to the Global Investment Performance Standards (GIPS®)
and
4 Global Investment Performance Standards

Learning Outcome Statements (LOS)

4-a	**Explain** why the GIPS standards were created.
4-b	**Explain** what parties the GIPS standards apply to and whom the standards serve.
4-c	**Characterize** "composites".
4-d	**Explain** the purpose of verification.
4-e	**Explain** why a global standard is needed and how it is being implemented.
4-f	**State** the "vision" of the GIPS standards.
4-g	**State** the objectives and key characteristics of the GIPS standards.
4-h	**State** the appropriate disclosure when the GIPS standards and local regulations are in conflict.
4-i	**Explain** the scope of the GIPS standards with respect to definition of the firm, historical performance record, and compliance.
4-j	**Name** and **characterize** the eight major sections of the GIPS standards.
4-k	**Explain** the fundamentals of compliance with the GIPS standards.

Introduction

These Reading Assignments look at Global Investment Performance Standards or GIPS® which cover the professional and ethical standards that should be followed for the calculation and presentation of investment performance. Candidates are expected to know the objectives of GIPS as well as the key characteristics of GIPS and the compliance procedures.

Note: Reading Assignment 3 does not contain any LOS; however, sections from "Introduction to the Global Investment Performance Standards" have been incorporated into the LOS for Reading Assignment 4.

LOS 4-a

Explain why the GIPS standards were created.

LOS 4-e

Explain why a global standard is needed and how it is being implemented.

Investment firms have been tempted to provide performance statistics that were misleading. Examples include quoting the performance of only top performing funds, survivorship bias (excluding data for portfolios that have been closed) and selecting time periods when a firm's performance looked best.

This has made it difficult to compare performance results between firms. The GIPS standards have been created to establish a standardized, industry-wide approach to calculating and reporting performance to prospective clients. They ensure fair presentation and full disclosure of performance.

In particular:

- The investment management industry itself is global: firms have operations in multiple countries; there is a need to standardize the calculation and presentation of performance.
- Prospective clients and investment firms will benefit from an established standard for performance presentation across different countries. Many countries have not established investment performance standards and, if they do have standards, these may only apply to the specific country and not have broad applicability.
- Investment management firms operating in countries with minimal standards will be in a better position to compete with firms from countries with more established standards if they comply with GIPS.
- Both prospective and existing clients will have greater confidence in performance numbers presented to them and will be able to compare performance across different investment management firms.

LOS 4-f

State the "vision" of the GIPS standards.

The vision statement has two components: GIPS will:

1. Lead to performance presentation that is readily comparable across investment firms regardless of geographical location.
2. Facilitate discussion between investment management firms and their prospective clients about past performance and future strategies.

LOS 4-b

Explain what parties the GIPS standards apply to and whom the standards serve.

GIPS standards apply to investment management companies which must define an entity that claims compliance ('firm').

The clients and prospective clients (the investors with money to be managed) will be the main beneficiaries of the GIPS. The aim is to create a greater confidence amongst investors who deal with firms that choose to comply with GIPS. Those firms who comply with GIPS will give assurance that the performance presentation will be fair and complete. They will also be comparable across compliant firms. Consultants are intermediaries between investment managers and large pension plans, and GIPS have been created to serve them, too.

LOS 4-c

Characterize "composites".

Composites

One of the key concepts is the use of "composites." A composite is a collection of portfolios which are grouped in a set, with reasonable and consistent criteria applied to them, based on investment strategies and/or objectives. To illustrate a composite, imagine that an investment manager has thousands of client portfolios, and each portfolio is invested in oneof three different assets: domestic equities, international equities, and fixed income securities. When the investment manager markets his skills to prospective clients, he/she will present historical performance for each of the three asset classes. These are the composites.

The standards require that all fee-paying discretionary portfolios (ones that the manager has the discretion to transact) be included in at least one composite under the criteria of an ex-ante basis (prior to the fact based on a pre-established criteria) not ex-post basis (after the fact). This prevents firms "cherry picking" the best performing portfolios for inclusion.

LOS 4-d

Explain the purpose of verification.

Verification

The main purpose of verification is to provide assurance that the firm claiming compliance has followed the standards on a firm-wide basis.

Investment firms that claim compliance with GIPS are responsible for their claim. If they wish to claim verification they must hire an independent third party.

Verification covers the whole firm, not just specific composites.

The verification tests:

- Whether the firm is compliant on a firmwide basis and the construction of all the composites follows GIPS requirements.
- Whether the firm's process and procedures of calculation are in compliance with the GIPS standards.

Verification is not required but is strongly recommended. An independent third-party verification brings credibility to the claim of compliance.

LOS 4-g

State the objectives and key characteristics of the GIPS standards.

GIPS objectives

- To obtain worldwide acceptance of a standard for the calculation and presentation of investment performance in a fair, comparable format that provides full disclosure.
- To ensure accurate and consistent investment performance data for reporting, record-keeping, marketing and presentation.
- To promote fair, global competition among investment firms for all markets without creating barriers to entry for new firms.
- To foster the notion of industry self-regulation on a global basis.

GIPS lay out the minimum requirements that a firm must follow in order to ethically calculate and fairly present the investment performance.

Compliance with GIPS is voluntary and not required by legal or regulatory bodies. GIPS set the minimum requirements that a firm should follow, in some cases providing additional information might give a client or prospective client a clearer understanding.

LOS 4-h

State the appropriate disclosure when the GIPS standards and local regulations are in conflict.

When GIPS and local regulations are in conflict, firms must comply with the local law or regulation and fully disclose the conflict.

LOS 4-i

Explain the scope of the GIPS standards with respect to definition of the firm, historical performance record, and compliance.

The firm must be defined as an investment firm, subsidiary, or division held out to clients or potential clients as a distinct business unit. Total firm assets must include all fee paying and non-fee paying, discretionary and advisory accounts. Firms are encouraged to take the broadest definition of the firm, and for example, include all geographic offices operating under the brand name.

There are only two options for compliance: fully comply with all the requirements or else, if not compliant, no reference to the GIPS is allowed.

There are a number of requirements that will go into effect at later date (including requirements on real estate valuations, valuing portfolios when large cash flows, monthly valuations, and carve-out returns). Until these become effective these are classed as recommendations and firms are encouraged to use them.

Firms are encouraged to conduct regular internal compliance checks to ensure the validity of their compliance claims.

Only investment management firms can claim compliance with GIPS. Consultants and software houses can assist investment management firms to meet compliance requirements, but they are unable to claim the compliance themselves.

Compliance requires a minimum historical performance record of 5 years (or since inception if the firm or composites existed for less than 5 years). Subsequently firms must build up year-by-year to a 10-year track record.

Firms can present their entire performance history if they choose to. If a firm has more than 5 years of historical performance, it may present its non-compliant performance results along with its compliant record, provided:

- the compliant track record begins no later than January 1, 2000; and
- the non-compliant periods are disclosed and the reasons for non-compliance are explained.

LOS 4-j

Name and **characterize** the eight major sections of the GIPS standards.

There are eight major sections to the GIPS standards which are divided between requirements and recommendations. It is important that you know which rules are requirements, which must be followed, and which rules are recommendations, which are optional. You can expect to be tested on knowing the difference. The eight major sections are outlined below.

1. *Fundamentals of Compliance*

These are discussed in LOS 4-k.

2. *Input data*

Consistency of input data is critical if investment performance is going to be comparable between firms.

3. *Calculation methodology*

The calculation methodology must be uniform across all portfolios and composites. Important methods include the use of total returns, which include cash flows (dividends and interest), realized gains (from sales) and unrealized gains from ongoing portfolio holdings. Returns for any period are linked together geometrically to create a return over a longer investment horizon.

4. *Composite construction*

A composite is a group of portfolios that represents a particular investment objective or strategy. The composite return is the asset-weighted average of the returns of the portfolios in the composite. Cash acts as a drag on portfolio performance over the long run, and cash must be allocated among the composites – it cannot be carved out and presented on its own.

5. *Disclosures*

These allow firms to elaborate on the performance figures provided and put the figures in context to ease comprehension. Disclosures would not normally change from period to period. Some disclosures are required, others are voluntary.

6. *Presentation and reporting*

After collecting the data, calculating returns and deciding on necessary disclosures this information must be include in presentations. If appropriate, firms also have the responsibility to include other information that may not be specifically required by the standards. A recommendation is to include the standard deviation of the composite, for example.

7. *Real estate*

The provisions in this section apply specifically to all real estate investments (land, completed building, or ones under development etc.).

Private equity

The provisions apply to all private equity investments whether held directly or through a fund or a partnership, except for open-end or evergreen funds which fall under the main GIPS requirements. The valuation methods to be used for private equity investments are specified by GIPS.

LOS 4-k

Explain the fundamentals of compliance with the GIPS standards.

Compliance

The fundamentals of compliance cover a number of topics:

Definition of the firm: See LOS 4-i.

Document policies and procedures: firms must document their policies and procedures with respect to GIPS compliance.

Claim of Compliance: Firm must use the following statement to indicate they are in compliance, ''(name of firm) has prepared and presented this report in compliance with the Global Investment Performance Standards (GIPS®)". The firm must meet all the required standards to claim compliance. Partial compliance of the requirements is not permitted.

Firm Fundamental Responsibilities:

- Firms should present a complaint presentation to all prospective clients, not just selected clients.
- Firms should provide a composite list and composite description if requested to do so by prospective clients.
- Firms must make available a compliant performance presentation for any composite which is requested by a prospective client.
- When two firms jointly market their performance, each firm must make clear who is claiming compliance.
- Firms must follow all requirements and any updates published by the CFA Institute. They are encouraged to comply with recommendations.

Verification: Firms are encouraged to undertake the verification process and to disclose in advertisements or presentation that the firm has been verified, and also the period of verification if the presentation includes periods which have not been verified.

5 The Corporate Governance of Listed Companies: A Manual for Investors

Learning Outcome Statements (LOS)

5-a	**Identify** the factors in evaluating the quality of corporate governance and the relative strength of shareowner rights.
5-b	**Define** corporate governance and identify practices that constitute good corporate governance.
5-c	Define independence as used to describe corporate board members, and explain the role of independent board members in corporate governance.
5-d	List and explain the major factors that enable a board to exercise its duty to act in the best long-term interests of shareowners.
5-e	**Identify** characteristics of a board that contribute to the board's independence, and **state** why each characteristic is important for shareowners' interests.
5-f	**Identify** factors that indicate a board and its members possess the experience required to govern the company for the benefit of its shareowners.
5-g	**Explain** the importance to shareowners of a board's ability to hire external consultants.
5-h	**Identify** advantages and disadvantages of annual board elections compared to less frequent elections.
5-i	Explain the implications of a weak corporate code of ethics with regard to related party transactions and personal use of company assets.
5-j	**Critique** characteristics and practices of board committees, and **determine** whether they are supportive of shareowner protection.
5-k	**Identify** the information needed for evaluating the alignment of a company's executive compensation structure and practices with shareowner interests.
5-l	**State** the provisions that should be included in a strong corporate code of ethics.

5-m	**Identify** components of a company's executive compensation program that positively or negatively affect shareowners' interests.
5-n	**Explain** the implications for shareowners of a company's proxy voting rules and practices.
5-o	**State** whether a company's rules governing shareowner-sponsored board nominations, resolutions, and proposals are supportive of shareowner rights
5-p	**Explain** the implications of different classes of common equity for shareowner rights.
5-q	Determine the probable effects of takeover defenses on share value

Introduction

This Reading moves on to a new topic which has been introduced in the 2006 curriculum.

Research finding states there is a strong correlation between good corporate governance and better valuation results of listed companies; one of the reasons it is important to alert investors to the importance of corporate governance. The manual considers how investors can evaluate the quality of corporate governance.

Corporate governance is topical, and the full document can be downloaded free of charge at

- http://www.cfainstitute.org/cfacentre/cmp/pdf/cfa_corp_governance.pdf

The first part deals with the role of the Board, its independence, qualifications, and the resources that should be available for the Board to exercise its independence.

The second part deals with the ethical issues that are the responsibility of management and reflect good governance.

The last part discusses the rights of shareowners, particularly in terms of their involvement in the governance of a company, such as voting, sponsoring resolutions and other shareowners' issues.

LOS 5-a

Identify the factors in evaluating the quality of corporate governance and the relative strength of shareowner rights.

The quality of corporate governance mainly depends on:

- The adequacy of a company's corporate governance structure.
- The strength of a shareowner's rights in voicing concern over governance matters.

The success of safeguarding shareowners' interests depends upon the satisfactory implementation of the two factors.

LOS 5-b

Define corporate governance and identify practices that constitute good corporate governance.

Corporate governance is the system of internal controls and procedures by which individual companies are managed.

It provides a framework that defines the rights, roles and responsibilities of the different stakeholders or parties involved in a company including the management, board, controlling shareowners and minority or non-controlling shareowners.

In general, good corporate governance seeks to ensure that:

- Board members act in the best interests of shareowners.
- The company acts in a lawful and ethical manner in its dealings with all stakeholders.
- All shareowners have the same rights to participate in the governance of the company, and all rights of shareowners and other stakeholders are clearly set out and communicated.
- The board and its committees are structured to act independently from management, individuals or entities that have control over management, and other non-shareowner groups.
- Appropriate controls and procedures are in place covering management's activities in running the day-to-day operations of the company.
- The company's operating, financial and governance activities are consistently reported to shareowners in a fair, accurate, timely, reliable, relevant, complete and verifiable manner.

LOS 5-c

Define independence as used to describe corporate board members, and explain the role of independent board members in corporate governance.

Independence

Board members refer to executive board members, independent board members and non-executive board members. In some countries these board members are called directors. Independence means that the members do not have material business or other relationships with:

- The company or its subsidiaries, including former employees, executives or their families.
- Individuals or groups (including potentially, the government) that are in a position to exert influence on the company.
- Executive management and their families.
- Company advisors and their families.
- Any entity which has a cross-directional relationship with the company.

The role of independent board members in corporate governance is expected to minimize the bias in management decisions that unfairly benefit the management or those who control the management at the expense of shareholders.

LOS 5-d

List and explain the major factors that enable a board to exercise its duty to act in the best long-term interests of shareowners.

The major factors that enable a board to act in the best long-term interests of shareowners can be summarized as:

1. Independence, which means that the board has the autonomy to act independently and does not only vote along with the management.
2. Experience and expertise, which means the board has the competence to evaluate the best interests of the shareowners. Depending upon the business, specialized expertise might be required.
3. Resources, which mean there are internal mechanisms that allow the board to exercise its independent work, including using outside consultants.

LOS 5-e

Identify characteristics of a board that contribute to the board's independence, and **state** why each characteristic is important for shareowners' interests.

The following characteristics would strengthen the board's independence:

- The majority of members are independent. The board will then be less likely to be influenced by management.
- The board members regularly meet without the presence of management and report at least annually to shareowners.
- Independent board members have a lead member if the board chair is not independent.

While the following might weaken it:

- The board chair also holds the title of chief executive. This will reduce the ability and willingness of independent board members to exercise independent judgment.
- The board chair is a former chief executive of the company. Likewise, the board's independence might be weakened by an influential personality.
- There are members of the board who are individuals connected to the company's suppliers or customers, or to the advisers to the company's share-option or pension plan. In some cases, however, a company with a large number of suppliers, customers and advisers may need to have such individuals in the board in order to benefit from their expertise.

LOS 5-f

Identify factors that indicate a board and its members possess the experience required to govern the company for the benefit of its shareowners.

The board and its members are likely to possess the experience required if they:

- Are competent to make the right decisions about the company's future.
- Are able to professionally deal with issues related to:
  - the principal technologies, products or services offered by the company,
  - financial operations,
  - legal matters,
  - accounting,
  - auditing,
  - strategic planning,
  - the risks the company assumes as part of its business operations.

- Have served on other boards, particularly with those with good governance practices.
- Regularly attend board and committee meetings.
- Have the background, expertise, and knowledge in specific subjects needed by the board.
- Have aligned their interest to those of the shareowners, for example by being investors themselves or by avoiding conflicts of interest with his or her position as a board member.
- Have served individually on the board for more than ten years. This might be favourable because they will have acquired a good knowledge of the company, but on the other hand they might be less willing to act in the best interests of shareowners.
- Have made public statements that can provide an indication of their ethical perspectives.
- Have successfully dealt with legal problems on the board of another company.

LOS 5-g

Explain the importance to shareowners of a board's ability to hire external consultants

External consultants

Independent board members may have limited time to devote to their board responsibilities and have insufficient time to collect and analyse the large amount of information relevant to overseeing the company's activities. They will also be involved with considering specialist issues such as compensation, mergers and acquisitions, legal, regulatory, financial matters and reputational concerns. If the board members have the freedom to use external consultants, without management approval, this will allow them to receive independent advice.

LOS 5-h

Identify advantages and disadvantages of annual board elections compared to less frequent elections.

Infrequent board elections make it more difficult to change, or at least delay the changing, of board members, which can be critical if the company's performance is not satisfactory. However a classified board (members are elected for staggered multiple-year terms) may provide better defence against an unwelcome takeover.

The main disadvantage of annual board elections as opposed to less frequent elections is the need for continuity of the board members.

LOS 5-i

Explain the implications of a weak corporate code of ethics with regard to related party transactions and personal use of company assets.

When a board member receives personal benefits from the company it can create a conflict of interest. Such transactions should be controlled, either by the company's ethical code or board policies, to ensure that board members are not using the company's resources to the detriment of shareowners.

Similarly there should be limits on third-party transactions such as board members, or parties related to them, receiving consultancy fees, for work done for the company.

LOS 5-j

Critique characteristics and practices of board committees, and **determine** whether they are supportive of shareowner protection.

LOS 5-k

Identify the information needed for evaluating the alignment of a company's executive compensation structure and practices with shareowner interests.

Committees

In this case we are considering committees such as an audit committee, to oversee the audit of a company's accounts; a remuneration/compensation committee to set executive remuneration, and a nominations committee to recruit board members.

Audit committee

The audit committee is responsible for hiring independent external auditors and ensuring their policies are in line with shareowner's objectives. This helps maintain the credibility of the company's financial reports. Investors need to consider the following when deciding whether the committee provides shareowner protection:

- The independence of the board members on the committee.
- Whether the board members are financial experts.
- Whether the shareowners can vote on the appointment of the external auditors.
- The audit committee has the right to veto the external auditor being used by the company for non-audit consultancy (potentially a conflict of interest).
- The access of the internal auditor to the audit committee and vice versa.
- Whether the external auditor has ever questioned accounting practices.
- Who has controls over the audit budget?

Remuneration /compensation committee

The committee should help to ensure that the rewards and incentives offered to management are consistent with the best long-term interests of shareowners. Investors need to consider the following when deciding whether the committee provides shareowner protection:

- Whether the compensation packages offered to senior management are appropriate. Whether senior management receives other benefits including loans from the company and the use of company assets, such as airplanes and real estate.
- Whether members of the committee regularly attend meetings.
- The committee's policies and procedures.
- Whether the company has provided detailed public information to shareowners on the compensation paid to the company's highest-paid executives and its board members.
- The terms and conditions of options granted to management and employees. Whether these options, if exercised, will be fulfilled by new shares (which will dilute the ownership of existing shareholders) or shares repurchased in the market. Does the company require shareowner approval to provide share-based remuneration plans?
- Whether executives from other companies that have cross-directorship links with the company are members of the committee.

Nominations committee

This committee is responsible for identifying new board members with the appropriate skills and expertise and also monitoring the skills, expertise and independence of existing board members. Investors need to consider the following when deciding whether the committee provides shareowner protection:

- The criteria for new board members and whether they complement the existing board.
- How they identify potential members (do they use executive search services?).
- Attendance records of board members.
- Succession plans.
- Availability and content of committee reports.
-

LOS 5-1

State the provisions that should be included in a strong corporate code of ethics.

Investors need to check if a company has a code of ethics. The code should set a framework for management and employees' behaviour that follows the principles of integrity, trust and honesty. A breach of the code, whether it leads to regulatory sanctions, management changes or negative media coverage will damage shareowners' interests.

Investors should check whether:

- The board has access to relevant corporate information in a timely manner.
- The company complies with the relevant country's corporate governance code and stock exchange requirements.
- The code prohibits any practice that would provide advantages, such as discounted shares, to company insiders (management, board member etc.) that are not also offered to shareowners.
- The company has designated someone who is responsible for corporate governance.
- The code does not provides waivers to certain levels of management.
- The company has not waived any of the provisions during recent periods.
- There is a regular audit of its governance policies and procedures.

LOS 5-m

Identify components of a company's executive compensation program that positively or negatively affect shareowners' interest.

It is important to determine whether compensation paid to its executives is commensurate with the level of responsibilities and performance. A poor compensation plan might encourage executives to make decisions that result in additional short-term benefits to themselves at the expense of long-term growth.

Investors should analyze:

- The amounts paid to key executives for managing the company, and whether it rewards short-term share price movements or long-term company growth. Also whether it reflects the company's performance relative to its competition.
- The manner in which compensation is provided; for example, in the form of stock options and how the compensation is linked to the long-term performance of the company.

LOS 5-n

Explain the implications for shareowners of a company's proxy voting rules and practices.

Shareowners prefer a company that allows proxy voting regardless of whether the shareowner is able to attend in person the meetings in person or not. It is desirable that proxy voting is not limited by means, so it can be done through paper ballot, electronic voting, proxy voting services, or by another remote mechanism. Any restrictions on voting impede a shareowner's right to vote and express their views on the company.

LOS 5-o

State whether a company's rules governing shareowner-sponsored board nominations, resolutions, and proposals are supportive of shareowner rights.

A company's rules governing shareowner-sponsored board nominations, resolutions, and proposals are generally supportive of shareowner rights, but the rules and the procedures to exercise such rights should not be prohibitively cumbersome. If this is the case, shareowners cannot readily address their concerns in order to protect the value of their shares.

LOS 5-p

Explain the implications of different classes of common equity for shareowner rights.

Companies with more than one class of common equity could affect the shareowners' rights in different ways.

Firstly, any potential acquirer would prefer to deal directly with those shareowners who own the shares with super-voting rights. Other shareowners' voices will be weaker in terms of voting for major resolutions.

Moreover, a company which separates the voting rights from the economic rights of the common shares would find it more difficult to raise additional equity capital than a company who combines the economic and voting rights.

LOS 5-q

Determine the probable effects of takeover defenses on share value.

"Shareowner rights plans" are often put in place in the articles of association of a company to defend against a takeover. The schemes force any potential acquirer to deal directly with management and the board hence reducing the chance of the takeover succeeding. Often certain provisions are also in place such as change-in-control provisions that will trigger large severance packages and other payments to company executives.

All these provisions create a barrier that may cause the market to discount the value of the company's shares in normal trading, to the detriment of shareowners.

STUDY SESSION 2

Quantitative Methods: Basic Concepts

Overview

Quantitative Methods, covered in Study Sessions 2 and 3, have a guideline weighting of 12% of the questions in the 2006 exams. For candidates without a strong maths background, parts of these two study sessions can be tough and time consuming but it is vital that you make the necessary effort to master the key principles. They will reoccur in several other study sessions in the Level I syllabus and again when you move on to Levels II and III. Remember that the focus is not just on learning the equations and quantitative methods but being able to apply them to decision-making in an investment context.

Study Session 2 starts out with the Reading Assignment on time value of money, which establishes the link between present and future values of sums of money, whether they are a single cash flow or multiple cash flows such as annuities and perpetuities. In the second Reading Assignment we move on to the application of time value of money techniques to calculating internal rates of return and net present values of investments to enable us to value securities. The third Reading Assignment provides an introduction to statistical concepts and provides the tools to describe and analyze data. The Study Session concludes with an introduction to probability which will help us to make investment decisions when outcomes are uncertain.

Reading Assignments

Quantitative Methods for Investment Analysis, 2nd edition, Richard A Defusco, Dennis W. McLeavey, Jerald E. Pinto, and David E. Runkle (CFA Institute, 2004)

6. "The Time Value of Money," Ch. 1
7. "Discounted Cash Flow Applications," Ch. 2
8. "Statistical Concepts and Market Returns," Ch. 3
9. "Probability Concepts," Ch. 4

6 The Time Value Of Money

Learning Outcome Statements (LOS)

6-a	**Explain** an interest rate as the sum of a real risk-free rate, expected inflation, and premiums that compensate investors for distinct types of risk.
6-b	**Calculate** and **interpret** the effective annual rate, given the stated annual interest rate and the frequency of compounding.
6-c	**Solve** time value of money problems when compounding periods are other than annual.
6-d	**Calculate** the PV of a perpetuity.
6-e	**Calculate** and **interpret** the FV and PV of a single sum of money, ordinary annuity, annuity due, or a series of uneven cash flows.
6-f	**Draw** a time line, **specify** a time index, and **solve** problems involving the time value of money as applied, for example, to mortgages and savings for college tuition or retirement.
6-g	**Show** and **explain** the connection between present values, future values, and series of cash flows.

Introduction

This is one of the most important Reading Assignments at Level I, and you must excel at calculating the present value and future value of cash flows. The time value of money is not only important at Level I but also at Levels II and III. Your investment now will pay off in your future studies.

When possible answer questions with your CFA Institute-approved financial calculator: Hewlett-Packard HP-12C or Texas Instruments BA II Plus. Practicing questions on the HP-12C or BA II Plus from the outset will help bolster your confidence for examination day, and you need not worry about learning new keystrokes at the last minute before the exam.

Note for BA II Plus users: before you attempt any of the examples, change the default number of annual compounding periods from 12 to 1. Do this by following these keystrokes:

2nd [P/Y] 1 ENTER 2nd [QUIT]

Interest rate and risk

LOS 6-a

Explain an interest rate as the sum of a real risk-free rate, expected inflation, and premiums that compensate investors for distinct types of risk.

An interest rate is simply the rate of return that links cash flows paid or received on different dates, or the required rate of return if a sum of money is received in one year's time rather than today. It is the opportunity cost of money since it is the interest lost if money is spent today rather than saved for a year. The interest rate is often referred to as the discount rate.

The interest rate, denoted by r, is made up of a real risk-free rate plus four risk premiums that compensate for risk.

r = Real risk-free rate + Inflation premium + Default risk premium + Liquidity premium+ Maturity premium

The **real risk-free rate** is the interest rate for a totally risk-free security assuming expectations of zero inflation. It reflects the underlying preference of individuals to consume today rather than tomorrow.

The **inflation premium** reflects the average inflation rate expected by investors and the inflation premium compensates for the erosion of purchasing power due to inflation. The nominal risk-free rate is approximately the sum of the real risk-free rate and the inflation rate (strictly the product of 1 plus the real risk-free rate and 1 plus the inflation rate). In the US, for example, the nominal risk-free rate is quoted as the Treasury bill rate over the appropriate time horizon.

A **default risk premium** is the compensation for the risk that the borrower will fail to make a payment that is contractually agreed.

The **liquidity premium** reflects the time or the cost involved in converting the asset to cash. A Treasury bill does not pay a liquidity premium but for a bond which is illiquid and/or is a long time way from maturity there might well be a liquidity premium.

A **maturity premium** reflects the increased sensitivity of long-term debt to a change in market interest rates. The difference in interest rates on long-term debt versus short-term debt will partly be explained by a maturity premium.

Future value and present value of a single sum

Inflation erodes the purchasing power of money, so one dollar tomorrow will buy fewer goods and services than one dollar today. We now need to answer the question: "what is a dollar to be received sometime in the future worth today?"

Future value of a single sum of money

Starting with a known value today (present value), Equation 6-1 finds the future value (FV) for a single sum of money paid over a number of discrete periods:

Equation 6-1

To calculate the future value (FV) and present value (PV) of a single sum of money use:

$$FV_N = PV(1+r)^N$$

where

FV_N	=	future value, N periods from today
N	=	number of periods from today
PV	=	present value today
r	=	rate of interest, or required rate of return, per period

If interest rates are assumed to be positive, then FV_N will always be greater than PV.

The raising of the term in brackets by the exponent N is called compounding. As interest is calculated in the first period, it is added to the initial amount to yield the closing balance for the first period. Interest is calculated on this higher closing value, therefore, the second interest payment will be higher than in the first period. This process continues each and every period.

Example 6-1 Future value of a single sum of money

A lump-sum of $1,000 is deposited today into an account that will pay interest at a rate of 10 percent annually for three years. What will be the value of the deposit at the end of three years?

Write down the known variables, and use Equation 6-1 to solve for FV_N.

Explicit use of Eq. 6-1:

$$PV = \$1{,}000$$
$$r = 10\% = 0.10$$
$$N = 3$$
$$FV_N = PV(1+r)^N$$
$$= \$1{,}000(1+0.1)^3$$
$$= \$1{,}000 \times 1.10^3$$
$$= \$1{,}000 \times 1.331$$
$$= \$1{,}331.00$$

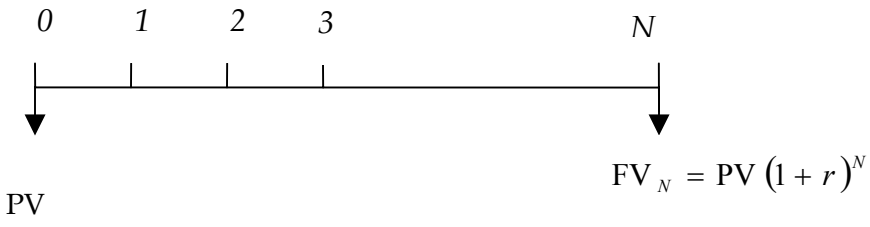
Calculator keystrokes for:

HP-12C		BA II Plus	
f CLEAR FIN		2nd [QUIT] 2nd [CLR TVM]	
1000 CHS PV		1000 +/- PV	
	-1,000.00		PV = -1,000.00
10 i	10.00	10 I/Y	I/Y = 10.00
3 n	3.00	3 N	N = 3.00
FV	1,331.00	CPT FV	FV = 1,331.00

You can directly enter percentages into the CFA Institute-approved calculators; only convert percentages to decimals if you are explicitly using Equation 6-1 (and equations to follow).

The deposit is a cash outflow; therefore PV is entered into the calculators as a negative value.

A time line can also be used to show the relationship between present values and future values. In a time line the index t represents a point in time a stated number of periods from today, so for a time N periods from today t = N. A time line is shown below:



Present value of a single sum of money

Starting with a known future value, Equation 6-1 can be rearranged for present value (PV) for a single sum of money:

Equation 6-2

$$PV = \frac{FV_N}{(1+r)^N}$$

where all variables have been defined in Equation 6-1.

The process of bringing distant cash flows to today is called discounting, which is the fundamental quantitative technique of investment analysis.

Assuming that the rate of interest (r) is positive, the denominator in Equation 6-2 will be greater than 1.0, and dividing FV by a number greater than 1.0 will always make PV < FV.

Note that PV does not have the subscript N. Unlike FV_N, PV can only be at one time: today.

Example 6-2 Present value of a single sum of money

An investment will be worth $7,000 in five years' time, and the opportunity cost rate (the best rate of return available on investments of similar risk) over the next five years will be 3 percent. What is the fair value of the investment today?

Write down the known variables, and use Equation 6-2 to solve for PV.

Explicit use of Eq. 6-2:

$$FV = \$7{,}000$$
$$r = 3\% = 0.03$$
$$N = 5$$
$$PV = \frac{FV}{(1+r)^N} = \frac{\$7{,}000}{(1+0.03)^5} = \frac{\$7{,}000}{1.15927} = \$6{,}038.26$$

Calculator keystrokes for:

HP-12C

f CLEAR FIN	
7000 FV	7,000.00
3 i	3.00
5 n	5.00
PV	-6,038.26

BA II Plus

2nd [QUIT] 2nd [CLR TVM]	
7000 FV	FV = 7,000.00
3 I/Y	I/Y = 3.00
5 N	N = 5.00
CPT PV	PV = -6,038.26

The investment will be a cash inflow in five years' time; therefore, FV is entered into the calculators as a positive value.

Stated and effective annual interest rates

LOS 6-b

Calculate and **interpret** the effective annual rate, given the stated annual interest rate and the frequency of compounding.

In all of the previous examples, we have assumed that interest payments are made once a year. In many cases, however, interest is paid more frequently than once a year, even though the interest rate is quoted in annual terms. The stated annual interest rate excludes the reinvestment of interest; whereas, the effective annual rate (EAR) includes the reinvestment of interest. The EAR for m compounding periods per year is given by Equation 6-3.

Equation 6-3

$$EAR = \left(1 + \frac{r_S}{m}\right)^m - 1$$

where

m	=	number of compounding periods per year
r_s	=	stated annual interest rate

If interest were paid continuously, then the EAR is given by Equation 6-4:

Equation 6-4

$$EAR = e^{r_S} - 1$$

If interest is compounded more frequently than once a year (m > 1), than the EAR will be higher than the stated rate. If interest is paid annually (m = 1), then the EAR will equal the stated annual rate.

Example 6-3 Computing effective annual rates

An investment product offers a stated annual interest rate of 6 percent, and interest will be reinvested at the same rate. What is the effective annual rate if interest is paid

annually?

quarterly?

monthly?

continuously?

If interest is paid annually, then m = 1, and we use Equation 6-3 to solve for EAR:

$$EAR = \left(1 + \frac{r_S}{m}\right)^m - 1 = \left(1 + \frac{0.06}{1}\right)^1 - 1 = 1 + 0.06 - 1 = 0.06, \text{ or } 6\%$$

If interest is paid quarterly, then m = 4, and we use Equation 6-3 to solve for EAR:

$$EAR = \left(1 + \frac{r_S}{m}\right)^m - 1 = \left(1 + \frac{0.06}{4}\right)^4 - 1 = (1 + 0.015)^4 - 1 = 0.0614, \text{ or } 6.14\%$$

If interest is paid monthly, then m = 12, and we use Equation 6-3 to solve for EAR:

$$EAR = \left(1 + \frac{r_S}{m}\right)^m - 1 = \left(1 + \frac{0.06}{12}\right)^{12} - 1 = (1 + 0.005)^{12} - 1 = 0.0617, \text{ or } 6.17\%$$

If interest is paid continuously, and we use Equation 6-4 to solve for EAR:

$$EAR = e^{r_S} - 1 = e^{0.06} = 1.0618 - 1 = 0.0618, \text{ or } 6.18\%$$

Note that the EAR becomes higher as the compounding frequency increases.

Value of money for periods other than annual

LOS 6-c

Solve time value of money problems when compounding periods are other than annual.

If payments are made more frequently than once a year we also need to adjust the FV formula. Equation 6-5 is the adjusted FV formula.

Equation 6-5

$$FV_N = PV\left(1 + \frac{r_S}{m}\right)^{m \times N}$$

where

m	=	number of compounding periods per year
r_s	=	stated annual interest rate
N	=	number of years

As the compounding frequency increases, FV increases. If taken to the limit, interest can be compounded over an infinite number of periods (m approaches ∞). This leads to the continuous compounding formula, shown in Equation 6-6:

Equation 6-6

$$FV_N = PVe^{r_S \times N}$$

where

e is the natural exponent whose value is approximately 2.7183.

To practice invoking the programmed value of e on your CFA Institute-approved financial calculator, follow the appropriate keystrokes:

HP-12C	1 [g] [e^x]	**2.7183**
BA II Plus	1 [2nd] [e^x]	**2.7183**

Example 6-4 Comparing FV for different compounding periods

An investment product offers a stated annual interest rate of 6 percent, with a three-year maturity. Interest will be reinvested at the same rate. If an investor buys $1,000 of the product, how much money will he receive in three years' time, assuming that interest is paid

annually?

quarterly?

monthly?

continuously?

Write down the known variables:

$PV = \$1{,}000$

$r_S = 6\%, \text{or } 0.06$

$N = 3$

If interest is paid annually, then m = 1, and we use Equation 6-1 to solve for FV:

$$FV_N = \$1{,}000(1+0.06)^3 = \$1{,}000 \times 1.191016 = \$1{,}191.02$$

If interest is paid quarterly, then m = 4, and we use Equation 6-5 to solve for FV:

$$FV_N = \$1{,}000\left(1+\frac{0.06}{4}\right)^{4\times 3} = \$1{,}000(1+0.015)^{12} = \$1{,}000 \times 1.195618 = \$1{,}195.62$$

If interest is paid monthly, then m = 12, and we use Equation 6-5 to solve for FV:

$$FV_N = \$1{,}000\left(1+\frac{0.06}{12}\right)^{12\times 3} = \$1{,}000(1+0.005)^{36} = \$1{,}000 \times 1.196681 = \$1{,}196.68$$

If interest is paid continuously, then use Equation 6-6 to solve for FV:

$$FV_N = PVe^{r_S \times N} = \$1{,}000e^{0.06\times 3} = \$1{,}000e^{0.18} = \$1{,}000 \times 1.197217 = \$1{,}197.22$$

Note that the FV becomes higher as the compounding frequency (m) increases.

Both CFA Institute-approved financial calculators can accommodate compounding periods that are more frequent that annually. Here, we demonstrate quarterly compounding over three years for an initial $1,000 deposit:

HP-12C		BA II Plus	
f CLEAR FIN	0.00	2nd [QUIT] 2nd [CLR TVM]	
1000 CHS PV	-1,000.00	2nd [P/Y] 4 ENTER	P/Y = 4.00
6 ENTER 4 ÷ i	1.50	2nd [QUIT]	
3 ENTER 4 × n	12.00	1000 +/- PV	PV = -1,000.00
FV	1,195.62	6 I/Y	I/Y = 6.00
		3 2nd [×P/Y] N	N = 12.00
		CPT FV	FV = 1,195.62

The HP-12C has special keys to handle monthly compounding, and resetting the BA II Plus restores monthly compounding as the default.

HP-12C		BA II Plus	
f CLEAR FIN	0.00	2nd [RESET] ENTER	
1000 CHS PV	-1,000.00	1000 +/- PV	PV = -1,000.00
6 g 12÷	0.50	6 I/Y	I/Y = 6.00
3 g 12×	36.00	3 2nd [×P/Y] N	N = 36.00
FV	1,196.68	CPT FV	FV = 1,196.68

A series of keystrokes invoking the percentage-change registers will enable both the HP-12C and BA II Plus to handle continuous compounding:

HP-12C		BA II Plus	
f CLEAR FIN	0.00	2nd [QUIT] 2nd [CLR TVM]	
1000 CHS PV	-1,000.00	2nd [P/Y] 1 ENTER	P/Y = 1.00
1 ENTER 6 % g e^x Δ% i	6.18	2nd [QUIT] 2nd [◢%]	
3 ENTER n	3.00	1 ENTER	OLD = 1.00
FV	1,197.22	⇩ 6 % 2nd [e^x] ENTER	NEW = 1.06
		⇩ CPT I/Y	%CH = 6.18
		2nd [QUIT]	
		1000 +/- PV	PV = -1,000.00
		3 N	N = 3.00
		CPT FV	FV = 1,197.22

LOS 6-e

Calculate and **interpret** the FV and PV of a single sum of money, ordinary annuity, an annuity due, or a series of uneven cash flows.

Series of cash flows (annuities)

In general, an annuity is a series of periodic, equal payments that occur during period N, and all payments are assumed to grow at a constant rate of interest (r). For ordinary annuities the first payment is made at the end of the first period.

The **future value** of an ordinary annuity is given by Equation 6-7:

Equation 6-7

$$FV_N = A\left[\frac{(1+r)^N - 1}{r}\right]$$

where

FV_N	=	future value of the annuity of N equal payments
A	=	amount of equal annuity payments
N	=	number of equal annuity payments
r	=	rate of interest, or required rate of return, per period

The term in brackets in Equation 6-7 is called the future value annuity factor, which gives the future value of an ordinary annuity of $1 per period.

Example 6-5 Future value of an ordinary annuity

An investor will make payments of $2,000 at the end of each of the next ten years, and the payments earn interest at an annual rate of 5 percent. Calculate the value of the accumulated funds at the end of the ten years.

Write down the known variables, and use Equation 6-7 to solve for FV.

Explicit use of Eq. 6-7:

$$A = \$2{,}000$$
$$r = 5\% = 0.05$$
$$N = 10$$
$$FV_N = A\left[\frac{(1+r)^N - 1}{r}\right]$$
$$= \$2{,}000\left[\frac{(1+0.05)^{10} - 1}{0.05}\right]$$
$$= \$2{,}000 \times 12.57789$$
$$= \$25{,}155.79$$

Calculator keystrokes for:

HP-12C		BA II Plus	
[f] CLEAR [FIN]		[2nd] [QUIT] [2nd] [CLR TVM]	
2000 [CHS] [PMT]	-2,000.00	2000 [+/-] [PMT]	PMT = -2,000.00
5 [i]	5.00	5 [I/Y]	I/Y = 5.00
10 [n]	10.00	10 [N]	N = 10.00
[FV]	25,155.79	[CPT] [FV]	FV = 25,155.79

If the first payment is made immediately, rather than paid at the end of the first year, then the annuity is an annuity due. To calculate the future value of an annuity due, multiply by the FV of an ordinary annuity by (1 + r), since all annuity payments will be received one period earlier and will earn an extra period of interest.

Equation 6-8 is the formula for an annuity due:

Equation 6-8

$$FV_N = A\left[\frac{(1+r)^N - 1}{r}\right](1+r)$$

where all variables have been defined previously.

Example 6-6 Future value of an annuity due

An investor will make payments of $2,000 at the beginning of each of the next ten years, and the payments earn interest at an annual rate of 5 percent. Calculate the value of the accumulated funds at the end of the ten years.

Write down the known variables, and use Equation 6-8 to solve for FV.

Explicit use of Eq. 6-8:

$A = \$2{,}000$

$r = 5\% = 0.05$

$N = 10$

$$FV_N = A\left[\frac{(1+r)^N - 1}{r}\right](1+r)$$

$$= \$2{,}000\left[\frac{(1+0.05)^{10} - 1}{0.05}\right](1+0.05)$$

$$= \$2{,}000 \times 12.57789 \times 1.05$$

$$= \$26{,}413.57$$

Calculator keystrokes for:

HP-12C

f CLEAR FIN	
g BEG	
2000 CHS PMT	
	-2,000.00
5 i	5.00
10 n	10.00
FV	26,413.57

BA II Plus

2nd [QUIT] 2nd [CLR TVM]	
2nd [BGN] 2nd [SET] 2nd [QUIT]	
2000 +/- PMT	
	PMT = -2,000.00
5 I/Y	I/Y = 5.00
10 N	N = 10.00
CPT FV	FV = 26,413.57*

Note that all variables in this example are the same as those in the Example 6-5 for an ordinary annuity. The future value of an annuity due will always be larger than the future value of an ordinary annuity because all payments will have one extra period to grow, which accounts for the multiplication of the annuity due by (1 + r).

Equation 6-9 gives the present value of an ordinary annuity:

Equation 6-9

$$PV = A\frac{\left[1-\frac{1}{(1+r)^N}\right]}{r}$$

where all variables have been defined previously.

Example 6-7 Present value of an ordinary annuity

An investor will make payments of $2,000 at the end of each of the next ten years, and the payments earn interest at an annual rate of 5 percent. Calculate today's value of the accumulated funds.

Write down the known variables, and use Equation 6-9 to solve for PV.

Explicit use of Eq. 6-9:

$$A = \$2{,}000$$
$$r = 5\% = 0.05$$
$$N = 10$$
$$PV = A\frac{\left[1-\frac{1}{(1+r)^N}\right]}{r}$$
$$= \$2{,}000\frac{\left[1-\frac{1}{(1+0.05)^{10}}\right]}{0.05}$$
$$= \$2{,}000 \times 7.72173$$
$$= \$15{,}443.46$$

Calculator keystrokes for:

HP-12C

f CLEAR FIN	
g END	
2000 CHS PMT	
	-2,000.00
5 i	5.00
10 n	10.00
PV	15,443.47

BA II Plus

2nd [QUIT] 2nd [CLR TVM]	
2000 +/- PMT	
	PMT = -2,000.00
5 I/Y	I/Y = 5.00
10 N	N = 10.00
CPT PV	PV = 15,443.47

Equation 6-10 gives the present value of an annuity due:

Equation 6-10

$$PV = A\frac{\left[1-\frac{1}{(1+r)^N}\right]}{r}(1+r)$$

where all variables have been defined previously.

You might be surprised that the right hand side of Equation 6-10 is multiplied rather than divided by (1 + r). Compared with an ordinary annuity, there is one less discounting period for each payment, which results in the multiplication by (1 + r).

Example 6-8 Present value of an annuity due

An investor will make payments of $2,000 at the beginning of each of the next ten years, and the payments earn interest at an annual rate of 5 percent. Calculate today's value of the accumulated funds.

Write down the known variables, and use Equation 6-10 to solve for PV.

Explicit use of Eq. 6-10:

$A = \$2{,}000$

$r = 5\% = 0.05$

$N = 10$

$$PV = A\frac{\left[1-\frac{1}{(1+r)^N}\right]}{r}(1+r)$$

$$= \$2{,}000\frac{\left[1-\frac{1}{(1+0.05)^{10}}\right]}{0.05}(1+0.05)$$

$$= \$2{,}000 \times 7.72173 \times 1.05$$

$$= \$16{,}215.63$$

Calculator keystrokes for:

HP-12C

f CLEAR FIN	
g BEG	
2000 CHS PMT	
	-2,000.00
5 i	5.00
10 n	10.00
PV	16,215.64

BA II Plus

2nd [QUIT] 2nd [CLR TVM]	
2nd [BGN] 2nd [SET] 2nd [QUIT]	
2000 +/- PMT	
	PMT = -2,000.00
5 I/Y	I/Y = 5.00
10 N	N = 10.00
CPT PV	PV = 16,215.64*

When there are unequal cash flows and we need to calculate the PV of this series of cash flows, we will need to compute the PV of each cash flow individually and then calculate the sum of these PVs. Similarly to calculate the FV we will need to calculate the FV of each cash flow individually and then take the sum of these FVs.

Example 6-9 FV and PV of a series of uneven cash flows

An investment will pay $5,000 at the end of the first year, $4,000 at the end of the second year, and $3,000 at the end of the third year. If the required rate of return is 12 percent, what will be the value of these payments at the end of three years?

Calculate the FV of each cash flow separately by compounding, and add them together:

Year 1: FV of $5,000	=	$5,000 × $(1.12)^2$	=	$6,272.00
Year 2: FV of $4,000	=	$4,000 × $(1.12)^1$	=	$4,480.00
Year 3: FV of $3,000	=	$3,000 × $(1.12)^0$	=	$3,000.00
		Sum	=	$13,752.00

If the cash flows were paid at the beginning of each year, then all of the cash flows would have been compounded by an extra period.

Calculate the PV of each cash flow separately by discounting, and add them together:

$$\begin{aligned} PV &= \frac{\$5{,}000}{(1.12)^1} + \frac{\$4{,}000}{(1.12)^2} + \frac{\$3{,}000}{(1.12)^3} \\ &= \$4{,}464.29 + \$3{,}188.78 + \$2{,}135.34 \\ &= \$9{,}788.41 \end{aligned}$$

We could have obtained the same answer by discounting $13,752 for three years:

$$\begin{aligned} PV &= \frac{FV}{(1+r)^N} \\ &= \frac{\$13{,}752}{(1+0.12)^3} \\ &= \frac{\$13{,}752}{1.404928} \\ &= \$9{,}788.40 \end{aligned}$$

You can also use the cash-flow worksheet embedded in your CFA Institute-approved financial calculator to solve for PV (but not FV) of a series of uneven cash flows:

Calculator keystrokes for:			
HP-12C		**BA II Plus**	
f CLEAR FIN	0.00	CF 2nd [CLR WORK]	$CF_0 = 0.00$
0 g CF_0	0.00	0 [ENTER]	$CF_0 = 0.00$
5000 g CF_j	5,000.00	⇩ 5000 [ENTER]	C01 = 5,000.00
4000 g CF_j	4,000.00	⇩ ⇩ 4000 [ENTER]	C02 = 4,000.00
3000 g CF_j	3,000.00	⇩ ⇩ 3000 [ENTER]	C03 = 3,000.00
12 i	12.00	NPV 12 [ENTER]	I = 12.00
f NPV	9,788.40	⇩ CPT	NPV = 9,788.40

LOS 6-d

Calculate the PV of a perpetuity.

A perpetuity is a special case of an ordinary annuity. A perpetuity's payments begin at the end of the first period, but the periodic payments last forever. Because there is not end date for perpetuities, you cannot calculate the FV of them. Thus, you can calculate only the PV of a perpetuity.

Equation 6-11 is the formula for the present value of a perpetuity:

Equation 6-11

$$PV = \frac{A}{r}$$

where all variables have been defined previously.

Example 6-10 Present value of a perpetuity

A perpetuity makes annual payments of $1,000, and the current rate of interest is 6 percent. What is the current value of the perpetuity?

Write down the known variables, and use Equation 6-11 to solve for PV:

$$A = \$1{,}000$$

$$r = 6\% = 0.06$$

$$PV = \frac{A}{r}$$

$$PV = \frac{\$1{,}000}{0.06}$$

$$PV = \$16{,}666.67$$

If cash flows or payments are not equal for each period then the cash flows must be discounted individually to calculate the present value, or compounded individually to calculate the future value.

Up to now we have looked at examples where we have been given the interest rate, number of time periods and either the present value or future values of the cash flows. We can use the same equations to calculate the interest rate, number of payments or periods, or annuity amount when the present or future values are given. The CFA Institute-approved financial calculators can easily solve for any unknown variable.

Example 6-11 Rate of interest for a perpetuity

A perpetuity with annual payments of $1,000 has a current market price of $7,125. Calculate the implied rate of interest:

Rearrange Equation 6-11 and solve for r

$$A = \$1000$$

$$PV = \$7{,}125$$

$$PV = \frac{A}{r}$$

$$\$7{,}125 = \frac{\$1{,}000}{r}$$

$$r = \frac{\$1{,}000}{\$7{,}125} = 0.140, \text{ or } 14.0\%$$

Example 6-12 Calculate the number of periods

An investor puts $200,000 into a mutual fund and expects to receive a return of 12% per annum. How long will it take to double the size of the investment?

Using Equation 6-1

$$FV_N = PV(1+r)^N$$

$$(1.12)^N = 2$$

Now we need to take the logarithm of both sides

$$N\ln(1.12) = \ln 2$$

$$N = 0.693/0.113 = 6.13$$

Or use a financial calculator.

It will take 6.13 years to double the value of the investment.

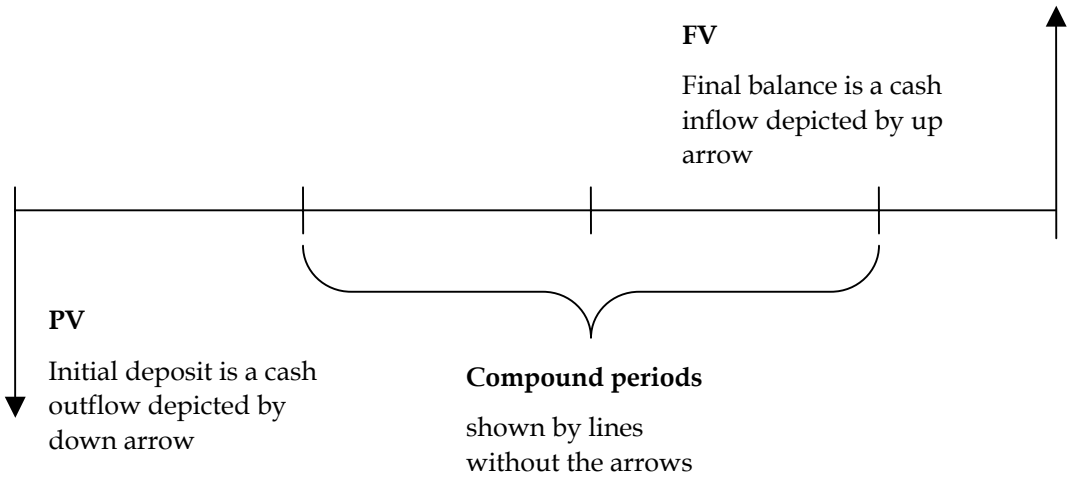
LOS 6-f

Draw a time line, **specify** a time index, and **solve** problems involving the time value of money as applied, for example, to mortgages and savings for college tuition or retirement.

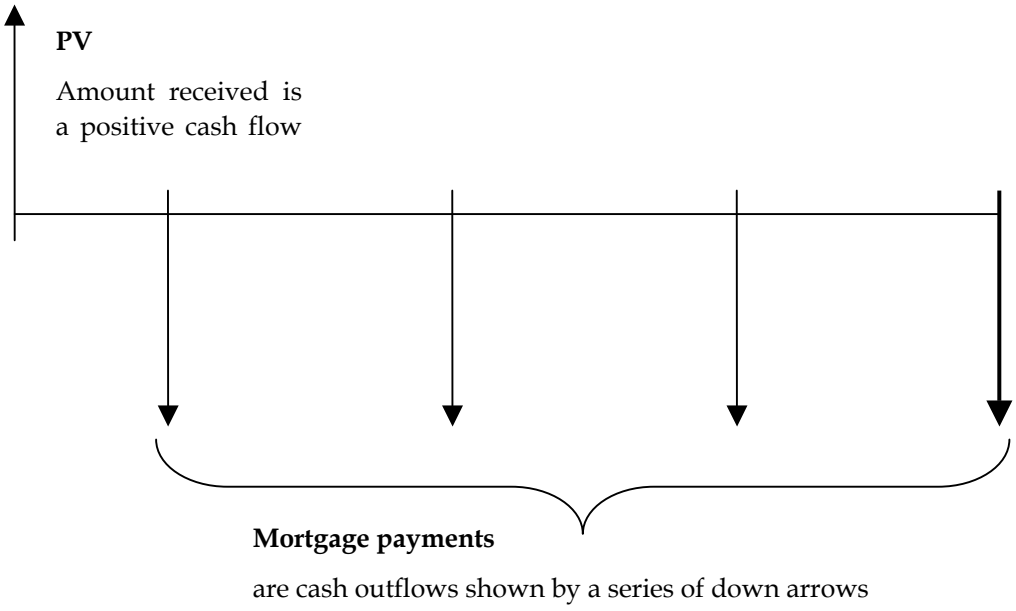
Time lines

A time line illustrates cash inflows and outflows for any given financial problem. A **time index** is a scale used on the time line to distinguish between PF, FV, and the intermediate cash flows. By visualizing the problem, a time line can help solve any financial problem.

Consider the time line containing information about a single cash deposit:



For a mortgage, the borrower receives an initial cash inflow (positive PV) and makes a series of payments (negative outflow) over the life of the mortgage.



We now look at solving questions on mortgages and savings plans.

Example 6-13 Mortgage payments

A house purchase is financed with a 20-year fixed rate mortgage with monthly payments. $200,000 is borrowed, and the interest rate is 6%. Monthly mortgage payments can be calculated using Equation 6-9 for the PV of an annuity.

PV = $200,000

Periodic interest rate = 6%/12 = 0.5%

Number of periods = 20 x 12 = 240

$$PV = A\frac{\left[1-\frac{1}{(1+r)^N}\right]}{r}$$

$$\$200{,}000 = A \times (200 - 60.4)$$

$$A = \$1{,}433$$

$1,433 is the monthly mortgage payment.

Example 6-14 Saving for retirement

An employee is saving for retirement and can afford to save $6,000 at the end of each year for the next 25 years. He decides to invest the money in a portfolio of assets that he expects to earn 8% per annum. At the end of 25 years the amount that he estimates will be available is given using Equation 6-7 for the future value of an ordinary annuity.

$$FV = A\left[\frac{(1+r)^N - 1}{r}\right]$$

$$= \$6{,}000\left[(1.08)^{25} - 1\right]/0.08$$

$$= \$6{,}000\,(5.8485)/0.08$$

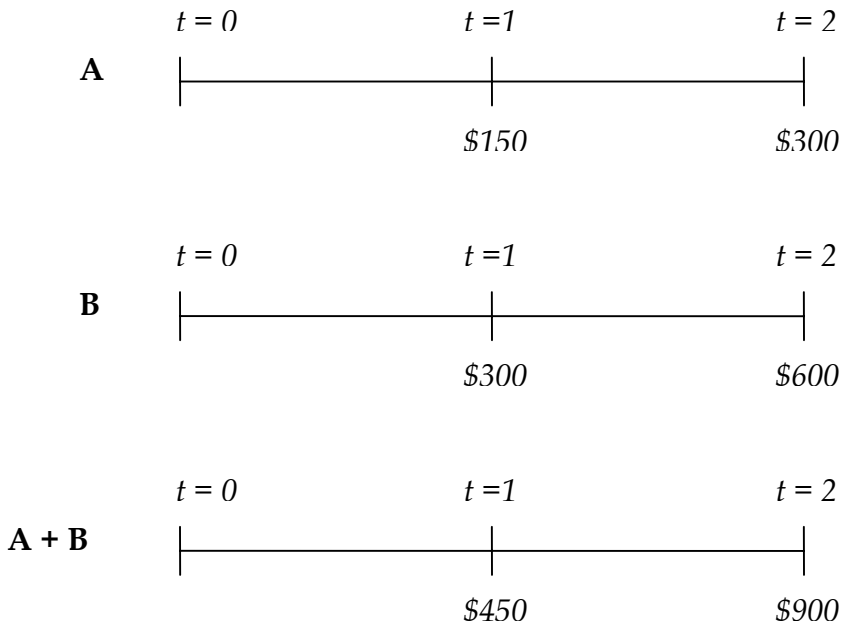
$$= \$438{,}638$$

LOS 6-g

Show and **explain** the connection between present values, future values, and series of cash flows.

We have seen in the preceding examples how present and future values of money are linked and also how a series of cash flows in the future are equivalent to a lump sum today (if they are equal cash flows this is the cost of the annuity). Similarly a series of cash flows has an equivalent lump sum value in the future.

When there are more than one series of cash flows the cash flow additivity principle says that cash flows indexed at the same point of time are additive. We can see this by looking at time lines. Assume two series of cash flows, A and B, as shown below:



If interest rates are 10% the future value of A's and B's cash flows are

A: $150(1.10) + $300 = $465

B: $300(1.10) + $600 = $930

The sum of the future values is $1,395. This is the same as the future value of the combined cash flows:

A + B: $450(1.10) + $900 = $1,395.

7 Discounted Cash Flow Applications

Learning Outcome Statements (LOS)

7-a	**Calculate** and **interpret** the net present value (NPV) and the internal rate of return (IRR) of an investment.
7-b	**Contrast** the NPV rule to the IRR rule.
7-c	**Discuss** problems associated with the IRR method.
7-d	**Calculate, interpret** and **distinguish** between the money-weighted and time-weighted rates of return of a portfolio and appraise the performance of portfolios based on these measures.
7-e	**Calculate** and **interpret** the bank discount yield, holding period yield, effective annual yield, and money market yield for a U.S. Treasury bill.
7-f	**Convert** and **interpret** among holding period yields, money market yields, and effective annual yields.
7-g	**Calculate** and **interpret** the bond equivalent yield.

Introduction

In the section we apply time value of money analysis to valuing financial instruments. First of all we consider internal rates of return and net present value calculations; these provide a critical input to the decision whether any investment (bond, equity, real estate etc.) is attractive or not. We also consider alternative measures for calculating portfolio returns and the impact of the choice of method on the calculation results. Finally we analyze cash flows from short-term money market instruments and look at the different methods for calculating yields.

LOS 7-a

Calculate and **interpret** the net present value (NPV) and the internal rate of return (IRR) of an investment.

Net Present Value (NPV)

NPV differs from present value (PV) in that it takes into account cash outflows. In the context of valuing an investment this means the present value is adjusted for the cost (cash outflow) of the investment.

The steps in valuing a project or investment are:

Step 1 Identify all the cash inflows and outflows

Step 2 Identify the appropriate discount rate or opportunity cost of capital

Step 3 Calculate the PV of each cash flow, outflows are negative, inflows are positive

Step 4 Sum all the PVs to arrive at the NPV of the project or investment

Step 5 Apply the NPV rule. If the NPV of a project or investment is positive, it is expected to add to shareholders' wealth and we should accept the investment, and if it is negative we should reject it.

The formula for NPV is given in Equation 7-1.

Equation 7-1

where

CF_t	=	expected net cash flow at time t
N	=	investment's life
r	=	discount rate or opportunity cost of capital

Example 7-1 Net present value

A company is considering an investment which will cost \$8 million and will generate net cash flows of \$1 million per annum in perpetuity. If the cost of capital is 12% should the investment be accepted or rejected?

$$NPV = CF_0 + \overline{CF}/r$$
$$= -\$8{,}000{,}000 + (\$1{,}000{,}000/0.12)$$
$$= \$333{,}333$$

where

= the cash flow in perpetuity

Since this is positive the project should be accepted.

Internal rate of return

This is the rate of return generated by an investment and it is the rate of return or discount rate which makes the NPV = 0, using Equation 7-1

NPV = 0 =

or, if we arrange and the investment equals the initial cash flow

Investment =

The assumption is made that cash flows are reinvested at the IRR.

The decision rule is that if the IRR is greater than the opportunity cost of capital (or hurdle rate) then the investment should be accepted, if less then the investment should be rejected.

Example 7-2 Internal rate of return

Using the data in Example 7-1, we need to solve

$8,000,000 = $1,000,000/IRR

IRR = 0.125 or 12.5%

Therefore, if the cost of capital is less than 12.5% then the company should invest, if it is more than 12.5% they should not invest, and if it is equal, investment will increase the size of the company but not increase stockholders' wealth.

LOS 7-b

Contrast the NPV rule to the IRR rule.

The NPV and IRR methods give the same decision for projects which are independent but when a company is making a choice between different projects, of different sizes or with different timings of cash flow, the two methods may produce conflicting recommendations. Since the NPV method uses the market-determined cost of capital, and we are concerned with shareholder wealth, it is the better measure to use.

These concepts are covered again in Study Session 11, Reading 47.

LOS 7-c

Discuss problems associated with the IRR method.

It is important to note that if the cash flows could only be reinvested at a rate less than the IRR, or 12.5% in Example 7-2, the actual return realized will be less than the IRR. Similarly if the reinvestment rates available are higher then the return would be higher.

LOS 7-d

Calculate, interpret and **distinguish** between the money-weighted and time-weighted rates of return of a portfolio and appraise the performance of portfolios based on these measures.

Measuring portfolio returns

Two ways of measuring the return from a portfolio are the money-weighted and time-weighted rates of return.

1. *Money-weighted rate of return*

This is the same as the internal rate of return for a portfolio and takes into account the timing and amount of cash flows in and out of a portfolio.

Example 7-3 Money-weighted rate of return

An investor purchases a share at $100 and a year later purchases another share at $120. At the end of the second year he sells both shares at $125 per share. He receives dividends of $5 per share at the end of each year but does not reinvest the dividends.

PV (outflows) = PV (inflows)

The outflows are the payments for the shares and the inflows are the dividends received and the proceeds of the sale of the shares. So if r is the internal rate of return or the discount factor used:

$$\$100 + \frac{\$120}{(1+r)} = \frac{\$5}{(1+r)} + \frac{\$10}{(1+r)^2} + \frac{\$250}{(1+r)^2}$$

Using a financial calculator to solve for r, r = 13.69%

Note - although the portfolio holding period return in the first year was ($120 + $5 - $100)/$100 = 25%, and in the second year was ($250 + $10 - $240)/$240 = 8.33% the money-weighted rate of return is below the average holding period returns. This is because the portfolio performed less well in the second year when there was more money invested in the portfolio.

2, *Time-weighted rate of return*

This is the standard measure of performance in the fund management industry. The returns from different periods are averaged over time but it requires doing the following for an exact measure:

1. Value the portfolio before any significant addition or withdrawal of funds, look at subperiods between cash inflows and outflows.

2. Calculate the holding period returns for each subperiod.

3. Compound the holding period returns to obtain the rate of return for the complete year. If required take the geometric mean of the annual returns to obtain the return over a longer measurement period.

Example 7-4 Time-weighted rate of return

Looking at the portfolio returns in Example 7-3 we have calculated the holding period returns to be 25% and 8.33%. Over the two periods we can calculate the time-weighted rate of return, R, by using

$$(1+R)^2 = (1.25)(1.0833)$$

R = 16.37%

This is the return achieved for each $1 invested in the portfolio at the beginning of the period.

Another example should help clarify the different results obtained from using the money-weighted and time-weighted rates of return.

Example 7-5 Money and time-weighted rate of return

A new fund was started with a value of $100 million, after 3 months the fund was revalued at $125 million and another $25 million was raised from investors. At the end of the year the fund had fallen in value to $140 million.

The money-weighted quarterly rate of return is given by r where

PV (outflows) = PV (inflows)

$$\$100 + \frac{\$25}{(1+r)} = \frac{\$140}{(1+r)^4}$$

Solving for r gives r = 3.025%

The annualized money–weighted rate of return is therefore $(1.03025)^4 - 1 = 13.65\%$

To calculate the time-weighted rate of return we need to calculate the rate of return in the first quarter and then the subsequent three quarters:

1Q, R = ($125 - $100)/$100 = 25%

2Q-4Q, R = ($140 - $150)/$150 = -6.67%

The annualized time–weighted rate of return is therefore

(1.25)(0.9333) – 1 = 16.66%

This is higher than the money-weighted performance since the money-weighted performance is dragged down by the negative performance in the second period when there were more funds invested in the portfolio.

LOS 7-e

Calculate and **interpret** the bank discount yield, holding period yield, effective annual yield, and money market yield for a U.S. Treasury bill.

Pure discount instruments are quoted on a bank discount basis, rather than on a price basis, whereas bonds and other longer-term instruments are quoted on a price basis.

1. Yield on a bank discount basis

The yield on a bank discount basis simply annualizes the discount as a percentage of face value, based on a 360-day year.

Equation 7-2

$$r_{BD} = \frac{D}{F} \times \frac{360}{t}$$

where

r_{BD}	=	annualized yield
D	=	discount amount
F	=	face value of the instruments
t	=	number of days remaining to maturity
360	=	convention for the number of days in the year for a bank discount calculation

Example 7-6 Bank discount yield

A T-bill has a face value of $1,000,000 and 270 days until maturity. What is its bank discount yield if it is selling at $950,000?

Applying Equation 7-2:

$$r_{BD} = \frac{D}{F} \times \frac{360}{t} = \frac{\$50,000}{\$1,000,000} \times \frac{360}{270}$$

$$= 6.67\%$$

The bank discount yield does not meaningfully measure the return earned by an investor since a proper return calculation ought to reflect the return relative to the purchase price and take into account the reinvestment on a compound basis. Also the bank discount yield is based on a 360 rather than 365 day year.

There are three other commonly used yield measures:

2. Holding Period Yield (HPY)

The holding period yield looks at the return (not annualized) relative to the purchase price.

Equation 7-3

$$HPY = \frac{P_1 - P_0 + D_1}{P_0}$$

where

P_0 = initial purchase price

P_1 = price at maturity

D_1 = interest or dividend income received during the holding period

Example 7-7 Holding period yield

The holding period yield of the T-bill in Example 7-6 will be:

HPY= (1,000,000 – 950,000 + 0)/950,000 = 5.26%

3. Effective Annual Yield (EAY)

This is the annualized holding period yield (based on 365 days) and takes into account interest earned on interest.

Equation 7-4

$$EAY = (1 + HPY)^{\frac{365}{t}} - 1$$

where

HPY = holding period yield

t = number of days to maturity

Example 7-8 Effective annual yield

The effective annual yield (EAY) for the T-bill in Example 7-6 will be:

$$EAY = (1 + HPY)^{\frac{365}{t}} - 1 = (1 + 0.0526)^{\frac{365}{270}} - 1 = 7.17\%$$

This is higher since the HPY calculation was based on only 270 days.

4. Money Market Yield (MMY), or the CD Equivalent Yield

This is the annualized holding period yield, but this time based on a 360-day year, to make it comparable with money market instruments that pay interest on this basis.

$$r_{MM} = (HPY)\left(\frac{360}{t}\right) = (r_{BD})\left(\frac{F}{P_0}\right)$$

In many cases we do not know the Treasury bill price so Equation 7-5 is more useful.

Equation 7-5

$$r_{MM} = \frac{360 \times r_{BD}}{360 - t \times r_{BD}}$$

where

r_{BD} = bank discount yield

t = number of days to maturity

Example 7-9 Money market yield

The MMY or CD equivalent yield for the T-bill in Example 7-6 will be:

$$r_{MM} = \frac{360 \times r_{BD}}{360 - t \times r_{BD}} = \frac{360 \times 0.0667}{360 - 270 \times 0.0667} = 7.02\%$$

LOS 7-f

Convert and **interpret** among holding period yields, money market yields, and effective annual yields.

Conversion among HPY, EAY and MMY is illustrated in Example 7-10.

Example 7-10 Conversion calculations

1. Given the MM (CD equivalent) yield is 7.5%, what would be the HPY for a 120-day T-bill?

Using Equation 7-5:

$$\frac{360r_{BD}}{(360-270r_{BD})}=0.075$$

$$r_{BD}=7.692\%$$

$$HPY=\frac{0.07692/(360/120)}{100-0.07692/(360/120)}=2.63\%$$

2. Given the EAY of 180-day T-bill to be 4.56%, what would be the MM (CD equivalent) yield?

Using Equation 7-4

$$EAY=(1+HPY)^{\frac{365}{t}}-1$$

$$HPY=\sqrt{(1+0.0456)}-1=2.255\%$$

The following relationship holds from Equation 7-3:

$$\frac{P_1-P_0}{P_0}=0.02255$$

Assuming $P_1 = 100$, P_0 then is 97.79

$$r_{BD}=\frac{100-97.79}{100}\times\frac{360}{2}=4.41\%$$

$$r_{MM}=\frac{360\times r_{BD}}{360-t\times r_{BD}}=\frac{360\times 0.0441}{360-180\times 0.0441}=4.51\%$$

which is the money market yield

LOS 7-g

Calculate and **interpret** the bond equivalent yield.

A convention in bond markets is to double the semiannual yield to arrive at a yield called the bond-equivalent yield.

Example 7-11 Bond-equivalent yield

A bond has a semiannual yield of 3%.

The annualized, or effective annual yield is $(1.03)^2 - 1 = 6.09\%$

The bond-equivalent yield is simply 3% x 2 = 6%.

8 Statistical Concepts and Market Returns

Learning Outcome Statements (LOS)

8-a	**Describe** the nature of statistics and **differentiate** between descriptive statistics and inferential statistics and between a population and a sample.
8-b	**Explain** the concepts of a parameter and a sample statistic.
8-c	**Explain** the differences among the types of measurement scales.
8-d	**Define** and **interpret** a frequency distribution.
8-e	**Define, calculate** and **interpret** a holding period return (total return).
8-f	**Calculate** and **interpret** relative frequencies and cumulative relative frequencies, given a frequency distribution.
8-g	**Describe** the properties of data presented as a histogram or a frequency polygon.
8-h	**Define, calculate** and **interpret** measures of central tendency, including the population mean, sample mean, arithmetic mean, weighted average or mean (including a portfolio return viewed as a weighted mean), geometric mean, and harmonic mean, median and mode.
8-i	**Describe** and **interpret** quartiles, quintiles, deciles, and percentiles.
8-j	**Define, calculate** and **interpret** 1) a range and mean absolute deviation, and 2) a sample and a population variance and standard deviation.
8-k	**Contrast** variance with semivariance and target semivariance.
8-l	**Calculate** and **interpret** the proportion of observations falling within a specified number of standard deviations of the mean, using Chebyshev's inequality.
8-m	**Define, calculate** and **interpret** the coefficient of variation and the Sharpe ratio.
8-n	**Define** and **interpret** skew, **explain** the meaning of a positively or negatively skewed return distribution, and **describe** the relative locations of the mean, median, and mode for a nonsymmetrical distribution.
8-o	**Define** and **interpret** kurtosis, and measures of population and sample skew and kurtosis.

Introduction

This section provides the tools for describing and analyzing data, and then for drawing conclusions from the analysis. The focus is on return distributions and defining firstly the average or central tendency and secondly the dispersion around this average. We also consider the different types of distributions of returns including normal and skewed distributions. The candidate will be expected to apply these concepts to returns from different investments or portfolios and interpret the implications of different return distributions.

LOS 8-a

Describe the nature of statistics and **differentiate** between descriptive statistics and inferential statistics and between a population and a sample.

LOS 8-b

Explain the concepts of a parameter and a sample statistic.

Statistics

Descriptive statistics is the study of how data can be effectively summarized to provide information on a larger group. **Statistical inference** refers to making estimates or judgments about the larger group. This requires knowledge of probability theory which will be covered in later Readings.

A **population** is all members of a specified group; whereas a **sample** is a subset of the population, which provides information on the population.

A **parameter** is used to describe a characteristic of a population, and population parameters are often unknown values. Population parameters are denoted by Greek letters. For example, the population mean is denoted by Greek letter μ (mu), while the population standard deviation is denoted by σ (sigma). A **statistic** is used to describe a sample, in many cases a sample statistic is computed to estimate a parameter of a population.

LOS 8-c

Explain the differences among the types of measurement scales.

Data can be measured using four different scales:

1. *Nominal scale*: the weakest level of measurement, where integers (integers are whole numbers: 0, 1, 2, 3, …) are assigned to different groups of data. There is no ranking in a nominal scale.
2. *Ordinal scale*: different groups are ordered with respect to a characteristic.
3. *Interval scale*: the scale is ordered and the difference between each scale value is equal. The Celsius scale for measuring temperature is an example of an interval scale.
4. *Ratio scale*: the strongest level of measurement, the ratio scale is an interval scale with zero representing zero value, or absence of, the item being measured. Rates of return of investments would be examples of a ratio scale.

LOS 8-d

Define and **interpret** a frequency distribution.

LOS 8-e

Define, calculate and interpret a holding period return (total return).

LOS 8-f

Calculate and **interpret** relative frequencies and cumulative relative frequencies, given a frequency distribution.

A frequency distribution is the grouping of data into a number of non-overlapping classes or intervals, so that the number of observations in each interval can be counted and the data can then be analyzed. The number of observations in each interval is called the **absolute frequency**, and the **relative frequency** is the percentage of the total observations falling into the interval. The **cumulative relative frequency** for an interval is the sum of the relative frequencies for the lowest interval up to an including the interval. It is the total percentage of the observations that are lower than the upper limit of the interval.

In many cases, analysts and fund mangers are using frequency distributions to summarize rates of return. If this is the case, they are often using the total return, also called the **holding period return** (HPR).

The HPR includes capital appreciation and cash flows paid over the life of the investment, as shown in Equation 8-1:

Equation 8-1

$$HPR = \frac{EV - BV + D}{BV}$$

where:

BV	=	beginning value of investment
EV	=	ending value of investment
D	=	cash distributions over the period (e.g dividends)

Example 8-1 Calculating the holding period return

If a stock is purchased at \$70 and is sold for \$85, and during the holding period the investor received a \$4 dividend, calculate the holding period return.

Write down the known variables, and use Equation 8-1 to compute HPR:

$$HPR = \frac{EV - BV + D}{BV}$$

$$= \frac{\$85 - \$70 + \$4}{\$70}$$

$$= \frac{\$19}{\$70} = 0.271, \text{ or } 27.1\%$$

Note that the HPR does not account for the amount of time over which the investment is held. In our example, the investment could have been held for one day, one month, or one year.

Example 8-2 shows how raw data can be converted into absolute, relative and cumulative relative frequencies.

Example 8-2 Organizing raw data into a frequency distribution

An analyst collects the number of house sales for a 25-month period by a large real estate agent:

254	85	218	162	104
166	193	115	122	97
125	178	66	112	108
130	165	81	145	232
185	210	282	216	297

This is an example of raw, ungrouped data, and the first step towards organizing it as a frequency distribution is to define the intervals. We note that the lowest reading is 66 and the highest reading is 297; for illustrative purposes, we round the lowest number down to 60 and round the highest number up to 300. If we decide to define six intervals, then each interval will be 40 wide. Thus, "60 up to 100" is the first interval; "100 up to 140" is the second interval; and so on. (The choice of upper and lower limits for intervals is flexible, but the intervals must be mutually exclusive.)

We count the number of observations in each interval to give the absolute frequency. The relative frequency is the absolute frequency divided by the total number of observations, which in this example is 25:

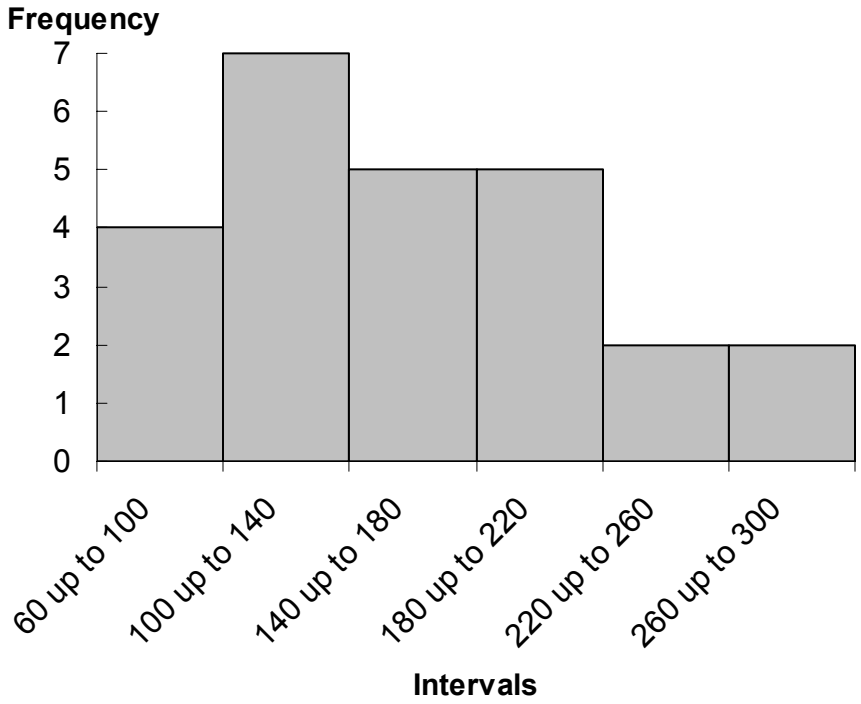
Number of Houses Sold	Absolute Frequency	Relative Frequency	Cumulative Frequency	Cumulative Relative Frequency
60 up to 100	4	4÷25 = 16%	4	16%
100 up to 140	7	7÷25 = 28%	11	44%
140 up to 180	5	5÷25 = 20%	16	64%
180 up to 220	5	5÷25 = 20%	21	84%
220 up to 260	2	2÷25 = 8%	23	92%
260 up to 300	2	2÷25 = 8%	25	100%

Now that the raw data is arranged into frequencies, we observe that house sales are concentrated (0.68 or 68% of observations) in the range of 100 to 220. The largest absolute and relative frequency occurs in the "100 up to 140" interval. We can see from the cumulative relative frequencies that in 84% of the months 220 or less houses are sold.

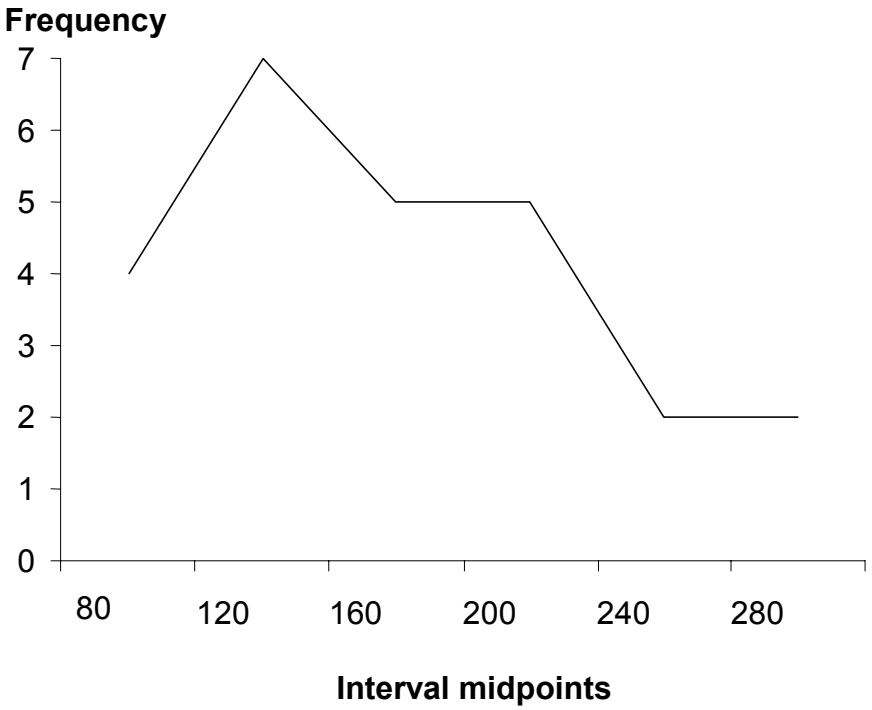
LOS 8-g

Describe the properties of data presented as a histogram or a frequency polygon.

A histogram is a bar chart showing the absolute frequency on the vertical axis and the intervals on the horizontal axis. The histogram below shows the frequency for the house sales given in Example 8-2:



A frequency polygon is a trend line showing the absolute frequency on the vertical axis and the interval midpoints on the horizontal axis. The frequency polygon below shows the frequency for the house sales in Example 8-2.



LOS 8-h

Define, calculate and **interpret** measures of central tendency, including the population mean, sample mean, arithmetic mean, weighted average or mean (including a portfolio return viewed as a weighted mean), geometric mean, and harmonic mean, median and mode.

There are two key ways of measuring the characteristics of a population - namely, central tendency and dispersion. First we look at central tendency, or the average, of a set of data.

The population mean is used when we can observe and measure all possible outcomes. Equation 8-2 gives the formula for population mean:

Equation 8-2

$$\mu = \frac{\sum_{i=1}^{N} X_i}{N}$$

where

μ	=	population mean
X_i	=	ith observation of the data
N	=	number of observations in the population

We use Greek letter μ (mu) to denote the population parameter. There can be only one population parameter, and in practice, knowing all possible outcomes of a population is rare. Rather, we observe a sample, or a subset of data from a population, this might be cross-sectional data when we look at the characteristics of certain items at one point in time (e.g company size at 31st December 2005) or time-series data when we look at data over a time period (monthly historic returns from a stock). We can calculate the sample mean as a statistic, as shown in Equation 8-3:

Equation 8-3

$$\overline{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

where

$\overline{X}$	=	sample mean (reads as "X bar")
X_i	=	ith observation of the data
n	=	number of observations in the sample

Observe that the formulas for the population mean and sample mean are the same, only the notation is different.

Example 8-3 Calculating the sample mean

The number of hours of sunshine is recorded on the final day of each month over a two-year period, as shown in the following data set:

2	3	4	5	5	6	8	8	5	4	3	2
1	2	3	5	6	7	9	8	6	3	3	2

Take the sum of all observations, and use Equation 8-3 to calculate the sample mean:

$$\frac{2+3+4+5+5+.....+8+6+3+3+2}{24} = \frac{110}{24} = 4.58$$

1. Mean

(i) Arithmetic mean is the simple average. It is illustrated by the above population mean and sample mean in Equations 8-2 and 8-3. It has the advantage of being a single value for a set of data and the sum of deviations of each value away from the mean will be zero.

(ii) Geometric mean is the nth root of n values. The geometric mean is often used to calculate average returns when a return is given for multiple periods.

The general equation is:

Equation 8-4

$$G = \sqrt[n]{X_1 \times X_2 \times X_3 \times .....X_n}$$

where

G = geometric mean

X_i = ith observation, which must be greater than or equal to zero

n = number of observations

When used for returns (which could be negative), the equation is modified to:

Equation 8-5

$$1 + R_G = \sqrt[n]{(1+R_1)(1+R_2).....(1+R_n)}$$

where

R_G	=	geometric mean return
R_i	=	return in ith period
n	=	number of observations

For calculating average historic returns the geometric mean, rather than the arithmetic mean, is the most suitable method. For projecting future returns the arithmetic mean is often used since it better predicts the future portfolio value.

Example 8-4 Arithmetic and geometric means

If the returns from a portfolio are 5%, 12% and –2% over each of the last three years then the average return is given by:

arithmetic mean = (5% + 12% - 2%)/3 = 5%

geometric mean = $\sqrt[3]{(1.05)(1.12)(0.98)}$ -1 = 4.8%

The geometric mean is always less than or equal to the arithmetic mean.

(iii) Weighted mean

If given a set of data where certain values occur more than once then it is quicker to calculate the weighted mean.

Equation 8-6

$$\overline{X} = \frac{\sum w_i X_i}{\sum w_i}$$

where

$\overline{X}$	=	weighted mean
X_i	=	ith observation
w_i	=	number of times that X_i occurs.

Example 8-5 Weighted mean

If the returns from a portfolio over twelve months are:

2% -0.5% 2.5% -1.5% 2% 1% 0% 1% -0.5% 0% 2% 1%

The weighted mean monthly return is

$$\frac{1(-1.5)+2(-0.5)+2(0)+3(1)+3(2)+1(2.5)}{12}=0.75\%$$

2. Median

This is the value of the middle item, or for an even number of readings the arithmetic mean of the middle two items, of an ordered data array. It is particularly useful if a small number of extreme values are distorting the arithmetic mean.

Example 8-6 Median

Using the data in Example 8-5 and putting it in an ordered display gives:

1 2 2 2 2 3 3 3 3 3 4 **4 5** 5 5 5 6 6 6 7 8 8 8 9

The median is the average of the two middle readings, which are 4 and 5. The median is therefore 4.5.

3. Mode

The mode is defined as the most frequently occurring observation. This measure of central tendency has the disadvantage that there may not be an observation appearing more than once or there may be multiple modes. It is useful if you need to select one reading which is the most popular.

Example 8-7 Mode

Using the ordered data display in Example 8-6:

1 2 2 2 2 3 3 3 3 3 4 4 5 5 5 5 6 6 6 7 8 8 8 9

3 is the most frequently occurring observation and therefore 3 is the mode.

For continuous distributions the interval with the highest frequency is the **modal interval**.

4. Harmonic mean

This is the mean calculated using the reciprocals of the observations using Equation 8-7

Equation 8-7

$$\overline{X}_H = \frac{n}{\sum_{i=1}^{n}\left(\frac{1}{X_i}\right)}$$

where

$\overline{X}_H$ = harmonic mean

X_i = ith observation

n = number of observations.

The harmonic mean is useful if we wish to calculate the average cost of an item when the total amount spent at each date is equal, this is illustrated in Example 8-8.

Example 8-8 Harmonic mean

An investor invests $10,000 in shares of a company at the end of January, February and March. The price she pays per share each month is $40, $42 and $47 respectively. Calculate the average price per share.

The harmonic mean is

$$\overline{X}_H = \frac{n}{\sum_{i=1}^{n}\left(\frac{1}{X_i}\right)} = \frac{3}{\frac{1}{40}+\frac{1}{42}+\frac{1}{47}} = \$42.81$$

An arithmetic mean calculation gives an average of $43, but this does not take into account that more shares will be bought at the lower price, reducing the average cost per share.

LOS 8-i

Describe and **interpret** quartiles, quintiles, deciles, and percentiles.

Whereas a median divides a distribution in half, **quartiles** divide it into quarters, **quintiles** into fifths, **deciles** into tenths and **percentiles** into hundredths. These are all examples of **quantiles.**

These measures are often used to classify performance, so for example if a fund is in the bottom quartile, it means that the return fell below the first quartile cut off point.

LOS 8-j

Define, calculate and **interpret** 1) a range and mean absolute deviation, and 2) a sample and a population variance and standard deviation.

Measures of dispersion

These measure the dispersion or variability of the data, and therefore indicate whether the mean is a reliable average.

1. Range

The range is the difference between the highest and the lowest value.

2. Mean absolute deviation

This is the mean of the absolute value of the deviations from the mean.

Equation 8-8

$$MAD = \frac{\sum_{i=1}^{n} |X_i - \overline{X}|}{n}$$

where

MAD = mean absolute deviation

$\overline{X}$ = mean

X_i = ith observation

$|X_i - \overline{X}|$ = absolute value of the difference between X_i and $\overline{X}$, it is always zero or a positive number

n = number of observations

Example 8-9 Mean absolute deviation

The following observations are recorded: 2, 5, 6, 8, 9.

The range is 9 - 2 = 7

The MAD =[|(2 - 6)| + |(5 - 6)| + |(6 - 6)| + |(8 - 6)| + |(9 - 6)|]/5 = 2

3. Variance

Variance is calculated using the squares of the deviations from the mean, so whether a difference from the mean is positive or negative by the time it is squared it is positive. This avoids the problem of positive and negative deviations canceling out. Variance and standard deviation are the most common risk measures used in investment.

Variance of a population is calculated as:

Equation 8-9

$$\sigma^2 = \frac{\sum_{i=1}^{N} (X_i - \mu)^2}{N}$$

where

σ^2	=	variance of a population
μ	=	population mean
X_i	=	ith observation
N	=	number of observations in the population

4. *Standard deviation*

This is the square root of the variance, and it is therefore in the same units as the original data. Standard deviation of a population is:

Equation 8-10

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N}}$$

where

σ	=	standard deviation of a population
μ	=	population mean
X_i	=	ith observation
N=	number of observations in the population	

Example 8-10 Variance and standard deviation

The ages of all the children in a violin lesson are 9, 11, 12, 13, and 15.

First calculate $\mu = 60/5 = 12$

The population variance is calculated as:

$\sigma^2 = [(9 - 12)^2 + (11 - 12)^2 + (12 - 12)^2 + (13 - 12)^2 + (15 - 12)^2]/5 = 4$

The standard deviation = $\sigma = 2$

The larger the standard deviation or variance of a distribution is, the wider the dispersion of the observations away from the mean.

When the data is for a sample, rather than the whole population, then the **sample variance** is given by the equation below:

Equation 8-11

$$s^2 = \frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}$$

where

s^2	=	variance of a sample
$\overline{X}$	=	sample mean
X_i	=	ith observation
n	=	number of observations in the sample

The denominator in Equation 8-11 is now (n - 1), using n would tend to underestimate the variance if we are using a sample, rather than the whole, of the population.

As before, the standard deviation of the sample is the square root of the sample variance.

LOS 8-k

Contrast variance with semivariance and target semivariance.

It can be argued that most investors are only concerned with downside risk, or the risk of returns falling below the mean. This is measured by semivariance which is the average squared deviation below the mean. The formula for semivariance is given in Equation 8-12, and semideviation can be calculated by taking the square root of the semivariance.

Equation 8-12

$$s_{semi}^2 = \frac{\sum_{\text{all } X_i < \bar{X}} (X_i - \bar{X})^2}{n^* - 1}$$

where

s_{semi}^2 = semivariance of a sample

$\bar{X}$ = sample mean

X_i = ith observation

n^* = number of observations that are smaller than the mean

Example 8-11 Semivariance

The returns from a portfolio over six months are -10%,-6%, + 5%, +6%, +8% and +9%.

The sample mean is (- 10% - 6% + 5% + 6% +8% + 9%)/6 = 2%.

Using Equation 8-11 variance of the sample is

$$s^2 = \frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{n - 1} = \frac{12^2 + 8^2 + 3^2 + 4^2 + 6^2 + 7^2}{5} = 63.60$$

To calculate semivariance, note that there are only 2 returns below the mean. Using Equation 8-12, semivariance is

$$s_{semi}^2 = \frac{\sum_{\text{all } X_i < \bar{X}} (X_i - \bar{X})^2}{n^* - 1} = \frac{12^2 + 8^2}{1} = 208.0$$

This is significantly higher than the variance since the lower readings are well below the means showing relatively high downside risk.

Target semivariance refers to when there is a target return and the target semivariance is calculated by taking the sum of the squared deviations of observations below the target, divided by the number of such observations minus one.

LOS 8-l

Calculate and **interpret** the proportion of observations falling within a specified number of standard deviations of the mean, using Chebyshev's inequality.

Chebyshev's inequality

For both discrete and continuous data distributions Chebyshev's Inequality states that:

For any set of observations at least $1 - 1/k^2$ percent of readings fall within k standard deviations of the mean, when $k > 1$.

Example 8-12 Chebyshev's Inequality

Data is collected on the monthly performance of a mutual fund and the sample mean is 2% and the standard deviation is 0.5%.

k	Interval (% return)	Percent of observations
1.25	1.375 to 2.625	36%
1.50	1.25 to 2.75	56%
2	1 to 3	75%
3	0.5 to 3.5	89%
4	0 to 4	94%

LOS 8-m

Define, calculate and **interpret** the coefficient of variation and the Sharpe ratio.

Coefficient of variation

A measure is needed to compare the dispersions of two or more distributions. The coefficient of variation is the standard deviation divided by the mean of a distribution, often expressed as a percentage. The higher the coefficient of variation, the higher the dispersion and vice versa.

Equation 8-13

$$CV = \frac{s}{\bar{X}} \times 100$$

where

CV = coefficient of variation, as a percentage

s = standard deviation

$\bar{X}$ = sample mean

Example 8-13 Coefficient of variation

Data is collected on (i) the monthly performance of a mutual fund, the sample mean is 2% and the standard deviation is 0.5% (ii) the monthly performance of a pension fund, the sample mean is 1.2% and the standard deviation is 0.4%.

The coefficients of variation are calculated using Equation 8-13

(i) CV(mutual fund)= (0.5%/2%) × 100 = 25%

(ii) CV(pension Fund) = (0.4%/1.2%) × 100 = 33.3%

This means that there is more dispersion relative to the mean in the distribution of the returns of the pension fund than the mutual fund.

An alternative measure is the **Sharpe ratio**, which is used to measure excess returns for each unit of risk taken.

Equation 8-14

$$\text{Sharpe ratio} = \frac{(\bar{r}_p - \bar{r}_f)}{s_p}$$

where

$\bar{r}_p$ = mean return of a portfolio p

$\bar{r}_f$ = mean return from the risk free asset

s_p = standard deviation of a portfolio p

Example 8-14 Sharpe ratio

A portfolio is providing a mean return of 12% per annum compared with a return of 5% per annum from the risk-free asset, the standard deviation of the portfolio returns is 10%.

Sharpe ratio = (12% - 5%)/10% = 0.7

This indicates the portfolio earned a 0.7% return for each unit of risk; a high Sharpe ratio is more attractive than a low one.

LOS 8-n

Define and **interpret** skew, **explain** the meaning of a positively or negatively skewed return distribution, and **describe** the relative locations of the mean, median, and mode for a nonsymmetrical distribution.

LOS 8-o

Define and **interpret** kurtosis, and measures of population and sample skew and kurtosis.

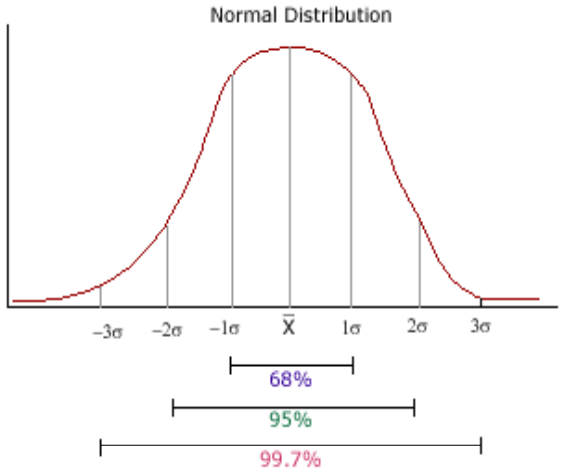
Symmetric and skewed distributions

A symmetric or normal distribution has the following characteristics:

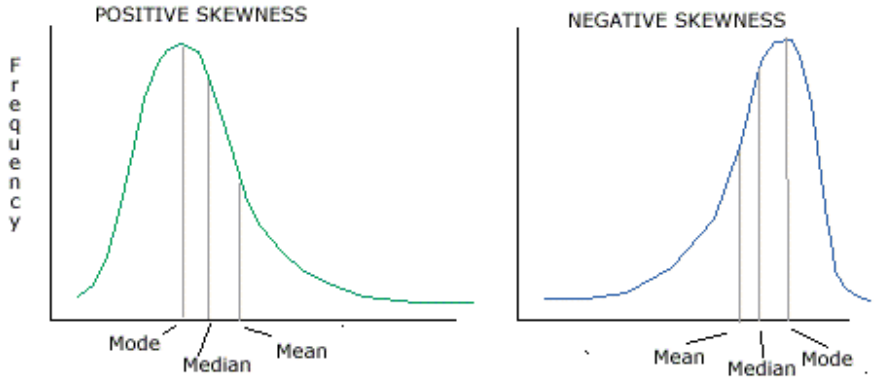
1. The mean and median are equal.
2. The mean and variance completely describe the distribution.
3. 68.3% of observations lie between (mean ± 1 standard deviation)

   95.5% of observations lie between (mean ± 2 standard deviations)

   99.7% of observations lie between (mean ± 3 standard deviations)



A nonsymmetrical distribution is **skewed**.



In a positively skewed distribution the mean will be higher than the median, which will be higher than the mode; the opposite will be the case for a negatively skewed distribution.

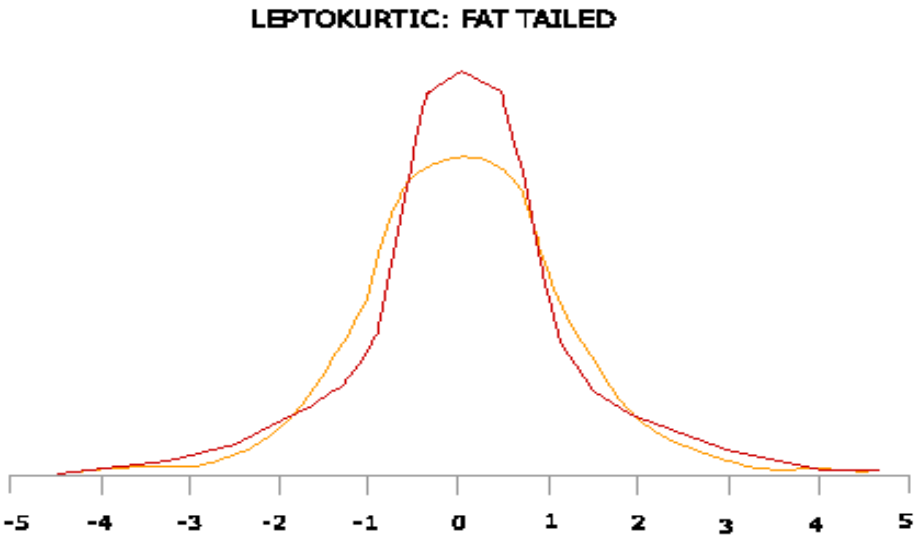
If a distribution of portfolio returns is positively skewed it indicates that poor returns occur frequently but losses are small, whereas very high returns occur less frequently but are more extreme.

Skewness is calculated using the cubes of the deviations, thereby keeping the 'direction' of the deviations i.e. whether the observations are above or below the mean. When interpreting investment returns positive skewness is considered attractive since it indicates that there is a greater probability of very high returns.

Kurtosis

Kurtosis measures whether a distribution is more peaked (leptokurtic) or less peaked (platykurtic) than a normal distribution.

Excess positive kurtosis, or leptokurtosis, would indicate that a distribution has fatter tails than a normal distribution. This is very important since, if a distribution of stock returns exhibits excess kurtosis (a sample excess kurtosis of 1.0 or larger would be considered unusually large) the probability of very good or very bad returns is more likely than if it were a normal distribution. If measures such as Value at Risk (VaR) are used to estimate the probability of a specified loss occurring, and the distribution has been assumed to be normal, then the chance of a major loss will have been underestimated.



Semi-logarithmic scale

When looking at graphs to assess historic returns, semi-logarithmic scales are often the most appropriate. A semi-logarithmic scale is logarithmic on the vertical axis and arithmetic on the horizontal axis. On a logarithmic scale equal distances represent equal percentage movements.

9 Probability Concepts

Learning Outcome Statements (LOS)

9-a	**Define** a random variable, an outcome, an event, mutually exclusive events, and exhaustive events.
9-b	**Explain** the two defining properties of probability.
9-c	**Distinguish** among empirical, subjective, and a priori probabilities.
9-d	**State** the probability of an event in terms of odds for or against the event.
9-e	**Describe** the investment consequences of probabilities that are mutually inconsistent.
9-f	**Distinguish** between unconditional and conditional probabilities.
9-g	**Define** a joint probability and **calculate** and **interpret** the joint probability of two events.
9-h	**Calculate** the probability that at least one of two events will occur, given the probability of each and the joint probability of the two events.
9-i	**Distinguish** between dependent and independent events.
9-j	**Calculate** a joint probability of any number of independent events.
9-k	**Calculate,** using the total probability rule, an unconditional probability.
9-l	**Explain** the use of conditional expectation in investment applications.
9-m	**Calculate** an expected value using the total probability rule for expected value.
9-n	**Diagram** an investment problem, using a tree diagram.
9-o	**Define, calculate** and **interpret** covariance and correlation.
9-p	**Calculate** and **interpret** the expected value, variance, and standard deviation particularly for return on a portfolio.
9-q	**Calculate** covariance given a joint probability function.
9-r	**Calculate** and **interpret** an updated probability, using Bayes' formula.
9-s	**Calculate** and **interpret** the number of ways a specified number of tasks can be performed using the multiplication rule of counting.

9-t	**Solve** counting problems using the factorial, combination, and permutation notations.
9-u	**Calculate** the number of ways to choose r objects from a total of n objects, when the order in which the r objects is listed matters, and **calculate** the number of ways to do so when the order does not matter.
9-v	**Identify** which counting method is appropriate to solve a particular counting problem.

Introduction

This section starts with a definition of the terms and the rules used in probability. It then considers the application to the key concepts used in investment including expected return and variability of returns for both single securities and portfolios. At the end of the Reading there is a summary of shortcuts used for counting possible outcomes. Candidates will be expected to do both the necessary calculations and also to be able to interpret the results of calculations.

LOS 9-a

Define a random variable, an outcome, an event, mutually exclusive events, and exhaustive events.

Random variables

A **random variable** is a quantity whose future outcomes are uncertain.

The return on a risky investment is an example of a random variable, when the event or outcome is not certain.

LOS 9-b

Explain the two defining properties of probability.

The two defining properties of probability are:

1. P(E) stands for the probability of any event E occurring and $0 \leq P(E) \leq 1$
2. The sum of the probabilities for any list of mutually exclusive and exhaustive events is one.

Mutually exclusive means that only one event can occur at one time.

Exhaustive means that the events cover all possible outcomes.

LOS 9-c

Distinguish among empirical, subjective, and a priori probabilities.

Calculating probabilities

There are different methods for estimating probabilities:

Empirical probabilities – probabilities are estimated from past data.

Subjective probabilities – probabilities are based on personal judgment.

A priori probabilities – probabilities are based on logical analysis.

Empirical and a priori probabilities are classed as objective probabilities, since they are usually independent of the forecaster's own view.

LOS 9-d

State the probability of an event in terms of odds for or against the event.

Probabilities are often stated in terms of odds that an event will happen.

For example an investor might say "The odds that the stock market index will close above 6,000 at year end are one to four".

The **odds for** an event happening are P(E)/[1 - P(E)]. This means the investor thinks the probability that the index will be above 6,000 at year end are 1/(1 + 4) = 0.20, or in 1 out of 5 cases the event will happen and in 4 out of 5 cases it will not.

However the investor might state the **odds against** interest rates being increased is eight to one.

The **odds against** an event happening are [1 - P(E)]/P(E), the reciprocal of the odds for the event. This means the investor thinks the probability that interest rates will be increased is 1/(1 + 8) = 0.11.

LOS 9-e

Describe the investment consequences of probabilities that are mutually inconsistent.

If one stock price discounts a certain probability of an event occurring and another stock price discounts a different probability, then there is an opportunity to take advantage of the inconsistency.

LOS 9-f

Distinguish between unconditional and conditional probabilities.

The probability that an event A occurs, if it is **unconditional**, is denoted by P(A).

This is also known as marginal probability.

Conditional Probability is the probability that A occurs given B has already occurred, it is denoted by P(A | B).

LOS 9-g

Define a joint probability and **calculate** and **interpret** the joint probability of two events.

Joint Probability is the probability that A and B occur together, it is denoted by P(AB).

General rule of multiplication

To calculate the joint probability of two events occurring use the general rule of multiplication:

Equation 9-1

$$P(AB) = P(A \mid B)P(B) = P(B \mid A)P(A)$$

Example 9-1 General rule of multiplication

If 5 out of 100 radios that are manufactured by a company are defective what is the probability, when selecting 2 radios from a shipment of 100 radios, of selecting one defective radio and then another?

Assuming the first radio selected is not replaced in the shipment, and P(A) is the probability of the first radio being defective and P(B | A) is the probability of the second radio being defective given the first defective radio has been taken out, then applying Equation 9-1:

P(AB) = P(B | A) P(A) = 4/99 x 5/100 = 0.002

LOS 9-h

Calculate the probability that at least one of two events will occur, given the probability of each and the joint probability of the two events.

General rule of addition

To calculate the probability that A or B occurs or that A and B both occur use Equation 9-2:

Equation 9-2

$$P(A \text{ or } B) = P(A) + P(B) - P(AB)$$

Example 9-2 General rule of addition

A company manufactures children's boots in three different sizes - small, medium and large, and makes equal numbers of each size in red, blue, green and yellow colors. What is the probability that a boot chosen at random will be either small or blue?

Using Equations 9-1 and 9-2 with P(A) the probability that the boot is small and P(B) the probability it is blue, then

Probability = 1/3 +1/4 – (1/3 x 1/4) = 0.5

(i.e. 6 out of all possible 12 combinations of color and size will be small or blue).

LOS 9-i

Distinguish between dependent and independent events.

Two events are **independent** if the occurrence of one event does not affect the probability of the other event occurring. In this case

$P(A \mid B) = P(A)$, or $P(B \mid A) = P(B)$

If they are not independent they are dependent.

LOS 9-j

Calculate a joint probability of any number of independent events.

The Multiplication Rule for Independent Events says that if two events are independent then Equation 9-3 holds:

Equation 9-3

$$P(AB) = P(A)P(B)$$

Example 9-3 Multiplication rule for independent events

What is the chance of throwing a double six if two dice are thrown?

Probability = 1/6 x 1/6 = 0.027

Note: events are mutually exclusive if P(AB) = 0

Equation 9-3 can be extended to any number of independent events i.e.

Equation 9-4

$$P(ABC\ldots) = P(A)P(B)P(C)$$

LOS 9-k

Calculate using the total probability rule, an unconditional probability.

In the investment business we are often interested in using scenarios, which are mutually exclusive, and then looking at the probability of an event, A, happening given certain scenarios. An example of this is saying event A is that the stock market rises over the next year and the different scenarios could be various economic scenarios; high growth, low growth etc.

The total probability rule says:

Equation 9-5

$$P(A) = P(A \mid S_1)P(S_1) + P(A \mid S_2)P(S_2) + \ldots\ldots\ldots + P(A \mid S_n)P(S_n)$$

where

S_N = scenario n

This rule expresses an unconditional probability in terms of conditional probabilities, with probabilities used as weights.

LOS 9-l

Explain the use of conditional expectation in investment applications.

LOS 9-m

Calculate an expected value using the total probability rule for expected value.

In investment decision-making we are often using **conditional expected values**. This refers to the expected value for a random variable X given a scenario or event S, which is denoted by E(X|S).

The total probability rule in Equation 9-5, can also be applied using expected values:

Equation 9-6

$$E(X) = E(X|S_1)P(S_1) + E(X|S_2)P(S_2) + \ldots\ldots + E(X|Sn)P(Sn)$$

Example 9-4 Total probability rule

You observe that a portfolio's quarterly returns have a 70% probability of being positive, and a 30% probability of being zero or negative. However you also note that if the previous quarter's returns were zero or negative then the probability of them being positive in the next quarter is only 55%.

Following a positive return you wish to calculate the probability of the next quarter also providing a positive return.

Define S_1 as the scenario that returns were positive in the previous quarter, and S_2 that they were zero or negative and A as the event that returns are positive in the next quarter. We can apply Equation 9-6:

$P(A) = P(A|S_1)P(S_1) + P(A|S_2)P(S_2)$

$0.70 = [P(A|S_1) \times 0.70] + [0.55 \times 0.30]$

$P(A|S_1) = 0.535|0.70 = 0.764$

This means that, given a positive return in the previous quarter, there is a 76.4% chance of achieving a positive return in the next quarter. This is higher than the unconditional probability of 70%.

LOS 9-n

Diagram an investment problem, using a tree diagram.

We will use Example 9-5 to show how a tree diagram is used to illustrate an investment problem.

Example 9-5 Tree diagram

An analyst is using a model to calculate the expected value of a share in one year's time; the price (P) is currently \$3.00. He is considering two scenarios, the first that the stock market rises over the year (0.80 probability), the second that it falls or is unchanged (0.20 probability). If the stock market rises there is a 0.75 probability that the share will close at \$3.50 and a 0.25 probability it will close at \$3.20. If the stock market is unchanged or falls there is a 0.50 probability that the share will close at \$3.10 and a 0.50 probability it will close at \$2.80.

We can calculate the probability of the share price closing at \$3.50 as 0.80 x 0.75 = 0.60. The remaining probabilities are illustrated in the tree diagram:

		Probability = 0.75	P = \$3.50 Probability = 0.60
	Rising stock market Probability = 0.80		
		Probability = 0.25	P = \$3.20 Probability = 0.20
Price = \$3.00			
		Probability = 0.50	P = \$3.10 Probability = 0.10
	Falling or unchanged stock market Probability = 0.20		
		Probability = 0.50	P = \$2.80 Probability = 0.10

Using Equation 9-6

E (P | rising stock market) = 0.75(\$3.50) + 0.25(\$3.20) = \$3.43

E (P | falling stock market) = 0.50(\$3.10) + 0. 50(\$2.80) = \$2.95

E(P) = 0.80(\$3.43) + 0.20(\$2.95) = \$3.33 which is the expected price of the share in one year's time.

LOS 9-o

Define, calculate and **interpret** covariance and correlation.

LOS 9-p

Calculate and **interpret** the expected value, variance, and standard deviation particularly for return on a portfolio.

The expected value of a random variable X, denoted by E(X), is the probability-weighted average of the possible outcomes of the random variable.

Equation 9-7

$$E(X) = \sum_{i=1}^{n} P(X_i)X_i$$

where

E(X)	=	expected value of the random variable X
X_i	=	a possible outcome of the random variable X
n	=	number of possible outcomes

The variance of a random variable is the expected value of the squared deviations of the random variable's expected value. This is given by:

Equation 9-8

$$\sigma^2(X) = E\left\{[X - E(X)]^2\right\}$$

or

$$\sigma^2(X) = \sum_{i=1}^{n} P(X_i)[X_i - E(X)]^2$$

where

$\sigma^2(X)$	=	variance of X
E(X)	=	expected value of the random variable X

The standard deviation is the square root of the variance.

Example 9-6 Standard deviation of a distribution

The following probability distribution is provided:

X	P(X)
0	0.20
1	0.30
2	0.40
3	0.10

The expected value or mean, using Equation 9-7, is

$$E(X) = \sum_{i=1}^{n} P(X_i)X_i = (0.20 \times 0) + (0.30 \times 1) + (0.40 \times 2) + (0.10 \times 3) = 1.4$$

The variance, using Equation 9-8, is

$$\sigma^2(X) = \sum_{i=1}^{n} P(X_i)[X_i - E(X)]^2$$

$$= 0.2(0-1.4)^2 + 0.3(1-1.4)^2 + 0.4(2-1.4)^2 + 0.1(3-1.4)^2 = 0.84$$

The standard deviation is the square root of the variance which is 0.92.

Covariance

When analyzing risk for a portfolio made up of a number of assets we need to know the covariance between the returns from each pair of assets. Covariance measures how closely two assets move together. If on average the return of one asset is above its expected value when the other is below its expected value then covariance will be negative. However when both assets tend to achieve high returns relative to their expected returns at the same time then the covariance will be positive.

Covariance is defined as:

Equation 9-9

$$Cov(R_i,R_j) = E\{[\ R_i\ - E(R_i)][\ R_j\ - E(R_j)]\}$$

where

R_i = return of asset i

Referring to Equation 9-9, we can see that Cov $(R_i,R_i) = \sigma^2(R_i)$, i.e. the covariance of an asset with itself is the same as the variance of the asset.

For a portfolio the variance of the returns is given by:

Equation 9-10

$$\sigma^2(R_P) = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov(R_i, R_j)$$

where

R_i = return of asset i

w_i = weighting in asset i

and the expected return is given by:

Equation 9-11

$$E(R_P) = \sum_{1}^{n} E(R_i) w_i$$

Example 9-7 Standard deviation of a portfolio

A portfolio is invested in three stock markets A, B and C. 50% of the portfolio is in market A, 30% in B and 20% in C. The expected return from each market is 20%, 15% and 10% respectively. The covariance matrix is as shown below:

Covariance	A	B	C
A	200	90	75
B	90	120	40
C	75	40	100

The expected return from the portfolio is given by Equation 9-11

$E(R_p)$ = (20% x 0.5) + (15% x 0.30) + (10% x 0.20) = 16.5%.

The variance is given by Equation 9-10

$$\sigma^2(R_p) = w_A^2\sigma^2(R_A) + w_B^2\sigma^2(R_B) + w_C^2\sigma^2(R_C) + 2w_A w_B Cov(R_A R_B) + 2w_A w_C Cov(R_A R_C) + 2w_B w_C Cov(R_B R_C)$$

= [$(0.5)^2$ x 200] + [$(0.3)^2$ x 120] + [$(0.2)^2$ x 100] + [2 x 0.5 x 0.3 x 90] + [2 x 0.5 x 0.2 x 75] + [2 x 0.3 x 0.2 x 40]

= 50 + 10.8 + 4 + 27 + 15 + 4.8 = 111.6

The standard deviation is given by the square root of the variance, which is 10.56.

Correlation

Correlation (denoted by ρ,) is given by:

Equation 9-12

$$\rho(R_i, R_j) = \frac{Cov(R_i, R_j)}{\sigma(R_i)\sigma(R_j)}$$

Correlation again describes the way that two variables move together, but it is easier to interpret than covariance since it lies between -1 and +1.

Example 9-8 Correlation

Restating the covariance table in Example 9-7, using Equation 9-12

$$\rho(R_A, R_B) = \frac{90}{\sqrt{200}\sqrt{120}} = 0.58$$

$$\rho(R_A, R_C) = \frac{75}{\sqrt{200}\sqrt{100}} = 0.53$$

$$\rho(R_B, R_C) = \frac{40}{\sqrt{120}\sqrt{100}} = 0.37$$

Correlations	A	B	C
A	1	0.58	0.53
B	0.58	1	0.37
C	0.53	0.37	1

A correlation of 0 indicates an absence of a linear relationship between the two variables.

A correlation of 1 indicates a perfect linear relationship.

A correlation of -1 indicates a perfect inverse linear relationship.

LOS 9-q

Calculate covariance given a joint probability function.

Estimating covariance and correlation

Covariance can be estimated using historical data or by using a **joint probability function**.

A joint probability function, P(X,Y), gives the probability that certain occurrences X and Y occur together. In the case of returns from two assets, R_A and R_B, covariance is given in Equation 9-13:

Equation 9-13

$$\text{Cov}(R_A, R_B) = \sum_{i=1}^{n}\sum_{j=1}^{n} P(R_{Ai}, R_{Bj})(R_{Ai} - ER_A)(R_{Bj} - ER_B)$$

Example 9-9 Covariance

The returns for two assets, A and B can be calculated under four different economic scenarios. The probability of each scenario is

1. Recession 30%,
2. Slowdown 40%,
3. Slow growth 20%,
4. Strong growth 10%.

The returns under each scenario are given below:

Economic Scenario	Return from A	Return from B
1	-10%	2%
2	0%	4%
3	5%	8%
4	20%	10%

First of all calculate the expected return from A and B, using Equation 9-6

$ER_A = (0.3 \times -10\%) + (0.4 \times 0\%) + (0.2 \times 5\%) + (0.1 \times 20\%) = 0.0\%$

$ER_B = (0.3 \times 2\%) + (0.4 \times 4\%) + (0.2 \times 8\%) + (0.1 \times 10\%) = 4.8\%$

Use Equation 9-13 to calculate the covariance

$Cov(R_A, R_B) = [0.3 \times (-10 - 0) \times (2 - 4.8)] + [0.4 \times (0 - 0) \times (4 - 4.8)] +$

$[0.2 \times (5 - 0) \times (8 - 4.8)] + [0.1 \times (20 - 0) \times (10 - 4.8)]$

$= 8.4 + 0 + 3.2 + 10.4 = 22.0$

LOS 9-r

Calculate and **interpret** an updated probability, using Bayes' formula.

Bayes' formula

Bayes' formula is used when we want to know, given an event (A_1), what was the probability of the scenario that created the event.

Prior probability is the initial probability based on the present level of information.

e.g. $P(A_1)$ is the result that the 'test' is positive, $P(A_2)$ is the opposite.

Posterior probability is the revised probability taking into account additional information, B.

e.g. $P(A_1 | B)$ is the probability that A_1 occurs given B.

Bayes' formula:

Equation 9-14

$$P(A_1 \mid B) = \frac{P(A_1)P(B \mid A_1)}{P(A_1)P(B \mid A_1) + P(A_2)P(B \mid A_2)}$$

Example 9-10 Bayes formula

An analyst is looking at data on left-handed people working for a certain company. He notes that 15% of the men are left-handed and 6% of the women are left-handed. 60% of the people working for the company are men. The analyst randomly selects an individual that is left-handed. Using Equation 9-14 we can calculate the posterior probability that this individual is a man.

Define A_1 = man

A_2 = woman

B = left handed

We are looking for the probability that the left handed individual is a man i.e. $P(A_1 \mid B)$

$$P(A_1 \mid B) = \frac{P(A_1)P(B \mid A_1)}{P(A_1)P(B \mid A_1) + P(A_2)P(B \mid A_2)}$$

$$= \frac{0.6 \times 0.15}{(0.6 \times 0.15) + (0.4 \times 0.06)}$$

$$= 0.09/0.114$$

$$= 78.9\%$$

More generally Bayes' formula can be expressed as

Updated probability of an event given new information =

probability of new information given event / unconditional probability of new information x prior probability of event

LOS 9-s

Calculate and **interpret** the number of ways a specified number of tasks can be performed using the multiplication rule of counting.

Multiplication rule of counting

If one thing can be done in n_1 ways, and the next thing, given the first, in n_2 ways, and so on for k things, then the number of ways that the k things can be done is

Equation 9-15

$$n_1 \times n_2 \times n_3 \times ..... \times n_k$$

Example 9-11 Multiplication rule of counting

If the first thing can be done in three ways, the second in five ways and the third in six ways then there are 3 x 5 x 6 = 90 ways in which the three steps could be carried out.

LOS 9-t

Solve counting problems using the factorial, combination, and permutation notations.

LOS 9-u

Calculate the number of ways to choose r objects from a total of n objects, when the order in which the r objects is listed matters, and **calculate** the number of ways to do so when the order does not matter.

LOS 9-v

Identify which counting method is appropriate to solve a particular counting problem.

If you have a certain number of people, n, to be assigned to n jobs and after the first job is assigned there are (n – 1) people left to be assigned to the next job and so on then the number of ways of assigning the jobs is:

Equation 9-16

$$n! = n \times (n-1) \times (n-2) \times ..... \times 1$$ (this is called **n factorial**)

The general formula for labeling problems

This is also called the multinomial formula and it is used when you want to label n objects in k different ways. If n_1 is the first way, n_2 the second and so on then the number of different ways is given in Equation 9-17:

Equation 9-17

$$\frac{n!}{n_1!\times n_2!\times .....\times n_k!}$$

Combination formula

This is also called the binomial formula and is used in the simpler case when we are looking to choose r objects, when the order does not matter, from a total of n objects. The number of ways is given in Equation 9-18:

Equation 9-18

$${}_nC_r = \binom{n}{r} = \frac{n!}{(n-r)!\times r!}$$

Example 9-12 Combination formula

In we want to know how many ways we can achieve 2 stock moves upwards and 1 downwards over three periods we can use Equation 9-18 and define r as upward moves. The number of ways is

$${}_nC_r = \binom{3}{2} = \frac{3!}{(2)!\times 1!} = 3$$

Permutation formula

In the case that the order does matter and we are choosing the r objects from n objects we need to use the permutation formula. This states that the number of ways this can be done is:

Equation 9-19

$${}_nP_r = \frac{n!}{(n-r)!}$$

Example 9-13 Permutation formula

If you have 8 stocks that you follow and you want to select the first and second strongest buys there are 8!/(8 – 2)! = 56 ways that they can be selected.

STUDY SESSION 3

Quantitative Methods: Applications

Overview

You will probably find Study Session 3 is more demanding than Study Session 2. We are moving on to focus on the application of the concepts and tools covered in the previous Session, and in particular their use in financial analysis and decision making.

In the first Reading Assignment we look at different discrete and continuous probability distributions, and how probability distributions can help us estimate the probability of achieving a specific outcome. In the next two Reading Assignments we study sampling, estimation and hypothesis testing. The objective is to examine the tools which will enable us to test whether a statement or hypothesis is to be 'accepted' or rejected. More specifically we are looking for evidence from a sample that the hypothesis is not correct, a statement that we can make with a certain level of confidence. Hypothesis testing involves understanding the different ways of selecting a sample, confidence intervals and how to select the appropriate test statistic and decision rule, before doing the number crunching to arrive at a decision to reject or not reject the hypothesis being tested.

In the final Reading Assignment we cover correlation and regression. Calculating and interpreting correlation, or the way two variables move together is relatively simple whereas regression analysis is more complex. Here we are looking at the relationship between a dependent variable (e.g. a stock return) and independent variable or variables (e.g. the market index return). We need to know how to calculate a regression equation and also how to apply the equation and test its significance.

Reading Assignments

Quantitative Methods for Investment Analysis, 2nd edition, Richard A Defusco, Dennis W. McLeavey, Jerald E. Pinto and David E. Runkle (CFA Institute, 2004)

10. "Common Probability Distributions" Ch. 5
11. "Sampling and Estimation" Ch. 6
12. "Hypothesis Testing" Ch. 7
13. "Correlation and Regression" Ch. 8

10 Common Probability Distributions

Learning Outcome Statements (LOS)

10-a	**Define** and **explain** a probability distribution.
10-b	**Distinguish** between and **give** examples of discrete and continuous random variables.
10-c	**Describe** the set of possible outcomes of a specified random variable.
10-d	**Define** a probability function, **state** its two key properties, and determine whether a given function satisfies those properties.
10-e	**Define** a probability density function.
10-f	**Define** a cumulative distribution function and **calculate** and **interpret** probabilities for a random variable, given its cumulative distribution function.
10-g	**Define** a discrete uniform random variable and **calculate** and **interpret** probabilities, given a discrete uniform distribution.
10-h	**Define** a binomial random variable and **calculate** and **interpret** probabilities, given a binomial probability distribution, and **calculate** the expected value and variance of a binomial random variable.
10-i	**Construct** a binomial tree to **describe** stock price movement.
10-j	**Describe** the continuous uniform distribution and **calculate** and **interpret** probabilities, given a continuous uniform probability distribution.
10-k	**Explain** the key properties of the normal distribution.
10-l	**Distinguish** between a univariate and a multivariate distribution.
10-m	**Explain** the role of correlation in the multivariate normal distribution.
10-n	**Construct** and **explain** confidence intervals for a normally distributed random variable.
10-o	**Define** the standard normal distribution, **explain** how to standardize a random variable, and **calculate** and **interpret** probabilities using the standard normal distribution.
10-p	**Define** shortfall risk, **calculate** the safety first ratio and **select** an optimal portfolio using Roy's safety-first criterion.

10-q	**Explain** the relationship between the lognormal and normal distributions and **explain** and **interpret** the use of the lognormal distribution in modeling asset prices.
10-r	**Distinguish** between discretely and continuously compounded rates of return; and **calculate** and **interpret** the continuously compounded rate of return, given a specific holding period return.
10-s	**Explain** Monte Carlo simulation and historical simulation and **describe** their major applications and limitations.

Introduction

This Reading focuses on probability distributions that will enable us to make clearer statements about a random variable, for example the return on a stock or earnings per share. Four distributions are considered: uniform, binomial, normal and lognormal distributions. These are used widely in finance, for example to estimate the probability of achieving a certain return and to control risk. Probability distributions will form the basis for understanding hypothesis testing and regression analysis, which are covered later in the Study Session. At the end of the section we touch on Monte Carlo simulations; these are analytical procedures which involve identifying risk factors and their probability distributions.

LOS 10-a

Define and **explain** a probability distribution.

LOS 10-b

Distinguish between and **give** examples of discrete and continuous random variables.

LOS 10-c

Describe the set of possible outcomes of a specified random variable.

Probability distributions

A **probability distribution** lists all possible outcomes of a random variable and the probability that each outcome occurs.

A **discrete** probability distribution is one where the random variable can take on a countable number of possible outcomes. Quoted stock prices are an example, if we are looking at a market where they are quoted in ticks.

A **continuous** probability distribution is one where we cannot count the outcomes. Rates of return are examples of a continuous probability distribution.

The range of possible outcomes can be finite or infinite in both discrete and continuous distributions.

LOS 10-d

Define a probability function, **state** its two key properties, and determine whether a given function satisfies those properties.

LOS 10-e

Define a probability density function.

LOS 10-f

Define a cumulative distribution function and **calculate** and **interpret** probabilities for a random variable, given its cumulative distribution function.

LOS 10-g

Define a discrete uniform random variable and **calculate** and **interpret** probabilities, given a discrete uniform distribution.

A **probability function** specifies the probability that a random variable takes on a specific value eg. P(X = x), written as p(x), or for a continuous function f(x). f(x) is called the **probability density function.**

A probability function has two key properties

- p(x) lies between 0 and 1,
- the sum of the probabilities p(x) over all values of X is 1.

In the case that we are looking at the probability that X lies within a range we can use the **cumulative distribution function** which gives the probability that X is less than or equal to a certain value denoted by P(X ≤ x), this is often denoted by F(x) for both discrete and continuous random variables.

A **discrete uniform distribution** is when the probability of each outcome is the same i.e. it is uniform. In Example 10-1 we look at an example of a discrete uniform random variable, the probability that the random variable takes on any particular discrete value (in this case the integers 1 to 6) is equal.

Example 10-1 Discrete uniform distribution and cumulative distribution function

Taking the example of throwing a dice where the probability of throwing a 1, 2, 3, 4, 5, or 6 is the same.

X = x	Probability function p(x)	Cumulative distribution function F(x)
1	0.167	0.167
2	0.167	0.333
3	0.167	0.500
4	0.167	0.667
5	0.167	0.833
6	0.167	1.000

LOS 10-h

Define a binomial random variable and **calculate** and **interpret** probabilities, given a binomial probability distribution, and **calculate** the expected value and variance of a binomial random variable.

Binomial distributions

Bernoulli trials refer to trials where there are **two** possible outcomes. If p is used for the probability of success, and Y = 1 denotes the outcome being a success and Y= 0 a failure then:

$$p(1) = P(Y = 1) = p$$
$$p(0) = P(Y = 0) = 1 - p$$

Such a random variable is referred to as a **Bernoulli random variable.**

If there are n trials, which are independent with probability p of success, and we define X as the number of successes, X is the **binomial random variable**. When Y_i is the outcome of the ith trial (1 if a success, 0 if a failure).

Equation 10-1

$$X = Y_1 + Y_2 + ...Y_n$$

X is described by n and p we write

$$X \sim B(n,p)$$

This means that X has a binomial random distribution with parameters n and p.

Binomial probability distribution

To calculate the probability of x successes from n trials when the trials are independent and the probability of success across trials is constant, use the formula:

Equation 10-2

$$p(x) = \frac{n!}{(n-x)!\times x!} p^x (1-p)^{n-x}$$

where

n	=	number of trials
x	=	number of observed successes
p	=	probability of success

Note that the first part of Equation 10-2 is the combination formula from Study Session 2 which is the number of ways of selecting x successes from n trials.

Example 10-2 Binomial probability distribution

A dice is thrown four times, what is the probability of throwing exactly one six?

$$p(1) = \frac{4!}{1!\times 3!} 0.167^1 (1-0.167)^3 = 0.386$$

Mean and variance of binomial random variables

For a distribution X ~ B(n,p), where X has a binomial distribution with parameters n and p, the mean is np, since the Bernouilli random variable Y ~ B(1,p) takes on the value 1 with probability p and 0 with probability (1 – p) and therefore has a mean of p.

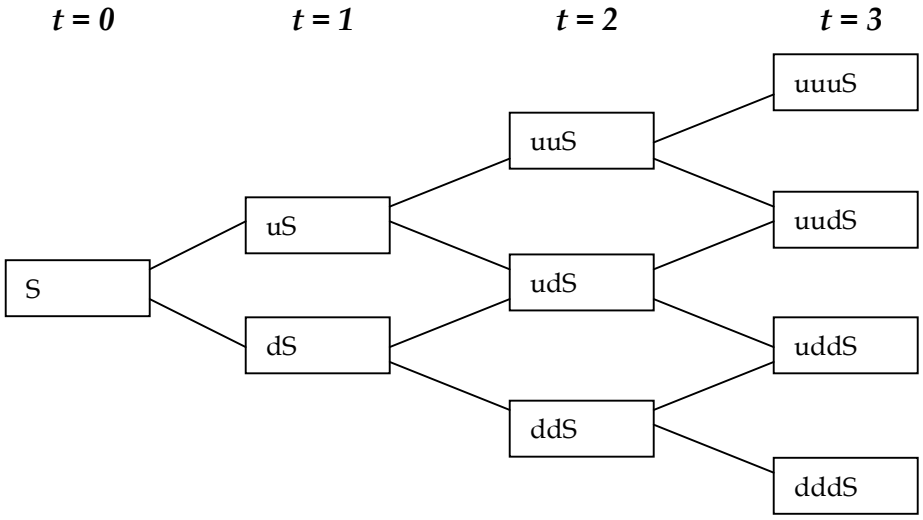
The variance of a Bernoulli trial is p(1 – p), this can be calculated working through Equation 2-37, where variance is $E[(Y - EY)^2]$. Since the trials are assumed to be independent the variance of a Binomial distribution is np(1 – p).

LOS 10-i

Construct a binomial tree to **describe** stock price movement.

Binomial trees

Binomial Trees can be used to illustrate a model where a stock price (S) either moves up with constant probability p, or down with constant probability 1- p. If u is 1 plus the return for an upward move, and d is 1 plus the return for a downward move and we look at a three period model, we can use a binomial tree to illustrate the possible outcomes. Each box is called a node and represents a potential value for the stock price.



Note that there are four possible terminal prices, but there is only one way to get to either uuuS or dddS but three ways to get either uudS or uddS. Probabilities can be calculated using the probability distribution formula and then the expected stock price can be calculated.

LOS 10-j

Describe the continuous uniform distribution and **calculate** and **interpret** probabilities, given a continuous uniform probability distribution.

Continuous uniform distribution

The probability density function for a uniform random variable is

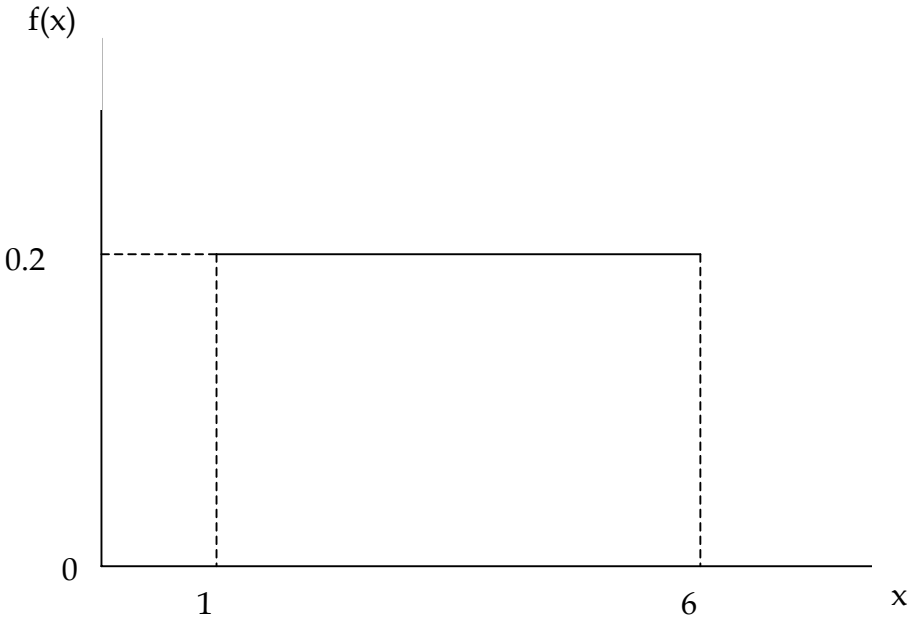
$$f(x) = \begin{cases} \dfrac{1}{b-a} & \text{for } a \le x \le b \\ 0 & \text{otherwise} \end{cases}$$

In general for continuous distributions when we are concerned with finding the probability that x lies between two values we would find the area under the curve representing the probability density function, this can be done by finding the integral of f(x) between the two points. In the case of a uniform distribution the curve is a horizontal line and the area underneath can be represented by a rectangle so

$$F(x) = \begin{cases} 0 \text{ for } x \le a \\ \dfrac{x-a}{b-a} \quad \text{for x between a and b} \\ 1 \text{ for } x \ge b \end{cases}$$

Example 10-3 Binomial probability distribution

A continuous uniform distribution is shown in the graph below



Between x = 1 and 6 f(x) = 1/(6 -1) = 0.2

If we select x = 5

F(5) = (5 – 1)/(6 – 1) = 0.8 which is the area between 0 and 5 on the x axis, which is four fifths of the total probability of 1.

LOS 10-k

Explain the key properties of the normal distribution.

Normal distribution

A normal distribution is a continuous distribution which is bell shaped and symmetrical with a range of possible outcomes from $-\infty$ to $+\infty$.

The following are also properties of a normal distribution:

- The distribution can be described completely by its mean, μ, and variance, σ^2. A distribution can be denoted by $X \sim N(\mu, \sigma^2)$. Note that N(0,1) is called the **standard normal distribution.**
- Skewness is 0 and the kurtosis (which measures how peaked it is) is 3. The mean, median and mode are the same.
- A linear combination of two or more normal random variables is normally distributed**.**

LOS 10-l

Distinguish between a univariate and a multivariate distribution.

LOS 10-m

Explain the role of correlation in the multivariate normal distribution.

A **univariate distribution** is one which describes a single random variable. A **multivariate distribution** considers probabilities for a number of related random variables. An example of a multivariate distribution is when we examine the distribution of stocks in a portfolio in order to decide whether the distribution of the returns from the portfolio is normally distributed. A multivariate distribution for a portfolio containing a number of stocks is described by

1. the mean returns of the stocks
2. the variance of each stocks' returns
3. the correlations between each pair of stocks' returns.

Note that in the multivariate normal distribution we need to specify correlations whereas in the univariate normal distribution we do not.

LOS 10-n

Construct and **explain** confidence intervals for a normally distributed random variable.

For a normally distributed random variable we can establish confidence intervals, a confidence interval gives the percentage of times that we expect the random variable to fall within the interval.

Some of the most important confidence intervals are

$P(X \text{ will lie between } \bar{x} \pm 1.645s) = 90\%$

$P(X \text{ will lie between } \bar{x} \pm 1.96s) = 95\%$

$P(X \text{ will lie between } \bar{x} \pm 2.58s) = 99\%$

where $\bar{x}$ is the sample mean and s the sample standard deviation.

LOS 10-o

Define the standard normal distribution, **explain** how to standardize a random variable, and **calculate** and **interpret** probabilities using the standard normal distribution.

A standard normal distribution is one with a mean of 0 and variance of 1. To standardize a normal distribution, i.e. to get in the format N(0,1), we simply need to subtract the mean from each observation and divide by the standard deviation. This means if $X \sim N(\mu, \sigma^2)$ and we calculate $z = (X - \mu)/\sigma$ then $z \sim N(0,1)$.

Note that z is the conventional symbol for the standard normal variable; sometimes this is also called a z-value.

Example 10-4 Z-value

If the mean of a normal distribution is 100 and the standard deviation is 10, what is the z-value for an observation of 80?

$$Z = \frac{80 - 100}{10} = -2.0$$

This indicates that an observation of 80 lies 2 standard deviations below the mean.

If the z-value of an observation X is an integer we can easily work out the probability of the observation lying between the mean and X.

Example 10-5 Interpreting z-values

If the z-value of an observation is -2.0, as calculated in Example 10-4, then 47.7% (95.44/2) of observations will lie between the mean and the observation.

If the z-value is not an integer you will need to use standard normal distribution tables, an excerpt of which is shown below:

P(Z ≤ z) for z ≥ 0

z	0.00	0.01	0.02
0.0	0.5000	0.5040	0.5080
0.1	0.5398	0.5438	0.5478
0.2	0.5793	0.5832	0.5871
0.3	0.6179	0.6217	0.6255
0.4	0.6554	0.6591	0.6628
			Etc.

For example, if Z is 0.22 then 58.71% of observations lie below, or are equal to, 0.22.

If required to find out the probability that an observation will be above or below a certain value then it may be necessary to compute z-values for two different observations.

Example 10-6 Interpreting z-values

If the mean of a normal distribution is 0 and the standard deviation is 2, what is the probability of an observation lying between -4 and -2?

First of all calculate z for -4:

Z = -4/2 = -2.0

Therefore the area between 0 and -4 is 47.7

The z-value for -2 is -1.

Therefore the area between 0 and -2 is 34.1

So the probability that a reading lies between - 4 and -2 is 47.7% - 34.1% = 13.6%.

LOS 10-p

Define shortfall risk, **calculate** the safety-first ratio and **select** an optimal portfolio using Roy's safety-first criterion.

Shortfall risk is relevant when the investor is concerned about the risk of the portfolio value falling below a minimum or threshold level of return (R_L) over a certain time period, in this case safety-first rules should be considered.

Roy's safety–first criterion minimizes the $P(R_p < R_L)$, or selects the portfolio for which $E(R_p) - R_L$ is largest in units of standard deviation. This is the same as maximizing the safety first ratio which is

Equation 10-3

$$\text{S F Ratio} = \frac{[E(R_P) - R_L]}{\sigma_P}$$

where

R_P	=	portfolio return
R_L	=	threshold level
σ_P	=	portfolio standard deviation

Note. This is similar to the Sharpe ratio; the portfolio with the highest Sharpe ratio will be the one that minimizes the probability of achieving a return below the risk-free rate.

Example 10-7 Shortfall risk

An investor needs to ensure that she achieves a return of at least the deposit rate of 5%. Two investment options are suggested, the first has an expected return of 20% with a standard deviation of 10%, the second has an expected return of 12% with a standard deviation of 8%. In order to decide which of the two options is the most attractive use the safety-first criterion and calculate:

S F Ratio(investment 1) = (20 – 5)/10 = 1.5

S F Ratio(investment 2) = (12 – 5)/8 = 0.875

The first investment option is the best according to the safety requirement.

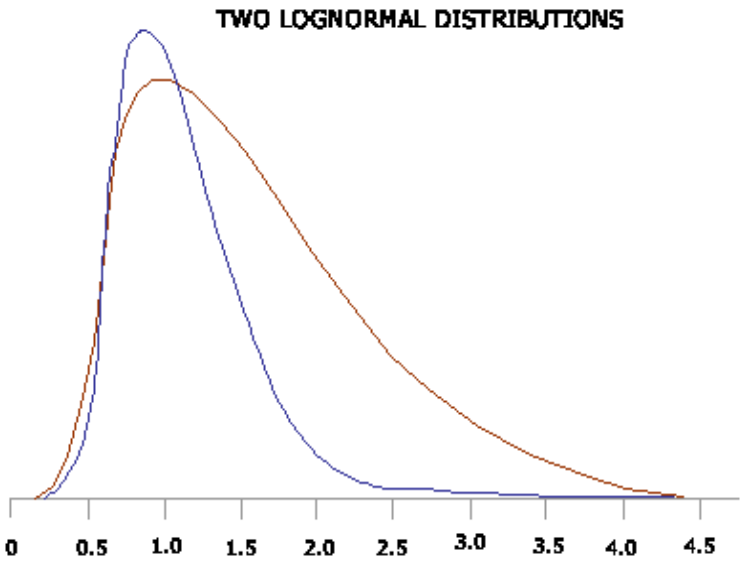
LOS 10-q

Explain the relationship between the lognormal and normal distributions and **explain** and **interpret** the use of the lognormal distribution in modelling asset prices.

Lognormal distributions

The price of many financial assets is lognormally distributed. A lognormal distribution is defined by Y where $Y = e^X$, where X is the underlying normal distribution. Alternatively we could say that ln Y has a normal distribution. A lognormal distribution is skewed to the right with the lowest value being zero. It is completely described by two parameters, the mean and standard deviation of the underlying normal distribution. Note that the mean and standard deviation of the lognormal distribution are different to those of the underlying normal distribution.

Lognormal distributions have been used to describe price distributions of financial assets, whereas normal distributions are often used to describe return distributions of assets.



LOS 10-r

Distinguish between discretely and continuously compounded rates of return; and **calculate** and **interpret** the continuously compounded rate of return, given a specific holding period return.

Turning to stock returns and stock prices: we need to define **continuously compounded return**, it is linked to the holding period return by:

Equation 10-4

$$r_{t,t+1} = \ln S_{t+1}/S_t = \ln\left[1 + R_{t,t+1}\right]$$

where

$r_{t,t+1}$ = continuously compounded return between t and t+1

S_t = stock price at time t

$R_{t,t+1}$ = holding period rate of return between t and t+1

Example 10-8 Continuously compounded returns

A stock price moves from \$50 to \$60. The return is 20% but the continuously compounded return is ln(\$60/\$50) = ln(1.2) = 0.1823, or 18.23%, less than the holding period return.

Extending the concept we have $r_{0,T} = \ln S_T/S_0$ or $S_T = S_0 \times \exp(r_{0,T})$

If $r_{0,T}$ is normal then S_T can be treated as a lognormal random variable. Even if the continuously compounded returns are not normally distributed a lognormal distribution will effectively describe asset prices.

Calculating portfolio end values using holding period returns will not represent actual returns as well as if the returns were converted to continuously compounded returns and the lognormal distribution was used to forecast end values.

LOS 10-s

Explain Monte Carlo simulation and historical simulation and **describe** their major applications and limitations.

A **Monte Carlo simulation** is when computer models are used to find approximate solutions to complex financial problems. Risk factors are identified and probabilities assigned to the different sources of risk, then random sampling is used to simulate the risk factors. A very large number of simulations would usually be performed.

Examples of when Monte Carlo simulations are used include:

- asset/liability planning for pension funds – risks would be stock market returns, interest rates, etc.
- estimating Value at Risk – the model provides a distribution for changes in portfolio value which gives an estimate of the probability of portfolio losses exceeding a specified amount.
- pricing of complex securities including options.

Historical simulation uses historical records to provide information on distributions. The disadvantage is that it only takes into account risks already reflected in the sample and doesn't include risks not reflected in the historic sample period.

11 Sampling and Estimation

Learning Outcome Statements (LOS)

11-a	**Define** simple random sampling, **define** and **interpret** sampling error, and d**efine** a sampling distribution and **interpret** sampling error.
11-b	**Distinguish** between simple random and stratified random sampling.
11-c	**Distinguish** between time-series and cross-sectional data.
11-d	**State** the central limit theorem and **describe** its importance.
11-e	**Calculate** and **interpret** the standard error of the sample mean.
11-f	**Distinguish** between a point estimate and a confidence interval estimate of a population parameter.
11-g	**Identify** and **describe** the desirable properties of an estimator.
11-h	**Explain** the construction of confidence intervals.
11-i	**Describe** the properties of Student's t-distribution.
11-j	**Calculate, explain** and **interpret** degrees of freedom.
11-k	**Calculate** and **interpret** a confidence interval for a population mean when sampling from a normal distribution with 1) a known population variance, 2) an unknown population variance, or 3) when sampling from a population with an unknown variance when the sample size is large.
11-l	**Discuss** the issues regarding selection of the appropriate sample size.
11-m	**Define** and **discuss** data-mining bias, sample selection bias, survivorship bias, look-ahead bias, and time-period bias.

Introduction

This Reading Assignment examines how data in a sample can be collected and then used to provide information on the wider population. Many of the examples are concerned with the mean of the sample being used to estimate the population mean, this is a practice often used in finance. The Central Limit Theorem allows us to make probability statements about a population mean based on sample data. It is imperative that you understand the concept and calculation of confidence intervals for the population mean and when to use the z-statistic or t-statistic before moving on to hypothesis testing in the next section.

LOS 11-a

Define simple random sampling, define and interpret sampling error, and define a sampling distribution and interpret sampling error.

Sampling

There are different ways of selecting a sample from a population. The basic type of sample is a **simple random sample**. In this sample each item or person in the population has an equal probability of being included.

Example 11-1 Simple random sample

Put each member of a population in a sequence and identify each member by a number then use random number tables to select the numbers for a sample (however many numbers needed for the sample size required). Match these numbers to the members of the population to identify the sample.

When it is not practical to assign a number to each item in a population then we might use **systematic random sampling**. In this case the items are arranged and then every nth item is included in the sample. This assumes that there is no pattern to the way that the items are arranged.

Example 11-2 Systematic random sample

A chocolate bar manufacturer selects every 100th chocolate bar coming off a conveyor belt for inclusion in a sample to test the weights of chocolate bars being produced.

Although a random sample will reflect the characteristics of the population in an unbiased way, there is likely to be a difference between the estimate from the sample and the actual population characteristic.

Sampling error is defined as the difference between the observed value of a sample statistic and the quantity that it is being used to estimate from the population.

Example 11-3 Sampling error

A chocolate bar manufacturer selects every 100th chocolate bar coming off a conveyor belt for inclusion in a sample to test the weights of chocolate bars being produced. The mean weight of chocolate bars in the sample is 105 grams, the mean population weight is 100 grams, and sampling error is therefore 5 grams.

A **sampling distribution** of a statistic is the distribution of all possible distinct values that the statistic can assume when samples of the same size are randomly taken from the population.

For example **the sampling distribution of the sample mean** is the distribution of all possible sample means of a given sample size and the probability of occurrence of each sample mean.

Example 11-4 Sampling distribution

The four employees of a firm have worked for the firm for 3, 7, 8 and 12 years. To calculate the sampling distribution of the sample mean for samples of two workers calculate the means for all possible samples

Employees in Sample (years worked)	Sample Mean (in years)
3 and 7	5.0
3 and 8	5.5
3 and 12	7.5
7 and 8	7.5
7 and 12	9.5
8 and 12	10.0

Therefore the sampling distribution of the sample mean is:

Sample Mean (in years)	Probability
5.0	0.167
5.5	0.167
7.5	0.333
9.5	0.167
10.0	0.167

We can see from the example that the mean of the sample mean is the same as the population mean, and the standard deviation of the distribution of sample mean is less than that of the population.

LOS 11-b

Distinguish between simple random and stratified random sampling.

Another method of taking a sample is **stratified random sampling**. In this case we divide the population into subgroups (or strata) and select a sample from each subgroup. If it is a **proportional sample** then the number of items selected from each subgroup will be the same as the size of the subgroup as a proportion to the total population.

Example 11-5 Stratified random sampling

If we wish to study the usage of cars by a population of car owners we might decide to divide car owners into three subgroups by age as shown below.

Age	Percentage of car owners	Number in sample
Under 25 years	15%	300
25 years up to 55 years	60%	1,200
55 years and over	25%	500
Total	*100%*	*2,000*

The number from each group selected for the sample is based on the percentage of car owners in that group.

LOS 11-c

Distinguish between time-series and cross-sectional data.

Two different forms of data are:

1. Time-series data

Time-series data is a sequence of returns collected at discrete and equally spaced time intervals, for example historic monthly stock returns.

2. Cross-sectional data

This is data collected on a characteristic of a group, which might be a group of individuals or companies, at a single point in time. Last year's closing prices for stocks that trade on the NYSE is an example of cross-sectional data.

LOS 11-d

State the central limit theorem and describe its importance.

Central limit theorem

For a population with a mean of μ and a variance of σ^2, the sampling distribution of the sampling mean ($\bar{X}$) of all possible samples of size n will be approximately normally distributed with a mean μ and variance σ^2/n (assuming n is large, say 30 or over).

To summarize:

- Even if the distribution of the population is not normal the sampling distribution of the sampling mean, $\bar{x}$, is approximately a normal distribution.
- The mean of the distribution of $\bar{x}$ will be equal to the mean of the population.
- The variance of the distribution of $\bar{x}$ will be equal to the variance of the population divided by the sample size.

LOS 11-e

Calculate and **interpret** the standard error of the sample mean.

The **standard error** of the sample mean is

Equation 11-1

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

This is the standard deviation of the sampling distribution of the sample mean.

If the population standard deviation (σ) is not known, then we can use the sample standard deviation, s, to estimate the standard error, it is then denoted by:

Equation 11-2

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

where:

Equation 11-3

$$s^2 = \frac{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}{n-1}$$

Example 11-6 Standard error of the sample mean

If the standard deviation of a population is 10 and a sample of 49 items is taken from the population then the standard error of the sample mean is:

$$\frac{\sigma}{\sqrt{n}} = \frac{10}{7} = 1.4285$$

LOS 11-f

Distinguish between a point estimate and a confidence interval estimate of a population parameter.

Estimating a population parameter

The formulae that we use to calculate a sample statistic are **estimators**. The particular value that we calculate using an estimator is an **estimate**.

A **point estimate** is a single estimate calculated from a sample which is used to estimate the population parameter. An example of this would be a sample mean being calculated as a point estimate of the population mean.

Another approach is to make an **interval estimate** of the parameter; this means we find an interval that will include the population parameter with a certain level of probability. This is a **confidence interval.**

LOS 11-g

Identify and **describe** the desirable properties of an estimator.

The three desirable properties of an estimator (or estimation formula) are:

1. Unbiased – the expected value (the mean of its sampling distribution) is the same as the parameter it is intended to estimate.
2. Efficient – there is no other unbiased estimate of the same parameter with a sampling distribution of smaller variance.
3. Consistent – the probability of accurate estimates increases as the sample size increases.

LOS 11-h

Explain the construction of confidence intervals.

Confidence intervals

This is an interval and the population parameter lies within this interval with a specified probability (1 – α). The probability is the **degree of confidence**. The interval is called the (1 – α)% confidence interval for the parameter.

The end points of the interval are called the lower and upper **confidence limits**.

A 95% confidence interval can be interpreted by considering the case when we take a large number of samples from the population and construct a confidence interval for each sample. We expect 95% of these confidence intervals to include the population mean. Following on, we can say that we are 95% confident that a single confidence level includes the population mean.

Constructing a confidence interval

A confidence interval is defined by:

Equation 11-4

point estimate ± reliability factor x standard error

where

point estimate = a point estimate of the parameter

reliability factor = a number based on the assumed distribution of the point estimate and degree of confidence for the interval

standard error = standard error of the sample statistic providing the point estimate

Applying this to the case where we are estimating the population mean and we are taking a sample from a normally distributed population with known variance. The confidence interval is given by:

Equation 11-5

$$\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

where

$\bar{x}$ = sample mean, which is the point estimate of the population mean
σ = population standard deviation
n = sample size
$z_{\alpha/2}$ = reliability factor, the point where $\alpha/2$ of the probability is in the right tail

Using the characteristics of a normal distribution, we can see that:

$z_{0.05}$ is used for 90% confidence intervals, since it is when 5% of the probability is in the top right tail and 5% in the bottom left tail. $z_{0.05}$ is 1.645.

$z_{0.025}$ which is used for 95% confidence intervals, is 1.960.

$z_{0.005}$ which is used for 99% confidence intervals, is 2.575.

Another way of saying this is that:

90% of the sample means will be within 1.645 standard deviations of the population mean.

95% of the sample means will be within 1.960 standard deviations of the population mean.

99% of the sample means will be within 2.575 standard deviations of the population mean.

For **any** distribution if we do **not** know the variance, and it is a **large** sample, we can use

Equation 11-6

$$\bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

where

s	=	sample standard deviation
$\bar{x}$	=	sample mean
n	=	sample size

Therefore:

The 90% confidence interval for the mean is $\bar{x} \pm \frac{1.645s}{\sqrt{n}}$

The 95% confidence interval for the mean is $\bar{x} \pm \frac{1.960s}{\sqrt{n}}$

The 99% confidence interval for the mean is $\bar{x} \pm \frac{2.575s}{\sqrt{n}}$

Example 11-7 Confidence intervals

A sample of 81 observations is taken from a normal population, the sample mean is 20 and the standard deviation is 3.

The 90% confidence interval is $20 \pm (1.645 \times 3)/9$ which is 19.45 up to 20.55.

This means we can be 90% confident that the population mean lies between 19.45 and 20.55.

The 95% confidence interval is $20 \pm (1.960 \times 3)/9$ which is 19.35 up to 20.65.

The 99% confidence interval is $20 \pm (2.575 \times 3)/9$ which is 19.14 up to 20.86.

LOS 11-i

Describe the properties of Student's t-distribution.

Student's *t* – distribution

An alternative method for constructing confidence intervals is to use the t-distribution. It is a more conservative method, giving wider intervals, and ideally is used in all cases even when it is a large sample. However when it is a small sample (less than 30), when we do not know the population variance, it is essential to use the t-distribution approach.

The t**-distribution** is a symmetrical probability distribution defined by a single parameter, the number of degrees of freedom (df).

LOS 11-j

Calculate, explain and **interpret** degrees of freedom.

Degrees of freedom are the number of independent observations used.

Example 11-8 Degrees of freedom

The equation for sample variance $\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{(n-1)}$

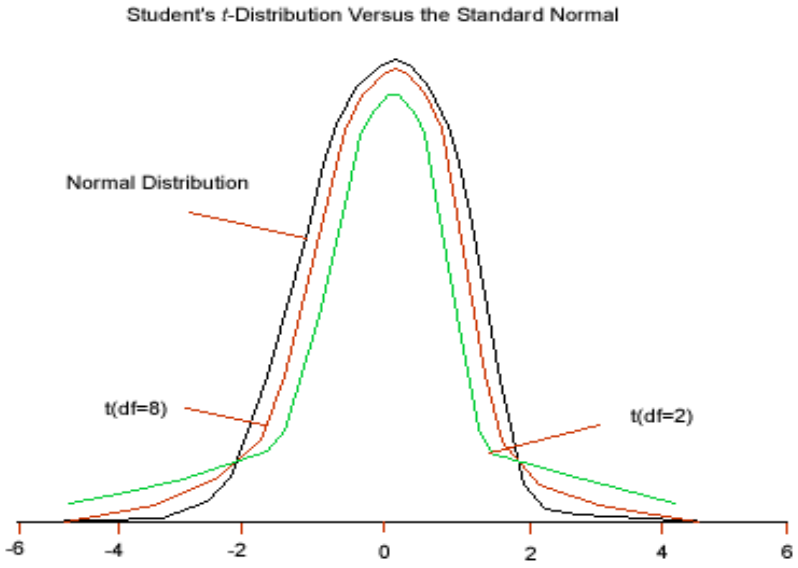
for a sample of size n uses a denominator of (n - 1). This is because there are (n – 1) ways of selecting the sample, if the mean is given (as it is in the numerator of the variance formula). Once you have selected (n – 1) items, the nth item will be determined by the mean. Therefore there are (n – 1) degrees of freedom.

The t-distribution with a mean of 0 and (n – 1) degrees of freedom is given by:

Equation 11-7

$$t = \frac{(\overline{x} - \mu)}{s/\sqrt{n}}$$

It is not normal since there are two random variables, the sample mean and standard deviation. However as the number of degrees of freedom increases the t-distribution approaches the normal distribution, as shown below:



LOS 11-k

Calculate and **interpret** a confidence interval for a population mean when sampling from a normal distribution with 1) a known population variance, 2) an unknown population variance, or 3) when sampling from a population with an unknown variance when the sample size is large.

Confidence intervals for the population mean

If we are considering a population with unknown variance and either

- the sample is large, or
- the sample is small but normally distributed, then

The (1 – α)% confidence interval is given by:

Equation 11-8

$$\bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

where the number of degrees of freedom for $t_{\alpha/2}$ is (n – 1), with a sample size of n.

In order to answer hypothesis questions you may be required to read t-distribution tables to find the critical value of t. We show an excerpt from the tables below. Note that these are for one-tailed tests, so for α = 0.05 then p = 0.05, whereas for a two-tailed test you would need to use p = 0.025, which is half the significance level.

For example to find the critical t-value with 5 degrees of freedom and α = 0.05 and a one-tailed test the critical t-value would be 2.015. For a two-tailed test (p = 0.025) it would be 2.571.

df	p =0.10	p = 0.05	p = 0.025
1	3.078	6.314	12.706
2	1.886	2.920	4.303
3	1.638	2.353	3.182
4	1.533	2.132	2.776
5	1.476	**2.015**	**2.571**
			Etc.

Example 11-9 Confidence intervals

An investor is looking at the quarterly returns from a mutual fund portfolio which are assumed to be normally distributed and have a mean of 3% and a sample standard deviation of 2%. He looks at 3 years' data and wishes to compute the 95% confidence interval. Since the sample is small he uses Equation 3-12.

He will need to use *t*-distribution tables to look up $t_{0.025}$ for 11 degrees of freedom (since the sample size is 12), this is 2.201.

The confidence interval is

$$\bar{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}} = 3\% \pm 2.201\frac{2\%}{\sqrt{12}}$$

$$= 3\% \pm 1.27\%$$

The 95% confidence interval is between 1.73% and 4.27%

The investor can be confident, at the 95% level, that this range includes the population mean.

In summary, the table below shows which statistic to use for different samples.

Distribution	Variance	Small Sample	Large Sample
Normal	Known	z	z
Normal	Unknown	t	z or t
Nonnormal	Known	Not Available	z
Nonnormal	Unknown	Not Available	z or t

LOS 11-l

Discuss the issues regarding selection of the appropriate sample size.

If a larger sample size is taken then the confidence interval will decrease as the standard error is lower. As you would expect, a larger sample gives more precise results.

LOS 11-m

Define and **discuss** data-mining bias, sample selection bias, survivorship bias, look-ahead bias, and time-period bias.

Biases impacting on data selected

Data-snooping bias

This is the bias that occurs if you use the empirical results of other analysts' research, or focus on patterns that may have been identified by other research. Ideally you would study new data but unfortunately this may not be practical in financial markets where much of the research is based on historic data.

Data-mining bias

This is when forecasting models are derived from searching through historic data for patterns/trading rules. The problems occur when a large number of models are tested but only the successful ones reported.

Sample selection bias

This occurs when certain data is excluded from the analysis, possibly because the data was not available.

Survivorship bias

This is one type of sample selection bias, which occurs when companies that have gone bankrupt, or funds or portfolios that have been liquidated, are not included in the analysis.

Look-ahead bias

This is when a test uses information that was not available at the test date. An example of this is when the success of valuation ratios is considered but all investors may not have had access to the accounting data incorporated in the valuation ratio at the test date.

Time-period bias

This is when the test period used does not match the conclusion being drawn, perhaps short-term data is being applied to provide long-term forecasts.

12 Hypothesis Testing

Learning Outcome Statements (LOS)

12-a	**Define** a hypothesis, **describe** the steps of hypothesis testing; **define** and **interpret** the null hypothesis and alternative hypothesis, and **distinguish** between one-tailed and two-tailed tests of hypotheses.
12-b	**Discuss** the choice of the null and alternative hypotheses.
12-c	**Define** and **interpret** a test statistic, a Type I and a Type II error, and a significance level, and **explain** how significance levels are used in hypothesis testing.
12-d	**Define** and **interpret** a decision rule and the power of a test.
12-e	**Explain** the relation between confidence intervals and hypothesis tests.
12-f	**Distinguish** between a statistical decision and an economic decision.
12-g	**Identify** the appropriate test statistic and **interpret** the results for a hypothesis test concerning the population mean of a normally distributed population with 1) known or 2) unknown variance.
12-h	**Identify** the appropriate test statistic and **interpret** the results for a hypothesis test concerning the equality of the population means of two normally distributed populations, based on independent random samples with 1) equal or 2) unequal assumed variances.
12-i	**Identify** the appropriate test statistic and **interpret** the results for a hypothesis test concerning the mean difference of two normally distributed populations (paired comparisons test).
12-j	**Identify** the appropriate test statistic and **interpret** the results for a hypothesis test concerning the variance of a normally distributed population.
12-k	**Identify** the appropriate test statistic and **interpret** the results for a hypothesis test concerning the equality of the variance of two normally distributed populations, based on two independent random samples.
12-l	**Distinguish** between parametric and nonparametric tests and **describe** the situations in which the use of nonparametric tests may be appropriate.

Introduction

In order to test statements in finance such as 'have the fund's returns been statistically different to the benchmark's returns?' or 'is the beta of a stock statistically different to 1?' we need to understand the procedure behind hypothesis testing. Essentially we need to state a null hypothesis and then collect data from a sample which will decide whether we have a basis for rejecting the null hypothesis. We will not be certain whether the null hypothesis can be rejected but will be able to state with a certain probability, or confidence level, whether we have evidence to reject it.

The focus of hypothesis testing is on testing a hypothesis concerning the population mean, although you need to be familiar with the tests that are used for population variances, difference between means and differences between variances.

LOS 12-a

Define a hypothesis, **describe** the steps of hypothesis testing; **define** and **interpret** the null hypothesis and alternative hypothesis, and **distinguish** between one-tailed and two-tailed tests of hypotheses.

LOS 12-b

Discuss the choice of the null and alternative hypotheses.

Hypothesis testing

A **hypothesis** is a statement about one or more populations developed for the purpose of testing.

Hypothesis testing is broken down into a 7-step process:

1. Stating the hypotheses.
2. Identifying the test statistic and its distribution.
3. Specifying the significance level.
4. Stating the decision rule.
5. Collecting the data and performing the calculations.
6. Making the statistical decision.
7. Making the economic or investment decision.

We will now look at each of these steps in turn.

1. *Stating the hypotheses*

We need to state two hypotheses, the null hypothesis and the alternative hypothesis.

The null hypothesis is defined as the statement being tested, and is denoted by H0. The null hypothesis will be considered to be true, and will be accepted, unless the hypothesis test gives evidence that it is false.

Note: the term 'accepted' for the null hypothesis is commonly used although it is misleading, it is better to use 'fail to reject it' since we do not have evidence that it is not true.

The alternative hypothesis is the statement that will be accepted if the sample data used in the test suggests that the null hypothesis is false; it is denoted by Ha.

The null and alternative hypothesis can be stated in three ways - as a two-tailed test, or in two different ways as one-tailed tests.

Two-tailed hypothesis test (or two-sided test)

If we are using the sample mean to test for the population mean a two-tailed test would be:

$H_0: \mu = \bar{x} \quad H_a: \mu \neq \bar{x}$

In this case the null hypothesis is rejected if the evidence indicates that the population parameter is either smaller or larger than $\bar{x}$.

One-tailed hypothesis test (or one-sided test)

One-tailed tests are used if we want to see if the population parameter is less than or equal to $\bar{x}$, or more than or equal to $\bar{x}$. The two hypotheses to test for the population mean are:

$H_0: \mu \leq \bar{x} \quad H_a: \mu > \bar{x}$

$H_0: \mu \geq \bar{x} \quad H_a: \mu < \bar{x}$

Note that the null hypothesis must always include the equals sign.

LOS 12-c

Define and **interpret** a test statistic, a Type I and a Type II error, and a significance level, and **explain** how significance levels are used in hypothesis testing.

2. *Identifying the test statistic and its distribution*

A **test statistic** is the quantity that is calculated from the sample whose value is used to decide whether to accept or reject the null hypothesis.

In the cases we are looking at, the test statistic is given by:

$$\textit{test}\ \text{statistic} = \frac{\text{sample statistic - value of parameter in } H_0}{\text{standard error of sample statistic}}$$

For example, when we are using the sample mean to estimate the population mean and we know the population standard deviation, the standard error is:

$\frac{\sigma}{\sqrt{n}}$ (using Equation 11-1)

The test statistic is $\frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$

If we do not know the population standard deviation we use $\frac{s}{\sqrt{n}}$ instead of $\frac{\sigma}{\sqrt{n}}$.

We are measuring how far the sample mean is from the center of the distribution in standard deviation terms.

Although different distributions can be tested, for the moment we will concentrate on t-tests and on z-tests for standard normal distributions.

3. *Specifying the significance level*

The significance level reflects how much evidence we require to reject the null hypothesis. This is the level of risk, called **alpha** risk, which is the probability of rejecting the null hypothesis when it is true (a **Type I error**). The risk of accepting the null hypothesis when it is false is **beta** risk (a **Type II error**).

Looking at the relationship between a decision and the true situation we can see there are four possibilities.

Decision	**True Situation**	
	H_0 True	**H_0 False**
Do not reject H_0	Correct	Type II Error
Reject H_0	Type I Error	Correct

For a given sample, if we want to reduce the probability of a Type I error, we will increase the probability of making a Type II error. We can only reduce the probability of errors occurring by increasing the sample size.

LOS 12-d

Define and **interpret** a decision rule and the power of a test.

LOS 12-e

Explain the relation between confidence intervals and hypothesis tests.

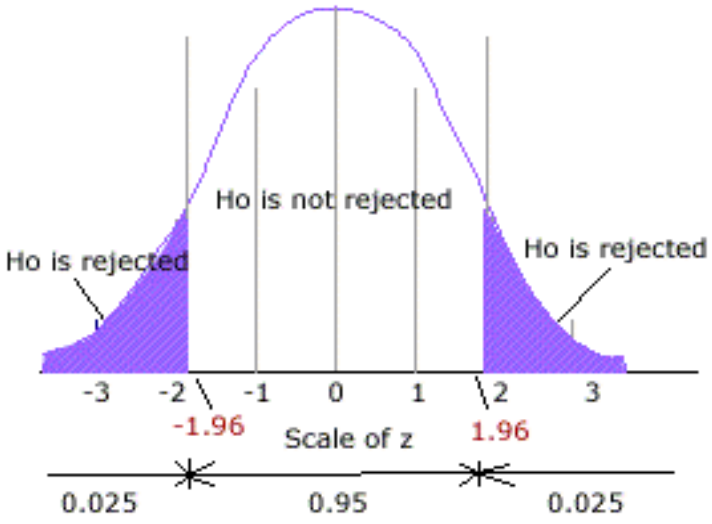
4. Stating the decision rule

The decision rule is based on deciding a critical value(s) or rejection point(s) for the test statistic, which will decide when the null hypothesis is accepted or rejected. These critical values are determined by the level of significance. For a z-test these are often set at:

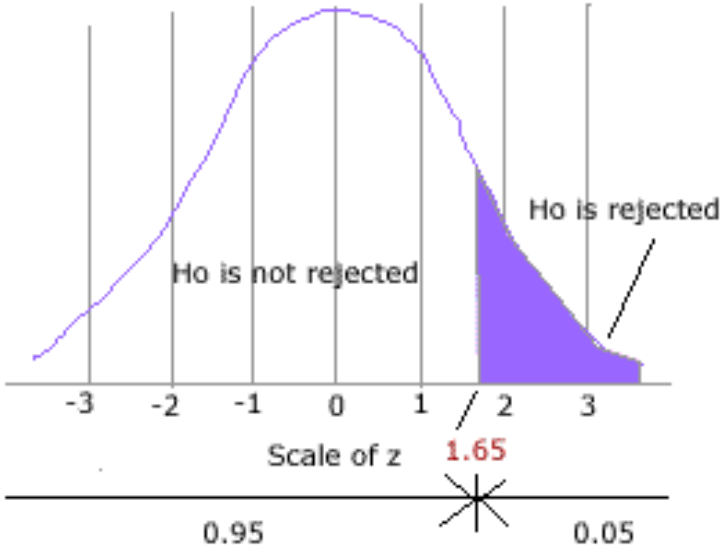
Level of Significance	1 Tail	2 Tails
.10	1.28	± 1.65
.05	1.65	± 1.96
.01	2.33	± 2.58

If the z-statistic or z-value is within these values, which means it is within the confidence interval or acceptance range, then the null hypothesis is not rejected, and the result of the test is **not statistically significant**. If it is outside the range then it is in the rejection region and then the null hypothesis is rejected, and the result is **statistically significant**.

The graph below shows the rejection points for the 0.05, or 5%, significance level for a two-tailed test when H_0: $\mu = 0$ H_a: $\mu \neq 0$. We reject the null hypothesis if the z-statistic is greater than 1.96 or less than -1.96.



For a one-tailed test the rejection region is at one end of the curve. In this case we have set the null hypothesis as H_0: $\mu \leq 0$ and H_a: $\mu > 0$. At the 0.05, or 5%, significance level, we can reject the null hypothesis if the z-statistic is greater than 1.645. The rejection region is shown below. If H_0: $\mu \geq 0$ and H_a: $\mu < 0$ then the rejection region would be at the lower end of the curve.



The p**-value** is used to measure how confident we can be in rejecting or accepting the null hypothesis, it is the smallest level of significance at which the null hypothesis can rejected. If the p-value is smaller than the significance level then H_0 is rejected and vice versa.

The p-value is the probability of observing a value as extreme, or more extreme, than the value observed given H_0 is true.

***p*-value less than**	**conclusion**
.10	some evidence that H_0 is not true
.05	strong evidence that H_0 is not true
.01	very strong evidence that H_0 is not true
.001	extremely strong evidence that H_0 is not true

Whereas the significance level of the test is the probability of incorrectly rejecting the null hypothesis, the **power** of the test is the probability of correctly rejecting the null hypothesis when it is false. If there is a choice of tests available we should use the one with the greatest power (perhaps because the sample size is larger).

5. *Collecting the data and performing the calculations*

When collecting data it is important to avoid the biases discussed in the previous section e.g. survivorship bias.

6. *Making the statistical decision*

This is the decision to accept or reject the null hypothesis based on the decision rule and the calculation of the test statistic.

LOS 12-f

Distinguish between a statistical decision and an economic decision.

7. *Making the economic or investment decision*

Other economic or investment considerations (for example client's risk tolerance, time horizon, transaction costs) need to be incorporated before the final decision is made.

LOS 12-g

Identify the appropriate test statistic and **interpret** the results for a hypothesis test concerning the population mean of a normally distributed population with 1) known or 2) unknown variance.

Choice of test

The z-test can be used when the population is normally distributed and the variance is known.

The z-test statistic for a single population mean is:

Equation 12-1

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

where

$\bar{x}$ = sample mean

μ_0 = hypothesized value of the population mean

σ = population standard deviation

n = sample size

If the sample is large, using the central limit theorem, we can use the sample standard deviation as an approximation of the population standard deviation even if the population is not normally distributed.

If the population variance is **not known** we should consider using the t-test. The t-test can be used if the variance is unknown and either (1) the sample is large or (2) the sample is small but the population is normally distributed.

Equation 12-2

$$t_{n-1} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

where

t_{n-1} = t-statistic with (n –1) degrees of freedom for a sample of size n

$\bar{x}$ = sample mean

μ_0 = hypothesized value of the population mean

s = sample standard deviation

Example 12-1 Hypothesis testing

1. We wish to test, at the 5% significance level, whether the mean of a population has changed from 25. The population standard deviation is 4. A sample of 100 observations is taken from the population and the sample mean is 24.

   The null hypothesis is that the mean of the population is 25. So define:

   H_0: $\mu = 25$

   H_a: $\mu \neq 25$

   In this case we have a large sample with a known population variance so we can use the z-statistic. Using Equation 12-1:

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{(24 - 25)}{0.4} = -2.5$$

   This is a two-tailed test so the critical values of z are plus or minus 1.96. z is less than -1.96, which is outside the acceptable range, so we reject the null hypothesis. We can conclude that there is statistical evidence that the mean has changed from 25.

2. We wish to test, at the 1% significance level, whether the mean of a population has risen above 100. The population standard deviation is 10. A sample of 70 observations is taken from the population and the sample mean is 102. Define

   H_0 : $\mu \leq 100$

   H_a : $\mu > 100$

   Again we can us the z-statistic since it is a large sample with a known variance.

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{(102 - 100)}{10/8.366} = 1.67$$

   This is a one-tailed test so the critical value of z is 2.33. Since 1.67 is less than the critical value we can conclude that we should not reject the null hypothesis and we do not have statistical evidence that the population mean is greater than 100. (At the 5% significance level we would need to reject the null hypothesis).

Example 12-1 Hypothesis testing (continued)

3. An investor is reviewing his fund's performance using 2 years' monthly data, the mean return is 1% per month with a standard deviation of returns of 3%. Returns are assumed to be normally distributed. He wishes to establish at the 0.05 level of significance whether the performance is consistent with a mean population return of a 1.3%.

   In this case apply a two-tailed test with:

   H_0: $\mu = 1.3\%$

   H_a: $\mu \neq 1.3\%$

   We can use the t-statistic since the sample is small but normally distributed.

   The rejection points are found in the t-distribution tables with 23 degrees of freedom, they are ± 2.069

   Calculate the t-statistic using Equation 12-2:

$$t_{n-1} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

$$t_{23} = \frac{1.0\% - 1.3\%}{3\%/\sqrt{24}} = -0.489$$

This does not lie outside the rejection points and is within the acceptance range so the null hypothesis cannot be rejected. We can conclude that the results appear to be consistent with a population mean of 1.3%.

LOS 12-h

Identify the appropriate test statistic and **interpret** the results for a hypothesis test concerning the equality of the population means of two normally distributed populations, based on independent random samples with 1) equal or 2) unequal assumed variances.

Tests for means of two different groups

In this case we want to establish whether the means of two different groups or populations are the same, or whether one is larger than the other. It is assumed that the two groups are approximately normally distributed and the samples are independent of each other. In the first case the populations' variances are assumed to be equal (although they may not be known) and in the second case they are assumed not to be equal.

In the first case the most likely hypotheses to use are:

$H_0: \mu_1 - \mu_2 = 0$ $\quad$ $H_a: \mu_1 - \mu_2 \neq 0$

$H_0: \mu_1 - \mu_2 \leq 0$ $\quad$ $H_a: \mu_1 - \mu_2 > 0$

$H_0: \mu_1 - \mu_2 \geq 0$ $\quad$ $H_a: \mu_1 - \mu_2 < 0$

where μ_1 and μ_2 are the population means of the two populations.

When the population variances are equal, we effectively combine or pool the observations and use a t-test based on:

Equation 12-3

$$t = \frac{\left(\overline{x_1} - \overline{x_2}\right) - \left(\mu_1 - \mu_2\right)}{\left(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}\right)^{1/2}}$$

where

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$\overline{x_i}$ = the sample mean for group i

μ_i = the mean for population i

t is the pooled estimator of the common variance.

There are $(n_1 + n_2 - 2)$ degrees of freedom.

Example 12-2 Means of different populations

The returns from a fund are shown below:

	Mean Weekly Return	Standard Deviation
Year 1	0.45%	2.6%
Year 2	0.20%	2.5%

We assume that the population variances are equal and the data is independent. We wish to establish if the mean returns were statistically different.

Define H_0: $\mu_1 - \mu_2 = 0$ H_a: $\mu_1 - \mu_2 \neq 0$ where μ_1 is the mean return for the fund in Year 1 and μ_2 is the mean return for the fund in Year 2.

Look at the 0.05 and the 0.01 levels of significance. Using tables with 102 degrees of freedom (52+ 52 –2) the rejection points are ±1.984 and ±2.626 respectively.

Using Equation 12-3:

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$$= \frac{(51 \times 2.6^2) + (51 \times 2.5^2)}{102}$$

= 6.51 This is effectively the pooled estimate of the common variance.

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\left(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}\right)^{1/2}}$$

$$= \frac{(0.45 - 0.20) - 0}{\left(\frac{6.51}{51} + \frac{6.51}{51}\right)^{1/2}} = 0.49$$

This is not significant at either the 0.05 or 0.01 levels and we can conclude that the means are not statistically different.

If we cannot assume that the population variances are equal the formula becomes:

Equation 12-4

$$t = \frac{\left(\overline{x_1} - \overline{x_2}\right) - \left(\mu_1 - \mu_2\right)}{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^{1/2}}$$

where the degrees of freedom are given by:

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(s_1^2/n_1\right)^2}{n_1} + \frac{\left(s_2^2/n_2\right)^2}{n_2}}$$

LOS 12-i

Identify the appropriate test statistic and **interpret** the results for a hypothesis test concerning the mean difference of two normally distributed populations (paired comparisons test).

Paired comparison tests

When two samples are **not** independent we cannot apply the test statistics shown in Equations 12-3 and 12-4. If, for example, we are comparing the mean returns of two portfolios investing in the US over the same time period, it is likely that the performance will not be independent. This is because they will both be affected by common risk factors, such as the return from the US market.

Denote $d_i = x_{Ai} - x_{Bi}$,where x_{Ai} and x_{Bi} are the ith pair of observations.

Then if μ_{D0} is the hypothesized value of the mean difference (often set at 0) the following hypotheses can be used:

$H_0: \mu_D = \mu_{D0}$. $H_a: \mu_D \neq \mu_{D0}$

$H_0: \mu_D \leq \mu_{D0}$ $H_a: \mu_D > \mu_{D0}$

$H_0: \mu_D \geq \mu_{D0}$ $H_a: \mu_D < \mu_{D0}$

The sample mean difference is given by:

$$\overline{d} = \frac{1}{n}\sum_{i=1}^{n} d_i$$

The sample variance by:

$$s_d^2 = \frac{\sum_{i=1}^{n}\left(d_i - \bar{d}\right)^2}{n-1}$$

The standard error of the mean difference is:

$$s_{\bar{d}} = \frac{s_d}{\sqrt{n}}$$

When the samples are taken from normally distributed populations with unknown variances the t-test is based on:

Equation 12-5

$$t = \frac{\bar{d} - \mu_{d0}}{s_{\bar{d}}}$$

with (n – 1) degrees of freedom where n is the number of paired observations.

Example 12-3 Paired comparison test

The following information is given regarding the performance of the two portfolios A and B. The performance is monthly over the last five years.

Portfolio	Mean Return	Standard Deviation
A	1.8%	4.5%
B	1.4%	3.6%
Difference	0.4%	1.3%

From the information we can see that:

$\bar{d} = 0.4\%$, and $s_d = 1.3\%$ and $n = 60$

We wish to establish whether the means of the two performances are equal, at the 0.05 significance level.

Set the hypothesis as:

$H_0: \mu_D = 0 \quad H_a: \mu_D \neq 0$

The test statistic is the t-statistic with 59 degrees of freedom.

Using tables the critical values are $t = \pm 2.0$

Using Equation 12-5:

$$t = \frac{\bar{d} - \mu_{d0}}{s_{\bar{d}}}$$

$$t_{59} = \frac{0.4\%}{1.3\%/\sqrt{59}} = 2.36$$

Since this is larger than 2 we reject the null hypothesis and conclude that the difference in mean returns is statistically significant.

LOS 12-j

Identify the appropriate test statistic and **interpret** the results for a hypothesis test concerning the variance of a normally distributed population.

Testing for variance

We now look at hypothesis testing in relation to the value of the variance, σ^2. If we set σ_0^2 as the hypothesized value of σ^2 we can set the hypotheses as one of the following:

$H_0: \sigma^2 = \sigma_0^2$ $\quad$ $H_a: \sigma^2 \neq \sigma_0^2$

$H_0: \sigma^2 \leq \sigma_0^2$ $\quad$ $H_a: \sigma^2 > \sigma_0^2$

$H_0: \sigma^2 \geq \sigma_0^2$ $\quad$ $H_a: \sigma^2 < \sigma_0^2$

For a single normally distributed population we use the **chi-square test statistic**, (χ^2). This requires the use of the appropriate distribution tables using (n –1) degrees of freedom for a sample size n. Note that the chi-square distribution is not symmetrical and has a lower bound of zero. It is also sensitive to violations in the assumptions used.

The test statistic is

Equation 12-6

$$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2}$$

where

s^2 = sample variance

σ_0^2 = hypothesized value of the variance

and there are (n - 1) degrees of freedom.

Example 12-4 Using a chi-square test statistic

We have the data for monthly returns for a portfolio over the last 5 years.

Mean Return	Standard Deviation
1.8%	4.5%

The managers of the portfolio say that their risk disciplines ensure that the standard deviation of returns is less than 5%.

We wish to test the hypothesis that:

$H_0: \sigma^2 \geq 25$ $H_a: \sigma^2 < 25$

The test statistic is the chi-square test statistic with 59 degrees of freedom.

Using chi-square tables and using 0.95 (we have a 95% probability of a test statistic this level or higher), the critical level is 43.188. We will reject the null hypothesis if the test statistic is less than this number.

$$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2} = \frac{59 \times 4.5^2}{25} = 47.79$$

This is more than 43.188 so we cannot reject the null hypothesis; there is insufficient statistical evidence that the standard deviation of the returns of the population is less than 5%.

LOS 12-k

Identify the appropriate test statistic and **interpret** the results for a hypothesis test concerning the equality of the variance of two normally distributed populations, based on two independent random samples.

Differences between variances

If we are interested in checking whether the variances of two normally distributed populations are the same then we can formulate the hypothesis as follows:

$H_0: \sigma_1^2 = \sigma_2^2$ $H_a: \sigma_1^2 \neq \sigma_2^2$

$H_0: \sigma_1^2 \leq \sigma_2^2$ $H_a: \sigma_1^2 > \sigma_2^2$

$H_0: \sigma_1^2 \geq \sigma_2^2$ $H_a: \sigma_1^2 < \sigma_2^2$

In this case we use the **F-test** where F is given by the ratio of the two sample variances:

Equation 12-7

$$F = \frac{s_1^2}{s_2^2}$$

F-distributions are asymmetrical with a lower bound of zero, and again are sensitive to violations in the assumptions. When looking at the differences between variances, we first need to formulate the null and alternative hypothesis, decide the level of significance, and use tables to find the critical values of F. The calculation of F will decide whether there is statistical evidence to reject the null hypothesis or not.

LOS 12-l

Distinguish between parametric and nonparametric tests and **describe** the situations in which the use of nonparametric tests may be appropriate.

A **parametric test** is one which is concerned with parameters and/or makes assumptions about the distribution of the sample. A **nonparametric test** is not concerned with the parameter or makes minimal assumptions about the distribution.

A nonparametric test might be used if we want to establish whether a set of data is random or if a distribution is strongly non-normal.

13 Correlation and Regression

Learning Outcome Statements (LOS)

13-a	**Define** and **interpret** a scatter plot.
13-b	**Calculate** and **interpret** a sample covariance and a sample correlation coefficient.
13-c	**Formulate** a test of the hypothesis that the population correlation coefficient equals zero and **determine** whether the hypothesis is rejected at a given level of significance.
13-d	**Differentiate** between the dependent and independent variables in a linear regression and **explain** the assumptions underlying linear regression.
13-e	**Define, calculate** and **interpret** the standard error of estimate and the coefficient of determination.
13-f	**Calculate** a confidence interval for a regression coefficient.
13-g	**Formulate** a null and an alternative hypothesis about a population value of a regression coefficient, **select** the appropriate test statistic, and **determine** whether the null hypothesis is rejected at a given level of significance.
13-h	**Interpret** a regression coefficient.
13-i	**Describe** the use of analysis of variance (ANOVA) in regression analysis and **interpret** ANOVA results.
13-j	**Calculate** and **interpret** a predicted value and a confidence interval for the predicted value for the dependent variable given an estimated regression model and a value for the independent variable.
13-k	**Discuss** the limitations of regression analysis and **identify** problems with a particular regression analysis or its associated results and any conclusions drawn from them.

Introduction

The last part of this Study Session looks at correlation and regression, tools that are used to examine the relationship between two or more financial variables. Whereas correlation measures the linear relationship between two variables, regression looks at the relationship between a dependent variable and independent variables. In addition to calculating correlation and regression coefficients you will need to be able to interpret the numbers, test their significance and discuss their limitations.

LOS 13-a

Define and **interpret** a scatter plot.

Scatter plots

In order to look at the relationship between two variables first of all we look at a **scatter plot**, which is a graph that visually describes the relationship between two series of data in two dimensions:

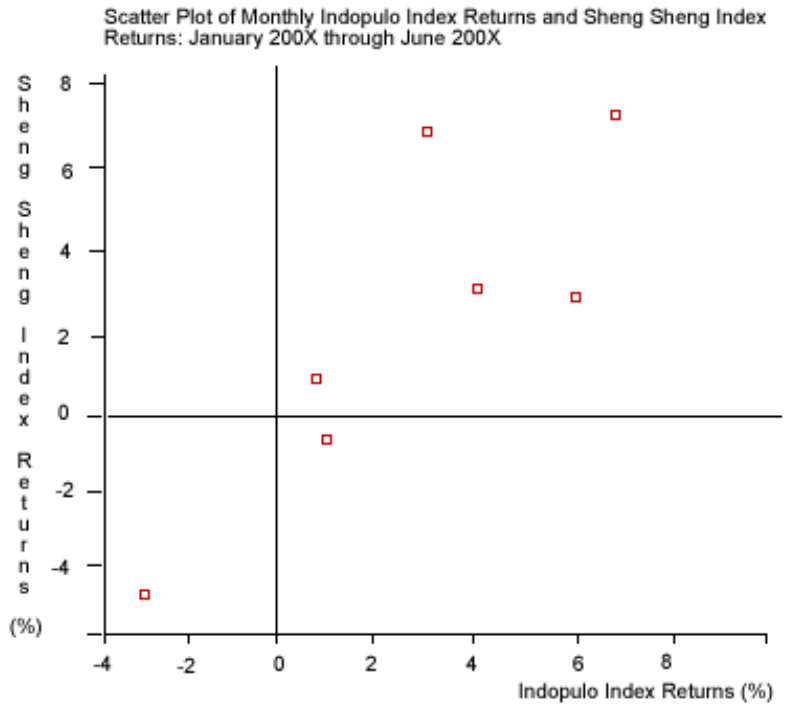
Example 13-1 Scatter plot

In the table below there is a series of data giving monthly returns for two stock markets, namely the Indopulo and Sheng Sheng Stock Exchanges.

	Indopulo Index Returns	Sheng Sheng Index Returns
January 200X	1.1%	-0.8%
February 200X	7.1%	6.8%
March 200X	5.9%	3.1%
April 200X	0.9%	1.2%
May 200X	-3.0%	-5.0%
June 200X	4.1%	3.2%
Average	*2.7%*	*1.4%*

The scatter plot of the two indices is shown below. The x-axis represents the data from the Indopolu index and the y-axis from the Sheng Sheng index, for each month's return there is a single point marked on the graph. Note that a scatter plot does not provide information on which period a point relates to.

Example 13-1 Scatter plot (continued)



The extent of the association between the two data series can be represented by a single number. This number is called the **correlation coefficient**. A correlation coefficient of 0 indicates that there is no linear relationship between the variables. A correlation coefficient of 1 means that the points on the scatter plot lie on a straight line that is upward sloping, and a coefficient of -1 means that the points lie on a straight line that is downward sloping.

LOS 13-b

Calculate and **interpret** a sample covariance and a sample correlation coefficient.

Before calculating correlation we will look at another measure of linear association, covariance. In Study Session 2, Equation 9-9, the definition of population covariance is given as the product of the deviations of two random variables from their respective means, i.e.:

$$Cov(R_i,R_j) = E\{[R_i - E(R_i)][R_j - E(R_j)]\}$$

For sample covariance with a sample size of n, the formula is:

Equation 13-1

$$\text{Cov}(X,Y) = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{(n-1)}$$

Example 13-2 Covariance

Using the data given in Example 13-1, the covariance of the two index returns can be computed using the cross product data.

	Indopulo Index Returns (X_i)	Sheng Sheng Index Returns (Y_i)	Cross Product $(X_i - \overline{X})(Y_i - \overline{Y})$	Squared Deviations $(X_i - \overline{X})^2$	Squared Deviations $(Y_i - \overline{Y})^2$
Jan	0.011	-0.008	0.000351	0.000251	0.000491
Feb	0.071	0.068	0.002378	0.001951	0.002898
Mar	0.059	0.031	0.000542	0.001035	0.000283
Apr	0.009	0.012	0.000039	0.000318	0.000005
May	-0.030	-0.050	0.003647	0.003230	0.004117
Jun	0.041	0.032	0.000253	0.000201	0.000318
Sum	0.161	0.085	0.007208	0.006985	0.008113
Average	0.027	0.014			
Variance				0.001397	0.001623
Stand. Dev.				0.037376	0.040281

$$\text{Cov}(X,Y) = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{(n-1)} = \frac{0.007208}{(6-1)} = 0.001442$$

The sample correlation coefficient is:

Equation 13-2

$$r = \frac{Cov(X,Y)}{s_X s_Y}$$

where

$Cov(X,Y)$ = covariance between variables X and Y

s_X = sample standard deviation of X

The correlation, r, always lies in the range of -1 and 1.

r = 1 means the sets of data have a perfect linear correlation

r = 0 means there is no linear relationship between the variables

r = -1 means the sets of data have a perfect negative linear correlation

Example 13-3 Correlation

Following on from Example 13-2

$s_x = 0.037376$ and $s_y = 0.040281$

The correlation coefficient is:

$$r = \frac{Cov(X,Y)}{s_X s_Y} = \frac{0.001442}{0.037376 \times 0.040281} = 0.9577$$

When a correlation coefficient is close to 1, as in this example, it tells us that the variables are highly correlated. So the movements of the Indopulo and Sheng Sheng Stock Exchanges are closely linked.

There may be a strong non-linear association between two variables but zero linear correlation between them. For example, if Y is linked to X by the equation $Y = X^2$, there is a perfect nonlinear association but there is no linear correlation.

LOS 13-c

Formulate a test of the hypothesis that the population correlation coefficient equals zero and **determine** whether the hypothesis is rejected at a given level of significance.

Hypothesis testing can be applied in assessing whether the existence of a correlation is real or due to chance.

The null hypothesis is that the correlation coefficient is zero. The alternative hypothesis will be that the correlation is not equal to zero so a two-tailed test will be used with:

$$H_0 : r = 0$$
$$H_1 : r \neq 0$$

The formula for the t-test is

Equation 13-3

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

At the .05 significance level the critical values for t are ± 3.182, and .01 significance level ± 5.481. If the t-statistic lies outside this range we can reject the null hypothesis and conclude that there is a correlation between the variables.

The critical values of t depend on the degrees of freedom.

Example 13-4 Testing correlation

Use the index returns in Example 13-1. The sample size is 6 and the coefficient of correlation is 0.9577

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.9577\sqrt{(6-2)}}{\sqrt{1-0.9577^2}} = 6.6560$$

We can reject the null hypothesis at a 99% confidence level. The test indicates that the correlation between the index returns is significantly different to zero.

The higher the sample size taken, the larger the t-value, and all else being equal it is more likely that the null hypothesis will be rejected.

The occurrence of outliers can affect the reliability of the computation of a correlation coefficient. **Outliers** are defined to be small number of observations of extreme values occurring in a sample.

Spurious correlation occurs not because the two variables have a theoretical relationship but because there is a relation caused by a third variable**.**

A good example is the case that in an emerging economy. There is a high correlation between the increase in the number of motorcycles and the number of televisions owned. There is no direct relationship here but both are correlated to the increase in disposable income.

LOS 13-d

Differentiate between the dependent and independent variables in a linear regression and **explain** the assumptions underlying linear regression.

If a linear relationship can be established between two variables, prediction of one variable can be made when the other is known.

Linear regression assumes that there is a linear relationship between the dependent and the independent variables. The **dependent variable** (often denoted by Y) is the variable you are seeking to explain (or to estimate). The **independent variable** (often denoted by X) is the variable that you are using to explain the behavior of the dependent variable (also called the predictor variable).

The general expression of linear regression is:

Equation 13-4

$$Y_i = b_0 + b_i X_i + \varepsilon_i$$

where i = 1, …, n

Example 13-5 Independent and dependent variables

Using the example of the Indopulo and Sheng Sheng index returns in Example 13-1, we could designate the Indopulo index returns as the independent variable and the Sheng Sheng index returns as the dependent variable. If we find the regression equation linking the two sets of returns we could work out what the estimated effect of a certain move in Indopulo index has on the Sheng Sheng index.

Using Equation 13-4 the **slope** of the regression line is b_i and the **intercept** is b_0. These are very important in linear regression. The slopes and the intercept are estimated by using a **least square** technique, i.e. finding the slope and the intercept in such a way that minimizes the sum of the squared vertical distances between the observations and the regression line. The least square technique seeks the minimization of these distances which is:

Equation 13-5

$$\sum_{i=1}^{n} (Y_i - \hat{b}_0 - \hat{b}_1 X_i)^2$$

where $\hat{b}_0$ and $\hat{b}_1$ are the estimated or fitted parameters (a hat over a symbol indicates an estimated value).

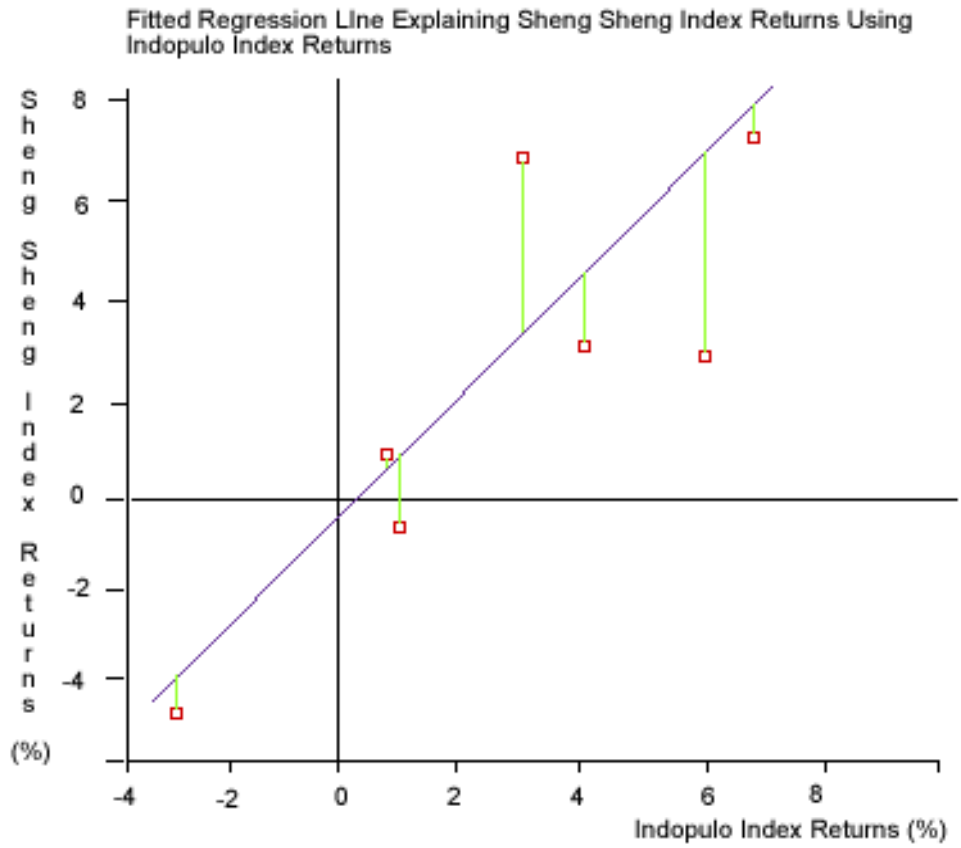
The graphical description of the **best estimate** or **fitted parameters** is given below.

In a regression with a single independent variable, the slope coefficient is:

Equation 13-6

$$\hat{b}_1 = \frac{\text{Cov}(Y, X)}{\text{Var}(X)}$$

$\hat{b}_o$ can be derived by solving the linear regression equation using the average values of Y_i and X_i.



Example 13-6 Regression equation

Using the calculations from the Indopulo and Sheng Sheng indexes:

	Indopulo Index Returns (Xi)	Sheng Sheng Index Returns (Yi)	Cross Product $(X_i - \overline{X})(Y_i - \overline{Y})$	Squared Deviations $(X_i - \overline{X})^2$	Squared Deviations $(Y_i - \overline{Y})^2$
Sum	0.161	0.085	0.007208	0.006985	0.008113
Average	0.027	0.014			
Covariance			0.001442		
Variance				0.001397	0.001623
Standard Dev.				0.037376	0.040281

Using Equation 13-6:

$$\hat{b}_1 = \frac{\text{Cov}(Y,X)}{\text{Var}(X)} = \frac{0.001442}{0.001397} = 1.0322$$

$\hat{b}_o$ can be found by solving $Y_i = b_0 + b_i X_i + \varepsilon_i$, using the average values of X and Y.

$$b_0 = \overline{Y} - b_i \overline{X}_i = 0.014 - (1.0322 \times 0.027) = -0.01387$$

The regression equation is $Y_i = -0.01387 + 1.0322X_i + \varepsilon_i$

We can only draw valid conclusions from a linear regression if the following assumptions (the classical normal linear regression model assumptions) are **all** met:

1. A linear relationship between the dependent variable Y_i, and the independent variable, X_i, exists. The relation is linear in the parameters b_0 and b_1.
2. The independent variable, X_i, is not random.
3. The expected value of the error term, $E(\varepsilon_i)$, is zero. This means that it is an **unbiased** model.
4. The variance of the error term is the same for all observations: $E(\varepsilon_i^2) = \sigma_i^2$, i = 1, …,n.
5. The error term, ε_i, is uncorrelated across observations. $E(\varepsilon_i \varepsilon_j) = 0$ for all i not equal to j.
6. The error term, ε_i, is normally distributed.

LOS 13-e

Define, calculate and **interpret** the standard error of estimate and the coefficient of determination.

Now we need to assess how well the regression model works, in terms of how well the independent variable explains the dependent variable. Graphically, on a scatter plot, this is illustrated by how close the observations are to the regression line.

For a regression model with one independent variable, the formula for the standard error of the estimate (SEE) is given below:

Equation 13-7

$$\left(\sum_{i=1}^{n}\frac{(Y_i-\hat{b}_o-\hat{b}_1X_i)^2}{n-2}\right)^{1/2}=\left(\sum_{i=1}^{n}\frac{(\hat{\varepsilon}_i)^2}{n-2}\right)^{1/2}$$

The numerator contains $Y_i-\hat{b}_0-\hat{b}_1X_i$ which is the difference between the actual value of the dependent variable and the predicted value, or the regression residual. The SEE indicates how well the model fits the data and the smaller the SEE, the better the model fits.

Example 13-7 Standard error

From the Indopulo and Sheng Sheng index returns, we have calculated in the table below the squared residuals, using the regression equation calculated in Example 13-6.

The SEE will be $\sqrt{0.000674/(6-2)}=0.01298$, or 1.298%

	Indopulo **Index Returns**	Sheng Sheng **Index Returns**	Predicted Sheng **Sheng Returns**	Regression **Residual**	Squared **Residual**
Jan	0.011	-0.008	-0.002216	-0.005784	0.000033
Feb	0.071	0.068	0.059716	0.008284	0.000069
Mar	0.059	0.031	0.047330	-0.016330	0.000267
Apr	0.009	0.012	-0.004280	0.016280	0.000265
May	-0.030	-0.050	-0.044536	-0.005464	0.000030
Jun	0.041	0.032	0.028750	0.003250	0.000011
Sum					**0.000674**

The **coefficient of determination** (R^2) tells us exactly how well the independent variable explains the variation of the dependent variable. It is the fraction of the total variance in the dependent variable that is explained by the regression.

The easiest way of computing the coefficient of determination is squaring the coefficient of correlation, r^2. This works well with a **single** independent variable.

A more general way is deriving R^2 is:

Total variation = Unexplained variation + Explained variation

$$R^2 = \frac{\text{Explained variation}}{\text{Total variation}} = \frac{\text{Total variation} - \text{Unexplained variation}}{\text{Total variation}}$$

Example 13-8 Coefficient of determination

1. The coefficient of determination for the Indopulo and Sheng Sheng index returns can be calculated using the correlation coefficient calculated in Example 13-3

$$R^2 = r^2 = (0.9577)^2 = 0.9169$$

2. The second way requires using the calculation of squared residuals which were calculated in Example 13-7, the sum of squared residual is the **unexplained variation**. Also recall from Example 13-2 that the sum of the squared deviation of the Sheng Sheng index is 0.008113. This is the **total variation**.

$$R^2 = \frac{\text{Total variation} - \text{Unexplained variation}}{\text{Total variation}}$$

$$= (0.008113 - 0.000674)/(0.008113) = 0.9169$$

The two methods arrive at the same result.

We can say that 91.69% of the variation in the Sheng Sheng index returns is explained by the variation in the Indopulo index.

LOS 13-f

Calculate a confidence interval for a regression coefficient.

Hypothesis testing can also be applied to the estimation of the regression coefficients, namely the slope and the intercept.

This can be done if we know the following:

1. The estimated parameter value, $\hat{b}_o$ and $\hat{b}_1$
2. The hypothesized value of the parameter, b_0 and b_1
3. A confidence interval around the estimated parameter.

Finding the confidence interval that includes the true parameter value, b_1 with a given degree of confidence, is illustrated in Example 3-30.

Example 13-9 Confidence intervals

We have calculated a linear regression model for a stock's returns (Y) which is dependent on the stock market's returns (X) as follows:

$$Y = 1.25 + 1.5X$$

In this case the b_1 equals 1.5 and is the beta of the stock.

Also the standard error of the estimate $s_{\hat{b}_1}$ is known to be 0.0175 and the sample size is 32.

We decide to use a confidence level of 95%.

The confidence interval for b_1 will be:

$$\hat{b}_1 \pm t_c s_{\hat{b}_1}$$

Where t_C is the critical value of t value.

With 30 degrees of freedom at the 95% confidence level this is 2.042.

So the confidence interval is 1.5 ± (2.042 x 0.0175), or between 1.464 and 1.535.

We can be 95% confident that the beta lies in this range.

Note the t-distribution is often used for this test because we use the sample estimate of the standard error $s_{\hat{b}_1}$, rather than the population (true) value of the standard deviation.

LOS 13-g

Formulate a null and an alternative hypothesis about a population value of a regression coefficient, **select** the appropriate test statistic, and **determine** whether the null hypothesis is rejected at a given level of significance.

Example 13-10 Interpreting the results of regression analysis

Using the regression equation in Example 13-6 where we have a model for a stock's returns (Y) which is dependent on the stock market's returns (X):

$$Y = 1.25 + 1.5X$$

We could follow the same method used in Example 13-11 to calculate whether the intercept of 1.25 is statistically different to zero. Assuming that both coefficients are significant we can use the regression equation to estimate the return of the stock as the market moves.

So for example, if we forecast a return of 10% from the market, the expected return from the stock is:

$Y = 1.25 + 1.5X = 1.25 + 1.5(10\%) = 16.25\%$

The most common statistic to test the population value of a regression coefficient is the **t-statistic** that has a **t-distribution** and (n – 2) degrees of freedom:

Equation 13-8

$$t = \frac{\hat{b}_1 - b_1}{s_{\hat{b}_1}}$$

It is a two-tailed test.

To formulate null and alternative hypotheses about a population value of a regression coefficient, the following is the procedure:

1. For the hypothesized value of B_1 and the estimated regression coefficient of $\hat{b}_1$ the null and alternate hypotheses are: $H_0 : \hat{b}_1 = B_1$ and $H_a : \hat{b}_1 \neq B_1$
   Note: that this test must be a two-tailed test.
2. We must know the standard error of the estimated coefficient, $s_{\hat{b}_1}$
3. The test statistic is: $t = \frac{\left(\hat{b}_1 - B_1\right)}{s_{\hat{b}_1}}$
4. We then select a level of significance, α, and the corresponding critical value for the t-statistic, t_c.

We reject the null hypothesis if the absolute value of t or $|\ t\ | > t_c$

Example 13-11 Hypothesis testing

Using the data in Example 13-9, let us test the null hypothesis that the beta of the stock is 1.

$H_0: \quad b_1 = 1.0$ and $H_a: \quad b_1 \neq 1$

We will reject the null hypothesis, at the 95% level if 1.0 does not lie in the confidence interval.

Next we calculate the test statistic, $t = \frac{\left(\hat{b}_1 - B_1\right)}{s_{\hat{b}_1}} = \frac{(1.5 - 1.0)}{0.2} = 2.5$

Since 2.5 is greater than 2.042 (the critical value of t) we can reject the null hypothesis and there is evidence that the beta is statistically different to 1.

LOS 13-h

Interpret a regression coefficient.

Example 13-12 Interpreting the results of regression analysis

Using the regression equation in Example 13-9 where we have a model for a stock's returns (Y) which is dependent on the stock market's returns (X):

Y = 1.25 + 1.5X

We could follow the same method used in Example 13-11 to calculate whether the intercept of 1.25 is statistically different to zero. Assuming that both coefficients are significant we can use the regression equation to estimate the return of the stock as the market moves.

So for example, if we forecast a return of 10% from the market, the expected return from the stock is:

Y = 1.25 + 1.5X = 1.25 + 1.5(10%) = 16.25%

The actual parameter value of a regression coefficient is neither observed nor precisely known. In our prediction or testing we use the estimated values of the coefficients. These estimated parameters are useful to arrive at certain a conclusion given a chosen confidence level.

LOS 13-j

Calculate and **interpret** a predicted value and a confidence interval for the predicted value for the dependent variable given an estimated regression model and a value for the independent variable.

There are two sources of errors that are introduced to a predicted value of a dependent variable:

1. the error term, ε_i,
2. the uncertainty from the estimated parameters, $\hat{b}_o$ and $\hat{b}_1$.

The standard deviation of the error term can be estimated from the standard error of estimate for the regression equation. There is also uncertainty from the estimated parameters, $\hat{b}_o$ and $\hat{b}_1$.

To calculate the estimated variance of the prediction error (s_f):

Equation 13-9

$$s_f^2 = s^2\left[1 + \frac{1}{n} + \frac{(X - \overline{X})^2}{(n-1)s_x^2}\right]$$

we must know:

- The squared standard error of estimate, s^2.
- The number of observations n.
- The value of the independent variable to predict the dependent variable.
- The estimated mean of the independent variable.
- The variance of the independent variable.

To determine the prediction interval, we go through the following steps:

1. Make the prediction.
2. Compute the estimated variance of the prediction error.
3. Choose a significance level, α.
4. Compute the prediction interval $\hat{Y} \pm t_c s_f$.

Example 13-13 Confidence interval for predicted values

Suppose the Indopulo index return is 4.5%. What would be the prediction interval of the Sheng Sheng index return?

1. Make the prediction: the Sheng Sheng index return will be (using the regression equation in Example 13-6):

$$Y_i = -0.01357 + 1.0322 \times 0.045 = 3.29\%$$

2. Compute the estimated variance of the prediction error

$$s_f^2 = s^2\left[1 + \frac{1}{n} + \frac{(X - \overline{X})^2}{(n-1)s_x^2}\right] = 0.01298^2\left[1 + \frac{1}{6} + \frac{(0.045 - 0.027)^2}{(6-1)0.001379}\right] = 0.000204$$

$$s_f = 0.014300$$

3. Choose α to be 0.05, we are looking at the 95% confidence interval.

4. The critical value of t, t_c, for the chosen significance level and 4 degrees of freedom is 2.776.

The predicted interval is 0.0329 ± 2.776 x 0.014300, or between – 0.67% and 7.26%.

The predicted interval is wide because the number of observations is small. The larger the number of observations the tighter the interval will be.

LOS 13-i

Describe the use of analysis of variance (ANOVA) in regression analysis and **interpret** ANOVA results.

Analysis of variance (ANOVA) is a statistical procedure for analyzing the total variability of a set of data into components, which can be attributed to different sources. The application of the ANOVA procedure in regression analysis is to gain information about the usefulness or strength of the independent variable(s) in explaining the variation in the dependent variable.

The statistical test used is the F-test.

The **F-statistic** is used to determine whether all of the slope coefficients in a linear regression are equal to zero.

However we need to know four things:

1. The total number of observations (n).
2. The total number of parameters to be estimated (slope and intercept).
3. The sum of squared errors or residuals $\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$, abbreviated to SSE, or the residual sum of squares.
4. The regression sum of squares $\sum_{i=1}^{n}(\hat{Y}_i - \overline{Y})^2$, abbreviated to RSS, or the amount of total variation in Y that is explained by the regression equation.

The formula for the F-statistic is:

Equation 13-10

$$F_{1,n-2} = \frac{RSS/1}{SSE/(n-2)} = \frac{\text{mean regression sum of squares}}{\text{mean squared error}}$$

where the subscripts 1 and (n - 2) are the degrees of freedom.

The F-statistic indicates how well the regression equation explains the variation in the dependent variable.

The higher the F-value the better the regression model explains the variation in the dependent variable.

LOS 13-k

Discuss the limitations of regression analysis and **identify** problems with a particular regression analysis or its associated results and any conclusions drawn from them.

There are three limitations of regression analysis:

1. Regression relations change over time. A particular regression may fit for a period of time but may no longer be valid in the other periods of time.
2. The change of regression relations may be caused by a self-fulfilling phenomenon; this is common in the financial industry. This means that once a relationship becomes well known security prices will adjust and the relationship will not hold in the future.
3. If any or several of the classical normal linear regression model assumptions as listed in LOS 13-d are violated, then the hypothesis test and predictions based on the regression analysis will no longer be valid.

STUDY SESSION 4

Economics: Macroeconomic Analysis

Overview

Economics have a guideline weighting of 10% of the exam questions. That is not a lot of questions for three study sessions but the material is relatively straightforward. Study Session 4 focuses on macroeconomics, 5 on microeconomics and 6 on global economic analysis.

For candidates who have studied economics or have knowledge of the basic concepts you will not need to spend much time on the Introduction. The Introduction is based on five chapters and covers the laws of supply and demand, market equilibrium, the markets for labor, loanable funds and foreign exchange, and the impact of government controls, black markets and taxes on supply and demand, measuring GDP and other measures of output and income, inflation, factors that affect aggregate demand and supply, and the basics of Keynesian economics.

It is important to note that the CFA Institute states that examination questions are drawn mainly from the subsequent Reading Assignments.

In Study Session 4 the Reading Assignments look at the key issues in macroeconomics – the study of economic growth and changes in levels of output, employment and prices. Initially we define and explain how the main indicators of the state of the economy are measured: the main indicators include demand and supply, inflation and unemployment. We then move on to examining how government policy can affect stability and economic growth. This is a key part of the Study Session, candidates need to understand the impact of changes in fiscal and monetary policies on the economy in both the short and long run, and be able to differentiate between the impact when policy changes are anticipated or unanticipated.

Reading Assignments

Economics: Private and Public Choice, 10th edition, James D. Gwartney, Richard L. Stroup, Russell S. Sobel, and David A. Macpherson (South-Western, 2003)

14. "Economic Fluctuations, Unemployment, and Inflation," Ch. 8
15. "Fiscal Policy," Ch. 12, pp. 269-283
16. "Money and the Banking System," Ch. 13
17. "Modern Macroeconomics: Monetary Policy," Ch. 14
18. "Stabilization Policy, Output, and Employment," Ch. 15, pp. 348−362

14 Economic Fluctuations, Unemployment and Inflation

Learning Outcome Statements (LOS)

14-a	**Explain** the phases of the business cycle.
14-b	**Discuss** the problems in measuring unemployment and **describe** the three types of unemployment.
14-c	**Explain** full employment and the natural rate of unemployment.
14-d	**Define** inflation, **discuss** its causes, **distinguish** between anticipated and unanticipated inflation, and **discuss** the harmful effects of both on economic activity.

Introduction

This Reading identifies the different phases of the business cycle and how GDP, inflation and unemployment are key indicators of the stage in the business cycle. We look at how inflation and unemployment are defined and measured. Candidates will need to be define inflation and describe the harmful effects of unanticipated inflation.

LOS 14-a

Explain the phases of the business cycle.

The business cycle

Swings in the output of an economy are referred to as the business cycle, even though the fluctuations in output are often irregular and unpredictable. The four stages are:

1. Peak – this is a boom and it is when businesses are generally operating at full capacity and GDP is growing rapidly.
2. Contraction – the sales of businesses are falling and unemployment is rising. Real GDP is growing at a slower rate or perhaps declining.
3. Trough – this is the bottom of the contraction phase.
4. Expansion – business sales start to rise, unemployment shrinks and GDP starts to increase.

A recession is when GDP declines for at least two consecutive quarters, if it lasts longer than two quarters and there is a sharp decline in GDP it is referred to as a depression.

LOS 14-b

Discuss the problems in measuring unemployment and **describe** the three types of unemployment.

The labor force

The **civilian labor force** is all the people of 16 years and over who are either employed or unemployed. Unemployed means the person is actively seeking employment or waiting for another job. It excludes, for example, students and retired workers.

Rate of labor force participation is the labor force as a percentage of the total civilian population of 16 years and over.

The **unemployment rate** is the number of unemployed as a percentage of the number in the labor force.

Problems with measuring unemployment include:

(i) labeling workers as unemployed when they have been laid off but are waiting to be recalled to their jobs

(ii) workers who have, for the time being, given up looking for a job who are not counted as unemployed

(iii) workers in part-time unemployment, but wanting full time work, who are still counted as employed.

Types of unemployment

Frictional – caused by changes in the economy that lead to qualified job seekers being temporarily unmatched with job openings, due to imperfect information and time taken in the job search by interviews etc.

Structural – due to structural changes in the economy that leave unemployed people not qualified for job openings.

Cyclical – caused by the overall level of economic activity.

LOS 14-c

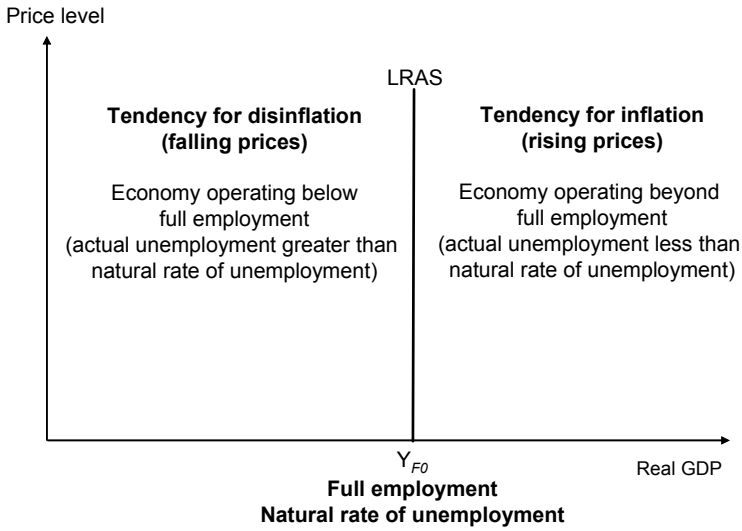
Explain full employment and the natural rate of unemployment.

Full employment relates to an economy which only has frictional and structural unemployment. In other words, an economy at full employment has no cyclical unemployment. The rate of unemployment at full employment is called the natural rate of unemployment.

If output is above full employment (actual unemployment is below the natural rate of unemployment), then inflationary pressures will emerge in the economy.

If output is below full employment (actual unemployment is above the natural rate of unemployment), then disinflationary pressures will emerge in the economy.

If output is at full employment (actual unemployment is at the natural rate of unemployment), then there will be no tendency for the prices to increase or decrease. Output and unemployment will coincide with the position of the LRAS curve.



LOS 14-d

Define inflation, **discuss** its causes, **distinguish** between anticipated and unanticipated inflation, and **discuss** the harmful effects of both on economic activity.

Inflation

Inflation is the persistent rise in prices that erodes over time the purchasing power of money. Inflation is calculated by comparing the change in a price level over a specified period of time. The most common price level is the Consumer Price Index (CPI).

Equation 14-1 shows the formula for the inflation rate using a generic price level:

Equation 14-1

$$\text{Inflation rate} = \left[\frac{\text{price index}_{\text{period t}} - \text{price index}_{\text{period t-1}}}{\text{price index}_{\text{period t-1}}} \right] \times 100$$

Example 14-1 Calculating the inflation rate

At the beginning of 2003, the Consumer Price Index was 143.7; at the beginning of 2004, the Consumer Price Index was 153.6; and at the beginning of 2005, the Consumer Price Index was 151.3. Calculate the inflation rate for 2004 and 2005.

Use Equation 14-1 to calculate the inflation rate for each year.

$$\text{Inflation rate}_{2004} = \left[\frac{\text{price index}_{\text{period t}} - \text{price index}_{\text{period t-1}}}{\text{price index}_{\text{period t-1}}}\right] \times 100 = \left[\frac{153.6 - 143.7}{143.7}\right] \times 100 = 6.9\%$$

$$\text{Inflation rate}_{2005} = \left[\frac{\text{price index}_{\text{period t}} - \text{price index}_{\text{period t-1}}}{\text{price index}_{\text{period t-1}}}\right] \times 100 = \left[\frac{151.3 - 153.6}{153.6}\right] \times 100 = -1.5\%$$

It is important to differentiate between inflation that is **anticipated** and **unanticipated**. Anticipated inflation is a change in prices that is widely expected, often when inflation rates are running at relatively low levels. Unanticipated inflation is generally a surprise, often this happens when inflation rates are higher and more volatile.

The effects of inflation are felt mainly when changes in inflation are unanticipated. The negative effects relate to the breakdown of the link between income and productive activity. They include:

1. Greater risk in investing in capital goods or other assets.
2. Distortion in pricing information.
3. Decision-makers focusing on protecting themselves from inflation rather than productive activities.

The effect of long-term inflation will be to damage the economy and **stagflation** is when there is rapid inflation combined with slow or negative growth in output.

15 Fiscal Policy

Learning Outcome Statements (LOS)

15-a	**Explain** the process by which, according to the Keynesian view, fiscal policy affects aggregate demand and aggregate supply.
15-b	**Explain** the importance of the timing of changes in fiscal policy and the difficulties in achieving proper timing.
15-c	**Discuss** the impact of expansionary and restrictive fiscal policies based on the basic Keynesian model, the crowding-out model, the new classical model, and supply-side model.
15-d	**Identify** automatic stabilizers and **explain** how such stabilizers work.

Introduction

This Reading investigates the impact of changes in fiscal policy on output, prices and employment, assuming monetary policy is constant. Different economic models – Keynesian, crowding-out, new classical and supply-side models disagree on the impact of an expansionary or restrictive fiscal policy and the candidate needs to be familiar with the effectiveness of fiscal policy according to the four models. This section also looks at automatic stabilizers that take effect without a change in fiscal policy.

LOS 15-a

Explain the process by which, according to the Keynesian view, fiscal policy affects aggregate demand and aggregate supply.

Keynesian economics

Fiscal policy is reflected in a government's policy on spending, tax and borrowing. Keynesian economists believe an increase in spending will increase aggregate demand (and vice versa). If personal taxes are decreased this will lead to an increase in consumption reflecting higher disposable incomes (only really effective if the changes are regarded as permanent). A reduction in business taxes would lead to higher investment spending. If the budget deficit is increased, borrowing to finance the deficit will increase.

Under Keynesian economics, an increase in government spending or reduction in taxes will lead to a larger increase in demand due to the effect of the expenditure multiplier. So when the economy is operating below capacity the government should adopt an expansionary fiscal policy (increase spending on goods and services and/or reduce taxes) and when there is an inflationary economic boom it should adopt a restrictive fiscal policy. In other words a counter cyclical government policy can be used to maintain a stable economy. This will take effect much more quickly than waiting for changes in resource prices and real interest rates to impact on demand.

LOS 15-b

Explain the importance of the timing of changes in fiscal policy and the difficulties in achieving proper timing.

There are several timing problems associated with fiscal policy including:

(i) the time lag between the forecast of recession/boom and when it actually starts.
(ii) it takes time to implement a change in fiscal policy.
(iii) it may take 6 to 12 months for the change in fiscal policy to take full effect.
(iv) if the timing of a change in policy is incorrect, and the economy's self-correcting mechanism is working, then the impact of the policy change may be to produce economic instability.

LOS 15-c

Discuss the impact of expansionary and restrictive fiscal policies based on the basic Keynesian model, the crowding-out model, the new classical model, and supply-side model.

The benefits of an expansionary fiscal policy will be diluted since higher government borrowing will tend to push up interest rates and reduce private investment. This is called the **crowding-out effect.** Additionally the globalization of financial markets now means that higher interest rates will lead to an inflow of foreign investment thereby strengthening the currency, which will lead to a decline in exports.

Under the **new classical model** the benefits of budget deficits will be offset by consumers who will expect taxes to rise in the future, and will therefore reduce current spending. Followers of the new classical model believe that switching between tax and debt is ineffective.

Supply-side economists believe a reduction in personal tax rates will increase the benefits of earning which will lead to an increase in aggregate supply. High taxes slow growth since they discourage work effort, discourage foreign investment, and switch spending to tax-deductible goods and services.

LOS 15-d

Identify automatic stabilizers and **explain** how such stabilizers work.

Automatic stabilizers (unemployment benefit, corporate and progressive income taxes) will change fiscal spending automatically.

For example, during economic expansion the rising government tax income and lower unemployment benefit payments will reduce the government budget deficit (or increase the surplus).

Overall the timing of the use of fiscal policy is key and changes in fiscal policy should only be used in response to major economic movements.

The importance of supply-side effects is subject to debate. In the 1980's, rates of tax were reduced in the U.S., but this led to only modest increases in output (and a decline in real tax revenues and an increase in the budget deficit). However supply-side economists say that reductions in the highest marginal tax rates are particularly important and also that reductions in taxes have led to long periods of economic expansion. On the other hand, it appears that increasing tax rates beyond a certain optimum level leads to a fall in taxes collected and reduces the output of the economy.

Internationally there is evidence that countries such as Ireland that have significantly cut personal and corporate tax rates have seen rapid growth rates. Other European countries, such as France, Germany and the Netherlands, which have high tax rates have experienced slow economic growth rates and a 'brain drain' as highly skilled workers choose to work in lower tax countries.

16 Money and the Banking System

Learning Outcome Statements (LOS)

16-a	**Explain** the relationship among the required reserve ratio, the potential deposit expansion multiplier, and deposit expansion multiplier.
16-b	**Describe** the role of a country's central bank and the tools that a central bank can use to control the money supply, and **explain** how a central bank can use monetary tools to implement monetary policy.
16-c	**Discuss** potential problems in measuring an economy's money supply.

Introduction

We now look at how money supply is defined and how the banking system operates. In particular we examine how the central bank in the US, the Federal Reserve System, controls money supply. This section provides the foundation for the next two Readings when we focus on monetary policy and its impact on an economy.

Money supply

Two of the most widely used measures of money supply are:

M1 = currency in circulation + demand and other checkable deposits + travelers' checks

M1 is essentially money and assets that can be converted into money at parity.

M2 = M1 + savings and time deposits (less than $100,000) + money market mutual funds

M2 is a broader definition that includes assets that can be easily converted to checking deposits or cash.

The banking system

The banking system in the US is under the jurisdiction of the Federal Reserve System.

The three institutions in the banking sector are:

1. Commercial banks.
2. Savings and loans - accept deposits in exchange for shares that pay dividends.
3. Credit unions - cooperative financial institutions for groups of individuals.

LOS 16-a

Explain the relationship among the required reserve ratio, the potential deposit expansion multiplier, and deposit expansion multiplier.

The US is a fractional reserve banking system which means banks are required by the Fed to hold only a proportion of their deposits in cash or reserves.

The minimum amount of reserves that must be kept available is the **required reserve ratio** and the remainder can be loaned to customers. As money is lent new deposits are made. The actual **deposit expansion multiplier** is the multiple by which an increase in reserves will increase the money supply. The **potential deposit expansion multiplier** is the reciprocal of the required reserve ratio and is the maximum potential increase in the money supply as a multiple of new reserves. The actual will be less than the potential deposit expansion multiplier for a number of reasons, e.g. some borrowers will hold as cash part of the money borrowed, banks may not use all excess reserves to make loans.

Example 16-1 Required reserve ratio

If the required reserve ratio is 5%, then the potential deposit expansion multiplier is 1/0.05 = 20.

LOS 16-b

Describe the role of a country's central bank and the tools that a central bank can use to control the money supply, and **explain** how a central bank can use monetary tools to implement monetary policy.

The main role of a country's central bank is to control money supply and provide a favorable monetary climate for the economy to thrive. In the US the Federal Reserve System, called the Fed, controls the money supply in three ways:

1. Adjusting the reserve ratio

Banks will tend to keep the minimum or near-minimum amount in reserves since reserves are not interest bearing. Therefore if the Fed lowers reserve requirements the banks will extend new loans and the money supply will increase. Similarly an increase in reserve requirements will reduce money supply.

2. *Open market operations*

The Fed buys and sells notes and bills to reduce or increase the monetary base. For example if the Fed wishes to increase money supply it would purchase US securities thereby injecting new money into circulation which increases the monetary base (the sum of reserves and money in circulation) which increase money supply.

3. *Changing the discount rate*

This is the interest rate charged to banks borrowing from the Fed. An increase in the discount rate would tend to make banks build up their reserves to avoid the position where they have to borrow funds. Therefore this would be a restrictive policy.

In summary:

Expansionary Monetary Policy	Restrictive Monetary Policy
Reduce reserve requirements	Increase reserve requirements
Purchase U.S. securities	Sell U.S. securities
Lower the discount rate	Raise the discount rate

LOS 16-c

Discuss potential problems in measuring an economy's money supply.

A number of factors are distorting the money supply numbers and therefore reducing the value of M1 and M2 as indicators of monetary policy:

Use of the US dollar overseas is significant which makes measuring the currency component inaccurate.

Growth in stock and bond mutual fund investment which is not included in M1 or M2.

Use of debit cards and electronic money reduces the need to hold currency thereby reducing money supply growth.

17 Modern Macroeconomics: Monetary Policy

Learning Outcome Statements (LOS)

17-a	**Discuss** the determinants of money demand and supply.
17-b	**Discuss** how anticipation of the effects of monetary policy can influence the policy's effectiveness.
17-c	**Identify** the components of the equation of exchange, and **discuss** the implications of the equation for monetary policy, **describe** the quantity theory of money, and **discuss** its implications for the determination of inflation.
17-d	**Compare** and **contrast** the impact of anticipated or unanticipated monetary policy on the inflation rate, real output, employment and interest rates.

Introduction

A successful monetary policy is critical to providing a stable environment for an economy to grow and to provide high levels of employment. We start the section with looking at the factors that affect the demand and supply of money. We then examine how changes in monetary policy affect the economy in terms of interest rates, output, prices and employment. It is important that candidates understand the short and long-run effects of expansionary and restrictive monetary policies.

LOS 17-a

Discuss the determinants of money demand and supply.

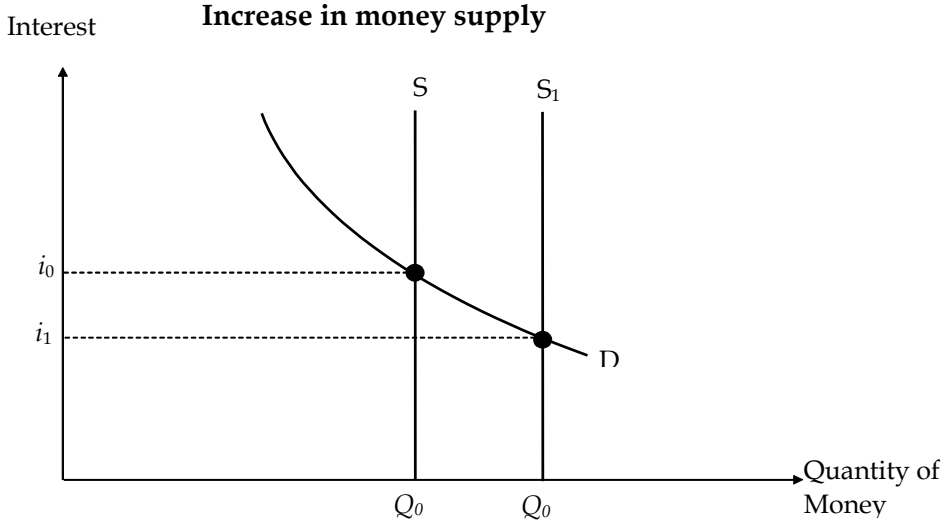
Money demand and supply

Monetarists believe that monetary instability is the major cause of instability in economic growth and rapid growth in the money supply causes inflation.

There are three chief motivations for people to hold money, rather to invest the proceeds in interest bearing securities:

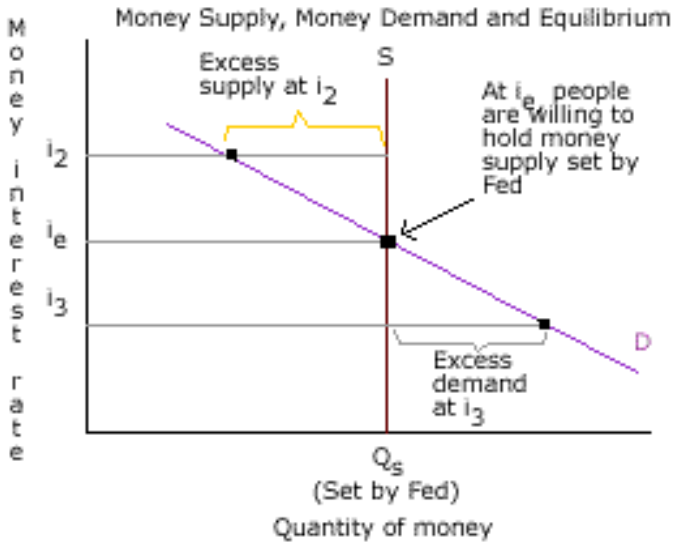
- To make regular transactions.
- To deal with uncertainties and emergencies.
- For speculative purposes.

However, as interest rates increase, the opportunity cost of holding cash increases. The demand for money is inversely related to interest rates; therefore, the money demand curve is downward-sloping.



The supply of money is independent of interest rates because it is not set by competitive market forces. The supply of money is determined by a nation's central bank (in the United States, the central bank is the Federal Reserve). Therefore, the supply of money is an upward-sloping line.

The intersection of the money demand and money supply curves determines the equilibrium level of interest rates, as shown in the graph below:



LOS 17-b

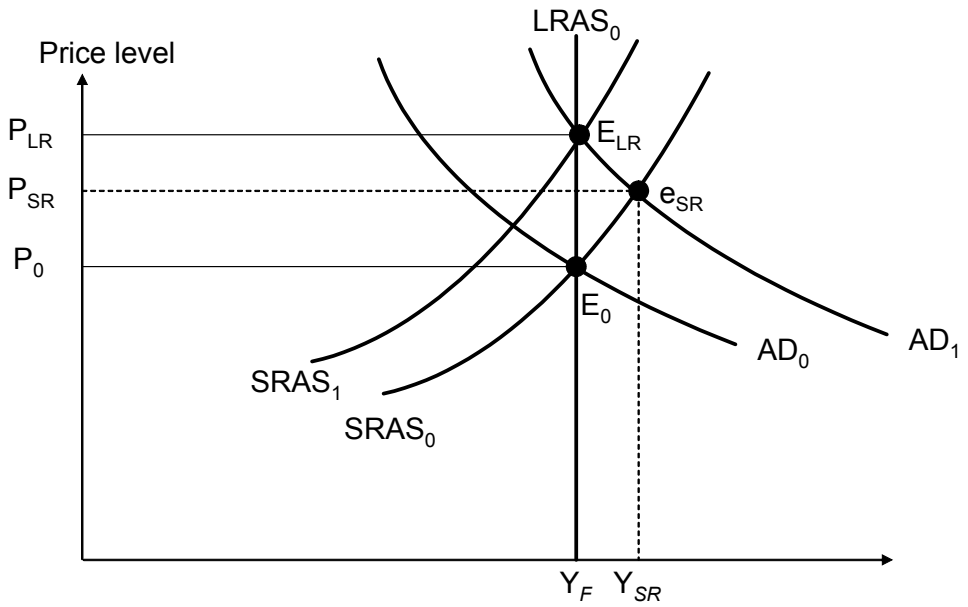
Discuss how anticipation of the effects of monetary policy can influence the policy's effectiveness.

LOS 17-d

Compare and **contrast** the impact of anticipated or unanticipated monetary policy on the inflation rate, real output, employment and interest rates.

A drop in interest rates would increase gross private business investment, which is a component of aggregate demand. In addition, lower interest rates would cause the domestic currency to depreciate, resulting in an increase in exports and a decrease in imports.

The increase in investment and net exports would increase AD curve (shift to the right), causing a short-run increase in output, employment, and the price level. Over time, higher resource price pressures would lower the SRAS curve, restoring output at full employment, though at a higher price level.



To summarize, if the Fed moves to an **expansionary monetary policy**, it will generally lead to an increase in aggregate demand. If this is unanticipated it will lead to a more rapid rise in prices than costs and a short-term increase in real output and employment. However in the long term the higher price levels will feed through to higher resource costs and unemployment will return to its natural rate. Therefore the long-run result of rapid money growth is inflation.

Similarly a **restrictive monetary policy** will, if the economy is running at full employment, reduce output and it can lead to a recession. However, if the economy is overheated, a restrictive monetary policy can be effective in preventing an inflationary boom.

Monetary policy affects the money supply curve. If the central bank wished to increase output, for example, it would increase the supply of money, which would cause interest rates to fall.

If the effects of a change in monetary policy are anticipated, then costs will rise as quickly as selling prices so output does not rise in the short run. Inflation will result without any short run increase in output.

Interest rates

A move to an expansionary monetary policy will involve injecting new funds into the market and reducing short-term nominal interest rates. However, the long-term interest rates will be affected by inflationary expectations and demand for long-term instruments. Over time higher inflation will also push up nominal short-term rates and increase the velocity of money (as the opportunity cost of holding money increases).

The table below summarizes the impact of changes in monetary policy.

Expansionary monetary policy (opposite impact for restrictive monetary policy).

	Short-run effects when policy is unanticipated	**Short-run effects when policy is anticipated and long-run effects**
Inflation	Small increase, depends on excess capacity	Increase
Real output and employment	Increase, particularly if excess capacity	No change
Nominal interest rates	Short-term rates probably decline	Increase
Real interest rates	Decline	No change

LOS 17-c

Identify the components of the equation of exchange, and **discuss** the implications of the equation for monetary policy, **describe** the quantity theory of money, and **discuss** its implications for the determination of inflation.

The equation of exchange states that:

Equation 17-1

$$MV = GDP = PY$$

where

M = money stock

V = velocity of money, the number of times each dollar is used in a year

P = economy's price level

Y = output, real income or real GDP

The equation says that output (Y) and velocity (V) are determined by factors other than the amount of money in circulation. For example Y is determined by the size of the economy's resource base and technology, these are factors which are insensitive to the money supply. V is affected by factors such as frequency of income payments, the banking system, and the communications system. Therefore Y and V can be assumed to be fairly constant over medium term, say two or three year, time periods.

The **quantity theory of money** says a change in money supply will lead to the same change in price levels, since velocity and output are unaffected by the quantity of money. In the long run this is consistent with the view that the only impact of an expansionary monetary policy is higher prices.

18 Stabilization Policy, Output and Employment

Learning Outcome Statements (LOS)

18-a	**Describe** the composition and use of the index of leading economic indicators.
18-b	**Discuss** the time lags that may influence the performance of discretionary monetary and fiscal policy.
18-c	**Contrast** the adaptive expectations hypothesis to the rational expectations hypothesis and **discuss** implications on prices and output under the two hypotheses when there are changes in macroeconomic policies.
18-d	**Distinguish** between an activist and a non-activist strategy for stabilization policy.

Introduction

We can now build on the earlier Readings on fiscal and monetary policy to study the impact of expansionary and restrictive policies and discuss the effectiveness of policies in stabilizing the economy. We examine the different theories on how expectations are formed and how expectations decide the effectiveness of policy changes. Candidates also need to be able to differentiate between activist and non-activist approaches to stabilizing the economy.

LOS 18-a

Describe the composition and use of the index of leading economic indicators.

In order for policy makers to be able to implement effective policies they need to have access to information on the future direction of the economy. The two most widely used sources of information are the leading economic indicators and economic forecasting models.

Index of leading indicators

There are ten variables in the composite index. Two or three consecutive declines in the index are a warning that the economy is heading towards a recession. The index has correctly forecast the seven recessions in the U.S. between 1959 and 2001, although it has also indicated recessions that did not happen. The time lag before a recession occurs has been anything between 5 and 30 months.

The ten indicators are:

1. Length of average work week
2. Initial weekly claims for unemployment compensation
3. New orders placed with manufacturers
4. Percentage of companies receiving slower deliveries from suppliers
5. Contracts and orders for new plant and equipment
6. Permits for new housing starts
7. Interest rate spread between 10-year Treasury bonds and the Fed Funds rate
8. Index of consumer expectations
9. Change in stock price index
10. Change in the money supply (M2)

The leading indicators allow policy makers to adopt a counter-cyclical macroeconomic policy to smooth the economic cycle. So, for example, a decline in the leading indicators would usually lead to an expansionary monetary policy. Although the stimulus might be moderate at first if signs of a downturn become more pronounced the policy could be accelerated.

LOS 18-b

Discuss the time lags that may influence the performance of discretionary monetary and fiscal policy.

The timing of changes in monetary and fiscal policy is critical and there are three types of time lag which make timing difficult.

1. Recognition lag

This is the time difference between when a change in policy is needed and it the need is recognized by policy makers.

2. Administrative lag

This is the time period between the recognition that a policy change is needed and implementation of the change. The lag for changes in monetary policy is much shorter than fiscal policy.

3. Impact lag

This is the time period between implementation of a change in policy and its impact on the economy. Changes in tax rates will have a faster impact than changes in government spending.

Activists believe that there is time for a government to act to change economic policy to minimize the effects of market downturns. Non-activists believe, for example, that by the time a change to an expansionary policy takes effect a downturn will be over and the policy will contribute to an inflationary boom.

LOS 18-c

Contrast the adaptive expectations hypothesis to the rational expectations hypothesis and d**iscuss** implications on prices and output under the two hypotheses when there are changes in macroeconomic policies.

Expectations

Adaptive expectations hypothesis – this states that future expectations of decision-makers are largely dependent on recent past data. This will lead to systematic error; there will be a time lag before people factor changes in economic policy into new expectations that will be incorporated in their business decisions.

Rational expectations hypothesis – this states that all available information is used to form expectations about the future. Errors will be random, not systematic. In this case the time lag between a change in economic policy and a change in expectations is very much shorter.

Example 18-1 Adaptive versus rational expectations

Money supply growth has been running at 5% per annum and the government adopts an expansionary monetary policy. According to the adaptive-expectations hypothesis people would expect money supply growth to continue at 5% per annum. According to the rational-expectations hypothesis people would expect money supply growth to be higher than 5%, other economic factors being equal.

The time lag between a change in economic policy and people's expectations changing, and whether errors are systematic or random, is critical to the effectiveness of the change in policy.

Example 18-2 Expectations and policy

If there is a shift to an expansionary monetary policy, under adaptive expectations, there will be a time period before higher inflation changes people's expectations. This means that there will be a period in which higher aggregate demand will lead to higher output. However, under rational expectations, higher prices will be anticipated so costs will rise as rapidly as prices and the result of the shift in policy will be increased prices without a change in output.

The impact of policy changes under adaptive and rational expectations will differ in the short run but be the same in the long run.

The **policy-ineffectiveness theorem** states that any systematic change in policy will be ineffective since decision makers will anticipate the impact of the change in policy and adjust their decisions accordingly.

LOS 18-d

Distinguish between an activist and a non-activist strategy for stabilization policy.

Non-activist strategy

Non-activists believe that:

1. discretionary economic policy increases economic instability.
2. predictable policies based on predetermined guidelines lead to economic stability.

They believe that if the government adheres to a long-term policy regardless of cyclical movements then people will gain confidence in the stability of the policy and private decision-making will be more efficient. This will lead to a stable and higher growth rate for the economy.

Non-activist monetary policy

Non-activists believe that monetary policy should either target a (i) stable growth rate in the money supply or (ii) stable prices.

Non-activist fiscal policy

In theory non-activists would try to run a balanced budget over a business cycle. Many non-activists would try to limit the flexibility of government in running large budget deficits.

STUDY SESSION 5

Economics: Microeconomic Analysis

Overview

In this Study Session the Reading Assignments focus on the key issues in microeconomics - the study of consumers' choices and their influence on demand, how firms operate and their competitive environment, and the choices of resource suppliers. Different market structures are covered - their characteristics and how they determine firms' decision-making on pricing their products and the optimum output levels.

In the final Reading we consider the relationship between the demand for funds and interest rates, and how market interest rates are determined.

Reading Assignments

Economics: Private and Public Choice, 10th edition, James D. Gwartney, Richard L. Stroup, Russell S. Sobel, and David A. Macpherson (South-Western, 2003)

19. "Demand and Consumer Choice," Ch. 19, including addendum "Consumer Choice and Indifference Curves"

20. "Costs and the Supply of Goods," Ch. 20

21. "Price Takers and the Competitive Process," Ch. 21

22. "Price-Searcher Markets with Low Entry Barriers," Ch. 22

23. "Price-Searcher Markets with High Entry Barriers," Ch. 23

24. "The Supply of and Demand for Productive Resources" Ch. 24

Fundamentals of Financial Management, 10th edition, Eugene F. Brigham and Joel F. Houston (Dryden, 1998)

25. "The Financial Environment: Markets, Institutions, and Interest Rates," Ch. 4, pp. 130-143

19 Demand and Consumer Choice, including Consumer Choice and Indifference Curves

Learning Outcome Statements (LOS)

19-a	**Explain** the fundamental principles of consumer choice and **discuss** marginal utility, marginal benefit, and the demand curve.
19-b	**Distinguish** between the income effect and the substitution effect.
19-c	**Discuss** the determinants of price and income elasticity of demand, and **explain** the concepts of price and income elasticity of supply.
19-d	**Calculate** and **interpret** price and income elasticity of demand, and e**xplain** why the price elasticity of demand tends to increase in the long run.
19-e	**Discuss** the characteristics of consumer indifference curves, the role of the consumption-opportunity constraint, and the budget constraint in indifference curve analysis.

Introduction

This Reading looks at consumer choice and the factors that affect consumer demand. Candidates need to understand the concepts of elasticity and be able to compute price elasticity (change in quantity demanded when the price changes) and income elasticity (change in quantity demanded when income changes) of demand. The Reading finishes with a discussion of indifference curves (points on an indifference curve are of equal benefit to a consumer) and how they determine optimal combinations of goods for a consumer to purchase.

LOS 19-a

Explain the fundamental principles of consumer choice and **discuss** marginal utility, marginal benefit, and the demand curve.

The main assumptions made about consumer behavior are as follows:

(i) Since consumers have limited income they must make choices about which goods they can purchase.

(ii) Choices are made on a rational basis.

(iii) All goods have substitutes.

(iv) Decisions are made without perfect information.

(v) The **law of diminishing marginal utility** holds. This says that as consumption rises the marginal benefit of consuming the next unit is less than the last.

The dollar value of a consumer's marginal utility from consuming another unit of a product is called the **marginal benefit**. It is the maximum price that a consumer will pay for an additional unit and will fall as consumption increases. When different products are available a consumer will ensure that the last dollar spent on each product gives an equal marginal utility (MU) per dollar spent. For two products A and B this can be expressed as:

Equation 19-1

$$\frac{MU_A}{P_A} = \frac{MU_B}{P_B}$$

where

MU_A = marginal utility of product A

P_A = price of product A

Example 19-1 Marginal utility

A shopper needs to buy fruit and has $6 available to spend. He sees that apples and oranges are available and apples cost $2 per kilogram and oranges cost $1 per kilogram. The marginal utilities of the first, second and third kilograms of apples are $3, $2.50 and $2 respectively and the marginal utilities of the first, second and third kilograms of oranges are $2.00, $1.25 and $1 respectively. The shopper would benefit most by buying 2 kilograms of apples and 2 kilograms of oranges, the marginal utility of the last kilogram of each per dollar price is 1.25.

LOS 19-b

Distinguish between the income effect and the substitution effect.

Other terms

Substitution effect - the component of an increase/decrease in demand for a good that results from the change in relative price of a good which can be substituted for the original good.

Income effect - the component of an increase/decrease in demand that results from the change in the consumer's real income as the price of a good changes. For example, if interest rates fall, some consumers will have reduced mortgage payments, effectively increasing their income, and this will allow them to spend more on other goods.

Time cost - the time it takes to purchase a good will influence the consumer, and the monetary cost alone will not determine the demand.

Advertising is neither positive nor negative in economic theory. Advertising is a cost which will be passed on to consumers but it is beneficial in that it provides information to consumers, can save them time, and promotes brand names. This gives consumers protection in the sense that once a brand name has value then the producer will strive to maintain the reputation of its product.

LOS 19-c

Discuss the determinants of price and income elasticity of demand, and **explain** the concepts of price and income elasticity of supply.

LOS 19-d

Calculate and interpret price and income elasticity of demand, and **explain** why the price elasticity of demand tends to increase in the long run.

LOS. 1. A. b) and LOS. 1. A. c) (as in preliminary reading)

Shifts in Demand

A shift in the demand curve will be a result of a change in demand due to factors other than price. Other factors include increases in consumer income, changes in taxes on the product, changes in price or availability of competing products, and changes in expectations of future prices. It is important to differentiate between changes in demand (a shift of the demand curve) and changes in quantity demanded (a movement along the same demand curve).

Price elasticity of demand

Demand elasticity is also covered in the Introductory Readings in Study Session 4.

Equation 19-2

$$\text{Price Elasticity of Demand} = \frac{\%\Delta Q}{\%\Delta P}$$

where

Q	=	the quantity demanded
P	=	the price
$\%\Delta Q$	=	the percentage change in quantity demanded

Price elasticity of demand is also called the elasticity coefficient.

Example 19-2 Demand elasticity

If the price of televisions produced by manufacturer is increased by 10% then demand is forecast to fall by 15%. The elasticity of demand is, using Equation 19-2:

$$\frac{\%\Delta Q}{\%\Delta P} = \frac{-15\%}{10\%} = -1.5$$

Determinants of Price Elasticity of Demand

(i) availability of substitutes - this will increase elasticity.

(ii) proportion of total spending on the product - if this is small it will tend to decrease elasticity of demand.

Total Expenditures and Demand Elasticity

Looking at total expenditure on a product in an industry:

Total expenditure = price x quantity

This means that if demand is inelastic, i.e. the price elasticity coefficient is less than 1, the percentage change in price is more that the percentage change in quantity and therefore a change in price will make total expenditure change in the same direction. So for example if the price of a product rises, there is a relatively small drop in demand so overall expenditures still increase.

Conversely, when demand is elastic, a change in price will cause expenditures to move in the opposite direction.

Total Revenues and Demand Elasticity

Looking at a firm's demand curve rather than the complete industry:

Firm's revenue = price x quantity sold

Using the same analysis, if the product's demand curve is inelastic, total revenues will change in the same direction as price. If the demand curve is elastic, revenues and price will move in the opposite direction.

Income elasticity

This is also covered in the Introductory Readings in Study Session 4.

Equation 19-3

$$\text{Income Elasticity} = \frac{\%\Delta Q}{\%\Delta I}$$

where

Q	=	the quantity demanded
I	=	income
$\%\Delta Q$	=	the percentage change in quantity demanded

Normal goods - income elasticity greater than 0

Luxury goods - income elasticity greater than 1

Inferior goods - income elasticity less than 0

Necessity goods - normal but low elasticity

The demand for products is more elastic in the long run than in the short run, as consumers and producers have more time to adjust to the change in price.

LOS 19-e

Discuss the characteristics of consumer indifference curves, the role of the consumption-opportunity constraint, and the budget constraint in indifference curve analysis.

Consumer indifference curves

All of the points along an indifference curve represent bundles of goods that are equally satisfying to an individual consumer.

Example 19-3 Indifference curves

Using an example of a customer who wishes to buy apples and oranges, the curve represents the trade-off he is willing to make between buying different amounts of apples and different amounts of oranges from an initial position of 3 kilograms of apples and 2 kilograms of oranges.**Draw indifference curve P. 520 changing axis to apples and oranges**.

Note that:

(i) it is better to have more apples and oranges so curves lying 'above' the indifference curve shown will be preferable.

(ii) the curve slopes downwards to the right since goods have substitutes.

(iii) the curves are convex since the value of a good declines as more of it is consumed.

(iv) indifference curves can be drawn through any point on the diagram.

(v) indifference curves do not cross.

The **consumption-opportunity constraint** differentiates between curves that are attainable and those that are unobtainable. The budget constraint is the constraint due to a limited income and the price of goods.

Example 19-4 Consumption-opportunity constraint

In Example 19-3, if we impose a constraint that the shopper has only $6 available, and apples cost $2 per kilogram and oranges cost $1 per kilogram. We can then add the constraint as shown by the line joining 3 kilograms of apples to 6 kilograms of oranges. The point A, where the line intersects the indifference curve, represents the optimal combination of fruit for the shopper to buy.

If the price of a product rises then the **substitution effect** means that the slope of the constraint line will change (holding real income constant), the **income effect** means that the constraint line will move downwards towards the bottom left hand corner.

20 Costs and the Supply of Goods

Learning Outcome Statements (LOS)

20-a	**Describe** the principal-agent problem of the firm, **distinguish** among the types of business firm, and **discuss** the major factors promoting cost efficiency and customer service.
20-b	**Distinguish** between 1) explicit costs and implicit costs, 2) economic profit and accounting profit, and 3) the short run and the long run in production.
20-c	**Define** and **identify** opportunity costs, fixed costs, variable costs, marginal costs, average costs, and sunk costs, and **differentiate** between economic costs and accounting costs.
20-d	**State** the law of diminishing returns and **explain** its impact on a company's costs.
20-e	**Describe** the shapes of the short-run marginal cost, average variable cost, average fixed cost, and average total cost curves.
20-f	**Define** economies and diseconomies of scale, **explain** how each is possible, and **relate** each to shapes of long-run average total cost curves.
20-g	**Describe** both the factors that cause cost curves to shift and the economic way of thinking about costs.

Introduction

We now move on to looking at firms and their cost bases. First of all candidates have to be able to distinguish between different types of costs, in particular explicit and implicit costs, and the difference between accounting and economic profits. They also have to be able to interpret the components of short-run and long-run costs and relate these to a firm's total cost curves. Finally they need to be able to make the link between the cost structure of firms and the impact on supply.

LOS 20-a

Describe the principal-agent problem of the firm, **distinguish** among the types of business firm, and **discuss** the major factors promoting cost efficiency and customer service.

principal-agent problems – an example of principal–agent problems is when the purchaser (principal) of a good or service does not have full knowledge of the good or service provided by the agent leading to potentially conflicting objectives. Another case is when there is an imperfect match between incentives and monitoring of a firm's management, and the management has different objectives to the owners or stockholders of the firm.

Firms in the U.S. fall into three main categories, namely:

Corporations, owned by stockholders whose liability is limited to their investment.

Partnerships, owned by two or more individuals who have full liability for the debts of the business.

Proprietorships, owned by a single person who has full liability for the debts of the business.

In a corporation there are three main factors that promote cost efficiency and customer service. They also bring the interests of corporate managers in line with other parties. These are

Competition for investment funds and customers. Investors (either directly or via investment advisors, pension funds and so on) are looking for good management strategy in the corporations that they invest in. They will purchase stock when they see opportunities and sell stock when they see problems. Managers have continuous feedback from investors on their performance and the stock price will reflect the views of investors.

In a similar way, customers are comparing a firm's products against those of its competitors, and if they are not satisfied by the quality and price will move their custom elsewhere.

Compensation and management incentives. Remuneration can be linked to the firm's performance by relating it to profits and/or stock price. Compensation in the form of stock options has become increasingly important in the U.S. Additionally job security is obviously higher for managers who add value.

Threat of corporate takeover. A poor performing company will be likely to have a weaker stock price and be liable to takeover reflecting the potential of new managers to add value. In such a situation the existing managers are likely to lose their jobs.

LOS 20-b

Distinguish between 1) explicit costs and implicit costs, 2) economic profit and accounting profit, and 3) the short run and the long run in production.

LOS 20-c

Define and **identify** opportunity costs, fixed costs, variable costs, marginal costs, average costs, and sunk costs, and differentiate between economic costs and accounting costs.

Business costs

Explicit costs – explicit costs have measurable cash flows, the costs relate to payment for resources. Examples are wages, rent, and raw material costs.

Implicit costs – these are opportunity costs of using the firm's resources, they are often not included in the accounting statements. Examples are wages or rental, which are not claimed by the owner of the business.

Total costs - the sum of explicit and implicit costs.

Opportunity cost of equity capital – this is the implicit cost of using the financial resources provided by equity shareholders. It is the normal or market rate of return on financial capital; it must be earned for investors to continue to provide capital to a firm.

Economic profit - takes into consideration total economic costs which include both explicit and implicit costs, including the opportunity cost of assets used by the firm. Zero economic profit means that the owners are receiving the normal rate of return on their investment. Accounting profit takes into consideration explicit costs, and usually not implicit costs. Accounting profit is therefore usually higher than economic profit.

Example 20-1 Economic and accounting profit

A manufacturing company has sales of $1 million per annum and explicit costs (raw materials, wages, rent, utilities, tax etc.) of $700,000. The accounting profit is $300,000. However the owner of the company is charging a rent of only $25,000 for the factory whereas the rent he could receive in the open market is $75,000. This gives an additional implicit cost of $50,000, reducing the economic profit to $250,000.

With respect to production activities the **short run** is defined as a time period in which a firm cannot alter the size of is production plant. The **long run** is the period in which a firm can alter all of the factors governing production.

Costs

Definitions are given for different types of a firm's costs:

Variable costs – these are costs that rise as output increases, the average variable cost is the total variable cost divided by the number of units produced.

Fixed costs – these costs do not vary with the level of output. The average fixed costs is the total fixed cost divided by the number of units produced; it will decline as production increase.

Total cost - total fixed costs plus variable costs.

Marginal costs - change in total costs to produce an additional unit of output.

Sunk costs - historical costs incurred due to past decisions, and the decisions cannot be reversed.

LOS 20-d

State the law of diminishing returns and **explain** its impact on a company's costs.

LOS 20-e

Describe the shapes of the short-run marginal cost, average variable cost, average fixed cost, and average total cost curves.

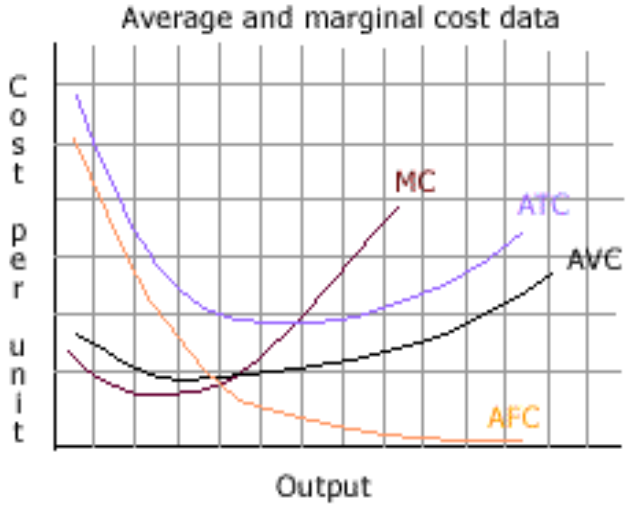
The law of diminishing returns

This law states that as more and more units of a variable resource are allocated to production they will eventually increase output at a decreasing rate. Mathematically, as the marginal costs increase they will become higher than the average total cost, thereby increasing the average total cost.

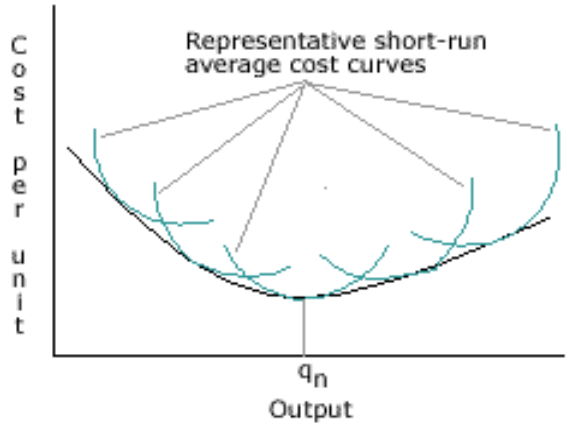
Example 20-2 Law of diminishing returns

Hiring additional employees (a variable resource) to work at a factory will initially increase output but eventually it will become more and more difficult to generate additional output from the fixed resources (due to plant size and equipment limitations).

The relationship between marginal costs (MC), average total costs (ATC), average variable costs (AVC) and average fixed costs (AFC) is shown below. Whilst AFC continuously decline as output expands, MC initially decline but at a certain output level they start to increase pushing up the AVC and ATC.



If a firm has the flexibility to alter its plant size then the long run average total cost curve becomes a combination of the short-run average total cost curves.

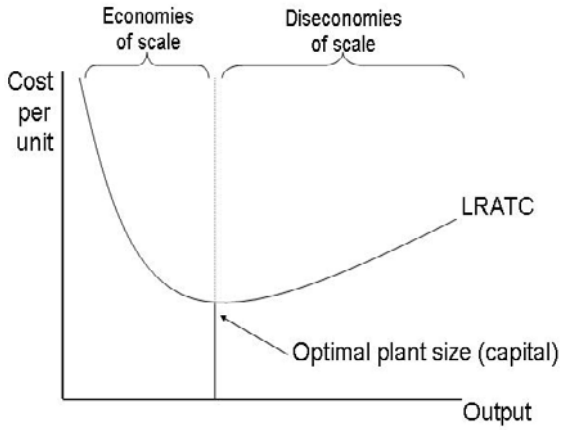


LOS 20-f

Define economies and diseconomies of scale, **explain** how each is possible, and **relate** each to shapes of long-run average total cost curves.

Economies of scale - refers to when unit costs fall as output increases, the long-run average total cost curve will decline. This is usually a result of mass production, specialized use of resources, and improvements in production techniques due to experience.

However there are cases of **diseconomies of scale** when the long-run average total cost curve rises. This might be due to increasing bureaucracy.



LOS 20-g

Describe both the factors that cause cost curves to shift and the economic way of thinking about costs.

Shifts in the cost curve are caused by a number of factors including:

(i) a change in price of resources - marginal cost curves will shift upwards.

(ii) a change in taxes - depending on the type of tax, it will change the fixed or variable costs.

(iii) a change in regulations - depending on the type of regulation, it will change the fixed or variable costs.

(iv) improvements in technology will reduce the resources needed to produce a unit of output.

Managers need to make choices in the real world and it is important to link this to the way that economists look at costs. Essentially when managers make decisions to incur costs they do so with uncertainty over what the actual costs will be, whether they are MC which are the costs of expanding output, or opportunity costs which are the costs of giving up other options. When managers forecast costs they are looking forward, whereas accounting costs look backward, they are based on historic cost numbers.

21 Price Takers and the Competitive Process

Learning Outcome Statements (LOS)

21-a	**Discuss** the conditions that characterize pure competition (a price taker market) and **explain** how and why price takers maximize profits at the quantity for which marginal cost, price, and marginal revenue are equal.
21-b	**Calculate** and **interpret** the total revenue and the marginal revenue for a price taker, **explain** the relationship between total revenue, total cost, price, marginal revenue, marginal cost, and the profit maximizing out put level.
21-c	**Explain** the decision by price takers to continue to operate, temporarily shut down, or go out of business, when faced with price below average total cost.
21-d	**Describe** the short-run supply curves for a company and for a competitive market.
21-e	**Explain** the impact on prices and output of increases or decreases in demand in a competitive market.
21-f	**Contrast** the role of constant-cost, increasing-cost, and decreasing-cost industries in determining the shape of a long-run market supply curve.
21-g	**Explain** the impact of time on the elasticity of market supply and **discuss** the role of profits and losses in a purely competitive market.

Introduction

We continue our analysis of firms by examining price-taker firms, these are firms who have to accept the market price for their products, otherwise their sales will disappear, so they face a perfectly elastic demand curve. Candidates need to understand at what production level price-taker firms maximize profits and be able to describe the short-run and long-run supply curves for different types of price-taker industry.

LOS 21-a

Discuss the conditions that characterize pure competition (a price taker market) and **explain** how and why price takers maximize profits at the quantity for which marginal cost, price, and marginal revenue are equal.

LOS 21-b

Calculate and **interpret** the total revenue and the marginal revenue for a price taker, **explain** the relationship between total revenue, total cost, price, marginal revenue, marginal cost, and the profit maximizing out put level.

Price-taker market

A price-taker market is a market characterized by:

1. All firms produce an identical product.
2. There are a large number of firms in the market.
3. Each firm is small relative to the market size.
4. There are no entry (or exit) barriers.

The demand curve is a horizontal line and demand is perfectly elastic, if a firm increases the price of its products above the market price its sales will be zero.

A price-taker market is also called a **purely competitive market**.

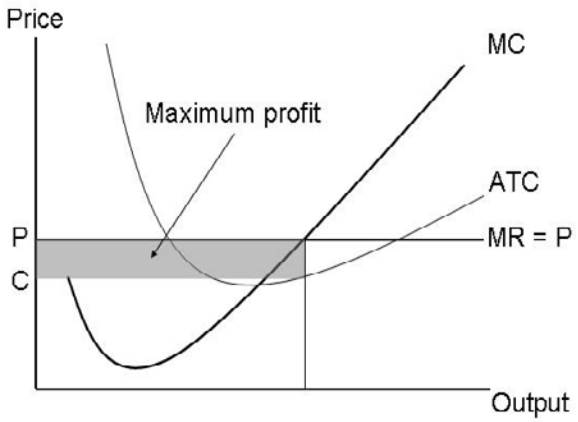
Examples of price-taker markets are to be found in the agricultural sector where producers of agricultural commodities must accept the market price for their goods.

In real economies most companies are not price takers but are **price searchers**. In a price-searcher market firms face a downward-sloping demand curve but can still set the price for their products.

A price taker can always sell more units at the market price so will expand output as long as the marginal revenue, which is the same as the market price, exceeds its marginal cost. Up to this point the production of additional units will add more to revenues than to costs, thereby increasing profits. Profits will be maximized at the point that:

Equation 21-1

P = MR = MC



Note - The total revenue is the sales price multiplied by the output, the total cost is the average total cost multiplied by the output.

LOS 21-c

Explain the decision by price takers to continue to operate, temporarily shut down, or go out of business, when faced with price below average total cost.

If prices are depressed in a price-taker market, a firm has three options:

1. Continue to operate in the short run - if it can cover its variable costs and thinks the downturn is temporary.

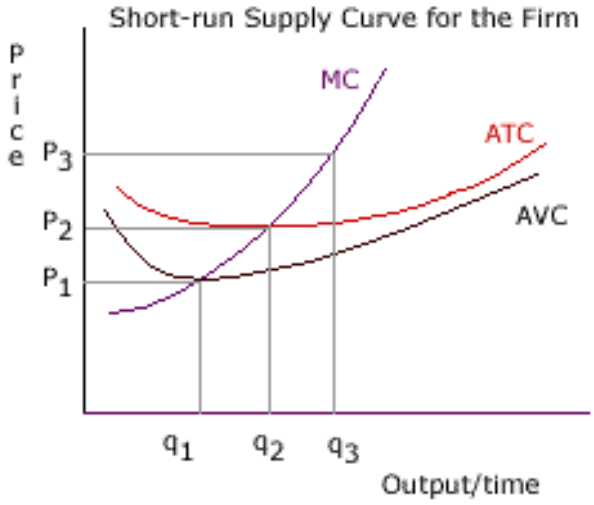
2. Shut down temporarily - incur fixed but not variable costs.

3. Go out of business, if market conditions are not expected to change.

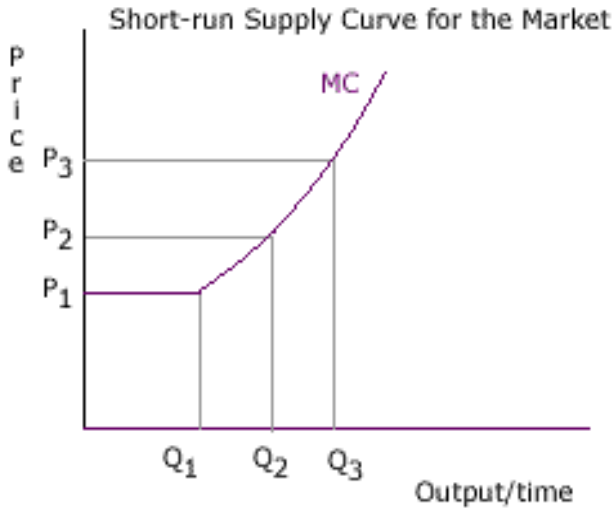
LOS 21-d

Describe the short-run supply curves for a company and for a competitive market.

A firm's short-run supply curve is shown below. The marginal cost curve is the same as the supply curve since it produces to the level where P = MC for a profit maximizing company .



The short-run supply curve for a competitive market, assuming resource prices are held constant, is the sum of the supply curves for the firms in the market. This is shown below:



LOS 21-e

Explain the impact on prices and output of increases or decreases in demand in a competitive market.

An increase in demand for a product (for reasons other than price) will lead to an increase in price. Firms will expand production as they move along their MC curves and in the short-term make economic profits. However, new entrants will come into the industry and existing firms will expand production, in turn pushing up supply until economic profits disappear. Assuming there is no change to the resource cost of the industry; prices will drop back to their original levels.

Similarly if there is a drop in demand prices will fall and economic losses will lead to a reduction in supply in the market. Prices will rise until firms can once again earn normal profits and a new equilibrium point is reached.

LOS 21-f

Contrast the role of constant-cost, increasing-cost, and decreasing-cost industries in determining the shape of a long-run market supply curve.

In the short run the supply curve for price takers will slope upwards to the right but in the long run there are three alternatives:

1. Constant-cost industries - costs of production remain constant as output is expanded so the supply curve is horizontal.
2. Increasing-cost industries - costs of production rise as output is expanded so the supply curve will slope upwards to the right. This is usually the case.
3. Decreasing-cost industries - costs of production decline as output is expanded so the supply curve will slope downwards to the right.

In price-taker markets, in long run equilibrium, all firms will earn a normal rate of return. If economic profits are available then new firms would enter the business and original companies would expand supply, putting downward pressure on prices. Similarly if firms are making economic losses then they will leave the market thereby reducing supply. So in the long-run supply is more elastic than in the short-run.

LOS 21-g

Explain the impact of time on the elasticity of market supply and **discuss** the role of profits and losses in a purely competitive market.

Profits occur when firms produce goods that consumers value more than the cost of the resources needed to produce the good. On the other hand, losses represent the loss in value of resources used by a firm. Therefore managers who can anticipate which products will generate high demand and can produce them efficiently have the opportunity to make economic profits, at least in the short term.

22 Price-Searcher Markets with Low Entry Barriers

Learning Outcome Statements (LOS)

22-a	**Describe** the conditions that characterize monopolistic competition (a competitive price-searcher market).
22-b	**Explain** how firms choose price and output combinations in monopolistic competition.
22-c	**Summarize** the debate about the allocative efficiency of monopolistic competition with low barriers to entry, including the implications of contestable markets and entrepreneurship.
22-d	**Discuss** the principle of price discrimination and **illustrate** how a firm might apply this principle to gain from such a practice.

Introduction

Price–searcher markets are ones which face downward–sloping demand curves for their products, so if they increase prices they will see demand fall but not completely disappear. Most firms are price searchers, they are looking to maximise profit and they decide what price to charge and how much to produce of their product. In this Reading we look at price-searcher markets with low entry barriers which can lead to a highly competitive environment. Again candidates have to understand how firms make decisions on levels of output and evaluate the efficiency of price-searcher markets.

LOS 22-a

Describe the conditions that characterize monopolistic competition (a competitive price-searcher market).

Competitive price-searcher markets

Competitive price-searcher markets are also called **monopolistic competition**, they are characterized by

1. Low entry barriers
2. Firms with downward-sloping demand curves.
3. Firms produce differentiated rather than identical products.

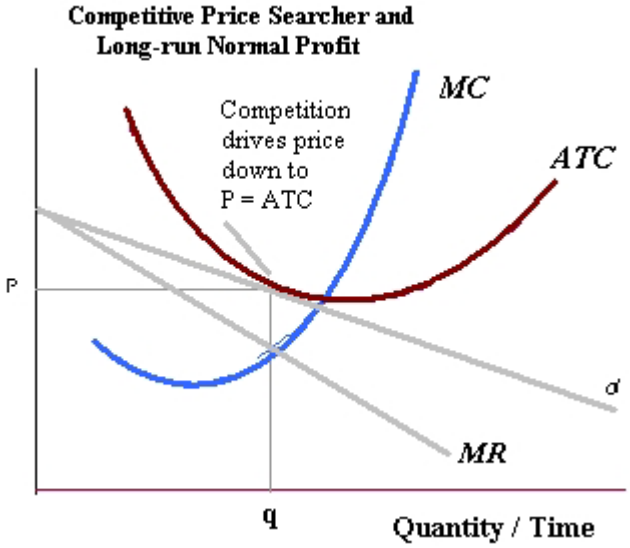
LOS 22-b

Explain how firms choose price and output combinations in monopolistic competition.

The demand curves of price-searcher markets are highly elastic due to the availability of substitutes.

Price searchers will need to decide between different price and output combinations, expanding output will lead to a lower price and vice versa. Firms will expand output until marginal revenue equals marginal cost since this will maximize profits, but due to the large number of competitors the sales of each firm will be below their least-cost capacity level. Prices in a price-searcher market will be slightly above those in a price-taker market.

The diagram below illustrates that over the long-term, if new firms can freely enter the market price will equal unit cost and there will be no economic profits available.



LOS 22-c

Summarize the debate about the allocative efficiency of monopolistic competition with low barriers to entry, including the implications of contestable markets and entrepreneurship.

A **contestable market** is one where the costs of entry and exit are low. An example of this is an airline route where only a small number of airlines cover the route but they cannot push up prices because other airlines are free to fly the route.

Entrepreneurship - this is important since entrepreneurs make decisions when there is not information available to apply economic models. Therefore entrepreneurs do not have a place in economic models.

Allocative efficiency - the allocation of resources to the production of goods and services most desired by consumers, at the lowest possible cost.

The debate about the efficiency of price-searcher markets with low entry barriers has two sets of arguments:

For

(i) incentive to produce efficiently
(ii) firms only undertake production if it increases the value of resources used.
(iii) firms are innovative in developing new products.

Against

(i) firms maximize profits when price is higher than marginal cost.
(ii) long-run average cost is not minimized.
(iii) heavy advertising is encouraged.

LOS 22-d

Discuss the principle of price discrimination and **illustrate** how a firm might apply this principle to gain from such a practice.

Price discrimination is when a producer can charge different prices to different customers for the same product. This is only possible when the customers who are paying less cannot resell at higher prices and when two groups of customers have demand curves with different elasticities.

Example 22-1 Price discrimination

Different pricing of airline fares to different groups of customers. Business travelers have an inelastic demand curve and are generally willing to pay higher prices compared to people on vacation, who have a more elastic demand curve and greater flexibility when they can travel.

Price discrimination increases output and profits and also reduces the allocative inefficiency with prices being set above marginal cost.

There are three main reasons why competition promotes economic progress:

1. Producers need to operate efficiently and meet customers' demands.

2. Producers have an incentive to innovate and find lower-cost methods of production.

3. Producers must adopt an effective business structure and decide the optimum size of business to keep costs low.

23 Price-Searcher Markets with High Entry Barriers

Learning Outcome Statements (LOS)

23-a	**Discuss** entry barriers that may protect companies against competition from potential market entrants.
23-b	**Differentiate** between a monopoly and an oligopoly.
23-c	**Describe** how a profit-maximizing monopolist sets prices and determines output and **discuss** price and output under oligopoly, with and without collusion.
23-d	**Discuss** why oligopolists have a strong incentive to collude and to cheat on collusive agreements and **discuss** the obstacles to collusion among oligopolistic companies.
23-e	**Describe** the different defects that can occur in a market with high entry barriers.
23-f	**Describe** government policy alternatives that are intended to reduce the problems stemming from high barriers to entry.
23-g	**Contrast** the pricing and output decisions of firms in pure competition, monopolistic competition, oligopoly, and monopoly with reference to quantity produced, price, marginal revenue, marginal cost, demand and average total cost.

Introduction

Price-searcher markets with high entry barriers (such as legal barriers, patents or economies of scale) have a limited number of participants in the market. In the case of only one participant it is a monopoly, in the case of a few firms it is an oligopoly. Candidates need to recognise the characteristics of monopolies and oligopolies and discuss how they set output levels. Additionally they need to understand the inefficiencies created by entry barriers and look at the rationale behind government policies that protect industries.

LOS 23-a

Discuss entry barriers that may protect companies against competition from potential market entrants.

Entry barrierss

There are four main types of entry barriers which make it difficult or impossible for competitors to enter a business. These are:

1. Economies of scale.
2. Government regulations.
3. Patents.
4. Control over an essential resource.

High entry barriers lead to reduced competition which means that resources are not used efficiently. Firms may use time in lobbying for government protection rather than focusing on productive activities. The consumer loses through lack of choice and they are usually overpaying for products that are produced inefficiently.

LOS 23-b

Differentiate between a monopoly and an oligopoly.

Monopoly

A monopoly is characterized by:

1. There is only one producer of a well defined product with no clear substitutes.
2. High entry barriers.

Examples of monopolies in the U.S. include local electricity suppliers who have a monopoly in a certain district.

Oligopoly

An oligopoly is characterized by:

1. A small number of producers.
2. Interdependence between producers.
3. High economies of scale.
4. Significant barriers to entry.

Examples of oligopolies in the U.S. include auto producers and steel manufacturers.

LOS 23-c

Describe how a profit-maximizing monopolist sets prices and determines output and **discuss** price and output under oligopoly, with and without collusion.

LOS 23-d

Discuss why oligopolists have a strong incentive to collude and to cheat on collusive agreements and discuss the obstacles to collusion among oligopolistic companies.

Monopolies face a downward sloping demand curve and will aim to maximize profit. They will also increase production until marginal revenue equals marginal cost.

Oligopolies tend to have demand curves that are very elastic and we see a strong link between the prices of different producers. Oligopolists must take into consideration the reaction of their competitors if they change prices. If all the participants in an industry are acting independently then the price will get driven down to the average unit cost of production, since any firm which raises the price above this level would quickly lose sales. Therefore there is a high risk of **collusion,** when firms agree to limit production and/or sell products at, or above, a minimum price. Collusion is attractive since producers want to avoid prices being pushed down to the cost of production. Collusion using a formal organization, which is called a cartel, will try to control supply to maximize the profits of members. An example of this is OPEC.

Collusion is difficult to maintain as there is a strong incentive for individual firms to 'cheat' to increase market share. There are five major obstacles to collusion:

1. An increasing number of firms in the market - each firm will have different objectives depending on its cost base and its estimates of market demand elasticity.
2. Price cutting is difficult to detect - there is a strong incentive for individual firms to cut prices if it cannot be easily detected or prevented.
3. Low entry barriers - a profitable market will attract new entrants.
4. Unstable demand - different demand expectations will make it difficult to reach agreement on pricing and supply.
5. Antitrust legislation.

LOS 23-e

Describe the different defects that can occur in a market with high entry barriers.

Problems arising from a market with high entry barriers include:

- Reduced options available to consumers
- Allocative inefficiency - production will not increase until prices fall to the cost level.

- Inefficient firms can make profits even when they are not meeting customers' requirements.
- Resources are used to try to obtain protection from government.

LOS 23-f

Describe government policy alternatives that are intended to reduce the problems stemming from high barriers to entry.

A government can try to improve the efficiency of a monopoly by measures such as:

1. Controlling the structure of the industry to ensure competitors enter the industry, including antitrust laws - this will not tend to be effective when the firms benefit from economies of scale. In this case increasing the number of firms will increase costs and therefore prices. There is a tendency for **natural monopolies** to form, when production costs continue to fall as output is increased. This will lead to one or a small number of firms dominating an industry.
2. Removing trade barriers and tariffs that limit competition - although this will strengthen competition there are often political reasons to keep trade restrictions in place.
3. Controlling prices charged and output of firms in the market - but fixing prices in relation to profits encourages inefficiency.
4. Supplying the goods by a government owned firm - but a government owned monopoly tend to be less efficient and less subject to scrutiny, leading to higher prices.

LOS 23-e

Contrast the pricing and output decisions of firms in pure competition, monopolistic competition, oligopoly, and monopoly with reference to quantity produced, price, marginal revenue, marginal cost, demand and average total cost.

In all price searcher and price taker markets firms will expand output until marginal revenue equals marginal cost in order to maximize profits. The main difference between price takers and price searchers is that in a price–taker market firms must accept the market price but in price-searcher markets they can choose which price to charge (which will theoretically determine the output level). Whilst in the long run firms in price-taker and competitive price searcher markets cannot earn economic profits, firms in markets with entry barriers are protected from competition (either because they are a single company, as in the case of a monopoly, or due to non-competitive pricing in the case of an oligopoly) and they have the potential to earn long-term economic profits.

We can generalize by saying that prices in a price-taker markets tend to be below those in monopolistic competition, an oligopoly and a monopoly, in that order.

24 The Supply of and Demand for Productive Resources

Learning Outcome Statements (LOS)

24-a	**Explain** the relationship between the price of a resource and the quantity demanded of that resource with reference to supply, demand, and derived demand.
24-b	**Identify** and **describe** three factors that may cause shifts in the demand curve for a resource.
24-c	**Define** marginal product, marginal revenue, value of marginal product (VMP), the marginal revenue product (MRP) of a resource and **explain** the relation between MRD and demand for that resource.
24-d	**Explain** the necessary conditions to achieve the cost-minimizing employment levels for two or more variable resources.
24-e	**Discuss** the factors that influence resource supply and demand in the short run and long run.

Introduction

Having examined the choices of consumers and firms, we turn to the suppliers of resources. These are individuals or firms that are motivated by the income they receive for supplying the resource. Supply and demand for the resource decide the price that they can charge. The candidate is expected to understand the factors that drive demand and how the marginal revenue product from a resource determines demand.

LOS 24-a

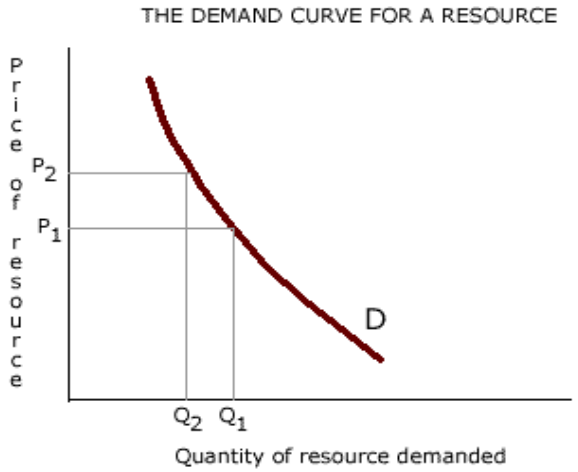
Explain the relationship between the price of a resource and the quantity demanded of that resource with reference to supply, demand, and derived demand.

There are two categories of productive resources:

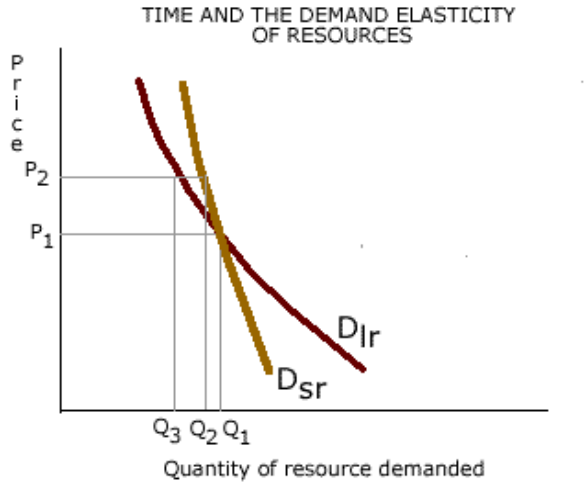
1. Human resources - the skill and knowledge of workers.
2. Nonhuman resources
   a. physical capital – resources made by humans e.g. tools and machines
   b. land
   c. natural resources

Demand for a resource is a **derived demand**, which means that the demand is dependent on the demand for the final good that the resource is used to produce.

There is an inverse relationship between the demand for a resource and the quantity demanded. If the price increases, producers will (i) turn to substitute resources and (ii) consumers will buy less of the final good as it becomes more expensive. The demand curve is shown below; as prices increase from P_1 to P_2, demand falls from Q_1 to Q_2.



Generally if the demand for the final product is elastic this will lead to demand for the resource being elastic and vice versa. In the long run the demand for a resource is more elastic than in the short run, as producers have more time to substitute another resource. The long-run demand curve will be flatter than the short-run curve. This is shown in the diagram below where the quantity demanded falls by more in the long run (to Q_3) than the short run (to Q_2) when prices increase from P_1 to P_2.



LOS 24-b

Identify and **describe** three factors that may cause shifts in the demand curve for a resource.

Shifts in the demand curve

Three are three factors that can cause a shift in the demand curve.

1. **A change in demand for the final product** will lead to a similar change in demand for the resources used to make the product, e.g. a fall in demand for technology products leads to workers being laid off in the technology sector.
2. **A change in the productivity of a resource**, a rise in productivity will lead to a rise in demand. Additional capital can be spent to improve productivity (of people or equipment), e.g. skilled labor is more in demand than unskilled labor.
3. **A change in price of a related product**, e.g. higher prices of wood for construction would lead to greater demand for bricks as builders switch from building wood to brick houses.

LOS 24-c

Define marginal product, marginal revenue, value of marginal product (VMP), the marginal revenue product (MRP) of a resource and **explain** the relation between MRD and demand for that resource.

The **marginal revenue product** (MRP) of a resource is the change in total revenue of a firm that results from the employment of one additional unit of resource. This is equal to the marginal product (the change in total output) multiplied by the marginal revenue. Following on from the law of diminishing returns, the marginal product (MP) and therefore the MRP of a resource will fall as employment of the resource increases.

For a price–taker firm, because marginal revenue equals market price, the MRP equals the resource's value of marginal product (the marginal product multiplied by the selling price of the product it produces). For a price-searcher firm, the MRP is less than the value of MP because marginal revenue is less than the price, since a price-searcher firm must reduce prices to sell more units.

All profit–maximizing firms will expand the use of each resource until the MRP of the resource is equal to the marginal cost of employing the resource.

The short-run demand curve for a resource is exactly the same as the MRP curve for the resource, in both cases it is downward sloping. As the quantity of the resource used expands the MRP declines and similarly as the resource price rises the quantity demanded falls.

LOS 24-d

Explain the necessary conditions to achieve the cost-minimizing employment levels for two or more variable resources.

Extending the analysis to the case when a firm is using a number of variable resources, or factors, for a profit-maximizing firm they will expand production until the MP per last dollar spent on each factor is equal. This is because if a marginal dollar spent on one resource increases output by more than if it was spent on another resource, then a firm would increase spending on this resource rather than ones with a higher marginal cost per dollar. However as more and more of a resource are added their MP will fall, until eventually equality is reached.

Example 24-1 Variable resources

A firm is using three variable resources, skilled labor, unskilled labor and machine rental. Unit costs will be minimized when:

$$\frac{\text{MP of skilled labor}}{\text{Price of skilled labor}} = \frac{\text{MP of unskilled labor}}{\text{Price of unskilled labor}} = \frac{\text{MP of machine rental}}{\text{Price of rental}}$$

LOS 24-e

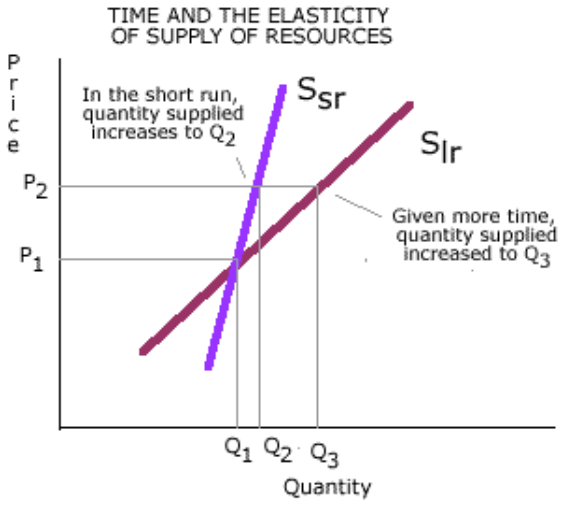
Discuss the factors that influence resource supply and demand in the short run and long run.

Supply of resources

Owners of a resource will sell the resource if the benefit exceeds the costs, and they will sell to the firm that offers them the most for the resource. An increase in the resource price will attract new suppliers and a decrease will lead to a shift of the resource sellers to other activities. The supply curve is upward sloping to the right.

Short-run and long-run supply

The supply response may well be different in the short and long run. In the short run, the response of suppliers to a price change will be less than in the long run. In the long run the suppliers of the resource can adjust their investment to supply more or less of a resource. Therefore supply will be more elastic in the long run than short run, as shown in the diagram below.



In the short run, how quickly supply responds to a change in price of a resource is determined by the resource mobility. Resource mobility is how easily the resource can be transferred to another use. High resource mobility leads to an elastic supply curve. Land is often a very mobile resource since it can be used for many different purposes, agriculture, building etc. Machines are usually not very mobile. Labor resources are mobile within a skill level and geographical area but mobility will tend to decline as the skill level increases.

In the long run, the supply of resources will naturally decline as machines wear out, people's skills decline etc. However, investment whether in machines or in education and training, can increase the supply of both physical and human resources. The time it takes for the resource supply to adjust to a change in prices will depend on the resource itself e.g. a doctor will take longer to qualify than a truck driver.

Resource prices

Resource prices are determined by supply and demand and the equilibrium is when the quantity supplied equals the quantity demanded.

If there is a sudden change in demand, the move in price is larger in the short run to long run. For example, if there is a sharp increase in demand, the price of the resource will increase. However, in the long run the increased elasticity in the supply curve of the resource will lead to supply adjusting which will put downward pressure on the price, leading to a smaller long-run increase in price.

Prices in resource markets are critical since they link the actions of firms using a resource and the provider of the resource. They provide information about the scarcity of a resource and provide an incentive to a provider of a resource to invest to increase supply. As consumer preferences change, the ability of resource prices to adjust is essential for a properly functioning market system to reallocate the use or resources between industries.

25 The Financial Environment: Markets, Institutions and Interest Rates

Learning Outcome Statements (LOS)

25-a	**Identify** and **explain** the factors that influence the supply of and demand for capital.
25-b	**Describe** the role of interest rates in allocating capital.
25-c	**Explain** how the supply of and demand for funds determine interest rates.
25-d	**Discuss** the factors that cause the supply of and demand curves for funds to shift.
25-e	**Distinguish** between the real and the nominal risk-free rate of interest.
25-f	**Discuss** economic conditions that can change the real risk-free rate of interest.
25-g	**Explain** the effect of inflation on the real rate of return earned by financial securities and by physical assets.
25-h	**Describe** default risk, liquidity risk, and maturity risk premiums.
25-i	**Explain** interest rate risk and reinvestment rate risk.
25-j	**Explain** how inflation-indexed bonds can protect investors from inflation and maturity risk.

Introduction

This Reading looks at the supply and demand for funds and the link to interest rates. Candidates should be able to differentiate between nominal and real interest rates and the effect of inflation on required returns. We also explore how market interest rates are determined and the premium required for default risk, liquidity risk and maturity risk.

LOS 25-a

Identify and **explain** the factors that influence the supply of and demand for capital.

Cost of capital

There are four main factors that affect the supply and demand for capital and therefore the cost of money (either the cost of borrowing or the cost of equity). These factors are:

Production opportunities - these are the returns available in an economy for investing in productive assets.

Time preferences for consumption – whether consumers prefer to consume today or save for tomorrow.

Risk – this is the risk that investments will not provide the expected returns.

Inflation – the expected rate of future inflation will influence required returns, higher inflation increases the required returns and vice versa.

LOS 25-b

Describe the role of interest rates in allocating capital.

LOS 25-c

Explain how the supply of and demand for funds determine interest rates.

LOS 25-d

Discuss the factors that cause the supply of and demand curves for funds to shift.

Interest rates determine the allocation of capital. If a firm has profitable investment opportunities it is willing to pay more for capital, and a less profitable firm will be able to afford less.

In a low risk market, interest rates will be set by the market at the level where demand for capital equals supply of capital, remember the graph in the Introductory Readings to Study Session 4. In a higher risk market, suppliers of capital will require a higher return and therefore equilibrium will be at a higher interest rate.

There is a different price for each type of capital (e.g. equities, home loans, federal loans etc.) and the prices will move as demand fluctuates. In a recession when businesses are not looking to raise capital the demand curve will shift to the left and then short-term interest rates will fall, whereas in an economic boom short-term rates will rise.

Similarly supply curves will be affected by the supply of capital. If the Fed adopts a restrictive policy the supple curves will shift to the left which will raise interest rates.

LOS 25-e

Distinguish between the real and the nominal risk-free rate of interest.

Nominal rate of interest

The quoted rate of interest on a debt security is usually the nominal rate of interest. The nominal rate is the real risk-free rate plus premiums that reflect inflation, the risk of the security and the security markets' liquidity. This means that

Equation 25-1

$$k = k_{RF} + DRP + LP + MRP$$

and $k_{RF} = k^* + IP$

where

k = nominal rate of interest on a security

k_{RF} = the risk-free rate of interest available on a risk-free asset, for example Treasury Bills in the U.S.

k^* = real risk-free rate, available on a risk-free asset if zero inflation is expected

IP = inflation premium, the expected average annual inflation rate over the life of the security

DRP = default risk premium, it reflects the risk the issuer does not pay the interest or principal

LP = liquidity or marketability premium

MRP = maturity risk premium, long-term securities have a greater risk of price decline

LOS 25-f

Discuss economic conditions that can change the real risk-free rate of interest.

The real risk-free rate of interest will be constantly changing reflecting economic conditions. In particular it will depend on

The rate of return corporations and other borrowers expect to earn on productive assets, which will determine the maximum they can afford to pay on borrowed funds and

Savers' time preferences for consumption. This will determine how much money they can deposit or lend at different rates.

LOS 25-g

Explain the effect of inflation on the real rate of return earned by financial securities and by physical assets.

Inflation premium

There is a link between inflationary expectations and interest rates. Fear of rising inflation will increase interest rates, and investors require a higher rate of return to compensate them for the decline in purchasing power of their capital for physical assets. However if investors are confident that inflation will remain under control, interest rates will ease.

It is important to note that the inflation rate used is the rate expected over the life of the security. Although this may be correlated to past trends in inflation, it is very likely to be a different rate to the current rate of inflation.

LOS 25-h

Describe default risk, liquidity risk, and maturity risk premiums.

Default risk premium

The default risk premium reflects the risk of the issuer failing to pay the interest or principal back in full. Ratings on corporate bonds give an indication of the default risk. The default risk premium is the difference between the interest rate on a Treasury bond (assumed to have no default risk) and a corporate bond with the same maturity, coupon, liquidity etc.

Liquidity premium

This reflects the risk that the investor cannot sell the security quickly to raise cash, and if it can be sold he will not receive its fair value.

Maturity risk premium

The maturity risk premium reflects the fact that bonds that have longer to maturity have greater interest rate risk. This premium fluctuates and tends to be higher when markets are more volatile.

Example 25-1 Nominal interest rate

The real risk-free rate is 2% and inflation is expected to be 3% over the next year. A corporate AAA bond with one year to maturity yields 0.5% over a one-year Treasury issue. A highly liquid AAA bond with one year to maturity would have an estimated nominal yield of:

Using Equation 25-1

$k = k^* + IP + DRP + LP + MRP = 2\% + 3\% + 0.5\% = 5.5\%$

We have assumed there is only a very small maturity risk premium.

LOS 25-i

Explain interest rate risk and reinvestment rate risk.

Although the maturity risk premium on 30 year Treasury bonds has recently been around one to two percent higher above the risk-free asset, the **reinvestment risk** of short-term bills needs to be considered. The reinvestment risk refers to the risk that when short-term paper matures, if interest rates have fallen, the investor will need to accept a lower rate when the proceeds are reinvested.

LOS 25-j

Explain how inflation-indexed bonds can protect investors from inflation and maturity risk.

An inflation-indexed bond offers investors protection against inflation. The mechanics are fairly straight forward, the principal value of the bond adjusts to reflect the inflation rate and the coupon paid is based on the adjusted principal value.

For example consider an inflation-indexed bond that is issued on January 1st with a coupon of 4% and principal value of $1,000. Over the next six months inflation (measured by the CPI) is 1.2% and the principal would adjust by this percentage amount to $1,012 and the coupon payment would be 0.02 x $1,012 = $20.24 (note that this is a semiannual coupon so the rate is 2% of the principal). The adjustment will continue to the maturity date when the inflation-adjusted principal will be repaid to investors.

It can be argued that inflation-indexed bonds should not have a maturity risk premium since if interest rates rise, so will inflation, and the investor will see an increase in the value of the bond to offset the impact of interest rate risk.

STUDY SESSION 6

Economics: Global Economic Analysis

Overview

This is a relatively short Study Session focusing on international trade. There has been rapid growth in the number of cross border transactions and the Session starts with an explanation of the benefits of international trade and the largely negative impact of trade barriers (tariffs, quotas etc.) which are widely used to restrict international trade. It also looks at the mechanics of the foreign exchange markets, how exchange rates are quoted and the main theories explaining forward exchange rates including interest rate and purchasing power parity. Candidates are also expected to understand the impact of government monetary and fiscal policies on currencies and the other factors that make currencies depreciate or appreciate.

Reading Assignments

Economics: Private and Public Choice, 10th edition, James D. Gwartney, Richard L. Stroup, Russell S. Sobel, and David A. Macpherson (South-Western, 2003)

26. "Gaining from International Trade," Ch. 17

International Investments, 5th edition, Bruno Solnik and Dennis McLeavey (Addison Wesley, 2004)

27. "Foreign Exchange," Ch. 1

28. "Foreign Exchange Parity Relations" Ch. 2, pp. 31−48

26. Gaining from International Trade

Learning Outcome Statements (LOS)

26-a	**State** the conditions under which a nation can gain from international trade in the context of both comparative and absolute advantage, and **describe** the benefits of international trade.
26-b	**Discuss** the effects of international trade on domestic supply and demand.
26-c	**Distinguish** between commonly used trade-restricting devices, including tariffs, quotas, voluntary export restraints, and exchange-rate controls and **explain** their impact on the domestic economy.
26-d	**Identify** who benefits and loses from the imposition of a tariff.
26-e	**Discuss** the three arguments to adopt trade restrictions and discuss popular fallacies related to trade restrictions.

Introduction

This Reading Assignment concentrates on the benefits for a nation if it exports goods where it has a comparative advantage (can produce goods at a lower opportunity cost than other nations) and import goods where it has a comparative disadvantage. This contributes to economic efficiency for the trading partners. However countries frequently impose trading barriers to protect domestic industries and candidates need to be aware of the beneficiaries and losers (usually the consumer) of barriers such as quotas, tariffs, export constraint and exchange-rate controls.

LOS 26-a

State the conditions under which a nation can gain from international trade in the context of both comparative and absolute advantage, and **describe** the benefits of international trade.

International trade has grown rapidly over recent decades. The principal behind international trade is that individuals and nations benefit from international trade if they buy goods from overseas which cannot be produced cheaply domestically, whereas they can export goods when they have a competitive advantage.

Comparative advantage is defined as the ability to produce goods at a lower opportunity cost than others. This is a relative measure.

Absolute advantage is when a nation can produce more of a product with the same level of resources than another nation, or produce a good with fewer resources.

The Law of Comparative Advantage says that trading partners can each benefit by specializing in producing goods where they have a lower opportunity cost, and trade them for goods where they have a higher opportunity cost. As long as the relative costs of producing goods differ between nations there will be mutual advantages in trading.

Example 26-1 Comparative advantage

	Output per worker per month FOOD	Output per worker per month COMPUTERS
France	4	6
Singapore	3	9

In France the opportunity cost of 1 unit of food is 1.5 units of computers, whereas in Singapore the opportunity cost of 1 unit of food is 3 units of computers, therefore France has a relative advantage in the production of food and Singapore in the production of computers. Both countries will benefit if France trades food for Singapore's computers.
It is assumed that the only resource used to produce the goods is labor.

Active trading between nations allows each nation to expand its production and therefore to also expand its consumption. Other benefits of international trade include:

- Domestic producers benefit from economies of scale as their potential markets are not restricted to their home country. This is particularly true for producers in smaller economies.
- Consumers can benefit from purchasing from large scale producers. Take the example of aircraft – it would not be economical for most countries to pay the design and development costs of building aircraft.
- It promotes competition and a wider variety of goods will be available to the consumer.
- In an open economy (one which is open to free trade) the government is under pressure to provide sound institutions and a healthy environment for corporations; if they do not do so capital and labor will move overseas.
- Exporters earn foreign exchange, which allows the country's residents to purchase imports.

LOS 26-b

Discuss the effects of international trade on domestic supply and demand.

Impact of free trade on supply and demand

If a country has a competitive advantage in the production of a particular good, and it is able to export the good at the world market price, then producers will benefit since they can sell a larger quantity at a higher price. Consumers will lose since they have to pay a higher world market price for the good; however the gain to producers outweighs the loss to consumers.

On the other hand the lower prices of imports of goods where the country has a competitive disadvantage will benefit consumers. International trade results in lower prices and higher consumption of imported goods and higher prices and lower domestic consumption of exported goods. Overall there will be an increase in output and consumption compared to the situation where there is no international trade or specialization in production.

LOS 26-c

Distinguish between commonly used trade-restricting devices, including tariffs, quotas, voluntary export restraints, and exchange-rate controls and **explain** their impact on the domestic economy.

LOS 26-d

Identify who benefits and loses from the imposition of a tariff.

Trade restrictions

Despite the benefits of free trade, most countries impose trade restrictions. The different types of restriction include:

Tariffs

Tariffs are taxes on imports. Consumers pay the cost of the tariff in the form of higher prices. Part of this loss to consumers represents a deadweight loss, due to a reduction in allocative efficiency. The remainder of the cost of the tariff goes to producers who benefit from selling at higher prices and the government which has increased tax revenues. When tariffs are in place a nation's resources are used in producing goods inefficiently rather in the production of goods where the country has a comparative advantage.

Import quotas

Import quotas are, in the same way as tariffs, usually imposed to protect domestic industries. Import quotas are ceilings on the amount of a product that can be imported in a set period. Once again consumers lose as they pay higher prices for goods. However in this case, it is domestic producers and the foreign producers who have a license, or quota, to sell into the market who are the beneficiaries. The government does not benefit, so arguably a quota is worse than a tariff for consumers since foreign producers rather than their own government are benefiting from the higher prices they pay for goods.

Governments also use regulations and political pressure to limit foreign competition. An example of this is voluntary export constraints, which is when firms agree to limit the exports of a product to a market, for example Japanese cars to the U.S. These are usually introduced under political pressure, often to avoid a trade barrier being imposed by the importing country. The economic impact is similar to a quota.

Exchange rate controls

This is when a country fixes the exchange rate at a level above the market rate and imposes restrictions on foreign exchange transactions. This will limit exports and therefore there will not be sufficient foreign exchange to pay for imports. The total value of trade will decline.

LOS 26-e

Discuss the three arguments to adopt trade restrictions and discuss popular fallacies related to trade restrictions.

The three main arguments for a country imposing trade restrictions to protect domestic industries are:

1. They are imposed in order to achieve self-sufficiency in defense industries and other industries which are vital to national defense.
2. Trade restrictions can protect infant industries from more established competitors. Although there are arguments for protection as a temporary measure, most protection tends to be difficult to remove.
3. When a nation sees foreign goods being dumped (sold at below cost or at a lower price than they are sold in the producer's domestic market) there is concern that domestic producers will be forced out of business and the foreign producer can establish a monopoly then raise pieces. Dumping is illegal and a government can introduce anti-dumping policies. However the risk is that anti-dumping rules can be applied excessively, at the disadvantage of consumers who will lose access to cheaper foreign goods.

There are strong arguments against these factors being sufficient justification for the imposition of barriers. It is often a case of the producers being represented by strong special interest groups whereas the consumer, who pays the cost of the trade barriers, is either unaware of the impact of barriers or does not have an effective vehicle by which to lobby the government to remove the barriers.

Two of the main arguments given for trade restrictions are:

1. Trade restrictions that limit imports protect jobs in a nation

Although restrictions may protect jobs in the specific industry being protected, they will lead to job losses in other industries. This is because foreigners will have earned less foreign exchange with which they can buy goods from that country, so the export industries will suffer.

In the U.S. in the 1980s and 1990s imports grew faster than GDP but employment also grew rapidly, showing that imports are not a threat to jobs.

2. Free trade with low wage countries reduces domestic wages

This will not happen since higher wages are paid to workers with higher productivity working with expensive capital equipment. Countries which have low wages often have a work force with low skills and only have a comparative advantage in labor-intensive industries. This produces a comparative advantage which can benefit high and low wage nations.

Studies have been done on the link between economic growth and trade openness. The data for some 91 countries was collected for the period 1980 to 1999. The twelve most open economies had GDP per capita which was almost eight times as large as that in the twelve least open economies. There is a strong relationship between trade openness and per capita GDP and economic growth.

27 Foreign Exchange

Learning Outcome Statements (LOS)

27-a	**Define** direct and indirect methods of foreign exchange quotations and **convert** direct (indirect) foreign exchange quotations into indirect (direct) foreign exchange quotations.
27-b	**Calculate** and **interpret** the spread on a foreign currency quotation and **explain** how spreads on foreign currency quotations can differ as a result of market conditions, bank/dealer positions, and trading volume.
27-c	**Calculate** and **interpret** currency cross rates, given two spot exchange quotations involving three currencies.
27-d	**Distinguish** between the spot and forward markets for foreign exchange.
27-e	**Calculate** and **interpret** the spread on a forward foreign currency quotation and **explain** how spreads on forward foreign currency quotations can differ as a result of market conditions, bank/dealer positions, trading volume, and maturity/length of contract.
27-f	**Calculate** and **interpret** a forward discount or premium and **express** it as an annualized rate.
27-g	**Explain** interest rate parity and **illustrate** covered interest arbitrage.

Introduction

This Reading focuses on the mechanics of the foreign exchange markets or the interbank market where most transactions take place. Candidates have to be familiar with the ways that foreign exchange rates are quoted, and whether they are on a direct or indirect basis. Reasonably simple computations of cross rates, spreads on spot and forward exchange rates, and discounts and premiums on forward rates need to be mastered. Finally, it is important that you understand the relationship between interest rate differentials and forward and spot rates which is called interest rate parity. Again you must be prepared to do calculations based on the interest rate parity equation.

LOS 27-a

Define direct and indirect methods of foreign exchange quotations and **convert** direct (indirect) foreign exchange quotations into indirect (direct) foreign exchange quotations.

Throughout these notes the notation used for quoting foreign exchange rates will be that €/$ means the number of euros per dollar.

€/$ = 0.90 means that one dollar can be converted into 0.90 euros

$/€ = 1.11 means that one euro can be converted into 1.11 dollars

(note that 1.11 is the reciprocal of 0.90)

Direct exchange rates are the most common method of quoting rates. It means that the rate is the amount of domestic currency (DC) needed to purchase one unit of the foreign currency (FC).

In New York and London traders generally quote the value of the FC in terms of one unit of the DC – this is an **indirect rate.**

Example 27-1 Direct and indirect quotations

In Japan the dollar exchange rate is 120 ¥/$, or 120 Japanese yen per dollar. This is a direct exchange rate quotation.

In New York the yen exchange rate is 120 ¥/$. This is an indirect exchange rate quotation.

Note that when a domestic currency appreciates a direct quote decreases (you need less of the domestic currency to buy a unit of foreign currency) and an indirect quote increases (one unit of domestic currency buys more of the foreign currency).

When quotations involve U.S. dollars, the dollar price of a unit of foreign currency is referred to as **American terms**, a direct quote in the U.S. The amount of the foreign currency for one U.S. dollar is called **European terms**, an indirect quote in the U.S.

LOS 27-b

Calculate and **interpret** the spread on a foreign currency quotation and **explain** how spreads on foreign currency quotations can differ as a result of market conditions, bank/dealer positions, and trading volume.

Bid-ask spreads

Foreign exchange rates are quoted by dealers as bid-ask prices. The bid price is the price the dealer is willing to buy at and the ask, or offer price, is the price they are willing to sell at. The midpoint is the average of the two.

The bid-ask spread is given by:

Equation 27-1

$$\text{Percent spread} = \frac{\text{ask} - \text{bid}}{\text{ask}} \times 100$$

Example 27-2 Calculating spreads

If the €/$ is quoted at 0.90100-0.90150, which means that one dollar will buy 0.90100 euros, or 0.90150 euros are needed to buy one dollar.

The spread is, using Equation 27-1:

$$\frac{\text{ask} - \text{bid}}{\text{ask}} \times 100 = \frac{(0.90150 - 0.90100)}{0.90150} \times 100 = 0.05546\%$$

The spread will depend on a number of factors:

- Volatility of the exchange rate – as volatility increases dealers will increase the spread as they require greater compensation for taking a position in a risky currency.
- Spreads are higher for less actively traded currencies.

A bank/dealer position such as shortage in a specific currency will lead to them moving the midpoint price, rather than the spread.

LOS 27-c

Calculate and **interpret** currency cross rates, given two spot exchange quotations involving three currencies.

To calculate the exchange rate between two currencies, or the cross rate, it may be necessary to use the exchange rates of each currency against another currency – often the dollar. When calculating a cross rate assume that you are selling at the bid rate and buying at the ask rate.

Note that the DC/FC direct ask exchange rate is the reciprocal of the indirect bid exchange rate, and vice versa.

Mathematically this can be expressed as:

Equations 27-2

$$(FC_1/FC_2)_{ask} = (FC_1/DC)_{ask} \times (DC/FC_2)_{ask}$$
$$(FC_1/FC_2)_{bid} = (FC_1/DC)_{bid} \times (DC/FC_2)_{bid}$$

and

Equations 27-3

$$\left(FC_2/FC_1\right)_{ask} = 1/\left(FC_1/FC_2\right)_{bid}$$
$$\left(FC_2/FC_1\right)_{bid} = 1/\left(FC_1/FC_2\right)_{ask}$$

where FC_1 and FC_2 are the foreign currencies and DC the domestic currency.

Example 27-3 Currency cross rates

Hong Kong dollars are quoted at HK$/US$ = 7.99800-8.00200 (the bid-ask price) and the Thai Baht/US$ = 43.50000–43.53000. The cross rate for the HK$/Baht ask price can be calculated using Equations 27-2 and 27-3.

Define FC_1 as HK$, FC_2 as Thai Baht and DC as US$:

$$\left(FC_1/FC_2\right)_{ask} = \left(FC_1/DC\right)_{ask} \times \left(DC/FC_2\right)_{ask}$$
$$HK\$/Baht_{ask} = HK\$/US\$_{ask} \times US\$/Baht_{ask}$$
$$HK\$/Baht_{ask} = HK\$/US\$_{ask} \times 1/Baht/US\$_{bid}$$
$$= 8.002 \times 0.02299$$
$$= 0.18395$$

LOS 27-d

Distinguish between the spot and forward markets for foreign exchange.

LOS 27-e

Calculate and **interpret** the spread on a forward foreign currency quotation and **explain** how spreads on forward foreign currency quotations can differ as a result of market conditions, bank/dealer positions, trading volume, and maturity/length of contract.

Forward exchange rates

In the **spot market** currencies are traded for immediate delivery (within 48 hours of the transaction taking place) whereas in the **forward market** transactions are made to buy and sell currencies for future delivery.

In the same way that spot rates are quoted bid-ask, forward rates are quoted with a spread. If a dealer quoted the six month €/$ exchange rate as 0.90600-0.90650, it means that the dealer is willing to commit today to buy dollars in six months' time at 0.90600 euros, or sell dollars in six months' time at 0.90650 euros. The spread of 0.00050 euros reflects the volatility and liquidity in the market. The spread tends to increase with a longer maturity contract since these contracts are less liquid.

Dealer positions will move the price, for example if dealers have large inventory in a currency they are likely to lower the bid and ask prices to attract buyers, although this will not affect the spread.

LOS 27-f

Calculate and **interpret** a forward discount or premium and **express** it as an annualized rate.

Forward premiums and discounts

The profit or loss on a forward transaction reflects the difference between the forward rate agreed in the contract and the spot rate at the time that the contract matures.

In the interbank market forward rates are quoted at a discount or premium to spot rates. The differential is the swap rate. There is a forward discount if the forward rate is below the spot rate (it is the 'weaker' currency) and a forward premium if it is above the spot rate (it is the 'stronger' currency).

To calculate the forward rate from the spot rate simply add the premium, or subtract the discount.

To express the discount or premium as an annualized percentage deviation from the spot rate, use the formula below:

Equation 27-4

$$\text{Forward premium/discount} = \frac{(F - S)}{S} \times \frac{12}{N}$$

where

F = the forward rate

S = the spot rate

N = the number of months of the forward contract

Example 27-4 Forward premiums

The spot rate for pounds sterling to the U.S. dollar rate is $/£ =1.5510 and the 90-day forward rate is $/£ =1.5625, so pounds sterling are trading at a 115-point premium, points are counted from the last digit quoted. The forward premium annualized is, using Equation 27-4:

$$= \frac{(F - S)}{S} \times \frac{12}{N}$$

$$= \frac{(1.5625 - 1.5510)}{1.5510} \times \frac{12}{3}$$

$$= 0.0297 \quad \text{or } 2.97\%$$

LOS 27-g

Explain interest rate parity and **illustrate** covered interest arbitrage.

Interest rate parity

Arbitrage means that, in theory, exchange rates and risk-free interest rates are aligned.

More specifically, interest rate parity theory says that in an efficient market, with no transaction costs, the interest differential will equal the forward differential.

So a currency with a forward premium will have a low interest rate and a currency with a forward discount will have a higher interest rate.

Mathematically interest rate parity theory says:

Equation 27-5

$$\frac{F}{S} = \frac{(1 + r_{FC})}{(1 + r_{DC})}$$

where

F	=	forward value of foreign currency per unit of domestic currency
S	=	spot value of foreign currency per unit of domestic currency
rFC	=	foreign interest rate
rDC	=	domestic interest rate

If one country has a higher interest rate than another, there will be forward discount on the currency. Conversely low interest rates will lead to forward premiums.

Conceptually it means that if you can earn a higher rate of interest on one currency you will receive a lower exchange rate if you sell it forward than if you sell it today in the spot market. If this was not the case all investors would hold on to the currency offering the highest risk-free rate and sell the currency forward to lock into an 'attractive' exchange rate.

Example 27-5 Interest rate parity

One-year interest rates in the U.S. are 6% and in Japan are 1%. The spot rate is Yen/$ = 112.00 and the forward rate is Yen/$ = 106.72. Interest rate parity holds since:

$$\frac{(1+r_{FC})}{(1+r_{DC})} = \frac{1.06}{1.01} = 1.0495$$

$$\frac{F}{S} = \frac{0.9371}{0.8929} = 1.0495$$

We are defining the FC as the U.S. dollar.

This means that $1,000,000 invested for 1 year earning 6% (giving $1,060,000) will be worth the same as $1,000,000 converted into Japanese yen at 112, invested at 1%, and selling the proceeds of yen 113,120,000 forward into dollars at 106.72.

If an interest rate differential exists it will produce the opportunity to make a profit – this is called **covered interest arbitrage.**

Example 27-6 Covered interest arbitrage

Referring to the data in Example 27-5 let us look at the case where Yen interest rates are now 2% and the other data remains the same. We now have an opportunity to arbitrage since interest rate parity no longer holds.

If we borrow $1 million and sell them into Yen at the spot rates and place them on deposit for one year, and at the same time sell the proceeds back into dollars in the forward market, this will give:

$1,000,000 converted to Yen 112,000,000, after one year at 2% gives Yen 114,240,000.

Sold forward at Yen/$ = 106.72, gives $1,070,465

Less borrowing costs for dollars of $60,000.

Profit is $10,465

This assumes zero transaction costs and the borrowing rate is the same as the risk-free rate.

28 Foreign Exchange Parity Relations

Learning Outcome Statements (LOS)

28-a	**Explain** how exchange rates are determined in a flexible or floating exchange rate system.
28-b	**Explain** the role of each component of the balance-of-payments accounts.
28-c	**Explain** how current account deficits or surpluses and financial account deficits or surpluses affect an economy.
28-d	**Describe** the factors that cause a nation's currency to appreciate or depreciate.
28-e	**Explain** how monetary and fiscal policies affect the exchange rate and balance-of-payments components.
28-f	**Describe** a fixed exchange rate and a pegged exchange rate system.
28-g	**Discuss** absolute purchasing power parity and relative purchasing power parity.

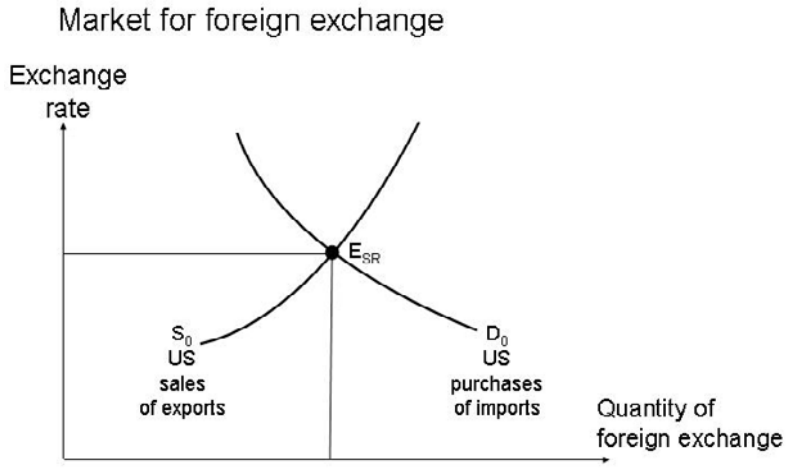
Introduction

We now look at different exchange rate systems before focusing on flexible or floating-rate systems where the rate is determined by supply and demand for the currency. Candidates need to be familiar with the main factors (growth in income, inflation and interest rates) that drive exchange rates and the impact of fiscal and monetary policy on exchange rates. The chapter finishes with the review of another parity relationship, the link between relative inflation rates and spot and forward rates.

LOS 28-a

Explain how exchange rates are determined in a flexible or floating exchange rate system.

Flexible exchange rates (the same as floating exchange rates) are determined by supply and demand for different currencies. A flexible exchange rate system has the advantage of providing market-determined exchange rates and allows the government to adopt independent fiscal and monetary policies. The disadvantage is that exchange rates can be quite volatile.The diagram below illustrates that as demand for foreign currency by U.S. citizens increases, perhaps for purchasing imports, if there is no equivalent increase in foreigners purchasing dollars, there will be a shortage of supply of foreign currency and the exchange rate will rise. This will lead to foreign goods becoming more expensive which will reduce future U.S. imports which leads to an increase in supply of the foreign currency.



LOS 28-b

Explain the role of each component of the balance-of-payments accounts.

Balance of payments

The **balance of payments** is a summary of all financial flows between a country and all other countries over a specific period. It therefore includes exports and imports of goods and services, capital movements, earnings by residents on overseas assets and foreigners' earnings on assets held in the country, and transactions by the central bank and government.

Imports are an example of a debit item since they create demand for a foreign currency whereas exports are a credit item since they create demand for the domestic currency. Foreign exchange markets will ensure that the quantity supplied and quantity demanded of a currency are equal, so the total debits must equal the total credits.

Transactions are put into two categories, the current account and the financial account (sometimes called the capital account).

Current account

The **current account** includes transactions that are done in the normal business by residents in the country.

The largest item is usually the **balance of trade** (merchandise exports less imports), other items are the export and import of services (invisible services such as insurance and communication), net current income on foreign investments and unilateral transfers (such as gifts). The current-account balance will be in surplus if the value of current exports plus earnings from investments abroad is higher than the value of its current imports plus earnings of foreigners on their domestic assets. Alternatively if the debit items are larger than the credit items, the country will have a current-account deficit.

Financial account

The **financial account** includes (i) cross border direct investment and (ii) portfolio investment in equities, bonds etc. (iii) other investments and liabilities including borrowing from foreign banks.

The sum of the current and financial accounts is called the **overall** balance. If this is not zero, since the balance of payments must balance, then the difference is accounted for by an increase or decrease in the central bank's **official reserves**. The official reserves refer to accounts held in foreign currencies and gold, which can be used by central banks to try to adjust or stabilize the exchange rate.

Under a pure flexible exchange rate system the official reserve transactions should be zero, an increase in the current-account deficit would lead to a greater capital-account surplus and so on.

LOS 28-c

Explain how current account deficits or surpluses and financial account deficits or surpluses affect an economy.

Current-account deficits are neither good nor bad for an economy and can persist over long periods of time. A current-account deficit means that there is a capital-account surplus (under a flexible rate system). The capital-account surplus could be the result of strong inward investment which is needed when domestic savings are insufficient to build an economy. The U.S. has had a persistent current-account deficit reflecting the low savings rate and the attractive investment environment, which brings in foreign investment to offset the current account outflows. On the other hand in the early nineties a number of Asian countries were running large current account deficits. Once foreign investors lost confidence in making investments in the countries leading to a rapid fall in capital inflows there was a major economic crisis and depreciation in the currencies.

LOS 28-d

Describe the factors that cause a nation's currency to appreciate or depreciate.

Factors affecting exchange rates

Inflation

When a country has a higher inflation rate than its trading partners, its goods will look expensive. This will reduce the country's exports and increase its imports, which will increase demand for foreign currency leading to currency depreciation. Similarly, relatively low inflation will lead to currency appreciation.

Real interest rates

When a country's real interest rates increase (relative to other countries) it will attract investment from overseas which will lead to currency appreciation. Similarly low real interest rates will lead to currency depreciation.

Economic growth

There are conflicting factors at work and it is unclear which is dominant. A strong economy will tend to attract overseas investors leading to currency appreciation. These flows are based on future expectations.

On the other hand increasing domestic income in a country relative to its trading partners will increase demand for foreign currency to buy imports, leading to depreciation in the currency. This will be a direct effect of strong economic growth. Similarly, relatively slow growth in incomes will lead to an appreciation in the currency.

LOS 28-e

Explain how monetary and fiscal policies affect the exchange rate and balance-of-payments components.

Monetary policy

An unanticipated move to a more expansionary policy will stimulate growth and net imports, push up inflation and reduce real interest rates. All of these factors will lead to a depreciation of the currency. Similarly an unanticipated move to a more restrictive monetary policy will lead to an appreciation in the currency.

So an expansionary monetary policy will initially tend to move the financial account to a deficit (or smaller surplus) and the current account towards a surplus (or smaller deficit), to offset the financial account deficit. It is assumed that the movement in capital flows, as a result of low real interest rates, takes effect more quickly. The opposite will happen if there is a shift to a more restrictive monetary policy.

However, longer term under an expansionary monetary policy, the depreciation of the currency will lead to an increase in net exports.

Fiscal policy

An expansionary fiscal policy will lead to higher demand and increasing inflation, which will tend to stimulate net imports putting downward pressure on the currency. However it will also lead to higher government borrowing which will increase real interest rates which will in turn pull in foreign capital and put upward pressure on the currency. Of the two conflicting pressures the inflow of foreign capital is likely to have the biggest impact in the short run since investors will be able to move more rapidly than importers and exporters.

A move to a restrictive fiscal policy will lead to lower demand and lower prices. This will help net exports and push up the exchange rate. However, the more immediate effect will be to lower real interest rates, leading to capital outflows and currency depreciation.

The impact of unanticipated changes in monetary and fiscal policies is summarized below:

	Expansionary monetary policy	Restrictive monetary policy	Expansionary fiscal policy	Restrictive fiscal policy
Exchange rate	Depreciates	Appreciates	Likely to appreciate	Likely to depreciate
Real interest rates	Decrease	Increase	Increase	Decrease
Flow of capital	Outflow	Inflow	Inflow	Outflow
Current account	Towards surplus	Towards deficit	Towards deficit	Towards surplus

LOS 28-f

Describe a fixed exchange rate and a pegged exchange rate system.

We have discussed flexible exchange rate systems, the other two types of exchange rate systems are:

1. Fixed exchange rate systems

In this system a fixed exchange rate is set by government policy rather than market supply and demand. A country that adopts a fixed rate system, in terms of fixing the domestic rate to a foreign currency, loses the flexibility to expand and contract the supply of money. For example, if the country's currency is linked to the U.S. dollar the central bank that decides the supply of money is the Federal Reserve. A currency can be fixed using a **currency board**. The role of the currency board is (i) to issue a currency with a fixed rate of exchange to another currency (ii) to

redeem the currency at that fixed rate and (iii) to maintain assets (in the base currency) to back all of the currency issued.

2. *Pegged rate systems*

This is when the government makes a commitment to use fiscal and monetary policy to maintain the exchange rate at a fixed rate, or near a fixed rate, to another currency. The country must follow a monetary policy consistent with the country to which it has pegged its currency.

LOS 28-g

Discuss absolute purchasing power parity and relative purchasing power parity.

Purchasing Power Parity (PPP)

In the previous section we covered interest rate parity, as given in Equation 27-5, which links forward and spot rate to interest rate differential.

$$\frac{F}{S} = \frac{(1 + r_{FC})}{(1 + r_{DC})}$$

We now look at another relationship between exchange rates, this time with inflation rates. The inflation rate (I) is defined as the rise in the consumer price index over a specific period. The inflation differential is the difference between the inflation rates in two different countries.

Absolute Purchasing Power Parity (Absolute PPP)

This is based on the concept that the price of a good must be the same in all countries. So if a good costs $1.00 in the U.S. and the exchange rate is €/$ = 0.90 then it will cost €0.90 in Europe. If, in the following year, the euro price rises by 10% to €0.99 and the U.S. price rises by 5% to $1.05, unless the exchange rate adjusts to €/$ = 0.94, the good will have different prices in the two countries and trade flows will increase to take advantage of this differential which will bring the currencies back into line again.

If we look at the average for all goods in an economy we can extend the example to say that the exchange rate should be the ratio of the average price of all goods in the economy.

Relative Purchasing Power Parity (Relative PPP)

This is the most commonly used version of the purchasing power parities. It says that exchange rate movements will offset inflation differentials between two countries. The theory cannot be expected to always be valid, particularly in the short term.

This is expressed as:

Equation 28-1

$$\frac{S_1}{S_0} = \frac{(1 + I_{FC})}{(1 + I_{DC})}$$

where

S_0 = spot exchange rate at the beginning of the period, the exchange rate is the foreign price of one unit of domestic currency

S_1 = spot exchange rate at the end of the period

I_{FC} = inflation rate over the period in the foreign country

I_{DC} = inflation rate over the period in the domestic country

Example 28-1 Purchasing power parity

The spot exchange rate for the Australian dollar against the pound (£) is Aus$/£ = 2.25.

Inflation in Australia is running at 5% per annum and in the U.K. at 3%. The end of period spot exchange rate can be calculated as, using Equation 28-1, with the U.K. as the domestic currency, as:

$$\frac{S_1}{S_0} = \frac{(1 + I_{FC})}{(1 + I_{DC})}$$

$$\frac{S_1}{2.25} = \frac{1.05}{1.03}$$

$$S_1 = 2.29$$

This means that the pound is expected to strengthen as each pound will buy more Australian dollars in one year's time, reflecting the lower inflation rate in the U.K.

STUDY SESSION 7

Financial Statement Analysis: Basic Concepts

Overview

Financial Statement Analysis and Corporate Finance have a guideline weighting of 28% of the exam questions so this is a topic you must do well on. Candidates who are not financial analysts may well find they are not sufficiently familiar with the details of accounting practices such as the treatment of inventory, leases, deferred tax and depreciation. None of the material is difficult but you will need to spend time working through the text and applying your knowledge to practice questions. In many cases you will be required to do calculations but more importantly you must be able to interpret the numbers or ratios computed. The objective of building up knowledge of financial statements and accounting principles is to allow you to use financial statement data to better understand a company's operations and position relative to its competitors and in order to make investment decisions.

In Study Session 7 the main Reading Assignments cover two key topics. The first topic is accounting for income and assets including when items should be recognized on the income statement and balance sheet. The second topic is analyzing cash flows and being able to differentiate between operating, investing and financing cash flows. The Study Session ends with a discussion of the changes in accounting methods that can be expected from efforts to harmonize standards worldwide.

Candidates who have studied accounting at an introductory level and are familiar with the relationship between the items on the income statement, balance sheet and cash flow statement and have knowledge of the basic concepts used in financial reporting will not need to spend much time on the Introductory Readings. It is important to note that the CFA Institute states that examination questions are drawn mainly from the subsequent Reading Assignments.

Readings Assignments

29. "Framework for Financial Statement Analysis," Ch. 1, The Analysis and Use of Financial Statements, 3rd edition, Gerald I. White, Ashwinpaul C. Sondhi, and Dov Fried (Wiley, 2003)

30. "Long-Term Assets," Ch. 10, Financial Accounting, 8th edition, Belverd E. Needles, Jr., and Marian Powers, (Houghton Mifflin, 2004)

31. "Accounting Income and Assets: The Accrual Concept," Ch. 2, (including Box 2-5), The Analysis and Use of Financial Statements, 3rd edition, Gerald I. White, Ashwinpaul C. Sondhi, and Dov Fried (Wiley, 2003)

32. "The Statement of Cash Flows," Ch. 14, Financial Accounting, 8th edition, Belverd E. Needles, Jr., and Marian Powers, (Houghton Mifflin, 2004)

33. "Analysis of Cash Flows," Ch. 3, pp. 74−82, 84 (Box 3-1) and 87−99, The Analysis and Use of Financial Statements, 3rd edition, Gerald I. White, Ashwinpaul C. Sondhi, and Dov Fried (Wiley, 2003)

34. Future FASB Changes and the Analytical Challenges of GAAP, Patricia A. Mc Connell (AIMR 2004), pp. 18−20 and 23-24

29 Framework for Financial Statement Analysis

Learning Outcome Statements (LOS)

29-a	**Discuss** the general principles of the financial reporting system and **explain** the objectives of financial reporting according to the Financial Accounting Standards Board (FASB) conceptual framework.
29-b	**Identify** the accounting qualities (e.g., relevance, reliability, predictive value, timeliness) set forth in Statement of Financial Accounting Concepts (SFAC) 2, and **discuss** how these qualities provide useful information to an analyst.
29-c	**Discuss** the roles of the International Organization of Securities Commissions (IOSCO) and the International Accounting Standards Board (IASB) in setting and enforcing global accounting standards.
29-d	**Describe** and **distinguish** between the principal financial statements: Balance Sheet, Income Statement, Statement of Comprehensive Income, Statement of Cash Flows and Statement of Stockholders' Equity and **discuss** the additional sources of information accompanying the financial statements, including the financial footnotes, supplementary schedules, Management Discussion and Analysis (MD&A) and Proxy statements.
29-e	**Discuss** the role of the auditor and the meaning of the audit opinion.

Introduction

In the Reading we look at how accounting standards are set in the U.S. and internationally, and the objectives of financial reporting. We also consider the relationship between the different statements and additional information that is provided. Finally the role of the auditor is discussed.

LOS 29-a

Discuss the general principles of the financial reporting system and **explain** the objectives of financial reporting according to the Financial Accounting Standards Board (FASB) conceptual framework.

LOS 29-b

Identify the accounting qualities (e.g., relevance, reliability, predictive value, timeliness) set forth in Statement of Financial Accounting Concepts (SFAC) 2, and discuss how these qualities provide useful information to an analyst.

The Financial Accounting Standards Board (FASB) conceptual framework is used by the board to set standards which form the basis of generally accepted accounting principles in the U.S. (U.S. GAAP). It sets out the characteristics of accounting information that will make it useful for the investment decision making process.

From an analyst's viewpoint financial reporting should aim to be:

- Relevant – the information should assist in decision making.
- Timely – if too much time elapses before data is released it will become worthless.
- Reliable – this includes the concepts of verifiability, representational faithfulness and neutrality. The data must be measured accurately and represent what it claims to be. Neutrality is concerned with whether it is unbiased.
- Consistent – the same accounting principles should be used over time.
- Comparable – the reports should make firms in the same industry/market easily comparable.
- Materiality – this can be defined as items that would make a difference to the value of a firm.

Role of FASB

In the U.S. the SEC governs the form and content of financial statements of companies that are publicly traded and acts as an enforcer of standards. Although it has delegated most of the responsibility for the form and content to the FASB, the SEC frequently adds its own requirements, e.g. supplementary information on leases, oil and gas reserves. Also reports filed with the SEC must include a Management Discussion and Analysis section.

The FASB is an independent non governmental body and sets accounting standards for all companies required to issue financial statements. These standards are then part of U.S. GAAP.

FASB statements immediately become part of U.S. GAAP. Prior to the establishment of FASB in 1973 accounting standards were set by the Accounting Principles Board (APB) a committee of the American Institute of Certified Public Accountants (AICPA). Unless superseded APB opinions remain part of GAAP.

LOS 29-c

Discuss the roles of the International Organization of Securities Commissions (IOSCO) and the International Accounting Standards Board (IASB) in setting and enforcing global accounting standards.

IOSCO is an organization of securities regulators from 65 countries (including the U.S.) and is concerned with the regulation of international security transactions. It is also working on Multinational Disclosure and Accounting, which includes looking at cross border securities issuance and is trying to promote effective and efficient international securities markets. It is still up to individual countries to agree with recommendations and enforce regulations.

The International Accounting Standards Board (IASB) was set up to harmonize accounting standards internationally and reduce the number of accounting treatments permitted. It has an operating model similar to the FASB.

LOS 29-d

Describe and **distinguish** between the principal financial statements: Balance Sheet, Income Statement, Statement of Comprehensive Income, Statement of Cash Flows and Statement of Stockholders' Equity and **discuss** the additional sources of information accompanying the financial statements, including the financial footnotes, supplementary schedules, Management Discussion and Analysis (MD&A) and Proxy statements.

The principal financial statements are the:

(i) **Balance sheet** – a statement of financial position in terms of assets, liabilities and stockholders' equity. In the U.S., firms issue balance sheets on a quarterly basis.

(ii) **Income statement** – reports on the performance of a firm and its operating activities. It explains most of the differences between the assets, liabilities and stockholders' equity on the balance sheets at the beginning and end of the reporting period.

(iii) **Statement of cash flows** – reports receipts and payments with respect to operating, investing and financing activities over the reporting period. It provides additional information to the income statement and assists in explaining the changes between consecutive balance sheets.

(iv) **Statement of stockholders' equity** – reports changes in equity resulting from capital transactions between the owners of the firm.

Additional information is provided in:

1. **Footnotes and supplementary disclosures and schedules**. These will provide additional disclosure on issues such as fixed assets, income tax rates, contingencies, and pension plans.
2. **Management discussion and analysis**. This is required for publicly quoted companies and will contain more information on the results of operations including sales and expense trends, capital resources and liquidity, and the outlook for the business.

LOS 29-e

Discuss the role of the auditor and the meaning of the audit opinion.

Role of the auditor

An auditor must ensure that the financial statements conform to generally accepted accounting principles. The auditor also examines the internal controls in place, verifies the assets, and tries to ensure there are no material errors in the financial statements. The auditor's report or opinion will confirm whether the accounting requirements have been met.

30 Long-Term Assets

Learning Outcome Statements (LOS)

30-a	**Describe** the factors that distinguish long-term assets from other assets, and **identify** the common types of long-term assets and their carrying values on the balance sheet.
30-b	**Determine** the cost, and **record** the purchase, of property, plant and equipment.
30-c	**Explain** depreciation accounting (including the reasons for depreciation), **calculate** depreciation using the straight-line, production (also known as units-of-production), and declining-balance methods, and **calculate** depreciation after revising the estimated useful life of an asset.
30-d	**Describe** how to account for the sale, exchange, or disposal of depreciable assets, and **determine** whether a gain or loss is recorded.
30-e	**Identify** assets that should be classified as natural resources, and **prepare** entries to account for such assets, including entries to record depletion.
30-f	**Identify** the types of intangible assets, and **describe** how the accounting treatment for goodwill under U.S. GAAP differs from the accounting treatment for other intangible assets.

Introduction

In this Reading we consider how the cost of long-term assets, which are used for more than one year or business cycle, are allocated over their useful life. For tangible assets, such as plant and equipment, the allocation of the cost is called depreciation and it can be calculated in a number of ways. This topic is covered in more detail in Study Session 9.

LOS 30-a

Describe the factors that distinguish long-term assets from other assets, and **identify** the common types of long-term assets and their carrying values on the balance sheet.

Long-term assets

These are defined as assets which:

(i) have a useful life of more than one year.

(ii) are acquired to be used in the operating activity of the company – assets that do not meet this requirement, such as land which is no longer used, should be classed as investments.

(iii) are not for resale to customers – these items should be classed as inventory.

Generally long-term assets will be used for periods of more than one year and are there to support the operating cycle of the firm. Examples of long-term assets are land, plant, computers and other equipment. They are usually reported on the balance sheet at their carrying value; this is the unexpired portion of the cost of the asset and is also called the book value. Note that this is *not* the market value of the asset. If the asset loses some of its revenue-generating potential prior to the end of its life it will be necessary to reduce its value due to impairment.

LOS 30-b

Determine the cost, and **record** the purchase, of property, plant and equipment.

The acquisition cost of property, plant and equipment should include expenditure made to get the asset in place and in use. This might include freight, installation or commissions and fees (for land acquisition).

LOS 30-c

Explain depreciation accounting (including the reasons for depreciation), **calculate** depreciation using the straight-line, production (also known as units-of-production), and declining-balance methods, and **calculate** depreciation after revising the estimated useful life of an asset.

Most tangible assets have a finite useful life and depreciation accounting allocates the cost of the asset over the estimated useful life of the asset, taking into account the estimated salvage value of the asset.

The calculation of depreciation, depletion and amortization is covered in detail in Study Session 9 Reading 41.

LOS 30-d

Describe how to account for the sale, exchange, or disposal of depreciable assets, and **determine** whether a gain or loss is recorded.

When an asset is disposed of part way through an accounting period then depreciation for the partial year should be calculated. This will match the depreciation cost to the benefit of using the asset for that period.

In many cases an asset has been used after the end of its estimated life. In this case no further deprecation will have been charged when the asset value reached its estimated residual or salvage value.

Gains and losses made on disposal are classed as other revenues or expenses on the income statement.

LOS 30-e

Identify assets that should be classified as natural resources, and **prepare** entries to account for such assets, including entries to record depletion.

The way that a cost of an asset is allocated depends on the type of asset:

Long-Term Assets	Examples	Expense
Tangible assets	Land, Plant, buildings and equipment	Land is not expensed Depreciation
Natural resources	Mines, oil and gas, timber, land	Depletion
Intangible assets	Patents, trademarks, goodwill	Amortization

LOS 30-f

Identify the types of intangible assets, and **describe** how the accounting treatment for goodwill under U.S. GAAP differs from the accounting treatment for other intangible assets.

An intangible asset is a long-term asset that has no physical form but still has a value as it provides benefits to the owner. Examples of intangible assets include goodwill, brand names, copyrights, patents, research and customer lists.

Intangible assets are accounted for at cost (either development cost or acquisition cost from a third party) and then are amortized over their useful life in a similar way to tangible assets being depreciated.

The treatment of goodwill is a little different. Goodwill reflects the amount paid by a company in an acquisition. It is the difference between the price paid and the fair value of the acquired company's assets. The FASB requires that goodwill must be stated as a separate item on the balance sheet and reviewed annually to check it is not being overstated relative to its fair value. If so, it must be reduced and a corresponding impairment charge recorded on the income statement.

31 Accounting Income and Assets: The Accrual Concept

Learning Outcome Statements (LOS)

31-a	**Describe** the format of the income statement and **describe** the components of net income.
31-b	**Explain** the importance of the matching principle for revenue and expense recognition, **identify** the requirements for revenue recognition to occur, **identify** and **describe** the appropriate revenue recognition, given the status of completion of the earning process and the assurance of payment, and **discuss** different revenue recognition methods and their implications for financial analysis.
31-c	**Identify** the appropriate income statement and balance sheet entries using the percentage-of-completion method and the completed contract method and **describe** and **calculate** the effects on cash flows and selected financial ratios that result from using the percentage-of-completion method versus the completed contract method.
31-d	**Describe** the types and analysis of unusual or infrequent items, extraordinary items, discontinued operations, accounting changes, and prior period adjustments.
31-e	**Discuss** managerial discretion in areas such as classification of good news/bad news, income smoothing, big bath behavior, and accounting changes, and **explain** how this discretion can affect the financial statements.
31-f	**Describe** the format and the components of the balance sheet and the format, classification, and use of each component of the statement of stockholders' equity.

Introduction

This Reading looks at the income statement (using accounting income as opposed to economic or other forms of income) and the balance sheet. The Reading focuses on the different methods for revenue recognition and discusses the areas where management has the most discretion with respect to revenue recognition. The balance sheet is also analyzed and in particular the components of stockholders' equity identified. The trickiest part of this Reading concerns accounting for long-term projects using the percentage-of-completion method or completed contract methods. You need to be familiar with the calculations using either method and also understand the impact on the financial statements of the choice of method used.

LOS 31-a

Describe the format of the income statement and **describe** the components of net income.

The chapter starts with a discussion of different types of income:

Economic earnings – net cash flow plus the change in market value of the firm's net assets.

Distributable earnings – amount of earnings that can be paid out as dividends without changing the value of the firm.

Sustainable earnings – level of income that can be maintained in the future given the firm's stock of capital investment (e.g. fixed assets and inventory).

Permanent earnings – the market value of the firm's assets multiplied by the firm's required rate of return.

Accounting income – net cash flow plus change in asset value that generally recognizes changes in value resulting from actual transactions. Using the **accrual concept** means that cash inflows and outflows are recognized in the relevant accounting period i.e. when services are provided rather than when cash is actually collected.

An example of the format of an income statement is given below.

Income statement

Revenues from sales of goods and services
- \- Operating expenses
- = Operating income from continuing operations
- \+ Other income and revenues
- = Recurring income before interest and taxes from continuing operations
- \- Financing costs
- = Recurring (pretax) income from continuing operations
- +/- Unusual or infrequent items
- = Pretax earnings from continuing operations
- \- Income tax expense
- = Net income from continuing operations
- +/- Income from discontinued operations (net of tax)
- +/- Extraordinary items (net of tax)
- +/- Cumulative effect of changes in accounting principles
- **=** Net income

The income statement starts with revenues generated by the sales of goods and services from the firm's continuing operations. It is important that revenue and income from continuing operations is separated from income from discontinued operations since the income from discontinued operations will not contribute to future profits. Operating expenses which include both the cost of purchasing or manufacturing the goods sold (COGS = cost of goods sold) and selling, general and administrative expenses (SG&A expenses) are deducted from the revenues to give the operating profit from continuing operations.

Other income may result from investment in other firms, gains or losses on the sale of assets. This income will contribute to the recurring income before income and taxes from continuing operations. This is the profit which is independent of how the firm is financed.

Next, the financing costs or interest expense is deducted to arrive at recurring income from continuing operations. Items that are classified as unusual or infrequent items (e.g. pretax gains or losses from the sale of assets or investments) are added/deducted and the income tax expense is deducted to arrive at net income from continuing operations.

Finally income from discontinued operations, extraordinary items and the impact of accounting changes made over the period are recorded. All of these items are net of tax. This gives net income for the firm. For analysts, the focus is usually on the income from continuing operations rather than income after nonrecurring items.

LOS 31-b

Explain the importance of the matching principle for revenue and expense recognition, **identify** the requirements for revenue recognition to occur, **identify** and **describe** the appropriate revenue recognition, given the status of completion of the earning process and the assurance of payment, and **discuss** different revenue recognition methods and their implications for financial analysis.

The **matching principle** states that related revenues and expenses should be accounted for in the same time period. This means that operating performance is measured in the period when goods are recorded as sold rather than when collections or expenditures occur.

Example 31-1 Matching principle

The cost of inventory is recorded in the same period as the sale of the inventory is recorded.

Revenue and expense recognition

Following on from the accrual concept, it is important to address two issues – timing and measurement of revenue and expense. When should they be recognized and how much should be recognized?

There are two conditions for revenue recognition to take place.

(i) Completion of the earning process

The firm must have provided all or virtually all of the goods or services and there is no remaining contingent obligation to provide further services. It must be possible to reliably estimate the total associated costs and there must be no significant contingent liabilities outstanding. An example of this is when a firm provides a warranty to replace or upgrade a product and cannot estimate the cost of replacement.

(ii) Assurance of payment

This means that the sales proceeds have been received, or can reasonably be expected to be collected.

The amount of revenue recognized at any point is:

$$= \frac{\text{Goods and services provided to date}}{\text{Total goods and services to be provided}} \times \text{Total expected revenue}$$

Revenues reported in a period will be the total revenue recognized less the revenue recognized in prior periods.

Usually revenue recognition will take place at the time of sale. Additionally revenue recognition can be based on cash expenditures, time or provision of services or goods.

Example 31-2 Revenue recognition

(i) Magazine publishers receive subscriptions prior to delivery of the magazine. In this case revenues are recognized in proportion to issues delivered.

(ii) Credit card fees – revenues are recorded as the right to use the card expires.

(iii) Revenue from leased equipment is recognized on time or usage basis.

Two factors have increased concern over the application of the principles for recognizing revenues and expenses. The first of these is the growth in technology and the second is the trend towards valuing companies using revenues and gross margins rather than net income.

There is considerable room for management discretion in deciding:

(i) Timing – when revenue and expense should be recognized.

(ii) Measurement – how much revenue or expense should be recognized?

Examples of issues that make it difficult to compare revenues of different firms are shown below:

Revenue recognition

- Sales incentives – such as discounts to customers are not recorded.
- Barter agreements – goods are supplied in exchange for other goods or services, they may not be recorded at market value.
- Membership fees – recorded as revenue when the agreement is signed rather than over the term of the membership.
- Recording revenues based on estimated usage.
- Agents recording total billings rather than commissions earned.
- Recognizing revenues before a customer has agreed a project is complete.
- Including shipping and handling costs in revenues.

Expense recognition

- Deferral of marketing expenses.
- Deferral of the cost of major maintenance work until work is actually done – an alternative method is to accrue the costs in advance.
- Bad debt expenses – estimating future bad debts and setting up a reserve account is another way of smoothing earnings. When a write-off occurs it is charged to the reserve not earnings.
- Warranty expense – again the estimated future expense can be used to smooth earnings.

Software revenue recognition

Four conditions must be satisfied before a software transaction can be recorded as revenue:

- Persuasive evidence of an arrangement between buyer and seller.
- Delivery.
- A fixed or determinable fee.
- Assurance of collectabilty.

In some cases revenue recognition is prior to the sale or delivery. The percentage of completion, completed contract methods which can be used for long–term contracts are discussed in more detail in LOS 31-c.

The two methods below are used when there is uncertainty concerning the collection of the sales revenue or the size of the costs.

Installment method

This method is used when there is no reasonable way to calculate the collectability of receivables. Under the installment method gross profit is recognized in proportion to cash collections, as opposed to recognizing the revenue at the time of sale.

Cost recovery method

Costs to provide a good or service cannot always be reasonably estimated. For example, the development of a housing project where future costs may depend on planning decisions. There may be also uncertainty over the collectability of receivables, for example if purchasers are only making small deposits at the time of sale. In these cases the cost recovery method should be used and all cash receipts are used to cover costs before income can be recognized.

These two methods may be used for real estate sales and also for recording franchise sales where the revenue is to be collected over a number of years.

LOS 31-c

Identify the appropriate income statement and balance sheet entries using the percentage-of-completion method and the completed contract method and **describe** and **calculate** the effects on cash flows and selected financial ratios that result from using the percentage-of-completion method versus the completed contract method.

We discuss below two methods for reporting revenues from long-term and short-term projects, such as building and construction projects.

Percentage-of-completion method

This method should only be used for long-term projects where (i) there is a contract and (ii) there are reliable estimates for the percentage of the project completed and revenues and costs.

Progress is measured either using engineering estimates or the percentage of costs incurred to total costs. We use the percentage of costs incurred in Example 31-3 below.

When there is a change in estimates the adjustment is made in the same accounting period and prior period adjustments are not made.

Completed contract method

Revenues and expenses are only recognized at the end of the project. It must be used for short-term contracts and when the percentage-of-completion method cannot be used.

The choice of method will have an impact on the income statement and balance sheet of the firm doing the project; this is summarized below.

	Percentage-of-completion method	**Completed contract method**
Income Statement	Revenues, expenses and income are reported throughout the contract period, based on the percentage of total costs incurred in each period.	Revenues, expenses and income are not recognized until the end of the project.
Balance Sheet	Costs are recorded as an asset (construction in progress). Also gross profit or income is recorded as part of construction in progress. Amounts billed to the customer are liabilities (advance billing) and an asset (accounts receivable). Construction in progress and advance billings are netted off in the financial reports.	Expenditures prior to completion are reported as inventory (construction in progress) and cash receipts as advances from customers. These are netted off in the financial reports.

At the end of a project the construction in progress and advance billings are brought to zero and only cash and retained earnings will remain in the accounts.

Example 31-3 Accounting for projects

Towbridge Engineering entered into a contract to build a road. The contract price agreed was $10 million and the estimated cost was $8 million, the project was expected to take 3 years to complete. The following information is provided:

Cash flow from operating activities				
		2003	**2004**	**2005**
Costs incurred	current year	$2 million	$4 million	$2 million
	cumulative	$2 million	$6 million	$8 million
Amounts billed and cash received	current year	$3 million	$3 million	$4 million
	cumulative	$3 million	$6 million	$10 million

Income statement ($million)

	Percentage-of-Completion			**Completed Contract Method**		
	Revenue	Expense	Income	Revenue	Expense	Income
2003	2.5	2.0	0.5	0	0	0
2004	5.0	4.0	1.0	0	0	0
2005	2.5	2.0	0.5	10.0	8.0	2.0
Total	10.0	8.0	2.0	10.0	8.0	2.0

Note: under the percentage-of-completion method, revenue in 2003 is recognized based on the percentage of costs incurred [($2 million/$8 million) x $10 million] using the matching principle. A similar calculation is used in 2004 and 2005.

Balance Sheet

Percentage-of-Completion Method			
$ million	Assets	Liabilities	Equity
2003	1.0	0.5	0.5
2004	1.5	0.0	1.5
2005	2.0	0.0	2.0

Assets = cash plus construction in progress (netted against liabilities)

Liabilities = advance billings, netted against construction in progress

Equity = revenues less costs incurred, refer to income statement above

Notes for 2003

Cash = cash received of $3 million – costs incurred of $2 million = $1 million

Construction in progress = costs incurred of $2 million + recognized profit $0.5 million = $2.5 million

Advance billings = $3 million, this is netted against construction in progress of $2.5 million, to give liabilities of $0.5 million

Accounting for projects (continued)

Notes for 2004

Cash = $6 million – $6 million (use cumulative figures) = $0 million

Construction in progress = $6 million + $1.5 million = $7.5 million

Advance billings = $6 million, this is netted against construction in progress of $7.5 million, to give assets of $1.5 million

Notes for 2005

Cash = $10 million – $8 million (use cumulative figures) = $2 million

Construction in progress = $8 million + $2 million

Advance billings = $10 million, this is netted against construction in progress of $10.0 million, to give liabilities of $0 million

Completed Contract Method			
$ million	Assets	Liabilities	Equity
2003	1.0	1.0	0.0
2004	0.0	0.0	0.0
2005	2.0	0.0	2.0

Assets = cash plus construction in progress (netted against liabilities)

Liabilities = advance billings, netted against construction in progress

Equity = revenues less costs incurred, recognized in last year

Notes for 2003

Cash = $1 million

Construction in progress = costs incurred of $2 million

Advance billings = $3 million, this is netted against construction in progress of $2 million, to give liabilities of $1 million

Notes for 2004

Cash = $0 million

Construction in progress = costs incurred of $6 million

Advance billings = $6 million, this is netted against construction in progress of $6 million

Notes for 2005

Cash = cash received of $10 million – costs incurred of $8 million

Construction in progress = costs incurred of $8 million + recognized profit $2 million

Advance billings = $10 million, this is netted against construction in progress of $10 million

The percentage-of-completion method is generally preferred by analysts since it gives more information about a company's operating activity.

The impact of a decision to use percentage of completion method on the financial statements is shown below. Note that the differences are throughout the life of the project, when the project is completed the numbers will be the same under both methods. It is assumed that the project is profitable.

Reported cash flows will be the same throughout the life of the project.

	Percentage-of-completion method
Income Statement	Income is higher throughout the project.
Balance Sheet	• Total assets are higher, when construction in progress exceeds billings. • Liabilities are lower since construction in progress is a larger offsetting item. • Equity is higher as income is accrued throughout the project.

The impact on the financial statements will follow through to financial ratios so, for example, the liabilities to equity will be lower.

It should be noted that the total revenues, expenses and income at the end of the life of the project will be the same under both methods. Also reported cash flows will be the same throughout the life of the project.

LOS 31-d

Describe the types and analysis of unusual or infrequent items, extraordinary items, discontinued operations, accounting changes, and prior period adjustments.

Nonrecurring items

Nonrecurring items can be divided into four categories:

(i) **Unusual or infrequent items** (but not both), these should be disclosed separately as a component of income from continuing operations.

Examples include:

- gains or losses from disposal of part of a business sector,
- gains or losses from disposal of investments in affiliates or subsidiaries,
- provisions for environmental remediation,
- impairments, write-offs and restructuring costs,
- expenses related to integrating acquired companies.

(ii) **Extraordinary items**. Extraordinary items must be unusual **and** occur infrequently **and** be material in amount. They must be reported separately net of income tax. They are also reported at the earnings per share level.

Examples include:

- foreign government expropriation of a firm's assets,
- prior to 2002 gains or losses due to early retirement of debt could be classified as extraordinary items.

(iii) **Discontinued operations**. The business being discontinued must be totally separable from that of the firm to qualify for it to be reported in this category. The date when the management formally decides to sell is defined as the measurement date. Income prior to this is reported separately net of tax. After the measurement date income is offset against the gain or loss on disposal.

(iv) **Accounting changes** – when a firm changes from one method to another, prior year results are not normally restated. The net cumulative effect on net income in prior year periods is reported on the current income statement after extraordinary items and discontinued operations.

Examples include:

- changing from LIFO to FIFO for inventory accounting (see Study Session 8),
- changing to percentage of completion method for accounting for projects,
- changing accounting for the value of pension plan assets.

It is important that analysts do not rely on a company's classification of which items are nonrecurring and they need to take an independent view. Although the focus of analysis will be on recurring income Nonrecurring items have implications for reported income in prior years (if they are effectively a correction of previously stated income) as well as future earnings (e.g. write downs will reduce future depreciation charges).

It is also important to consider the cash flow implications and distinguish between items that have no cash flow implications (e.g. write downs), ones that affect current cash flows (e.g. company restructuring) and one that affect future cash flows.

IAS 8 deals with the treatment of nonrecurring items under IAS GAAP. The treatment is broadly similar to U.S. GAAP with the following exceptions:

- IAS has slightly different definitions of extraordinary items.
- IAS 8 does not require separate reporting of earnings from continuing operations, discontinued operations and before extraordinary items.
- When there are accounting changes under IAS 8 either prior years can be restated **or** the cumulative effect of the changes can be reported.
- Errors can be corrected by either restating prior periods or including the difference in the current period's earnings (U.S. treatment).

IAS 35 deals with the treatment of discontinued operations. Again there are some differences between IAS GAAP and U.S. GAAP.

- Whereas U.S. GAAP accrues estimated losses from a discontinued operation, IAS GAAP requires the loss is reported.
- Under IAS GAAP, impairment losses associated with discontinued operations can be reported as part of the loss from continued operations.
- Discontinuation dates may differ under IAS versus U.S. GAAP.

LOS 31-e

Discuss managerial discretion in areas such as classification of good news/bad news, income smoothing, big bath behavior, and accounting changes, and **explain** how this discretion can affect the financial statements.

There is a fair degree of management discretion as regards to timing of an event and classification of an item (e.g. unusual or extraordinary).

The following are ways that management can manipulate earnings:

- Classification of good/bad news – management may report good news as part of continuing operations and bad news as part of discontinued operations or as an extraordinary item.
- Income smoothing – this can be through the choice of the accounting method, timing of expenditures or *classificatory smoothing* where an item may be classed as either income from ordinary operations or an extraordinary item.
- 'Big bath' accounting – this is when management prefers to record all the bad news in one year so they can move forward to report healthier profits.
- Accounting changes – this includes voluntary and mandatory changes, in many cases they are used to smooth earnings.

LOS 31-f

Describe the format and the components of the balance sheet and the format, classification, and use of each component of the statement of stockholders' equity.

Balance sheet

The balance sheet, or statement of financial position, reports the assets (resources), liabilities (claims on the resources) and stockholders' equity at a specific point in time. Assets equal liabilities plus stockholders' equity.

The balance sheet is an important source of information for an analyst; it provides information on the resources of a company that can be used to generate future profit. Also creditors will use a balance sheet to provide information on the assets available to repay debt.

Assets are classified as current assets if they are to be converted into cash or used within one year or operating cycle if this is longer than a year. Similarly current liabilities include obligations that are to be settled within one year or operating cycle, if it is longer.

An example of items that are included in a balance sheet is given below:

BALANCE SHEET	Notes
ASSETS	
Current Assets	
Cash and cash equivalents	Risk-free assets, originally purchased with 90-days or less to maturity
Marketable securities	
Accounts receivable	Includes trade receivables (from customers) and notes receivable (from asset sales or loans to management)
Inventories	
Deferred income taxes	These will be reported as an expense in the future
Prepaid expense	These will be reported as an expense in the future
Deferred taxes	
Property, plant and equipment	Reported less accumulated depreciation
Capital leases	
Investment in affiliates	
Prepaid pension costs	
Intangible assets	Includes goodwill, brand names etc.
LIABILITIES	
Current Liabilities	
Accounts payable	Includes trade payables (amounts owing to suppliers) and obligations to employees.
Current portion of debt	Debt to be repaid within a year
Income tax liability	
Advance billings	
Long-Term Liabilities	
Bonds payable	
Other long-term debt	
Capital leases	
Deferred income tax	
Minority interests in consolidated subsidiaries	Amount of consolidated net assets that does not belong to the firm
STOCKHOLDERS' EQUITY	
Preferred stock	

Common stock	
Additional paid-in capital	
Retained Earnings	Profits not paid out to stockholders but retained in the company
Cumulative translation adjustment	For foreign currency
Minimum pension liability	
Unrealized gains and losses	
Treasury stock	Shares repurchased by the company

Generally items are recorded on the balance sheet at historic cost, although in some cases these are adjusted to a value closer to net realizable value.

In some cases items that will reduce the value of a long-lived asset will be recorded in a contra account. Similarly an adjunct account can be used to accumulate changes in asset and liability values.

Stockholders' equity

Generally the components of stockholders' equity are reported in the order of preference in liquidation.

The par value and additional paid up capital of common and preferred stock (but not redeemable preferred) represent the investment in the company by the owners. Retained earnings are the profits that have been reinvested in the company. Additionally the following changes may also be included:

(i) Cumulative foreign exchange adjustments.
(ii) Changes in minimum liability for an under funded pension scheme.
(iii) Unrealized gains and losses on cash flow hedges.
(iv) Changes in market values of non current investments.
(v) Unearned shares issued to stock ownership plans.

32 The Statement of Cash Flows

Learning Outcome Statements (LOS)

32-a **Identify** the types of important information for investment decision making presented in the statement of cash flows.

32-b **Compare** and **contrast** the categories (i.e., cash provided or used by operating activities, investing activities, and financing activities) in a statement of cash flows, and **describe** how noncash investing and financing transactions are reported.

32-c **Calculate** and **interpret,** using the indirect method, the net cash provided or used by operating activities.

32-d **Prepare** and **interpret,** using the indirect method, the statement of cash flows for investing activities and financing activities.

Introduction

Candidates are required to have an in-depth knowledge of the cash flow statements and how items are classified as either cash from operations, investing and financing. At this stage we provide a very brief introduction, but in Reading 33 cash flows are considered in much greater detail.

LOS 32-a

Identify the types of important information for investment decision making presented in the statement of cash flows.

The cash flow statement provides information on a company's cash receipts and payments in an accounting period. This is important for investors and creditors since it provides information that can be used to analyze the company's ability to generate future cash flows, to repay its liabilities, to pay dividends and interest and decide whether the company will need further financing.

The cash flow statement can also explain differences between cash flows from operations and net income.

LOS 32-b

Compare and **contrast** the categories (i.e. cash provided or used by operating activities, investing activities, and financing activities) in a statement of cash flows, and **describe** how noncash investing and financing transactions are reported.

Cash flows are divided into three categories:

Cash flows from operating activities

These are cash flows that result from, or relate to, transactions that generate the company's net income. Effectively the net income statement is changed to cash accounting rather than accrual accounting.

Cash flows from investing activities

This includes the acquisition of and sale of long-term assets and marketable securities, and from making and collecting loans.

Cash flows from financing activities

This is concerned with cash flows to the owners and creditors of the business.

Noncash investing and financing transactions, such as the exchange of a long-term asset for a long-term liability, do not involve a payment or receipt of cash so will not be directly reflected in the statement of cash flows. However the FSAB requires that they are disclosed in a separate schedule.

For a detailed allocation of cash flows refer to Reading 33.

LOS 32-c

Calculate and **interpret,** using the indirect method, the net cash provided or used by operating activities.

LOS 32-d

Prepare and **interpret**, using the indirect method, the statement of cash flows for investing activities and financing activities.

See Reading 33 for the preparation and interpretation of cash flows from operating, investing and financing activities.

33 Analysis of Cash Flows

Learning Outcome Statements (LOS)

33-a	**Classify** a particular transaction or item as cash flow from 1) operations, 2) investing, or 3) financing.
33-b	**Compute** and **interpret** a statement of cash flows, using the direct method and the indirect method.
33-c	**Convert** an indirect statement of cash flows to a direct basis.
33-d	**Explain** the two primary factors that may cause discrepancies between balances of operating assets and liabilities reported on the balance sheet and those reported in the cash flow statements.
33-e	**Describe** and **compute** free cash flow.
33-f	**Distinguish** between the U.S. GAAP and IAS GAAP classifications of dividends paid or received and interest paid or received for statement of cash flow purposes.

Introduction

Cash flows are critical. Not only do they provide the link between the income statement and balance sheet but they provide data which is less susceptible to being distorted by management choices on accounting methods. A net cash flow number is not particularly helpful; to understand the dynamics of a company the breakdown of the cash flow into cash flow from operating, financing and investing activities is far more useful. Most cash flows fall into the operating category and reflect the ability of the company to generate funds internally. Investing cash flows provide information on the cash being used to buy assets which will maintain current capacity and support future growth. Financing cash flows reflect the capital structure of the company and the cash that is being paid, or collected, from providers of capital (but be careful, interest paid, interest and dividends received are operating cash flows under U.S. GAAP).

For the exam, candidates need to be comfortable using the direct and indirect methods to compute a statement of operating cash flows.

Statement of cash flows

The statement of cash flows reports the cash inflows and outflows for a company over a period. It provides a link between the beginning and end-period balance sheets and provides additional information to that provided by the balance sheet and income statement.

The cash flow is broken into three components:

Cash Flow from Operations (CFO) – this is the amount of cash generated by a firm as a result of its production of goods and services. A company undergoing rapid growth might show negative cash flow from operations. Longer term a company should be able to achieve positive cash flow from operations in order to pay dividends, repay debt and fund expansion.

Cash Flow from Investing (CFI) – this is the amount of cash generated from the purchase and sale of productive assets and investments. This is necessary to maintain and expand a company's operating capacity.

Cash Flow from Financing (CFF) – this is the amount of cash used to pay dividends and repurchase shares, repay borrowings and the cash received from the issue of equity and debt.

LOS 33-a

Classify a particular transaction or item as cash flow from 1) operations, 2) investing, or 3) financing.

LOS 33-b

Compute and **interpret** a statement of cash flows, using the direct method and the indirect method.

LOS 33-c

Convert an indirect statement of cash flows to a direct basis.

Classification of individual items

The following tables link cash flow items to the income statement and changes in the balance sheet accounts:

Cash Flow from Operations (CFO)	Income Statement	Balance Sheet
Cash received from customers	Sales	Accounts receivable, advances from customers
Cash paid for inputs and operating expenses	COGS, SG&A expense, rent expense	Inventories, accounts payable, prepaid expenses, rent payable, accrued expenses
Interest paid	Interest expense	Interest payable
Income tax paid	Income tax expense	Income tax payable, deferred income taxes

Cash flow from investing activities

Cash Flow from Investing (CFI)	Income Statement	Balance Sheet
Capital expenditures	Depreciation and amortization expense	Property, plant and equipment, intangible assets
Cash paid for and received from investments in affiliates	Equity in income of affiliates	Investment in affiliates
Cash paid for and received from sale of investments	Realized gains or losses on investments	Short and long-term investments and gains (losses) on certain investments
Cash paid for acquisitions and received from divestitures		Assets and liabilities resulting from acquisitions and divestitures

Cash flow from financing activities

Cash Flow from Financing (CFF)	Income Statement	Balance Sheet
Increase or decrease in debt		Notes payable, short and long-term debt, bonds payable
Equity financing or repurchase of stock		Increase or decrease in equity
Dividends paid		Retained earnings, dividends payable

It is important to note that an increase/decrease in an asset represents a net cash outflow/inflow respectively. Similarly an increase/decrease in a liability represents a net cash inflow/outflow.

To calculate cash flow from operations one can use either the direct or indirect method:

1. **Direct method**

The direct method identifies the items shown in the tables above to compute the cash flow from operations. Remember to adjust items taken from the income statement for changes in operating asset and liability accounts.

2. **Indirect method**

This method starts with the net income number and adjusts for:

(i) Non-cash revenues and expenses.
(ii) Non-operating items in the income statement.
(iii) Changes in operating asset and liability accounts.

Example 33-1 Computing cash flows

Molesely Corp. provides the following information in its financial statements:

2005

Income Statement (in $'000)

Sales	1,000
COGS	(750)
Operating expense	(100)
Depreciation expense	(35)
Rent expense	(15)
Interest expense	(40)
Income before taxes	60
Income tax expense	(20)
Net income after taxes	40

Balance Sheet (in $'000)

Assets	end 2004	end 2005
Cash	35	50
Accounts receivable	50	60
Inventory	250	300
Property, plant & equip	170	190 (net of acc depreciation)
Total Assets	**505**	**600**

Example 33-1 (continued) Computing cash flows

Liabilities		
Bank notes	0	50
Accounts payable	30	45
Advances from customers	15	45
Deferred taxes	90	40
Dividends payable	0	0
Stockholders' Equity		
Common stock	120	150
Retained earnings	250	270
Total liabilities and equity	505	600

Total dividends of $20,000 were declared.

The cash flow from operations in 2005 can be calculated in two ways:

Direct method

Cash collection	
Sales	1,000
Increase in receivables	(10)
Increase in advances	30
Cash input	
COGS	(750)
Increase in inventory	(50)
Increase in accounts payable	15
Cash expenses	
Operating expense	(100)
Rent expense	(15)
Increase in accrued liabilities	0
Cash taxes paid	
Tax expense	(20)
Increase in deferred taxes	(50)
Cash interest paid	
Interest expense	(40)
Increase in interest payable	0
Cash flow from operations	**10**

Example 33-1 (continued) Computing cash flows

Indirect method

Net income	40	
Adjust for		
Depreciation	35	Non cash expense
Increase in deferred taxes	(50)	Decrease in liability
Increase in accounts receivable	(10)	Increase in asset
Increase in inventory	(50)	Increase in asset
Increase in accounts payable	15	Increase in liability
Increase in advances from customers	30	Increase in liability
Cash flow from operations	**10**	
Cash flow from investments		
Capital expenditure	(55)	
Investment in affiliates	0	
Cash flow from investments	**(55)**	
Cash flow from financing		
Increase in borrowing	50	
Increase in stock outstanding	30	
Dividends paid	(20)	
Cash flow from financing	**60**	
Net cash flow	**15**	

Note: Property, plant and equipment is quoted net of depreciation. To calculate the investing cash flow, add together the increase in net value of property, plant and equipment and the depreciation expense.

The net cash flow is equivalent to the change in cash balances between year-ends.

Molesely Corp. has a small positive cash flow from operations, but insufficient to cover the investment spending. The investment spending has been paid for by an increase in equity and bond financing (cash flow from financing). A weak operating cash flow might indicate the company is in the growth phase, or possibly there are problems such as difficulty collecting receivables, poor inventory management etc.

LOS 33-d

Explain the two primary factors that may cause discrepancies between balances of operating assets and liabilities reported on the balance sheet and those reported in the cash flow statements.

There are two main factors that create differences between balances of operating assets and liabilities reported on the balance sheet and those reported in the cash flow statements. These are:

Acquisitions and divestures

Changes in reported balances can reflect operating activities and acquisitions and divestures. For example inventory can be purchased from a supplier (operating activity) or from the acquisition of another firm which has inventory on its balance sheet (investing activity). This means that adjustments to income to calculate cash flow from operations will not match the increase or decrease in the balance sheet. The difference should be the amount of inventory obtained through the acquisition. This will often lead to the subsequent overstatement of cash flows from operations as the cost of inventory was not fully reflected in the cash flow from operations.

Foreign subsidiaries

Assets and liabilities of foreign subsidiaries will be translated into the reporting currency; this will lead to operating changes (real cash flow effects) and exchange rate effects that will not lead to any cash movement. Exchange gains from translation are excluded from cash flows from operating and financing activities although they will be reflected in balance sheet amounts.

Analysis of cash flows

The cash flow statement is important because it gives a true picture of what events have occurred without the distortion of the choice of accounting assumptions, e.g. whether a project uses the completed contract method or percentage-of-completion method of revenue recognition it will produce the same cash flow entries.

Analysis of the cash flow statement gives information on:

(i) The company's ability to generate cash flows from its operating activities.
(ii) The impact of investing and financing decisions.

Problems mainly occur in the classification of different cash flows between operating, investment and financing activities. These include:

- Operating cash flows do not include the cost of using the productive capacity, i.e. plant cost. Positive cash flow from operations does not imply that there is sufficient cash flow to replace the productive capacity as needed.
- Cash flows involved in paying operating leases will go through as operating cash flows, whereas an outright purchase of assets is an investing cash flow, this is not consistent.
- If a company has acquired another company and has taken over its inventory, the cost of this will be recorded in investing cash flows, but sales of the inventory will go through operating cash flows.
- Interest income and dividends received from investments in other firms are classified as operating cash flows (under U.S. GAAP).
- Interest payments are classified as operating cash flows whereas part of these payments reflects debt financing. However dividends paid are reported in financing cash flows (under U.S. GAAP).
- Some transactions do not require cash outlays, such as taking on a mortgage.

LOS 33-e

Describe and **compute** free cash flow.

Free cash flow (FCF) measures the amount of cash available to a company for discretionary spending after making all required cash outlays. The free cash flow can be used for expansion, reducing debt, and paying dividends. The calculation of free cash flow varies from analyst to analyst but a standard definition is:

FCF = cash flow from operations – cash required to maintain the firm's present productive capacity

In many cases capital expenditure is used as a proxy for the cash required to maintain existing capacity due to the difficulty in deciding which capital expenditure is being used for maintenance and which for expansion.

An alternative method is to use cash flow from operations less depreciation, since depreciation is proxy for the cost of using productive capacity. However this is not recommended since depreciation is based on the historic cost of assets.

Another issue is whether we are calculating FCF available to the **firm** which means to all providers of capital whether debt or equity. In this case we should look at the cash flow **before** interest. However if we are looking at FCF available to **equity shareholders** we should calculate the FCF **after** interest, since the debt holders need to be paid first.

Example 33-2 Free cash flow

Using the data in Example 33-1 for Molesely Corp.

Free cash flow to equity shareholders

= cash flow from operations - capital expenditure

= 10 - 55

= (45)

This shows that the company – rather than having cash available to repay debt or pay dividends to stockholders – is depending on raising debt and equity finance for its operations and spending. Further analysis may show that in fact a large proportion of the capital expenditure is for expansion, and the company is in a growth phase which requires outside financing.

LOS 33-f

Distinguish between the U.S. GAAP and IAS GAAP classifications of dividends paid or received and interest paid or received for statement of cash flow purposes.

There are a number of differences between IAS GAAP and U.S. GAAP in the treatment of interest and dividends paid or received. These are summarized in the table below:

	U.S. GAAP	IAS GAAP
Bank overdrafts	A liability- changes shown in cash flow statement	Often part of cash equivalents, changes not shown in cash flow statement
Interest and dividends received	CFO	Either CFO or CFI
Interest paid	CFO	Either CFO or financing CFF
Dividends paid	CFF	Either CFO or CFF

34 Future FASB Changes and the Analytical Challenges of GAAP

Learning Outcome Statements (LOS)

34-a	**Identify** the projects on the FASB agenda that were/are related to international convergence.
34-b	**Describe** two different guidance rules for revenue recognition discussed by the FASB and IASB.

Introduction

The Financial Accounting Standards Board (FASB) is in the process of harmonizing U.S. GAAP with International Accounting Standards (IAS), with the aim of achieving harmonization in 2007. There are a number of areas that are key, including stock compensation, business combinations and revenue recognition. The changes to accounting methods will not only affect how companies produce financial reports but also the stock valuation by analysts and the market. This is of particular relevance to companies who are listing in both U.S. and European markets (and other world markets) and will need to provide financial statements complying with different standards.

LOS 34-a

Identify the projects on the FASB agenda that were/are related to international convergence.

Projects related to international convergence

The projects that were/are under discussion are listed below:

- Accounting for stock compensation.
- Changes in methodology used for purchase accounting.
- Revenue recognition changes.
- Accounting conventions for convertible debt and other exotic instruments with both equity and liability characteristics.
- Financial performance with regard to revising the form and the content of the income statement.
- Fair-value measurement.
- Elimination of many small differences between U.S. GAAP and IAS GAAP.

Stock-base compensation

Both the FASB and the IASB have been working on standardizing the accounting for employee stock options, and both sets of standards should be very similar.

They will require that stock options are valued at the grant date and the cost amortized over the vesting period of the option.

This is the same way that other employee compensation plans are accounted for. Note that options will not be revalued during the vesting period regardless of movement in the underlying stock price.

Business combinations

Following on from the FASB's decision to stop the pooling-of–interest method being used for business combinations, and only allow the purchase method, the FASB and IASB have been working on amending some of the accounting procedures used under the purchase method. This includes reviewing treatment of *in-process research and development* (R&D), (historically R&D was expensed at the date of acquisition, and under the new rules it will be capitalized and shown in the balance sheet), *restructuring costs* (historically the costs of restructuring an acquired company have been treated as a liability for the acquired company, it is proposed that costs will now be charged to earnings when the liabilities are recorded) and *measurement of the purchase price* when an acquisition is paid for with stock (historically when stock is used to pay for a transaction, the value of the stock was calculated based on the price at the announcement date of the transaction, it is proposed that this is changed to the price at the closing date of the transaction).

LOS 34-b

Describe two different guidance rules for revenue recognition discussed by the FASB and IASB.

Revenue recognition

This is a joint project between the FASB and the IASB with the objective of ensuring companies worldwide measure revenue on the same basis. The aim is to eliminate inconsistency between two different guidelines being used. The first, Concept Statement 6, says that income is recognized as the increase in a company's net assets (assets minus liabilities) that results from any transaction other than with the company's shareholders. So, for example, a transaction that increases net assets, other than selling new stock, is revenue.

However Concept Statement 5 says that to recognize revenues the earnings process must be complete and the collectibility of the revenue reasonably assured. These two guideline statements are inconsistent. The example given in the text is that a health club sells a three-year membership which is non-refundable after 60 days. After 60 days the club has increased its assets in the form of cash it does not have to return, but under Standard 5 it should amortize the revenue over the three year membership period.

The indication is that the FASB and IASB will move towards using the asset minus liability approach although there may be the need to recognize a performance liability at the time of the transaction. This could have a significant impact on company accounts with the potential to bring forward revenue recognition, and similarly recognition of associated costs and expenses.

STUDY SESSION 8

Financial Statement Analysis: Financial Ratios and Earnings per Share

Overview

Analyzing financial statements through the use of ratios is the backbone of this Study Session. Numbers taken from financial statements are, on their own, fairly meaningless. It is only when the relationship between the numbers or ratios are computed that we can start to get an idea of the financial strength and profitability of a company. When we start comparing the ratios of a company with its own past ratios or with ratios of other companies in the industry we get a much clearer idea of the company's relative performance.

The next Reading Assignment looks at the calculation of earnings per share and how to accommodate potentially dilutive securities which, if exercised or converted, would lead to lower earnings per share. Finally there are two Readings on financial shenanigans which are used by companies to manipulate reported earnings. These Readings identify the most commonly used tricks and the effect on revenues, income and liabilities.

Reading Assignments

35. "Analysis of Financial Statements," Ch. 10, pp. 319−358 and Exhibits 10.1, 10.2, and 10.3, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (Dryden, 2003)

36. "Dilutive Securities and Earnings per Share," Ch. 16, pp. 788–801 and Appendix 16B pp. 809-814, *Intermediate Accounting*, 11th edition, Donald E. Kieso, Jerry J. Weygandt and Terry D. Warfield (Wiley, 2004)

Financial Shenanigans, 2nd edition, Howard Schilit (McGraw-Hill, 2002)

37. "Seek and Ye Shall Find," Ch. 2

38. "Searching for Shenanigans," Ch. 3

35 Analysis of Financial Statements

Learning Outcome Statements (LOS)

35-a	**Interpret** common-size balance sheets and common-size income statements and **discuss** the circumstances under which the use of common-size financial statements is appropriate.
35-b	**Calculate**, **interpret**, and **discuss** the uses of measures of a company's internal liquidity, operating performance (i.e. operating efficiency (activity) and operating profitability), risk profile, and growth potential.
35-c	**Calculate** and **interpret** the various components of the company's return on equity using the original and extended DuPont systems and a company's financial ratios relative to its industry, to the aggregate economy, and to the company's own performance over time.

Introduction

This Reading includes the definitions of a large number of ratios and candidates should attempt to memorize the ratios. Although some of the definitions may differ from those you are familiar with, the definitions given in the source text and used in these notes, should be the ones applied in the exam. Candidates will not only be expected to calculate ratios but more importantly to be able to use ratios to draw conclusions about a company's performance both over time and relative to other participants in the market and industry. Ratios not only reflect the profitability of a company and its growth prospects but also its capital structure and the risk inherent in its business and as a result of financing decisions. Finally, the DuPont analysis of return on equity and the calculation of the sustainable growth rate of a company are important topics to revise.

The main categories of analysis where financial ratios are used are as follows:

1. Common size statements
2. Internal liquidity (solvency)
3. Operating performance
   a. Operating efficiency
   b. Operating profitability
4. Risk Analysis
   a. Business risk
   b. Financial risk
   c. Liquidity risk
5. Growth analysis

We will discuss the definition of the ratios used and the application and interpretation of the ratios one by one for Ripley Corporation, whose financial statements are shown below. It is important to always consider ratios in the context of the firm's industry, its major competitors, the market and the overall economy as well as against the company's own history.

Financial information used in Examples 35-1 to 35-7

RIPLEY CORPORATION BALANCE SHEET Year end December 31st 2004 and 2005, US$ million		
	2004	**2005**
Assets		
Current Assets		
Cash and cash equivalents	950	1,350
Accounts receivable	14,200	13,600
Inventories	2,500	4,600
Other current assets	235	765
Total Current Assets	17,885	20,315
Property, plant and equipment (net of accumulated depreciation)	124,000	128,050
Other noncurrent assets	36,600	35,700
Total Assets	178,485	184,065
Liabilities and Shareholders' Equity		
Current Liabilities		
Short-term debt	500	455
Trade accounts payable	8,100	7,345
Accrued expenses and other liabilities	**17,885**	**9,756**
Income taxes payable	827	956
Total Current Liabilities	27,312	18,512
Long-term debt	25,000	25,000
Other noncurrent liabilities	0	0
Deferred income taxes	1,050	1,065
Common shareholders' equity		
Common stock	87,000	98,000
Paid-in capital	15,000	18,000
Retained earnings	23,123	23,488
Total Common Shareholders' Equity	**125,123**	**139,488**

Total Liabilities Common Shareholders' Equity	**178,485**	**184,065**

RIPLEY CORPORATION INCOME STATEMENT Year end December 31st 2005, US$ million	
	2005
Net sales	184,235
Cost of goods sold	(163,910)
Gross profit	20,325
Selling, general and administrative expenses	(15,424)
Operating profit (EBIT)	4,901
Interest income	60
Interest expense	(1,972)
Operating income before tax	2,989
Provision for income taxes	(1,136)
Reported net income	1,853
Dividends declared	1,488

LOS 35-a

Interpret common-size balance sheets and common-size income statements and **discuss** the circumstances under which the use of common-size financial statements is appropriate.

1. Common-size statements

Example 35-1 Common-size statement

The first part of Ripley Corporation's balance sheet is restated as a common-size statement in the right hand column below.

		2005
Assets	**$ million**	%
Current Assets		
Cash and cash equivalents	1,350	0.73
Accounts receivable	13,600	7.39
Inventories	4,600	2.50
Other current assets	765	0.42
Total current assets	20,315	11.04
Property, plant and equipment (net of depreciation)	128,050	69.57
Other noncurrent assets	35,700	19.40
Total assets	184,065	100.00

The common size income statement is shown below:

	2005	
	$ million	%
Net sales	184,235	100.00
Cost of goods sold	(163,910)	(88.97)
Gross profit	20,325	11.03
Selling, general and administrative expenses	(15,424)	(8.37)
Operating profit	4,901	2.66
Interest income	60	0.03
Interest expense	(1,972)	(1.07)
Operating income before tax	2,989	1.62
Provision for income taxes	(1,136)	(0.62)
Reported net income	1,853	1.01

LOS 35-b

Calculate, **interpret**, and **discuss** the uses of measures of a company's internal liquidity, operating performance (i.e. operating efficiency (activity) and operating profitability), risk profile, and growth potential.

LOS 35-c

Calculate and **interpret** the various components of the company's return on equity using the original and extended DuPont systems and a company's financial ratios relative to its industry, to the aggregate economy, and to the company's own performance over time.

2. Internal liquidity (solvency)

Internal liquidity ratios give an indication of a company's ability to pay short-term financial obligations. The most commonly used are:

Current ratio	=	$\frac{\text{current assets}}{\text{current liabilities}}$
Quick ratio	=	$\frac{\text{(cash + marketable securities + receivables)}}{\text{current liabilities}}$
Cash ratio	=	$\frac{\text{(cash + marketable securities)}}{\text{current liabilities}}$
Receivables turnover	=	$\frac{\text{net sales}}{\text{average receivables}}$
Average receivables collection period	=	$\frac{365}{\text{receivables turnover}}$
Inventory turnover	=	$\frac{\text{COGS}}{\text{average inventory}}$
Average inventory processing period	=	$\frac{365}{\text{inventory turnover}}$
Payables turnover ratio	=	$\frac{\text{COGS}}{\text{average trade payables}}$
Payables payment period	=	$\frac{365}{\text{payables turnover ratio}}$
Cash conversion cycle	=	receivables collection period + inventory period – payables payment period

Example 35-2 Liquidity ratios

Using the financial statements for Ripley Corporation, the ratios are calculated below:

Current ratio

2004: $\frac{17,855}{27,312} = 0.65$ 2005: $\frac{20,315}{18,512} = 1.10$

The ratio has improved sharply between the two year ends. At the end of 2004, since the current ratio is less than 1, the company did not have sufficient current assets to meet its current liabilities. By the end of 2005 the current assets had increased and current liabilities had fallen indicating a healthier liquidity position.

Quick ratio

2004: $\frac{15,150}{27,312} = 0.55$ 2005: $\frac{14,950}{18,512} = 0.81$

The quick ratio is stricter than the current ratio in the sense that it considers only relatively liquid current assets, and does not include inventory. Again these look like low ratios for Ripley Corporation, but they are improving, and must be looked at on a comparative basis against the rest of the industry.

Cash ratio

2004: $\frac{950}{27,312} = 0.03$ 2005: $\frac{1,350}{18,512} = 0.07$

Cash is being kept at very low levels but this may not be a cause for concern if the company has strong credit lines with banks.

Receivables turnover

The average receivables are computed by taking the average of the year-end numbers, 14,000 and 13,800.

Example 35-2 (continued) **Liquidity ratios**

2005: $\frac{184,235}{13,900} = 13.25 \text{ times}$

Average receivables collection period 2005: $\frac{365}{13.25} = 27.55 \text{ days}$

This means that the company collects its receivables in 27.55 days, on average. To see if this is acceptable we would need to look at the company's credit policy and at the collection period for other companies in the industry. Clearly a relatively long collection period indicates that customers are taking a long time to pay and probably too much capital is tied up in receivables.

Inventory turnover 2005: $\frac{163,910}{3,550} = 46.17 \text{ times}$

(remember to use COGS and **not** sales)

Average inventory processing period 2005: $\frac{365}{46.17} = 7.91 \text{ days}$

This measures how long capital is tied up in inventory, if it is too short it might indicate that insufficient inventory is being held, if it is too long it might indicate that the inventory has become obsolete.

Payables turnover ratio 2005: $\frac{163,910}{7,723} = 21.22 \text{ times}$

Payables payment period 2005: $\frac{365}{21.22} = 17.20 \text{ days}$

This means that Ripley Corporation takes just over 17 days on average, to pay suppliers. The longer the period the better for the company's cash flow.

The cash conversion cycle 2005: 27.55 + 7.91 – 17.20 = 18.26 days

This shows that, after offsetting the period in which capital is tied up in receivables and inventory by the period that the company can wait before they pay suppliers, the period that cash is tied up is just less than 18 days.

3. Operating performance

a. Operating efficiency

Total asset turnover	=	net sales / average total net assets
Fixed asset turnover	=	net sales / average net fixed assets
Equity turnover	=	net sales / average equity

Note: 'net' in total net assets and net fixed assets means the fixed assets are net of depreciation.

b. Operating profitability

Gross profit margin	=	gross profit / net sales
Operating profit margin	=	operating profit / net sales
Net profit margin	=	net income / net sales
Return on total capital*	=	(net income + gross interest expense) / average total capital
Return on total equity	=	net income / average total equity
Return on owners' equity	=	(net income – preferred dividend) / average common equity

* If a company uses operating leases, for example an airline that leases aircraft, then the return on capital including leases could be calculated. The present value of the leases is added to both the fixed assets and long-term debt. Also the income needs to be adjusted for the implied interest expense and implied depreciation expense. Leases are covered in detail in Study Session 10.

Example 35-3 Operating performance

Using the financial statements for Ripley Corporation the ratios are calculated as below:

Total asset turnover 2005: $\frac{184,235}{181,275} = 1.02 \text{ times}$

This is a low number indicating that perhaps Ripley Corporation is in a capital intensive industry, or a new company that is not yet efficiently using its assets.

Fixed asset turnover 2005: $\frac{184,235}{126,025} = 1.46 \text{ times}$

Again this is a low number implying a lot of capital is tied up in fixed assets compared to sales.

Equity turnover 2005: $\frac{184,235}{132,306} = 1.39 \text{ times}$

Note that equity includes preferred and common stock, paid in capital and retained earnings. If a company decided to change its capital structure this would change the equity turnover. For example, if the company decided to increase the debt financing and reduce the equity financing this would increase the equity turnover.

Gross profit margin 2005: $\frac{20,325}{184,235} = 11.03\%$

COGS are high as a proportion of sales; the gross profit is only just over 11% of sales.

Operating profit margin 2005: $\frac{4,901}{184,235} = 2.66\%$

After selling, general and administrative expenses operating profits are reduced to only 2.66% of sales.

Net profit margin 2005: $\frac{1,853}{184,235} = 1.01\%$

Example 35-3 (continued) Operating performance

In the case of Ripley Corporation the net income is the same as the operating income after tax since there are no non-operating adjustments. These ratios should be calculated using income from continuing operations.

Return on total capital 2005: $\frac{1{,}853 + 1{,}972}{181{,}275} = 2.11\%$

Note. Total capital is the total capital being used in the business. Interest expense is not netted off against interest income.

Return on total equity 2005: $\frac{1{,}853}{132{,}306} = 1.40\%$

(This is the same as the **return on owners' equity** since there is no preferred stock in issue).

The return on capital and the return on equity look low, the return should reflect the risk of the business. It would suggest that, unless there was a forecast improvement in the return that the company is generating, investors' capital could be used more productively elsewhere.

Later in this Reading we will use the DuPont system to break down and analyse the return on equity.

4. Risk analysis

Risk analysis looks initially at the internal factors that lead to volatility in the earnings of a company. The two components of this are business risk and financial risk.

Business risk

Business risk is usually measured by the coefficient of variation of a firm's operating earnings (the standard deviation of operating earnings/mean operating earnings).

Two factors which will contribute to the variability of operating earnings are:

1. **Sales variability** – measured by the coefficient of variation of sales.
2. **Operating leverage** – measures the sensitivity of operating earnings to changes in sales. It reflects the proportion of costs that are fixed as opposed to variable, high fixed costs will increase the operating leverage.

Financial risk

Financial risk measures the variability of returns to equity shareholders.

Relevant ratios are divided into two categories:

(i) Ratios to measure the percentage of capital that is debt financed

Debt to equity ratio	=	total long-term debt / total equity
If there are leases, this becomes		
	=	Noncurrent liab.+defd. taxes+PV of lease obligations / Total equity
Long-term debt/total capital ratio	=	total long-term debt / total long-term capital
		Long-term capital is long-term debt plus shareholders' equity
Total debt ratios	=	current liabilities + total long-term debt / total debt + total equity

Note – include deferred taxes in debt if the deferred tax is likely to be actually paid

(ii) Ratios to measure the cash flow available to meet interest payments

Interest coverage*	=	earnings before interest and taxes / interest expense
	=	net income + interest expense + income taxes / interest expense
Fixed charge coverage ratio	=	EBIT and lease payments / interest + lease payments + preferred div.(1 – tax rate)]
Cash flow coverage of fixed financial costs*	=	net cash flow from operations + interest expense / interest expense
Cash flow/long-term debt* ratio	=	cash flow from operations / book value of long-term debt
Cash flow/total debt ratio*	=	cash flow from operations / total long-term debt + current interest bearing liabilities

* If the company uses leases then the estimated lease interest expense would be added to the interest expense. The present value of lease obligations is added to the book vale of long-term debt.

Cash flow used is often defined as: net income + depreciation + change in deferred taxes.

Example 35-4 Risk analysis

Applying these ratios to Ripley Corporation:

Debt to equity ratio

2004: $\frac{26{,}050}{125{,}123} = 20.82\%$ 2005: $\frac{26{,}065}{139{,}488} = 18.69\%$

Note: Deferred taxes have been included in debt

The debt burden looks relatively low and is falling, partly due to increased equity financing.

Long-term debt/total capital ratio

2004: $\frac{26{,}050}{151{,}173} = 17.23\%$ 2005: $\frac{26{,}065}{165{,}553} = 15.74\%$

Again this is a low figure and declining.

Total debt ratios

2004: $\frac{(27{,}312 + 26{,}050)}{(53{,}362 + 125{,}123)} = 29.90\%$ 2005: $\frac{(18{,}512 + 26{,}065)}{(44{,}577 + 139{,}488)} = 24.22\%$

This shows that, in 2005, 24.22 % of the company's assets were financed by debt. This includes both short and long-term debt, some of which is not interest-bearing. The ratio looks relatively low but needs to be seen in the context of other companies.

Interest coverage

2005: $\frac{1{,}853 + 1{,}136 + 1{,}972}{1{,}972} = \frac{4{,}921}{1{,}972} = 2.52 \text{ times}$

This shows that EBIT could decline by approximately 60% (1.52/2.52) and Ripley Corporation could still pay its interest costs.

To calculate the cash flow coverage ratios we need further information on Ripley Corporation's operating cash flow. This was 1,560 in 2005, this is fairly low partly reflecting the sharp increase in inventories and decrease in accrued expenses.

Example 35-4 (continued) Risk analysis

Cash flow coverage of fixed financial costs

2005: $\frac{(1{,}560 + 1{,}972)}{1{,}972} = 1.79 \text{ times}$

This is also looks low but we need to consider the business risk involved in achieving the cash flow.

Cash flow/ long-term debt ratio

2005: $\frac{1{,}560}{26{,}065} = 5.99\%$

Cash flow/total debt ratio

2005: $\frac{1{,}560}{(26{,}065 + 455)} = 5.88\%$

These figures look low. If the cash flow continues to be poor relative to debt it might be a signal of increased bankruptcy risk.

Liquidity risk

External market liquidity is measured by the ability to buy and sell an asset without significantly moving the price. This can be measured by the value of shares traded or the bid-ask spread. Other indicators are market value of outstanding securities, number of owners of the security, and the percentage of shares traded in a period.

5. Growth analysis

The sustainable growth rate depends on the resources the company has to generate earnings and the rate of return it generates on these resources.

Sustainable growth rate = earnings retention rate x return on equity

Earnings retention rate = $1 - \frac{\text{dividends declared}}{\text{operating income after taxes}}$

In many cases net income is used rather than operating income after tax. In Ripley Corporation's case it does not make a difference since there is no non-operating income.

Example 35-5 Growth analysis

For Ripley Corporation:

Retention rate

2005: $1-\frac{1,488}{1,853}=19.70\%$

Sustainable growth rate

2005: $1.40\%\times19.70\%=0.28\%$

This is a low number reflecting the poor return on equity and low earnings retention rate. The company does not appear to be generating an attractive return to shareholders. If the company has few growth prospects it is paying out earnings as dividends rather then reinvesting them in the company for growth.

DuPont system

The DuPont system breaks down return on equity into different components and is useful for analyzing a firm's ROE and looking at ROE on a relative basis to other firms.

Breaking down the ROE into three components under the original DuPont system:

$$\text{Return on equity}=\frac{\text{net income}}{\text{net sales}}\times\frac{\text{net sales}}{\text{total assets}}\times\frac{\text{total assets}}{\text{common equity}}$$

$$=\text{net profit margin}\times\text{total asset turnover}\times\text{financial leverage}$$

Example 35-6 DuPont system

Ripley Corporation's return on equity in 2005:

Return on equity

= net profit margin x total asset turnover x financial leverage

$$=\frac{1,853}{184,235}\times\frac{184,235}{184,065}\times\frac{184,065}{139,488}$$

$$=1.01\times1.00\times1.32$$

$$=1.33\%$$

Note that we have used end year data for the ratios rather than the average for the year.

The extended DuPont system breaks down the ROE into 5 components, by breaking the net profit margin down further.

$$\text{Return on equity}$$
$$= \frac{\text{net profit}}{\text{pre - tax profit}} \times \frac{\text{pre} - \text{tax profit}}{\text{operating profit}} \times \frac{\text{operating profit}}{\text{net sales}} \times \frac{\text{net sales}}{\text{total assets}} \times \frac{\text{total assets}}{\text{common equity}}$$
$$= \text{tax retention rate} \times (1 - \text{interest expense as \% of pre - tax profits}) \times \text{operating profit margin}$$
$$\times \text{total asset turnover} \times \text{financial leverage}$$

Example 35-7 Return on equity

Ripley Corporation's **return on equity** in 2005

0.62 x 0.61 x 0.03 x 1 x 1.32 = 1.33%

Limitations of financial ratios

There are a number of limitations as detailed below:

1. Differences between accounting policies used by firms. This is particularly important if making international comparisons. Ideally you should adjust the accounts for major differences before making comparisons.
2. It may be difficult to make industry comparisons if a firm is operating in different industrial sectors.
3. An analyst needs to look at a range of ratios to understand the profile of the firm. Drawing conclusions from one set of ratios may give an overly optimistic or pessimistic indication of the firm's prospects.
4. An analyst needs to look at the acceptable range for the industry for each ratio. A ratio that is either too high or too low may indicate a problem.

36 Dilutive Securities and Earnings per Share

Learning Outcome Statements (LOS)

36-a	**Differentiate** between simple and complex capital structures for purposes of calculating earnings per share (EPS), **describe** the components of EPS, and **calculate** a company's EPS in a simple capital structure.
36-b	**Calculate** a company's weighted average number of shares outstanding.
36-c	**Describe** stock dividends and stock splits, and **determine** the effect of each on a company's weighted average number of shares outstanding.
36-d	**Distinguish** between dilutive and antidilutive securities and **calculate** a company's basic and diluted EPS in a complex capital structure and **describe** and **determine** the effects of convertible securities, options, and warrants on a company's EPS.
36-e	**Compare** and **contrast** the requirements for EPS reporting in simple versus complex capital structures.

Introduction

This Reading looks at the computation of basic and diluted earnings per share. Candidates need to be comfortable calculating weighted-average numbers of shares outstanding and adjusting for complex capital structures when there are potentially dilutive securities such as convertible bonds or options outstanding. The calculations are not difficult but remember to adjust for tax on interest payments on convertible bonds and use the Treasury stock method (not a particularly intuitive method) when there are options or warrants outstanding.

LOS 36-a

Differentiate between simple and complex capital structures for purposes of calculating earnings per share (EPS), **describe** the components of EPS, and **calculate** a company's EPS in a simple capital structure.

Simple capital structure

Earnings per share (EPS) refer to the income earned by each share of common stock. In terms of calculating earnings per share a **simple capital structure** is when a firm's capital structure consists only of common stock or there is no **potential common stock**. If there is potential common stock which could dilute earnings then it has a **complex capital structure.**

In a simple capital structure, **basic EPS** are given by:

$$\text{EPS} = \frac{(\text{net income} - \text{preferred dividends})}{\text{weighted average number of shares outstanding}}$$

EPS is also stated before and after extraordinary items.

LOS 36-b

Calculate a company's weighted average number of shares outstanding.

LOS 36-c

Describe stock dividends and stock splits, and **determine** the effect of each on a company's weighted average number of shares outstanding.

Weighted average number of shares

The weighted average number of shares outstanding refers to the shares issued, weighted by the proportion of the period for which they were outstanding. However, in the case of a stock dividend or stock split the additional shares issued are included as if they had been outstanding for the complete period. This is because a stock dividend or stock split does not change the asset base of the firm whereas a new issue will increase the cash position of the firm.

Example 36-1 Weighted average number of shares

Date	Share Changes	Shares Outstanding
January 1st		100,000
February 1st	Issue 10,000 shares for cash	110,000
October 1st	20% stock dividend	132,000
December 1st	Issue 30,000 shares for cash	162,000

First of all, restate the shares outstanding prior to October for the stock dividend, and then work out the percentage of the year the different numbers of shares were outstanding.

Date	Shares Outstanding	Percentage of the Year
January 1st to February 1st	120,000	1/12
February 1st to October 1st	132,000	8/12
October 1st to December 1st	132,000	2/12
December 1st to December 31st	162,000	1/12

The weighted average number of shares outstanding is:

(1/12 x 120,000) + (8/12 x 132,000) + (2/12 x 132,000) + (1/12 x 162,000)

= 133,500

LOS 36-d

Distinguish between dilutive and antidilutive securities and **calculate** a company's basic and diluted EPS in a complex capital structure and **describe** and **determine** the effects of convertible securities, options, and warrants on a company's EPS.

Complex capital structure

Dilutive securities are ones which, if exercised or converted, would lead to lower earnings per share. **Antidilutive securities** are ones which, if exercised or converted, would increase earnings per share.

In a complex capital structure EPS need to be adjusted to take account of the dilutive effect of convertible bonds, options, warrants and any other dilutive securities outstanding.

$$\text{Diluted EPS} = \frac{\text{adjusted income available for common shares}}{\text{weighted average common shares and potential common shares}}$$

In calculating diluted earnings per share each issue must be considered separately to work out whether it is dilutive or antidilutive. Antidilutive issues should not be included in the calculation since they are unlikely to be converted or exercised. Looking at each of the types of security in turn:

Convertible securities

There are two steps to adjusting EPS when convertible securities are outstanding:

1. Adjust the net income for the interest saved (if it is a security that pays interest) if the security is converted into common stock. This must be the after-tax adjustment as interest is a tax deductible expense.
2. Increase the weighted average number of shares assuming that the security is converted.

In both cases the adjustment should be done from the beginning of the period, or the time of issue if it was during the period.

Example 36-2 Convertible bonds

Newington Corporation had net income of $5,000,000. There is $1,000,000 of an 8% convertible bond outstanding. Each bond is convertible into one common share. There are 5,000,000 common shares outstanding over the period (weighted average). The tax rate is 30%.

1. Adjusted net income = $5,000,000 + [$80,000 x (1 - 0.30)] = $5,056,000
2. Adjusted number of shares = 6,000,000

EPS (basic) = $5,000,000/5,000,000 = $1.00

EPS (diluted) = $5,056,000/6,000,000 = $0.84

Options and warrants

When calculating diluted EPS when options or warrants have been issued, it is assumed that proceeds from their exercise are used by the company to repurchase their own stock (treasury stock) at the average market price for the accounting period. However, the option or warrant will only be exercised if the average market price is above the exercise price in the period. This is called the treasury stock method.

Example 36-3 Warrants

Barnsfield Corporation had net income of $3,000,000. There are 600,000 common shares outstanding over the period (weighted average). The average market price of the shares over the year was $70. The company has 100,000 options outstanding, each option gives the holder the right to buy one share at an exercise price of $40.

The proceeds from the exercise of the options would be $4,000,000.

This will be sufficient for the company to buy 57,143 shares (at $70).

Total new shares will be 100,000 - 57,143 = 42,857.

Basic EPS = $5.00.

Diluted EPS = $3,000,000/642,857 = $4.67.

LOS 36-d

Compare and **contrast** the requirements for EPS reporting in simple versus complex capital structures.

In summary the different steps for calculating the basic and diluted EPS are shown below:

Simple capital structure

a. Compute income applicable to common stock (deduct preferred dividends).

b. Compute weighted average number of common shares outstanding.

c. Basic EPS = (net income- preferred dividends)/weighted average number of shares.

Complex capital structure

a. Compute basic EPS.

b. Check each potentially dilutive security to see if it is dilutive or antidilutive, this involves calculating the impact on net income and the adjusted weighted average number of shares, assuming maximum dilution. Only include securities that are dilutive in the final calculation.

c. Diluted EPS = [net income - preferred dividends + interest saving (net of tax)]/(weighted average common shares + potentially dilutive common shares).

37 Seek and Ye Shall Find
38 Searching for Shenanigans

Learning Outcome Statements (LOS)

37-a	**Explain** the two basic strategies underlying all accounting "shenanigans," and **describe** seven categories of technique that may be used by management to distort a company's reported financial performance and financial condition.
37-b	**Identify** conservative and aggressive accounting policies.
37-c	**Describe** why "shenanigans" exist and **explain** where they are most likely to occur.
38-d	**List** the documents that an analyst should use to identify "shenanigans" and **explain** what information to look for in such documents.

Introduction

These Readings look at tricks or shenanigans that companies use to ensure that their reported earnings are in line with expectations. Obviously the intention is often to hide potentially disappointing earnings. The candidate has to be familiar with specific tricks that are used and the impact on the financial statements, and where they need to look for clues that such shenanigans are being used.

LOS 37-a

Explain the two basic strategies underlying all accounting "shenanigans," and **describe** seven categories of technique that may be used by management to distort a company's reported financial performance and financial condition.

"Shenanigans" refer to a company taking steps to deliberately distort its financial results. These can range from relatively benign actions such as changing accounting estimates to committing fraud.

There are two basic strategies underlying accounting tricks – the objective is to either increase current earnings or increase future earnings.

Inflate current period earnings

This is done by inflating current-year revenues and/or deflating current year expenses. See techniques 1, 2, 3, 4 and 5 below.

Deflate current period earnings and inflate future period earnings

Deflate current-year revenues and/or inflate current year expenses. This is done to 'transfer' earnings to a future period when they may be needed.

See techniques 6 and 7 below.

There are seven techniques used to distort financial results:

1. Recording revenue too early, or revenue that is of questionable quality.
   - Recording revenue when future services still need to be provided.
   - Recording revenue before shipment or before the customer has unconditionally accepted the goods/service.
   - Recording revenue when the customer is not obligated to pay.
   - Selling to an affiliate.
   - Giving the customer something of value for doing a transaction.
   - Grossing up revenue.
2. Recording bogus revenue.
   - Recording sales that lack economic substance.
   - Recording cash received in lending transactions as revenue.
   - Recording investment income as revenue.
   - Recording as revenue supplier rebates that are dependent on future purchases.
   - Releasing revenue that was held back prior to a merger.
3. Boosting income with one-time gains.
   - Selling undervalued assets.
   - Including investment income or gains as revenue or as a reduction in operating expenses.
   - Reclassification of balance sheet accounts to generate income.
4. Shifting current expenses to a later or earlier period.
   - Capitalizing rather than expensing normal operating costs.
   - Changing accounting policies to shift current expenses to an earlier period.
   - Amortizing costs too slowly.
   - Failing to write-down impaired assets.
   - Reducing asset reserves.
5. Failing to record or improperly reducing liabilities.
   - Failing to record expenses and related liabilities when future obligations remain.
   - Reducing liabilities by changing accounting assumptions.
   - Releasing questionable reserves into income.
   - Creating false rebates.
   - Recording revenue when cash is received, even though future liabilities remain.
6. Shifting current revenue to a later period.
   - Creating reserves and releasing them into income in a later period.
   - Improperly holding back revenue just before an acquisition closes.

7. Shifting future expenses to the current period as a special charge.
   - Improperly inflating the size of a special charge.
   - Improperly writing off in-process R&D costs from an acquisition.
   - Accelerating discretional expenses in current period.

LOS 37-c

Describe why "shenanigans" exist and **explain** where they are most likely to occur.

Generally companies that use accounting tricks are attempting to cover up a deterioration in operations. Investors may well lose confidence in management (if they detect the shenanigans) and the share price will perform badly.

Why do people resort to shenanigans?

The text gives three reasons:

It pays to do it

Managers' bonuses and stock options are often linked to the performance of the company. Additionally a poor performing division may be threatened with closure so the managers are motivated to artificially boost revenues.

Analysts' should be concerned if they see a company has a compensation structure that is heavily reliant on a company's income.

It's easy to do

Management has significant discretion selecting accounting policies which are acceptable under GAAP. This is because there is flexibility in interpreting GAAP – GAAP can be applied to boost profits, and there is often a time lag between a financial deficiency being noted and changes in GAAP being made. A good manager will select the policies which give a fair view of the company's position; other managers can use the flexibility to distort results.

An analyst should consider whether accounting polices are overly aggressive. For example the method of accounting for inventory, amortization period and revenue recognition policies. Also they should also look at the strength of internal controls and whether they are a deterrent to management adopting unethical policies.

It's unlikely that you will get caught

In many cases manipulating accounts remains undetected by regulators and auditors. Even if they are detected the penalties are not severe.

Although most companies do not distort their financial reports there are certain warning signs to look out for:

- Weak control environment, e.g. lack of independent directors or independent auditor.
- Management under extreme competitive pressure.
- Management which does not have a good reputation.

Pressures may arise when a company's rapid growth rate starts to slow, companies are struggling to survive. Also companies that are newly listed or privately owned that have not been audited and lack strong internal controls have more flexibility to distort accounts.

LOS 37-b

Identify conservative and aggressive accounting policies.

The text looks at two cases, AOL and Medaphis (MEDA). In these cases we find examples of aggressive accounting methods.

Aggressive Accounting Policy	AOL Example
Capitalized normal operating costs	AOL capitalized marketing costs as "deferred subscriber acquisition costs".
Amortized costs too slowly	AOL extended amortization period from 12 to 24 months.
Shifted future expenses to the current period as a special charge	AOL wrote off the "deferred subscriber acquisition costs" as a one-off nonrecurring charge.
	MEDA Example
Recorded revenue too soon	MEDA used percentage-of-completion accounting – recording revenue before products were shipped. Revenue was recorded before billing.
Recorded investment income as revenue	Included net earnings from a joint venture.
Capitalized normal operating costs	MEDA capitalized costs which were the equivalent of 52% of pretax earnings in one year.
Amortized costs too slowly	MEDA extended amortization period from 5 to 7 years.
Operational problems	MEDA's cash flow from operations was deteriorating. MEDA's margins were deteriorating. MEDA had acquired troubled companies.
Shifted future expenses to the current period as a special charge	MEDA recorded a restructuring charge and created reserves.

More generally if company uses conservative accounting principles it suggests that the management is of high quality and has integrity.

A summary of aggressive and conservative accounting policies is shown below:

Accounting Policy	Aggressive	Conservative
Revenue recognition	Recognize revenue when sale made, when risk remains with seller	After sale is made, and risk passed to buyer
Depreciation method	Straight-line method over long period	Accelerated method over short period
Amortization of goodwill	Over 40 years	Over shorter period
Inventory method, if prices rising	FIFO, which will lead to lower costs	LIFO, which will lead to higher costs
Estimate of warranty costs	Low	High
Estimate of bad debts	Low	High
Treatment of advertising costs	Capitalize	Expense
Loss contingencies	Refer to in footnote	Accrue

LOS 38-d

List the documents that an analyst should use to identify "shenanigans" and **explain** what information to look for in such documents.

It is essential that analysts are able to spot indicators that a company has resorted to using shenanigans. The following should be looked at for early signs:

Press releases

Disclosers in press releases, for example warnings that revenues or transactions have not been as positive as previously expected.

Pro forma earnings are an area to watch. Pro forma earnings aim to adjust earnings prepared under GAAP for income items that are not related to the normal operations of the company. They can be useful for new companies or for companies that will be created by a merger. However, there is the temptation to use proforma accounts to present a much more optimistic earnings number than is acceptable under GAAP.

SEC filings

Regular filings with SEC are the main sources of financial information on public companies (in the US). Companies also have to file irregular reports when specific events occur.

Regular filings - annual

Form 10-K – to be filed within 90 days of the fiscal year end. This report contains detailed financial results and must be audited.

Annual report – this is essentially an abbreviated version of form 10-K, and is provided to the shareholders once a year.

Proxy – this contains matters on which shareholders can vote at the annual stockholders' meeting. It also contains information on the directors' and managers' compensation.

Regular filings – quarterly

Form 10-Q – to be filed 45 days after the close of each quarter. It is not audited and less detailed than form 10-K.

Form 8-K- a company must use this form to let the SEC know about special events such as acquisitions, changes in control, or a change in auditor. It must be submitted within 15 days, and in the case of auditor changes within 5 days.

Form 144 – Insiders use this to register when they buy or sell stock.

Registration – A registration statement including a prospectus must be filed when a company plans to issue securities.

International reporting standards are less onerous than those in the U.S.

When an analyst searches for shenanigans they look at the following:

Auditor's report

First of all consider the reputation of the auditor. Then read the report to see whether it contains a 'clean' opinion or if it is 'qualified'. A qualified report might mean that the auditor has reservations about the fairness of the financial statements or the company's financial position. Of particular concern would be a 'going concern' qualification where the auditor is doubtful that the company will continue as a going concern.

An analyst should also be concerned if there is no audit committee including members outside the board of directors. This committee will be a buffer between the company and the auditors.

Proxy statements

These can include important information such as compensation for directors and also lawsuits or continent obligations faced by the company.

Footnotes to the financial statements

These are attached to the financial statements and in many cases provide more information than the statements themselves. They provide details of many subjects including changes in accounting policies, related party transactions and contingencies and long-term purchase commitments. These will give an overall indication of the health of the company and whether the company is using aggressive or conservative accounting principles.

President's letter

Don't expect this to be cautious, most presidents' letters are upbeat. It might be useful to compare letters over the last few years to get an indication of whether the company is operating in more 'challenging' or difficult times. Also look if there have been many changes to top management.

Management discussion and analysis

This should discuss the current financial position, liquidity and planned capital expenditure. Look for consistency with data given in the footnotes.

Form 8-K

Look for a change in auditors; this might have occurred because the previous auditors disagreed with the management's interpretation of GAAP.

Registration statement

If a company has submitted a registration statement this will give information on the past performance of management and the future plans for the business.

Form 144

Major sales of stock by directors might be a warning signal of bad company news ahead.

The next step for an analyst is to visit the company to collect additional information and meet management. SEC guidelines restrict the information given out.

STUDY SESSION 9

Financial Statement Analysis: Assets

Overview

This Study Session looks at some important issues concerning the reporting of assets in financial statements and how different accounting methods can be used. Often the choice of method makes a substantial difference to the reported financial position and profitability of the company. It can also impact on actual cash flows in the form of taxes paid. An analyst needs to consider the necessary adjustments to the reported figures to better understand the underlying position of the company.

In the following Readings we look at two specific issues relating to assets on the balance sheet, these are accounting for inventory and long-lived assets.

Reading Assignments

The Analysis and Use of Financial Statements, 3rd edition, Gerald I. White, Ashwinpaul C. Sondhi, and Dov Fried (Wiley, 2003)

39. "Analysis of Inventories," Ch. 6, pp. 192−215 and pp. 219-220

40. "Analysis of Long-Lived Assets: Part I − The Capitalization Decision," Ch. 7, pp. 227−240, including Box 7-1 and pp. 242−244

41. "Analysis of Long-Lived Assets: Part II − Analysis of Depreciation and Impairment," Ch. 8, pp. 257−278 and pp. 280−282

39 Analysis of Inventories

Learning Outcome Statements (LOS)

39-a	**Compute** ending inventory balances and cost of goods sold using the LIFO, FIFO, and average cost methods to account for product inventory and **explain** the relationship among and the usefulness of inventory and cost-of-goods-sold data provided by the LIFO, FIFO, and average cost methods when prices are 1) stable or 2) changing.
39-b	**Adjust** the financial statements of companies using different inventory accounting methods to **compare** and **describe** the effect of the different methods on cost of goods sold and inventory balances. **Discuss** how a company's choice of inventory accounting method affects other financial items such as income, cash flow, and working capital, and **compute** and **describe** the effects of the choice of inventory method on profitability, liquidity, activity, and solvency ratios.
39-c	**Discuss** the reasons why a LIFO reserve might decline during a given period and **discuss** the implications of such a decline for financial analysis.
39-d	**Discuss** how inventories are reported in the financial statements and how cost, market and net realizable value are generally determined.

Introduction

When a company sells an item of inventory they must assign a cost to the item. In some cases the company records the cost as that of replacing the item of inventory or, more precisely, as that of the last unit of inventory purchased (last-in, first-out or LIFO). In other cases they record it as the cost of the first unit of inventory purchased (first-in, first-out, or FIFO). Another method is to use the average cost of items in inventory. The choice of method will not only have a direct impact on the cost assigned to each unit of inventory sold in the income statement but also on the value of the remaining inventory in the balance sheet. It can also have a real (as opposed to only an accounting) effect on the company since cash flows will reflect the tax paid by the company under the different methods. Candidates will need to able to compute financial statement items using the different methods and to work out the effect on financial ratios.

The material is relatively straightforward and will hopefully provide some easy marks in the exam.

LOS 39-a

Compute ending inventory balances and cost of goods sold using the LIFO, FIFO, and average cost methods to account for product inventory and **explain** the relationship among and the usefulness of inventory and cost-of-goods-sold data provided by the LIFO, FIFO, and average cost methods when prices are 1) stable or 2) changing.

The fundamental relationship between beginning inventory values, ending inventory values, goods purchased and the cost of goods sold is given by:

Equation 39-1

$$EI = BI + P - COGS$$

where: EI = Ending inventory

BI = Beginning inventory

P = Purchases

COGS = Cost of goods sold

Example 39-1 Cost of goods sold

At the beginning of an accounting period the inventory is valued at $50,000. Purchases are made of $30,000 and ending inventory is $45,000. We can use Equation 39-1 to compute the COGS as:

$$COGS = BI + P - EI = \$50{,}000 + \$30{,}000 - \$45{,}000 = \$35{,}000$$

There are three main methods of accounting for the cost of inventory that is sold.

FIFO – First In, First Out means that the cost assigned to the unit sold is the one associated with the unit in inventory that was purchased first. Therefore the units held in inventory are those purchased last.

LIFO – Last In, First Out means that the cost assigned to the unit sold is the one associated with the unit in inventory that was purchased last. Therefore the units held in inventory are those purchased first.

Weighted-Average Cost – Units in inventory are assigned the same average cost as the units sold.

Example 39-2 Accounting for the cost of inventory

A wholesaler had, at the beginning of the year, 1,000 units of inventory, held at a cost of $3.00 per unit. Over the year the company bought 4,200 additional units at steadily increasing prices, as shown in the table below. 4,000 units were sold over the year giving an ending inventory of 1,200 units.

Quarter	Units Purchased	Unit Cost	Units Sold
1	1,000	$3.10	800
2	1,000	$3.20	1,000
3	1,100	$3.30	1,100
4	1,100	$3.50	1,100

Using the different accounting methods we can calculate the COGS and ending inventory values.

FIFO

Under FIFO the first units sold are the ones held in inventory at the beginning of the year, the next are the ones purchased in the first quarter, and so on. The units remaining in the ending inventory are the ones purchased in the third and fourth quarter.

COGS (FIFO)		Ending Inventory (FIFO)	
1,000 units @ $3.00 =	$3,000	100 units @ $3.30 =	$330
1,000 units @ $3.10 =	$3,100	1,100 units @ $3.50 =	$3,850
1,000 units @ $3.20 =	$3,200		
1,000 units @ $3.30 =	$3,300		
4,000	$12,600	1,200	$4,180

Example 39-2 (continued) Accounting for the cost of inventory

LIFO

Under LIFO the first units sold are the last purchased. The units remaining in the ending inventory are the ones held in inventory at the beginning of the year and a portion of those purchased in the first quarter.

COGS (LIFO)		Ending Inventory (LIFO)	
1,100 units @ $3.50 =	$3,850	1,000 units @ $3.00 =	$3,000
1,100 units @ $3.30 =	$3,630	200 units @ $3.10 =	$ 620
1,000 units @ $3.20 =	$3,200		
800 units @ $3.10 =	$2,480		
4,000	$13,160	1,200	$3,620

Weighted-average method

The average cost per unit is calculated on based on the units in the beginning inventory plus the units purchased.

Total cost

= (1,000 x $3.00) + (1,000 x $3.10) + (1,000 x $3.0) + (1,100 x $3.30) + (1,100 x $3.50)

= $16,780

$$\text{Average cost} = \frac{\$16{,}780}{5{,}200} = \$3.23$$

$$\text{COGS} = 4{,}000 \times \$3.23 = \$12{,}908$$

$$\text{Ending inventory} = 1{,}200 \times \$3.23 = \$3{,}872$$

Since unit costs are rising over the period, COGS under FIFO, which takes the cost of items sold as the cost of the first items bought, will be the lowest of the three methods. As a result the remaining inventory will have the highest value.

Applying Equation 39-1 we can check the calculations:

	EI	=	BI	+	P	–	COGS
FIFO	$4,180	=	$3,000	+	$13,780	–	$12,600
LIFO	$3,620	=	$3,000	+	$13,780	–	$13,160
Weighted-average	$3,872	=	$3,000	+	$13,780	–	$12,908

Balance sheet

We can see from the Example 39-2 that if prices rise over a long period then the value of inventory under LIFO or the average cost method will give little indication of the inventory's current value or replacement cost. When analyzing a balance sheet FIFO is generally preferred since the inventory value is closer to its economic value. (GAAP requires the lower-of-cost-or-market valuation for inventories, where market value is defined as replacement cost).

Income statement

If net income is defined as the amount available for distribution to shareholders without impairing a company's operations it would be generally relevant to consider the cost of goods sold to be the replacement cost of the goods. In this case LIFO would be more relevant than FIFO or the average cost method.

LOS 39-b

Adjust the financial statements of companies using different inventory accounting methods to **compare** and **describe** the effect of the different methods on cost of goods sold and inventory balances, **discuss** how a company's choice of inventory accounting method affects other financial items such as income, cash flow, and working capital, and **compute** and **describe** the effects of the choice of inventory method on profitability, liquidity, activity, and solvency ratios.

LIFO versus FIFO – impact on income statement and balance sheet

In a period when prices are *rising* and inventory quantities are stable or increasing the impact on the financial statements is shown below. The opposite will hold if prices are decreasing.

	LIFO	FIFO	
COGS	Higher	Lower	Under LIFO costs are assigned to units purchased the most recently
Income before tax	Lower	Higher	Since costs are higher, income before tax under LIFO will be lower
Tax	Lower	Higher	If LIFO is permitted for income tax calculation, the tax paid will be lower
Net income	Lower	Higher	
Cash flows	Higher	Lower	The tax payment is lower under LIFO
Inventory balances	Lower	Higher	Under LIFO the goods in inventory are those purchased the first
Working capital	Lower	Higher	Under LIFO these are reflecting lower inventory, although this is partially offset by lower tax payments increasing cash*

*This is illustrated in the Example 39-2 where, using LIFO, with a tax rate of 40%,

COGS is higher by \$13,160 - \$12,600 = \$560

Tax saving is \$560 x 40% = \$224

Ending inventory is lower by \$4,180 - \$3,620 = \$560

Working capital is lower by \$336

It should be noted that the main economic impact (as opposed to accounting difference) is the tax payable which will impact on actual cash flows.

The average cost method will result in financial statement items between those calculated by FIFO and LIFO.

When prices are rising, inventories using LIFO will have little economic relevance. Therefore companies using LIFO are required to disclose the LIFO reserve, which is needed to make the adjustment to quoting inventories under FIFO.

LIFO reserve is defined by:

Equation 39-2

$$\text{Inventory}_{\text{FIFO}} = \text{Inventory}_{\text{LIFO}} + \text{LIFO Reserve}$$

where $\text{Inventory}_{\text{FIFO}}$ refers to inventory calculated using the FIFO method and so on.

Combining Equation 39-2 with Equation 39-1: $EI = BI + P - COGS$ gives the following equation:

Equation 39-3

$$\text{COGS}_{\text{FIFO}} = \text{COGS}_{\text{LIFO}} - \text{Change in LIFO Reserve}$$

Change in LIFO Reserve is LIFO reserve at the end of the period less LIFO reserve at the beginning of the period, so it is positive if the reserve is increasing.

Example 39-3 LIFO reserve

A company uses **LIFO** in presenting its financial statements which include the following data:

	Year 1	*Year 2*
Inventories	58	67
COGS	355	475
LIFO reserve	42	52

Restating the accounts under **FIFO**, using Equations 39-2 and 39-3:

	Year 1	*Year 2*
Inventories	100	119
COGS		465

Adjustment of income to current cost income

Here we consider the adjustments to FIFO and average cost COGS calculations to arrive at an estimate for COGS under LIFO.

Equation 39-4

$$\text{COGS}_{\text{LIFO}} = \text{COGS}_{\text{FIFO}} + \left(\text{Beginning Inventory}_{\text{FIFO}} \times \text{r}\right)$$

Equation 39-5

$$\text{COGS}_{\text{LIFO}} = \text{COGS}_{\text{W}} + \left(\text{Beginning Inventory}_{\text{W}} \times \text{r}/2\right)$$

where

r is the specific inflation rate for the goods being held as inventory.

$\left(\text{Beginning Inventory}_{\text{FIFO}} \times \text{r}\right)$ and $\left(\text{Beginning Inventory}_{\text{W}} \times \text{r}/2\right)$ are estimates of the gain in value of the inventory under FIFO and the weighted average method, respectively.

The inflation rate, r, may be readily available. For example if the inventory is a commodity the quoted spot price for the commodity can be used. If this is not the case r can be estimated by looking at the LIFO reserve of a competing firm in the same industry and:

Equation 39-6

$$\text{r} = \frac{\text{Change in LIFO Reserve}}{\text{Beginning Inventory}_{\text{FIFO}}}$$

Example 39-4 LIFO effect

An oil producer uses FIFO accounting and reports the following:

$ million	2004	2005
COGS	1,250	1,300
Ending Inventory	220	180

If the oil price rose by 10% over 2005, then the adjustment to the 2005 COGS to arrive at a current cost COGS (the LIFO effect) is:

$$\text{Beginning Inventory}_{\text{FIFO}} \times r = \$220 \text{ million} \times 10\% = \$22 \text{million}$$

This reflects the gain in value of the inventory that has been included in the income under FIFO, since COGS under FIFO are understated by this amount.

Using Equation 39-5

$$\text{COGS}_{\text{LIFO}} = \text{COGS}_{\text{FIFO}} + (\text{Beginning Inventory}_{\text{FIFO}} \times r)$$

= $1,300 million + $22 million = $1,322 million

Financial ratios under LIFO and FIFO

Generally an analyst should use LIFO when calculating ratios from an income statement and FIFO for ratios from a balance sheet.

Gross profit margin: LIFO is more accurate, when prices are rising FIFO will overstate margins since it includes holding gains due to the rising prices.

Working capital ratios: FIFO is more accurate, when prices are rising; inventory under LIFO will be understated leading to understated working capital.

Inventory turnover: use LIFO for COGS and FIFO for inventories, this gives the best approximation of current costs in both the numerator and denominator in the inventory turnover calculation.

Debt to equity ratio: stockholders' equity (if LIFO is used) should be increased by the LIFO reserve. This is a follow through from inventories being understated under LIFO.

LOS 39-c

Discuss the reasons why a LIFO reserve might decline during a given period and **discuss** the implications of such a decline for financial analysis.

A decline in LIFO reserves may be due to:

1. Liquidation of inventories

If the old inventory was carried at a very low cost the use of this inventory could result in abnormally high profits since LIFO costs are much lower than current costs. This is called LIFO liquidation and it might reflect that the company is in decline and production is being cut. In the case of LIFO liquidations an analyst should exclude the gains from using old inventory from the operating results.

2. Price declines

If prices fall, the difference between LIFO and FIFO cost inventories will also fall leading to a lower LIFO reserve. This means that the LIFO inventory values are not current and should be adjusted. However whereas LIFO based costs are current and should be used, as in the case of rising prices.

LOS 39-d

Discuss how inventories are reported in the financial statements and how cost, market and net realizable value are generally determined.

Historically the LIFO method was used principally in the U.S. with FIFO or weighted-average methods used in other countries. LIFO is not popular outside the U.S., partly because LIFO, although allowed for financial reporting, is not generally permitted for income tax reporting.

Under IASB Standards, FIFO and the weighted-average methods are the benchmark treatments, although LIFO is an allowed alternative. If a firm uses LIFO it must provide FIFO/weighted-average or current cost disclosures.

Inventories are reported at the lower of cost (depends on method used) or market value (net realizable value).

40 Analysis of Long-Lived Assets, Part 1 – The Capitalization Decision

Learning Outcome Statements (LOS)

40-a	**Compute** and **describe** the effects of capitalizing versus expensing on net income, shareholders' equity, cash flow from operations, and financial ratios and **explain** the effects on financial statements and the interest coverage (times interest earned) of capitalizing interest costs, and **explain** the circumstances in which intangible assets, including software development costs and research and development costs, are capitalized.
40-b	**Calculate** and **describe** both the initial and long-term effects of asset revaluations on financial ratios.

Introduction

Now we turn to long-term assets which are not, as in the case of inventory, held for the purpose of selling to customers. Examples would be plant and machinery, computer software and patents. This Reading centers on the rationale behind, and the impact of, a decision to expense versus capitalize the cost of these assets. Candidates need to know the effects of these decisions on the financial statements and ratios.

LOS 40-a

Compute and **describe** the effects of capitalizing versus expensing on net income, shareholders' equity, cash flow from operations, and financial ratios and **explain** the effects on financial statements and the interest coverage (times interest earned) of capitalizing interest costs, and **explain** the circumstances in which intangible assets, including software development costs and research and development costs, are capitalized.

Long-lived assets are ones that are not bought for re-sale but are used in the company's operations. They include tangible fixed assets as well as intangible assets.

Costs incurred in the acquisition of a long-lived asset prior to it being used should normally be capitalized (including invoice costs, delivery costs, sales tax and installation costs). However there are differences in accounting treatment between firms for a number of items, such as

- Which components of acquisition costs should be capitalized (e.g. interest costs during construction)?
- Should research and development and software development costs be capitalized?
- Which accounting method should be used to decide the amount of costs that will be capitalized?

Example 40-1 Capitalizing versus expensing

We look at a very simplified example of two companies, each starts with an asset base of $10 million which generates income of $1,000,000, and neither pay tax. Company A purchases an asset which costs $1 million and their policy is to capitalize the cost, spreading the cost equally over a five year asset life. Company B also purchases an asset which costs $1 million but expenses the cost. The new asset generates income of $300,000 per year for each company, before accounting for the cost of the asset.

In the second year companies A and B each purchase an additional asset at a cost of $2 million which generates an additional income of $600,000 a year and has a five year life. Company A and Company B capitalize and expense the cost, respectively.

Income	Company A	Company B
Year 1		
Income	$1,300,000	$1,300,000
Less cost of asset	$200,000	$1,000,000
Net income	$1,100,000	$300,000
Year 2		
Income	$1,900,000	$1,900,000
Less cost of assets	$200,000 + $400,00	$2,000,000
Net income	$1,300,000	($100,000)
Year 3		
Income	$1,900,000	$1,900,000
Less cost of assets	$600,000	0
Net income	$1,300,000	$1,900,000
etc.		
Balance Sheet		
Year 1		
Assets	$11,000,000 - $200,000 = $10,800,000	$10,000,000
Year 2		
Assets	$12,800,000 - $200,000 -$400,000 = $12,200,000	$10,000,000
Year 3		
Assets	$11,600,000	$10,000,000
etc.		

This illustrates that Company A's decision to capitalize assets increases income in the first two years and leads to a higher asset base. Company B has lower income in the first two years as the complete cost of the assets is expensed, and the company has a lower asset base.

If we continued the example over time, with each company purchasing further assets, we can see the impact of the capitalizing/expensing decision as shown below.

Impact of capitalizing versus expensing costs

- A company that capitalizes costs will have more stable earnings – capitalized costs will be depreciated over a period of time, whereas costs that are expensed will be charged in one period's accounts. As a company gets larger the variability of earnings will tend to decline.
- Capitalizing costs will tend to increase profitability of a young company since the depreciation cost will be spread over several years, rather than expensing which will have a greater immediate impact. However as the company matures, from a return on equity viewpoint, expensing costs will give a higher return on equity or return on assets since the asset base will be lower.
- The components of cash flow will be different depending on the choice to capitalize or expense costs. If costs are capitalized they will be recorded in the cash flow from investments rather than the cash flow from operations. If costs are expensed they will be recorded in the cash flow from operations. Cash flow from operations will always be higher for a company that capitalizes costs.
- Companies that capitalize costs will have a higher asset base. This will mean that debt to equity ratios will be lower for companies that capitalize rather than expense costs.

Capitalization of interest

In the U.S. it is required to capitalize interest costs on funds used during construction of a long-lived asset, if the company has borrowings. The calculation of interest costs is simplified if specific borrowing has been arranged for a project, the interest cost of this borrowing is the amount capitalized. In the case that there is no separate financing for a project, the weighted average interest rate on the company's outstanding debt is used to calculate the interest cost.

The text argues that this treatment is inconsistent because the cost of equity is not capitalized if the firm has no borrowing. Therefore the costs being capitalized result from a financing decision rather than an operating decision. For the purpose of analysis, interest that has been capitalized should be reversed and treated as an expense.

The impact of reversing the capitalization of interest will be:

1. Capitalized interest is added back to interest expense. This will reduce net income.
2. The amortization of interest must be added back if it is a significant amount.
3. Cash flow statements must be adjusted. The interest that was capitalized must be added back to cash flow from investment and deducted from operating cash flow.
4. The interest cover ratio must be adjusted to include the capitalized interest; otherwise the interest expense will be understated, leading to the interest cover being overstated.

Internationally there is no single rule whether interest costs during construction or acquisition of assets are capitalized or expensed.

Capitalization of intangible assets

Intangible assets are identifiable resources controlled by companies that are not tangible and do not have physical substance. Over recent years the growth of internet, telecommunication and service industries has increased the importance of analyzing the accounting treatment of intangible assets.

In general, when an intangible asset is acquired from a third party it is capitalized on the balance sheet at the acquisition costs, which is assumed to represent its market value. In other cases when the asset is internally generated or granted by a government, one alternative would be to value the asset at cost, although in practice this may be difficult to calculate.

Research and development costs

The benefits from research and development spending will usually only come through in the medium to long term and due to the uncertainty of any benefit materializing, research and development spending is expensed in the U.S. Outside of the U.S. different treatment is allowed, including capitalization of development costs when the following requirements are met:

1. The product (or process) is clearly defined.
2. Costs can be clearly identified.
3. Technical feasibility has been established.
4. The firm intends to use the product (or process).
5. The market has been clearly identified.
6. The firm has sufficient resources to complete the project.

IAS require that companies expense research costs.

Patents and copyrights

All costs, with the exception of legal fees, incurred in developing patents or copyrights are expensed. However, if they are purchased from another party the complete cost is capitalized.

Under U.S. law, patents have a legal life of 17 years and copyrights of 50 years beyond the creator's life. However, in many cases they should be amortized over a shorter period reflecting their economic life.

Franchises

The franchisee should capitalize the cost of purchasing franchise rights.

Brand names and trademarks

These can only be capitalized if acquired from a third party. U.S. GAAP and IAS state that they must be expensed if internally generated. IAS applies the same rule to similar items such as customer lists.

Advertising costs

Generally it is difficult to measure the benefit of advertising, and advertising costs are expensed. However, direct response advertising costs can be capitalized.

Goodwill

This is the difference between the amount paid for an acquired company and the fair market value of its net assets. It can only be recognized when acquisitions are accounted for using the purchase method.

Software development costs

U.S. accounting rules cover the accounting for development costs for software being developed for sale or lease to other parties. Up to economic feasibility being established software development costs must be expensed, thereafter costs can be capitalized as part of product inventory. This means that they will be amortized using the straight-line method or based on product revenues.

LOS 40-b

Calculate and **describe** both the initial and long-term effects of asset revaluations on financial ratios.

Asset revaluation

IASB standards permit revaluations of fixed assets, although U.S. GAAP does not. Although under IAS the benchmark treatment is to use historic cost less accumulated depreciation, fixed assets can be valued at fair value less accumulated depreciation as long as all items in an asset class are revalued and revaluation is done on a regular basis. Revaluations below historic cost must be reported in income otherwise they are reported directly to equity (unless they are reversing a previous write down).

An increase in value of fixed assets will increase depreciation charges in the future reducing future net income. The asset value and equity will increase which will reduce return on asset and return on equity ratios over the long term.

41 Analysis of Long-Lived Assets, Part 2 – Analysis of Depreciation and Impairment

Learning Outcome Statements (LOS)

41-a	**Identify** the different depreciation methods and **discuss** how the choice of depreciation method affects a company's financial statements, ratios, and taxes. **Explain** the role of depreciable lives and salvage values in the computation of depreciation expenses, and **compute** and **describe** how changing depreciation methods or changing the estimated useful life or salvage value of an asset affects financial statements and ratios.
41-b	**Discuss** the use of fixed asset disclosures to compare companies' average age of depreciable assets, and **calculate**, using such disclosures, the average age and average depreciable life of fixed assets.
41-c	**Define** impairment of long-lived assets and **explain** what effect such impairment has on a company's financial statements and ratios.
41-d	**List** the requirements of SFAS 143, Accounting for Asset Retirement Obligations (AROs), and **explain** the likely financial statement and ratio effects for most firms.

Introduction

Moving on from the previous Reading, we now look in more detail at the accounting treatment of long-lived assets on the balance sheet and income statements. We compare the effects of using different methods of depreciating, or allocating the cost, of tangible assets over their useful life. Candidates will need to be able to compute depreciation expense and net book values using straight-line and accelerated methods. Also candidates need to be familiar with the accounting treatment of impairment of assets which must be recognized when the value of an asset on the balance sheet is more than the cash flows that will be generated by the asset.

LOS 41-a

Identify the different depreciation methods and **discuss** how the choice of depreciation method affects a company's financial statements, ratios, and taxes. **Explain** the role of depreciable lives and salvage values in the computation of depreciation expenses, and **compute** and **describe** how changing depreciation methods or changing the estimated useful life or salvage value of an asset affects financial statements and ratios.

Depreciation is the allocation of the cost of property, plant or equipment over its useful life. It is important to appreciate that this is quite different to estimating the fair value of assets. It is a method used to calculate the book value of assets reported in financial statements.

Depletion is allocation of the cost of natural resources on the basis of the rate of extraction or production, usually the units-of-production method is used.

Amortization is applied to intangible assets such as patents, trademarks, and goodwill.

Different methods of calculating depreciation

Annuity or sinking fund appreciation

When this method is used the rate of return earned on the asset determines the depreciation expense. This method is not allowed under U.S. GAAP.

Example 41-1 Annuity approach

An asset costs $3 million and generates a return of 10% over a three-year life. It generates a cash flow of $1.2 million per year and will have zero value at the end of three years. The depreciation expense will increase over time in order for the rate of return to be constant.

Values in $millions

Year	Opening Balance Asset Value	Cash Flow	Net Income (opening balance x 10%)	Depreciation Expense (cash flow - net income)	Return
1	$3.00	$1.20	$0.30	$0.90	10%
2	$2.10	$1.20	$0.21	$0.99	10%
3	$1.11	$1.20	$0.11	$1.09	10%

The depreciation in the final year should lead to a zero balance at the end of year 3 (errors are due to rounding).

Straight-line depreciation

This is the method of depreciation that is the most commonly used in the U.S. and internationally.

The straight-line method allocates equal depreciation expenses over each year of the asset's life.

Equation 41-1

Depreciation expense in each year:

$$= \frac{1}{n} \times (\text{Original Cost} - \text{Salvage Value})$$

where

n = depreciable life in years.

Example 41-2 Straight-line depreciation

Using the example above of an asset that costs $3 million generates a cash flow of $1.2 million per annum and has zero salvage value, we can calculate straight-line depreciation as shown below:

Values in $millions

Year	Opening Balance Asset Value	Cash Flow	Depreciation Expense	Net Book Value	Net income	Return
1	$3.00	$1.20	$1.00	$2.00	$0.20	6.7%
2	$2.00	$1.20	$1.00	$1.00	$0.20	10.0%
3	$1.00	$1.20	$1.00	$0.00	$0.20	20.0%

The net book value is the original cost less the accumulated depreciation.

Note that the rate of return is increasing over the asset's life.

Accelerated depreciation methods

These depreciation methods attempt to match higher depreciation costs with the greater benefits that can be generated from an asset when it is new. Additionally the maintenance costs are usually higher for an asset when it is old and therefore an accelerated method will tend to lead to more consistent total costs for each year of an asset's life.

Since accelerated depreciation methods give higher depreciation costs in the early years they are often used for tax reporting. There are two main accelerated depreciation methods, the **sum-of-years'-digits method** and the **declining-balance** method.

1. *Sum-of-years'-digits method (SYD)*

The depreciation expense in year *i* is given by:

Equation 41-2

$$\text{Depreciation Expense} = \frac{(n - i + 1)}{SYD} \times (\text{Original Cost} - \text{Salvage Value})$$

where

n = depreciable life in years

i = the year for which the depreciation is being calculated.

$$SYD = (1 + 2 + K \;\; K + n) = n(n + 1)/2$$

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2. *Double-declining-balance method*

(An example of a declining-balance method, double since the rate is **2**/n)

In this method the depreciation expense is based on the net book value, or original cost less the accumulated depreciation, of the asset.

Equation 41-3

$$\text{Depreciation Expense} = \left(\frac{2}{n}\right) \times (\text{Original Cost - Acc. Deprec. Expense})$$

where

n = depreciable life in years

Using this method we need to continue to depreciate the asset until the book value is the same as the salvage value. In many cases when the depreciation expense falls below that calculated using the straight-line rate method a company would switch to using the straight-line method for the remainder of the asset's life.

Example 41-3 Accelerated depreciation methods

Assume that an asset has a depreciable life of 3 years, costs $800,000 and has a salvage value of $200,000.

Sum-of-Years'-Digits Method

Using Equation 41-2

$$\text{Depreciation expense in year i} = \left[\frac{(3-i+1)}{6}\right] \times (\$800{,}000 - \$200{,}000)$$

Year	Rate	Depreciation Expense	Accumulated Expense	Net Book Value
0				$800,000
1	3/6	$300,000	$300,000	$500,000
2	2/6	$200,000	$500,000	$300,000
3	1/6	$100,000	$600,000	$200,000

Double-Declining-Balance Method

Using Equation 41-3

$$\text{Depreciation expense in year i} = \left(\frac{2}{n}\right) \times (\text{Original Cost - Acc. Deprec. Expense})$$

Year	Rate	Depreciation Expense	Accumulated Depreciation	Net Book Value
0				$800,000
1	2/3	$533,333	$533,333	$266,667
2	2/3	$66,667	$600,000	$200,000
3	2/3	$0	$600,000	$200,000

It is important to note that in year 2 the full depreciation expense according to the formula is not charged (it is calculated as $177,778) since the asset's book value has already reached the salvage value.

Units-of-production and service hours method

These methods calculate the depreciation expense based on usage of the asset. This method will reduce the volatility of earnings since depreciation becomes a variable expense. The disadvantage is that if the company loses competitiveness and/or machinery becomes obsolete leading to lower production the depreciation expense is also declining, but this is the time that the machinery is losing most economic value.

The service hours method bases the depreciation on the number of service hours that the asset is expected to operate for.

Example 41-4 Units-of-production method

Use the data on the asset in Example 41-3, which costs $800,000 and has a salvage value of $200,000, and assume that the asset is a piece of machinery that has a total expected output of 120,000 units, 40,000 in the first year, 50,000 in the second year and 30,000 in the third year. The cost per unit is ($800,000 - $200,000)/120,000 = $5.

Year	Units of Output	Depreciation Expense	Accumulated Depreciation	Net Book Value
0				$800,000
1	40,000	$200,000	$200,000	$600,000
2	40,000	$250,000	$450,000	$350,000
3	30,000	$150,000	$600,000	$200,000

Depletion

The accounting treatment for natural resources is similar to those for tangible assets. The cost of acquisition of the resources including exploration and development may be capitalized or expensed. The carrying cost is allocated by the units-of-production method based on the initial estimate of the units in the resource base.

Amortization

Intangible assets can be amortized over their useful lives or the periods set by law or regulations. Straight-line or units-of-production methods are used.

Impact of choice of depreciation method on the financial statements

At the beginning of an asset's life

Using accelerated depreciation methods reduces net income and stockholders' equity compared with straight-line methods. The percentage effect on net income is usually greater than that effect on asset values so return ratios (ROE and ROA) tend to be lower.

These methods are considered more conservative.

At the end of an asset's life

Using accelerated depreciation methods increases net income compared with straight-line methods.

For a growing company with rising capital expenditure depreciation expense will usually continue to be higher if they are using accelerated depreciation methods.

Accelerated depreciation methods are considered more conservative but are usually used to decrease the tax burden.

Inflation

In a period of high inflation it is likely that the total depreciation expense over the asset's life will be insufficient to replace the asset, so in effect the depreciation expense has been too low since it is based on historical cost. In this case the firm has effectively over-stated income and the tax paid is too high, and taxes become a tax on capital.

If inflation is an issue, using accelerated depreciation methods and short asset lives will increase the depreciation expense.

Although companies may use the same depreciation methods, comparison between companies' accounts is made difficult if they have different estimates for depreciable lives (useful lives) and salvage values. The assumptions may not be completely transparent – for example companies providing information on useful lives often give the range of periods used rather than precise numbers.

Using long depreciable lives will underestimate annual depreciation expenses. Similarly using high salvage values will reduce the depreciation base (cost minus salvage value) and depreciation expense.

Changes in depreciation method

A company can:

A. Change the method and only apply to newly acquired assets.

Usually this change will have a gradual impact on results since previously acquired assets will be depreciated under the old method. It is not necessary to restate past earnings.

B. Change the method and apply to all assets.

If the change is applied retroactively it will be considered a change in accounting principle and the cumulative effect must be reported separately, net of taxes, in the financial statements. The company must disclose the pro forma impact on prior period results.

C. Change asset lives or salvage values.

These are changes in accounting estimates rather than accounting principles, no retroactive or cumulative changes need to be recognized.

LOS 41-b

Discuss the use of fixed asset disclosures to compare companies' average age of depreciable assets, and **calculate**, using such disclosures, the average age and average depreciable life of fixed assets.

Analysis of fixed asset disclosures

Fixed asset data in a company's financial statements can be used to calculate the age of a company's property, plant and equipment. This is useful information since older assets can be less efficient and it will also give an indication if major capital expenditure will be needed in the future. The data can be used to compare firms in similar industries.

If **straight-line depreciation methods** are used the formulae are:

Relative Age as Percentage of Depreciable Life

This gives the average age of assets as a percentage of their useful lives and indicates whether the asset base is old or new.

Equation 41-4

Relative Age (%)

= Accumulated Depreciation/Ending Gross Investment

Average Depreciable Life

This can give useful information of a company's depreciation policy although it will be influenced by the mix of assets the company is using.

Equation 41-5

Average Depreciable Life

= Ending Gross Investment/Depreciation Expense

Average Age

This will give the approximate age of the company's assets, although again it will be distorted by the mix of assets and any acquisitions.

Equation 41-6

Average Age

= Accumulated Depreciation/Depreciation Expense

Example 41-5 Average age and depreciable life

Cobham Industries and Byfleet Industries are both manufacturers of engine parts and the following information is provided on their fixed assets for the previous year:

Machinery and Equipment	Cobham Inds. ($mn)	Byfleet Inds. ($mn)
Gross Investment	15,600	5,800
Accumulated Depreciation	6,200	1,200
Net Investment	9,400	4,600
Depreciation Expense	750	400
Relative Age %	39.7%	20.7%
Average Depreciable Life	20.8 years	14.5 years
Average Age years	8.3 years	3.0 years

The relative age as a percentage of the depreciable life of assets is much higher for Cobham Inds. This is probably explained by the fact that Byfleet Inds. purchased the machinery more recently.

The average depreciable life is longer for Cobham Industries – this may be the result of a different asset mix or a policy to assume longer depreciable lives. The average depreciable life will also be shortened if one company takes over another company and sets the depreciation balance of the acquired assets to zero.

For Byfleet Inds. the average age is much lower indicating recent heavy capital expenditure or acquisitions.

LOS 41-c

Define impairment of long-lived assets and **explain** what effect such impairment has on a company's financial statements and ratios.

Impairment of long-lived assets

Impairment is when the carrying value of a long-lived asset cannot be recovered from the expected future level of operations.

Impairments refer to both when a company has decided to dispose of an asset (not discussed here) and to when it will continue to use an asset, albeit at a reduced level.

Accounting standards say that impairment must be recognized when the value of an asset cannot be recovered. Indicators of this include:

- Cost overruns.
- Deterioration in the business environment.
- A significant decrease in the market value of the asset.
- Operating or cash flow losses and a forecast of a decline in the long-term profits that will be derived from an asset.

Impairment must be recognized when the carrying value of an asset is higher than the expected future cash flows from its use plus its disposal value. (Note, these are undiscounted cash flows).

If impairment is recognized then the value of the loss must be calculated. The loss is either the difference between the carrying cost and the fair value (less the cost to sell the asset); or, if the fair value cannot be determined, it is the difference between the carrying cost and the discounted value of future cash flows. They should be discounted at the company's marginal cost of borrowing.

The loss is reported in pretax income but is not recognized for tax purposes until the asset is disposed of.

The major impacts on the balance sheet will be to reduce:

(i) Carrying value of plant and equipment.
(ii) Deferred tax liabilities (since the reduction in value is not recognized for tax purposes until sale – see Study Session 10 Reading 42 for more on deferred tax).
(iii) Stockholders' equity.

In turn this will increase asset turnover ratios and increase the debt-to-equity ratio.

In the future, impairment write-offs will lead to lower depreciation expense, leading to higher reported earnings and higher return on assets and return on equity. Also the average age of the assets will appear to be extended.

LOS 41-d

List the requirements of SFAS 143, Accounting for Asset Retirement Obligations (AROs), and **explain** the likely financial statement and ratio effects for most firms.

The requirements of SFAS 143 come into effect for fiscal years starting after June 15th 2002 and are concerned with Asset Retirement Obligations (AROs). This refers to costs associated with retiring assets such as companies being obliged to remedy environmental damage caused by their operations or restore land to its pre-existing condition. This might include removing toxic waste, removing offshore oil platforms at the end off their life etc.

The provisions of SFAS 143 are as follows:

- It applies to all entities and to all legal obligations connected with the retirement of tangible fixed assets.
- Affected firms must recognize the fair value of an ARO liability in the period when it is incurred (normally at acquisition).
- Fair value is market value, but if there is no market value use the present value of the expected cash flows required to extinguish the liability, (discount at the credit-adjusted risk-free rate).
- The liability is carried at fair value, and an accretion expense recognized in the income statement for each period. (Accretion expense is calculated using an interest method – this increases the company's interest expense).
- An amount equal to the initial liability is added to the carrying value of the asset, and depreciated over its useful life.
- Changes in the estimated value of the ARO liability are accounted for prospectively, and prior years' accounts are not restated.
- Disclosures include:
  - Description of the ARO and associated asset.
  - Reconciliation of the ARO liability showing new liabilities incurred and liabilities extinguished, accretion expense, revision of the estimated AROs.
  - Fair value of any funds set aside to meet ARO obligations.

Effects on the financial statements

Companies that follow SFAS 143 will generally see:

- Increase in the carrying value of fixed assets (as the present value of future liabilities is added to asset values).
- Increase in liabilities (as the ARO is added to liabilities).
- Lower net income due to higher depreciation expenses and accretion expense (the accretion expense will tend to increase each year).

The effect on financial ratios is:

- Lower asset turnover (assets are higher).
- Lower/higher debt to equity (retained earnings lower, but depends on whether ARO is considered debt or operating liability).
- Lower return on assets.
- Lower interest coverage (lower income, higher interest expense).

STUDY SESSION 10

Financial Statement Analysis: Liabilities

Overview

This is another Study Session containing important topics in financial statement analysis. The first Reading looks at tax and the differences between accounting for tax in financial statements and in tax reports. The differences give rise to deferred tax assets and liabilities when tax is 'overpaid' or 'underpaid' according to the financial statements. In addition to mastering the different terminology used in the reporting systems, candidates need to understand the details of how deferred tax items are created and recorded.

The last two Readings tackle analysis of liabilities. First we look at financial liabilities where there is debt as a result of a financing decision. Generally debt is recorded on the balance sheet as the present value of future cash flows (interest and principal repayment) that the company will need to pay on the debt. The Reading focuses on the impact on the financial statements of issuing bonds when they are issued at a premium or discount to par value. Next we look at contractual liabilities such as leases and other forms of off-balance-sheet debt. Candidates need to differentiate between the effect of companies using operating leases (which are an expense and not recorded on the balance sheet) and using capital leases (where the accounting treatment is similar to the company actually owning the asset).

Reading Assignments

The Analysis and Use of Financial Statements, 3rd edition, Gerald I. White, Ashwinpaul C. Sondhi, and Dov Fried (Wiley, 2003)

42. "Analysis of Income Taxes," Ch. 9, pp. 290−314 (including Box 9-1 and 9-2)
43. "Analysis of Financing Liabilities," Ch. 10, pp. 322−332, 337−343
44. "Leases and Off-Balance-Sheet Debt," Ch. 11, pp. 363−383 (including Box 11-1) and pp. 386-393

42 Analysis of Income Taxes

Learning Outcome Statements (LOS)

42-a	**List** and **explain** the key terms used in income tax accounting, **explain** why and how deferred tax liabilities and assets are created, and **describe** the liability method of accounting for deferred taxes.
42-b	**Discuss** the implications of a valuation allocation (i.e. when it is required, what impact it has on the financial statements, and how it might affect an analyst's review of a company).
42-c	**Explain** the factors that determine whether a company's deferred tax liabilities should be treated as a liability or as equity for purposes of financial analysis.
42-d	**Distinguish** between temporary and permanent items in pretax financial income and taxable income.
42-e	**Compute** income tax expense, income taxes payable, deferred tax assets, and deferred tax liabilities.
42-f	**Calculate** the adjustment to the financial statements related to a change in the tax rate.

Introduction

The objectives of financial reporting are to produce statements that are useful to assess the financial position and performance of the company and there is an incentive to reduce the taxes that will have to be paid in the near term. However tax reporting is based on different objectives and often taxable income is calculated using modified cash methods. This, plus differences in reporting methods and estimates, results in differences between income tax expense on the financial statements and taxable income on tax reports. The differences give rise to deferred tax assets (which the company can reclaim in the future) or deferred tax liabilities (which the company must pay in the future). Candidates need to able to differentiate between temporary and permanent differences between the two reporting systems.

The Study Guide says that deferred taxes are applicable globally and therefore are the focus of the Reading Assignment. We look at accounting differences that create deferred tax assets and liabilities in the notes below.

LOS 42-a

List and **explain** the key terms used in income tax accounting, **explain** why and how deferred tax liabilities and assets are created, and **describe** the liability method of accounting for deferred taxes.

Terms used in income tax accounting

The terms used in the financial statements and tax returns are different; the most important terms are shown below:

Tax Return	
Taxable income	Income subject to tax
Taxes payable (current tax expense)	Tax return liability as a result of current period's taxable income
Income tax paid	Actual cash flow of income taxes paid, including payment made for other years
Tax loss carryforward	Loss that can be used to reduce taxable income in future years
Financial Reporting	
Pretax income	Income before income tax expense
Income tax expense	Expense as a result of current period's pretax income. Includes taxes payable and deferred income tax expense
Deferred income tax expense	Accrued income tax expense expected to be paid in future years. It is the difference between income tax expense and taxes payable. Under SFAS 109 it depends on the change in deferred tax assets and tax liabilities.
Deferred tax asset	Balance sheet amount, expected to be recovered from future operations
Deferred tax liability	Balance sheet amount, expected to result in future cash outflows
Valuation allowance	Reserve against deferred tax assets based on the likelihood that assets will be realized
Timing difference	The difference (timing or amount) between tax return and financial statement treatment of a transaction
Temporary difference	Difference between tax and financial statement reporting, which will affect taxable income when the difference reverses.

The **liability method of tax accounting** focuses on the impact on the balance sheet. This is based on SFAS 109 in the U.S. and IAS 12 internationally. This method measures the balance sheet deferred tax assets and liabilities first on the basis that temporary differences will reverse, and then the reported income is a consequence of the balance sheet amounts.

Whereas the deferral method calculates the impact of tax expense on the income statements first, and then calculates the implied impact on the balance sheet, as in Examples 42-1 and 42-2.

LOS 42-e

Compute income tax expense, income taxes payable, deferred tax assets, and deferred tax liabilities.

First we will consider some of the issues that arise when tax-based and GAAP-based accounting differ by working through an example of how deferred tax liabilities are created in Example 42-1.

Example 42-1 Deferred tax liability

A company pays $60,000 for an asset and for tax accounting purposes the asset is depreciated over three years using the straight-line method. However the company estimates that the asset will generate additional income of $30,000 per annum over its useful life of four years and depreciates the asset over this period using the straight-line method. Other costs are assumed to be zero. The salvage value is estimated to be zero and the tax rate is 40%.

Income Tax Reporting

$'000	Year 1	Year 2	Year 3	Year 4	Total
Revenue	30.0	30.0	30.0	30.0	120.0
Depreciation	(20.0)	(20.0)	(20.0)	(0.0)	(60.0)
Taxable income	10.0	10.0	10.0	30.0	60.0
Taxes payable	(4.0)	(4.0)	(4.0)	(12.0)	(24.0)
Net income	6.0	6.0	6.0	18.0	36.0

Reporting under GAAP and IAS

$'000	Year 1	Year 2	Year 3	Year 4	Total
Revenue	30.0	30.0	30.0	30.0	120.0
Depreciation	(15.0)	(15.0)	(15.0)	(15.0)	(60.0)
Pretax income	15.0	15.0	15.0	15.0	60.0
Tax expense	(6.0)	(6.0)	(6.0)	(6.0)	(24.0)
Net income	9.0	9.0	9.0	9.0	36.0
Taxes payable	4.0	4.0	4.0	12.0	24.0
Deferred tax expense	2.0	2.0	2.0	(6.0)	0.0
Deferred tax liability	2.0	4.0	6.0	0.0	N/A

Note: Deferred tax expense is the difference between the tax expense under GAAP and the taxes payable under income tax accounting, so deferred tax expense = tax expense – taxes payable.

The deferred tax liability is the amount that will need to be paid in year 4 when the difference in accounting methods reverses. This is entered on the balance sheet.

Deferred tax liabilities and assets

Deferred tax liabilities occur when the future taxable income is expected to be higher than future pretax income. This is due to **timing differences**, when the tax return treatment is different from the financial reporting treatment of an item(s). Similarly a **deferred tax asset** is created when the future taxable income is expected to be lower than future pretax income.

An example of when deferred tax assets are created is when a company issues a warranty on its product. In this case, warranty expenses are recognized for financial reporting each year. However for tax purposes, the cost can only be recognized when the actual repairs are done. Therefore the future taxable income is expected to be lower than future pretax income. Example 42-2 looks at a deferred tax asset created by a warranty expense:

Example 42-2 Deferred tax asset

A company assumes that warranty expenses will cost 10% of each year's revenues so under GAAP the company will record a warranty expense each year. However all repairs will occur in year 4 and for income tax reporting the cost of repairs is only recognized when it actually occurs. Revenues each year are $30,000 and the tax rate is 40%.

Example 42-2 (Continued) Deferred tax asset

Income Tax Reporting

$'000	Year 1	Year 2	Year 3	Year 4	Total
Revenue	30.0	30.0	30.0	30.0	120.0
Warranty expense	(0.0)	(0.0)	(0.0)	(12.0)	(12.0)
Taxable income	30.0	30.0	30.0	18.0	108.0
Taxes payable	(12.0)	(12.0)	(12.0)	(7.2)	(43.2)
Net income	18.0	18.0	18.0	10.8	64.8

Reporting under GAAP and IAS

$'000	Year 1	Year 2	Year 3	Year 4	Total
Revenue	30.0	30.0	30.0	30.0	120.0
Warranty expense	(3.0)	(3.0)	(3.0)	(3.0)	(12.0)
Pretax income	27.0	27.0	27.0	27.0	108.0
Tax expense	(10.8)	(10.8)	(10.8)	(10.8)	(43.2)
Net income	16.2	16.2	16.2	16.2	64.8
Taxes payable	12.0	12.0	12.0	7.2	24
Prepaid tax expense	1.2	1.2	1.2	(3.6)	0
Deferred tax asset	1.2	2.4	3.6	0	N/A

Note: prepaid tax expense = taxes payable - tax expense

The deferred tax asset is the amount that will need to be paid in year 4 when the difference in accounting methods reverses. This is entered on the balance sheet.

Deferred tax assets can also be created for other recurring transactions such as management compensation, bad-debt reserves, and irregular events such as environmental remediation and impairment.

Treatment of operating losses

Tax losses can be carried back to obtain refunds for a prior year tax that has been paid. If insufficient prior year tax is available then they can be carried forward as **tax loss carryforwards**. These are treated as deferred tax assets but a **valuation allowance** is made if full recoverability is unlikely.

LOS 42-b

Discuss the implications of a valuation allocation (i.e. when it is required, what impact it has on the financial statements, and how it might affect an analyst's review of a company).

A valuation allowance will reduce the value of a deferred tax asset when management, or the auditor, after analyzing future income streams think it is likely that all or some of the deferred tax asset will be realized. Changes in a valuation allowance are included in income from continuing operations (except when they arise from the change in carrying value of assets and liabilities including investment in securities). If a company has large deferred tax assets it is important that analysts review the company's accounting choices and decide whether the assets are likely to be realized.

LOS 42-c

Explain the factors that determine whether a company's deferred tax liabilities should be treated as a liability or as equity for purposes of financial analysis.

Deferred tax liability or an increase in stockholders' equity?

If deferred liabilities arising from temporary differences in financial and tax reporting are not going to reverse in the future, arguably they should be treated as increases to equity.

When analyzing a company an analyst needs to consider each of the following situations in turn to decide on the treatment of deferred tax liabilities:

Change in tax law and accounting methods

Realization of a future tax liability or asset will depend on the realization of the temporary difference that created the deferred liability or asset in the first place. If tax rates are reduced, the size of the deferred assets and liabilities will also be reduced. Changes in GAAP can also impact on deferred taxes, e.g. the introduction of accrual accounting for post retirement benefits created sizeable liabilities whereas cash based accounting was being used for tax payments thus creating large tax assets.

Growth rate of company

Growing companies will tend to have a deferred tax liability that increases over time and in this case the liability may never be paid.

Nonrecurring items and equity adjustments

Nonrecurring items include restructuring charges, early retirement of debt and unrealized gains on market securities. These will have to be analyzed to establish whether they are likely to be reversed.

If the decision is made to continue to treat the deferred tax as a liability, an analyst needs to calculate the present value of the liability based on an estimate of when it will actually be reversed. If a deferred tax liability is not going to be treated as a liability then an adjustment to increase stockholders' equity should be made. This is because if the tax expense creating the liability had not been recorded, income and equity would have been higher. A decision to increase equity will affect financial ratios such as the debt/equity ratio.

Measures used to assess tax rates

Valuation models often take into account a company's effective tax rate. These can be calculated in different ways.

The reported effective tax rate is:

$$\frac{\text{income tax expense}}{\text{pretax income}}$$

However the income tax expense is influenced by management accounting choices so an alternative is to look at:

$$\frac{\text{taxes payable}}{\text{pretax income}} \quad \text{and} \quad \frac{\text{income tax paid}}{\text{pretax income}}$$

LOS 42-d

Distinguish between temporary and permanent items in pretax financial income and taxable income.

Temporary differences occur between financial statements and tax reporting, but there may also be permanent differences. A permanent difference occurs when there are revenues or expenses reported on financial statements or tax reports but not on both.

Examples in the U.S. of this include interest income on tax-exempt bonds and amortization of goodwill which may have been recorded on the financial statements but not on the tax return.

Conversely, depletion for tax purposes may exceed cost-based depletion that is reported in the financial statements and tax credits.

In the case of permanent differences, there are no deferred tax consequences and they are not reported on the financial statements. They will however give rise to a difference between the effective tax rate and the statutory rate.

LOS 42-f

Calculate the adjustment to the financial statements related to a change in the tax rate.

Changes in tax rates

When a tax rate increase or decrease takes effect there are two adjustments to make:

1. Recalculate the deferred tax liabilities or assets at the new rate.
2. Calculate the deferred tax liability and taxes payable in the current year at the new tax rate.

Tax rate changes are reported in the year that they take effect under the liability method.

Example 42-3 Tax rate changes

Use the data in Example 42-1 and assume that the tax rate is reduced from 40% to 30% at the beginning of year 2. Assume that the change is announced during year 2 and the change is reflected in the year 2 financial statements.

Step 1 – recalculate the deferred tax liabilities in year 1.

Year 1 reported deferred tax liability of $2 million, but restating using a tax rate of 30% gives revised deferred tax liability of $1.5 million [($15 - $10 million) x 0.30], a reduction of $0.5 million. This $0.5 million will reduce the year 2 income tax expense.

Step 2 – calculate the deferred tax liability and taxes payable in year 2.

Year 2 – increase in the deferred tax liability is $1.5 million, giving a total deferred tax liability of $3 million.

Year 2 – the income tax expense is $4.5 million ($15 million x 30%) less adjustment in deferred tax liability for previous years of $0.5 million. The total income tax expense is $4 million.

43 Analysis of Financing Liabilities

Learning Outcome Statements (LOS)

43-a	**Compute** the effects of debt issuance and amortization of bond discounts and premiums on the financial statements and ratios; **discuss** the effect on reported cash flows of issuing zero-coupon debt. **Determine** the appropriate classification for debt with equity features and **calculate** the effect of issuance of such instruments on the debt to total capital ratio.
43-b	**Discuss** the effect of changing interest rates on the market value of debt and on financial statements and ratios.

Introduction

This Reading looks at the treatment of bonds on the issuer's financial statements. The liability and interest expense associated with the bond are based on interest rates at the time of issue, not the par value of the bond. The liability is the present value of the cash flows payable to the bond holders, and if a bond is issued at a discount or a premium this discount or premium is amortized over the life of the bond so the liability is equal to the par value at maturity. This method of accounting has an impact on cash flows reporting and candidates must understand the implications for the categorization of cash flow. Interest paid is based on the coupon rate and is a cash outflow from operations, whereas the repayment of capital or amortization of the premium is a cash flow from financing. This leads to inconsistencies in the treatment of cash flow for high versus low or zero coupon bonds.

LOS 43-a

Compute the effects of debt issuance and amortization of bond discounts and premiums on the financial statements and ratios; **discuss** the effect on reported cash flows of issuing zero-coupon debt. **Determine** the appropriate classification for debt with equity features and **calculate** the effect of issuance of such instruments on the debt to total capital ratio.

Treatment of debt issuance in the financial statements

Current liabilities, as a result of debt, consist of:

1. *Short-term debt* – amounts borrowed from banks or the credit markets to be repaid within one year or less.
2. *Current portion of long-term debt* – the portion of long-term debt that is payable within the next year.

Long-term debt

Companies acquire long-term debt by public or private issues. Often the debt is purchased by pension funds or other institutional investors. In the examples below we focus on bonds to illustrate the accounting practice, although bonds are only one of the different types of long-term debt.

It is important to remember that:

- The liability equals the present value of the future stream of interest and principal payments to be made on the debt.
- Interest expense is the amount paid to the creditor in excess of the amount borrowed.

The **initial liability recorded at issue** is the present value of future coupon payments (coupons are the stated cash interest paid) and principal repayment, discounted at the market interest rate at the time of issue. In the case of bonds, it is usually the amount actually paid by investors for the bonds.

The **effective interest rate** is the market interest rate at the time of issue. This is the constant rate of interest applied over the life of the obligation.

The **balance sheet liability after issue** is the present value of future payments discounted at the effective interest rate.

Whilst the total amount of interest paid is usually known at the time of issue, the allocation of the interest expense over different time periods will vary according to the terms of the debt issued.

When the market rate is above/below the coupon rate at the time of issue the bond will be issued at a **discount/premium**. In the case that the bond has been issued at a premium the coupon payment will be broken down into an interest payment and a principal repayment. The principal repayment will reduce the outstanding liability. If the bond was issued at a discount the coupon payment will be less than the interest in which case the difference increases the balance sheet liability. In both cases the balance sheet liability will tend towards the face value of the bond at maturity.

The interest expense, recorded on the income statement, is the effective interest rate multiplied by the balance sheet liability at the beginning of the period. The interest expense will change over time for a bond issued at a discount/premium since the liability is increasing/decreasing.

Example 43-1 examines the different treatment of bonds issued at par, a premium and a discount.

Example 43-1 Accounting for bonds

A. A two-year bond is issued at par on January 1st 2004, with a coupon rate of 8%, making payments semi-annually. The face value is $1,000,000. The market rate (MR) is 8%, or 4% semiannually.

(In $'000)

Period ending	Opening liability	Interest expense (liability x MR)	Coupon payment	Change in liability (interest – coupon)
1 Jan 2004	Proceeds*			
30 June 2004	1,000.00	40.00	40.00	0
31 Dec 2004	1,000.00	40.00	40.00	0
30 June 2005	1,000.00	40.00	40.00	0
31 Dec 2005	1,000.00	40.00	40.00	0
Total		160.00	160.00	

*The proceeds are: PV of coupon payments = $145.20

plus: PV of maturity value = $854.80

B. A two-year bond is issued at a **premium** on January 1st 2004, with a coupon rate of 8%, making payments semi-annually. The face value is $1,000,000. The market rate (MR) is 6%.

(In $'000)

Period ending	Opening liability	Interest expense (liability x MR)	Coupon payment	Change in liability (interest – coupon)	Closing Premium
1 Jan 2004	Proceeds*				
30 June 2004	1,037.17	31.11	40.00	(8.88)	28.29
31 Dec 2004	1,028.29	30.85	40.00	(9.15)	19.14
30 June 2005	1,019.14	30.57	40.00	(9.43)	9.71
31 Dec 2005	1,009.71	30.29	40.00	(9.71)	0
Total		122.82	160.00	(37.17)	

*The proceeds are: PV of coupon payments = $148.68

plus: PV of maturity value = $888.49

Example 43-1 (continued) Accounting for bonds

C. A two-year bond is issued at a **discount** on January 1st 2004, with a coupon rate of 8%, making payments semi-annually. The face value is $1,000,000. The market rate (MR) is 10%.

Period ending	Opening liability	Interest expense (liability x MR)	Coupon payment	Change in liability (interest – coupon)	Closing Discount
1 Jan 2004	Proceeds*				
30 June 2004	964.54	48.23	40.00	8.23	27.23
31 Dec 2004	972.77	48.64	40.00	8.64	18.59
30 June 2005	981.41	49.07	40.00	9.07	9.52
31 Dec 2005	990.48	49.52	40.00	9.52	0
Total		195.46	160.00	35.46	

* The proceeds are: PV of coupon payments = $141.83

plus: PV of maturity value = $822.70

Financial statement effects

On the income statement the cost of the bond is recorded as the interest expense. On the balance sheet the closing liability is the opening liability plus the change in liability over the year, as calculated in Example 43-1 above. The cash flow treatment is more complex. The repayment of principal is a cash flow from financing, coupon payments are cash flows from operations.

Example 43-2 Cash flow classification

In all three cases in Example 43-1

(In $'000)

Year	Cash Outflow	
	Operations	Financing
2004	80.00	0
2005	80.00	1,000.00
Total	160.00	1,000.00

For bonds that are issued at a premium or discount, the cash flow classification incorrectly states the economic transaction. Coupon payments partly represent interest and partly repayment or increase of principal.

Taking the case of a bond issued at a premium and a discount we can reclassify the cash flows as follows:

Example 43-3 Reclassifying cash flows

Using the bonds in Example 43-1

(In $'000)

Year	Cash Outflow Bond issued at Premium		Cash Outflow Bond issued at Discount	
	Operations	Financing	Operations	Financing
2004	61.96	18.03	96.87	(16.87)
2005	60.86	1,019.14	98.59	981.41
Total	122.82	1,037.17	195.46	964.54

The proceeds are: PV of coupon payments = $148.68

In the case of a **zero coupon bond**, the bond will be issued at a significant discount. The impact on reported cash flow from operations will be zero and all of the interest costs will be allocated as cash flows from financing. Since the interest is effectively paid as part of the repayment of principal at maturity, the reported cash flow will overstate cash flow from operations and understate cash flow from financing.

Convertible bonds, warrants, and convertible preferred stock

Convertible bonds

The accounting treatment ignores the conversion terms at issue, so when the convertible bond is issued the entire proceeds are recorded as a liability and the interest expense is the same as for a conventional bond. An analyst should adjust for the equity feature using one of the following methods:

1. Separate bond and equity components of convertible value using option-pricing models.
2. Look at the financial implications of treating the convertible as a bond or equity. If they are significant then assess the likelihood that the bond will be converted to equity. If the stock price is significantly above the conversion price of the convertible bond it is likely to be converted and vice versa. Then make the necessary adjustments to equity and debt components of the balance sheet.

Bonds with warrants

When bonds and warrants are issued together it is necessary to allocate the proceeds of the issue between the two instruments. The fair value of the bond is accounted for as a liability and is issued at a discount. As before, the interest expense includes the amortization of the discount. The fair value of warrants is accounted for as equity and if they are exercised the additional cash paid by the investor increases equity capital.

In both the case of convertible bonds and bonds with warrants the interest expense is lower than that of a conventional bond. *However, this is misleading since the cost of the equity component is ignored.*

Looking at the reporting of a conventional bond versus a convertible bond versus a bond with warrants:

Interest Expense	Balance Sheet Liability	Operating Cash Flow
Conventional bond *higher than*	Conventional bond *equal to*	Conventional bond *lower than*
Bond with warrants *higher than*	Convertible bond *higher than*	Bond with warrants *equal to*
Convertible bond	Bond with warrants	Convertible bond

Preferred stock

Preferred stock or preference shares have benefits over ordinary shares. Most preferred shares are callable by the issuer and some are also redeemable by the holder. Redeemable preference shares are often classified separately to debt or equity on the balance sheet but an analyst should treat them as debt and the dividend payments as interest. Many of the shares are actually converted into ordinary shares further confusing the issue of whether they should be treated as debt or equity.

LOS 43-b

Discuss the effect of changing interest rates on the market value of debt and on financial statements and ratios.

Changes in interest rates

If market interest rates rise after a firm has issued debt, then the market value of the debt falls providing an economic gain to the firm. Similarly, if interest rates fall then there is an economic loss. These are not reported in the financial statements but for the purpose of analyzing the company's debt position, market values should be used. In the U.S. firms are required to disclose the fair value of outstanding debt.

44 Leases and Off-Balance-Sheet Debt

Learning Outcome Statements (LOS)

44-a	**Classify** a lease as capital or operating and **discuss** the factors that determine whether a company would tend to favor leasing over outright asset purchases and more specifically, factors that would favor capital or operating leases.
44-b	**Calculate** the effects of capital and operating leases on financial statements and ratios of the lessees.
44-c	**Explain** and **differentiate** the accounting treatment for a sale and leaseback of assets under U.S. and IASB GAAP.
44-d	**Describe** the types and economic consequences of off-balance-sheet financing and **determine** how take-or-pay contracts, throughput arrangements, and the sale of receivables affect selected financial ratios.
44-e	**Distinguish** between a sales-type lease and a direct-financing lease and **describe** the effects on the financial statements and ratios of sales-type and operating leases.

Introduction

This Reading starts with an analysis of leases and a discussion of why lessees generally prefer to structure and report leases as operating leases where they are essentially paying a rental expense for the use of an asset (the asset could be anything from an airplane to a photocopier). However, when a company effectively purchases an asset through a lease agreement the lease must be treated as a capital lease. The asset is then reported on the balance sheet and depreciated and a liability is also recorded which is the present value of future lease payments. Candidates need to study the impact on financial ratios of the different methods of lease accounting. Operating leases are often referred to as off-balance-sheet financing. Candidates are expected to be able to describe other forms of off-balance-sheet financing such as the sale of receivables and take-or-pay contracts.

LOS 44-a

Classify a lease as capital or operating and **discuss** the factors that determine whether a company would tend to favor leasing over outright asset purchases and more specifically, factors that would favor capital or operating leases.

Classification of leases

Firms generally acquire the right to use property, plant and equipment by an outright purchase which transfers legal ownership to the firm. This will involve a potentially large capital outlay and although the firm will receive the full benefits of ownership they will also take on the associated risks. These risks have grown with rapid technological change and the internationalization of product markets and resources. In some case firms decide to use a lease agreement to acquire the use of an asset (and some or all of the benefits and risks of owning the asset) through a lease agreement. There are two types of lease agreement, operating and capital (also called finance) leases.

Lessees must disclose in the notes to accounts future lease obligations for the next five years.

Operating lease

The concept of an operating lease is that the lessee can use the property for a portion of its useful life. The cost of the lease is reported as an expense by the lessee and the lessor keeps the asset on its balance sheet. This is a form of off-balance-sheet financing for the lessee.

Capital lease

A longer-term lease transfers the risks and rewards of ownership to the lessee and therefore the accounting treatment is as if the asset had been sold, and the asset is included on the lessee's balance sheet. The lessee depreciates the asset over its life and allocates lease payments to payments of principal and interest.

Generally lessees prefer to structure leases as operating leases since this will give higher operating ratios and lower leverage, whereas lessors prefer to structure leases as capital leases since it allows earlier recognition of revenue and income.

Other factors to consider include:

- The lessee only wants use of the asset for a relatively small part of its life.
- The lessor may be able to resell the asset more easily than the lessee.
- The tax benefits of owning assets will be of most benefit to a higher rate taxpayer.
- Bond covenants may limit the flexibility to increase debt, operating leases provide a way to finance off-balance-sheet.
- Management contracts may provide incentives based on the company's return on invested capital.

The following rules decide how leases should be classified.

Under U.S. GAAP, if **any** of the following conditions hold, a lease is classified as a capital lease. Otherwise it is classified as an operating lease on the lessee's accounts.

1. Title is transferred to the lessee at the end of the lease period.
2. The lease contains an option for the lessee to purchase the asset at a bargain price.
3. The lease term is for 75% or more of the economic life of the asset (not applicable to land or when the lease term begins in the final 25% of the life of the asset).
4. The present value of the minimum lease payments (MLPs), discounted at the minimum of the lessee's incremental borrowing rate or the rate implicit in the lease, is equal to 90% or more of the fair value of the asset, adjusted for the tax credit received by the lessor.

IAS rules are less stringent and make it easier to classify a lease as an operating lease.h

LOS 44-b

Calculate the effects of capital and operating leases on financial statements and ratios of the lessees.

Entries in financial statements for operating and capital leases.

The different accounting treatment is illustrated in Example 44-1.

Example 44-1 Operating versus financial leases

A firm decides to lease a photocopier and the annual minimum lease payments (MLPs) are $20,000 at the end of each year for three years. The lease agreement starts on January 1st 2003. The discount rate used is 8%.

Operating lease

Balance Sheet: no entries.

Cash Flow: $20,000 cash outflow each year, classified as cash flows from operations.

Income Statement: annual rental expense of $20,000 will be charged on the income statement.

Capital lease

Balance Sheet: at inception the asset and leasehold liability, which is equal to the present value of the MLPs, will be recorded. The asset will be depreciated over the life of the lease and the principal repayments will reduce the size of the liability, see the table below.

Example 44-1 (continued) Operating versus financial leases

Cash Flow: $20,000 total cash outflow each year, the interest payments are cash outflows from operations, and the principal repayments are cash outflows from financing.

Income Statement: annual rental expense of $20,000 will be divided between interest and principal repayments on the liability as shown in the table below.

Calculation of interest and principal repayments for the capital lease:

Year	Opening liability	Interest (liability x 8%)	Principal	Closing liability
2003	$51,542*	$4,123	$15,877	$35,665
2004	$35,665	$2,853	$17,147	$18,518
2005	$18,518	$1,482	$18,518	0

* present value of MLPs.

Income Statement

	Operating Lease	Capital Lease		
Year	Rental Expense	Depreciation*	Interest	Total Expense
2003	$20,000	$17,181	$4,123	$21,304
2004	$20,000	$17,181	$2,853	$20,034
2005	$20,000	$17,181	$1,482	$18,663
Total	$60,000	$51,542	$8,458	$60,000

* Calculate depreciation using the straight-line method with the cost as the opening liability and the salvage value set at zero.

Balance Sheet (for Capital Lease)

	2003	2004	2005
Assets			
Leased assets	$51,542	$51,542	$51,542
Accumulated depreciation	$17,181	$34,362	$51,542
Leased assets, net	$34,361	$17,181	0
Liabilities			
Current portion of lease obligation	$17,147	$18,518	0
Long-term debt: lease obligation	$18,518	0	0
Total	$35,665	$18,518	0

Example 44-1 (continued) Operating versus financial leases

Cash Flow

	Operating Lease	Capital Lease		
Year	Operations	Operations	Financing	Total
2003	$20,000	$4,123	$15,877	$20,000
2004	$20,000	$2,853	$17,147	$20,000
2005	$20,000	$1,482	$18,518	$20,000

Financial impact of choice of lease classification

1. There is higher **total expense** (interest plus depreciation) at the beginning of the lease period with a capital lease due to the higher interest payments but as the lease expires the operating lease will have a higher total expense.
2. There are lower operating expenses with a capital lease since part of the expense is interest payment.
3. Ratios – using a capital lease:
   - Increases asset values resulting in lower asset turnover and return on assets.
   - Leverage and liquidity ratios will be affected by the addition of current and non-current liabilities.
   - The current ratio and working capital will be lower as a result of an increase in non-current liabilities.
   - The debt-to-equity ratio will usually be higher since a capital lease adds current and long-term debt to the balance sheet.
4. Total cash flow is unaffected by the lease classification. However with a capital lease both financing and operating cash flows are impacted, with an operating lease only operating cash flows are impacted. Therefore with a capital lease a lessee will report higher operating cash flows.

Analysts should make the appropriate adjustments to the financial statements to restate the impact of using operating leases rather than capital leases.

LOS 44-c

Explain and **differentiate** the accounting treatment for a sale and leaseback of assets under U.S. and IASB GAAP.

Sale and leaseback of assets refers to a firm selling an asset and then continuing to have the use of that asset through a leaseback arrangement. This can be an attractive way of raising funds for a company with a low credit rating.

Both U.S. and IAS GAAP require that the lessees, in the case of a capital lease, do not immediately recognize any gain on the sale but amortize the gain over the life of the lease. For operating leases the treatment is different under U.S. and IAS GAAP; under U.S. GAAP amortization over the term of the lease is required, under IAS GAAP the gain can be recognized immediately.

LOS 44-d

Describe the types and economic consequences of off-balance-sheet financing and **determine** how take-or-pay contracts, throughput arrangements, and the sale of receivables affect selected financial ratios.

Off-balance-sheet financing

Operating leases are one example of financing that gives rise to off-balance-sheet debt. We have considered other types of off-balance-sheet financing below:

A. Take-or-pay or throughput agreements

This is when one company commits to buy a certain amount of another company's future production. The price is agreed in the contract and may be linked to the market price of the product (often a commodity). The purchaser does not report the assets and liabilities resulting from the commitment on the balance sheet, thereby often understating debt to equity ratios. An analyst should adjust the balance sheet for the present value of future commitments.

B. Sale of receivables

When a company sells its receivables to a third party this is usually recorded as a sale, decreasing receivables and increasing cash from operations. However the transaction is effectively borrowing money and using the receivables as collateral, and usually the seller still bears the credit risk. Adjustments should be made to increase the accounts receivable and current liabilities to reflect the receivables sold but not collected and the increase in borrowing. This will decrease the receivables turnover ratio and lead to poorer leverage ratios.

Cash flow should be adjusted so the uncollected amount is classified as a cash flow from financing rather than operations.

C. Joint ventures, investment in affiliates and finance subsidiaries

Joint ventures are used to share opportunities and risks, in many cases these ventures may enter into take-or-pay or throughput arrangements. Joint ventures and affiliates are usually accounted for using equity accounting (if ownership is between 20% and 50%) so only the net investment is shown on the parent's balance sheet.

Finance company subsidiaries or affiliates are set up to provide finance to the parent company. The balance sheets are not consolidated if ownership is kept to less than 50%.

In cases when an analyst sees off-balance-sheet financing the balance sheet should be adjusted to reflect the true liabilities of the company.

LOS 44-e

Distinguish between a sales-type lease and a direct-financing lease and **describe** the effects on the financial statements and ratios of sales-type and operating leases.

Financial reporting by lessors

A **sales-type lease** is used by manufacturers and includes a manufacturing or merchandising profit as well as interest income reflecting the financing element of the transaction.

A financial institution uses a **direct-financing lease** when the only profit is from interest income.

For a lessor to treat a lease as a capital lease (which they would generally prefer) it must meet at least *one* of the criteria set out in the above list in LOS 44-a and *both* of the following criteria:

1. Collectibility of the MLPs is reasonably certain.
2. There are no significant uncertainties regarding the amount of reimbursable costs under the lease agreement.

Financial statement reporting for a sales-type lease

Gross investment is the sum of lease payments and residual value.

Net investment is the sum of present value of lease payments and residual value.

Gross minus net investment is the **unearned income** or interest component of the lease.

Sales revenue is the present value of lease payments.

COGS are manufacturing costs less the present value of the residual value.

Example 44-2 Accounting for lessors

A firm manufactures and then leases a photocopier; the annual minimum lease payments (MLPs) are $20,000 at the end of each year for three years. The cost of manufacture is $40,000. At the end of the lease the unguaranteed residual value is $10,000. The discount rate used is 8%.

If the lease is treated as a sales-type capital lease the *lessor's* financial reporting at the beginning of the lease agreement will be as follows.

Gross investment in lease	
MLPs of $20,000 x 3	$60,000
Residual value	$10,000
	$70,000
Net investment in lease	
Present value of MLPs	$51,542
Present value of residual value	$7,938
	$59,480
Unearned income	$10,520
At inception, in financial statements	
Sales revenue	$51,542
COGS	$32,062
Gross profit on sale	$19,480
Gross investment in lease	$70,000
less unearned income	$10,520
Net investment in lease	$59,480

Thereafter the lease payments received of $20,000 a year are divided between interest income (8% of the net investment) and a reduction in investment.

The interest payment is cash flow from operations and the reduction in investment is an investing cash flow.

If a lease is accounted for as an **operating lease** then:

The assets will continue to be reported on the lessor's balance sheet, they will be depreciated as usual (with a cost of $40,000, salvage value of $10,000).

The lease payments will be rental income and be allocated to operating cash flow.

Financial statement reporting for a direct-financing lease

The treatment here is quite different. These are pure financing transactions and therefore no sale is recognized and only financing income is reported. There are no income or cash flow entries at the inception of the lease. In many cases an allowance for uncollectible payments will be made.

STUDY SESSION 11

Corporate Finance

Overview

This is a long Study Session covering important corporate finance concepts, including cash flow, leverage, cost of capital and how they impact on the value of a company. These concepts also appear in other Level I Study Sessions and throughout the CFA syllabus.

The first Reading looks at agency problems and then we move on to the core of the Study Session. The next four Readings deal with capital budgeting, and the decision-making process for whether potential investments or projects should be undertaken. This involves calculating the cost of capital, estimating the future cash flows from the investments and deciding whether the cash flows will cover the cost of capital. We also consider measures of risk for a company which will give an indication of the level of uncertainty surrounding the cash flow forecasts.

In the last two Readings we look at capital structure and dividend policy. We consider the issues that affect how a company should balance debt and equity financing to maximise its share price. We then look at dividends and how high or low dividend payout ratios will affect the company's share price.

Reading Assignments

Fundamentals of Financial Management, 8th edition, Eugene F. Brigham and Joel F. Houston (Dryden, 1998)

45. "An Overview of Financial Management," Ch. 1, pp. 18–22
46. "The Cost of Capital," Ch. 9
47. "The Basics of Capital Budgeting," Ch. 10
48. "Cash Flow Estimation and Other Topics in Capital Budgeting," Ch. 11
49. "Risk Analysis and the Optimal Capital Budget," Ch. 12
50. "Capital Structure and Leverage," Ch. 13, including Appendix 13A
51. "Dividend Policy," Ch. 14

45 An Overview of Financial Management

Learning Outcome Statements (LOS)

45-a	**Discuss** potential agency problems of stockholders versus 1) managers and 2) creditors and **describe** four mechanisms used to motivate managers to act in stockholders' best interests.

Introduction

This is a short Reading which discusses the potential problems that may arise when a principal (shareholder) appoints agents (managers) and gives authority to the latter to make decisions. Conflicts of interest may also occur between stockholders and creditors. Ways to alleviate these agency problems and conflicts of interest are discussed.

LOS 45-a

Discuss potential agency problems of stockholders versus 1) managers and 2) creditors and **describe** four mechanisms used to motivate managers to act in stockholders' best interests.

In general terms an **agency relationship** refers to when **principals** employ **agents** to perform a service, which involves giving the agent some decision-making authority. Two types of agency problems are considered, namely stockholders versus managers and stockholders versus creditors.

Stockholders versus managers

When an owner-manager sells part of his company to external shareholders this creates a potential agency problem since the owner-manager no longer benefits from all the wealth created by his work, he also no longer pays all the expenses of the company.

Example 45-1 Owner-manager agency problems

- An owner-manager stops working hard if he/she is no longer the sole owner.
- An owner-manager takes advantage of perquisites (incidental benefits) if other shareholders are paying part of the cost.

In most large corporations agency problems exist since the managers only hold at most a small stockholding in the company. The managers' objectives should be to create shareholder wealth but in fact their remuneration is largely based on their salaries and benefits.

Example 45-2 Stockholder-manager agency problems

- Managers' objectives are often to increase the size of the company thereby:
  (i) increasing their job security as a hostile takeover becomes less likely,
  (ii) increasing their status and salary packages, and
  (iii) benefiting managers working for them.
- Managers use their employers' money to make donations to charities to improve their standing in the community.

Stockholders (through managers) versus creditors

Other examples of agency problems arise from the conflicts of interest between the stockholders and the creditors of a corporation. From the creditors' viewpoint, the rates at which they lend money will depend on the riskiness of the corporation's cash flows and its ability to repay the interest and capital on the debt. However it is the stockholders that are in a position to take measures that determine the risk of the corporation.

Example 45-3 Stockholders-creditors agency problems

- If a corporation embarks on a major new project that is riskier than the creditors expected then the value of the debt will decline. Benefits from the project will go to the stockholders rather than the creditors, whose return is decided by the interest rate at which they lent money. Return and risk are borne by different parties.
- A corporation issues additional debt and uses the funds raised to buy back ordinary stock. This will increase the default risk of debt issued by the corporation.

Debtors will try to protect their position by placing restrictive covenants in debt agreements. However, it is the responsibility of management to act in the best interests of both shareholders and creditors.

Mechanisms used to motivate managers to act in stockholders' best interests

1. *Managers' compensation*

Performance shares – managers are rewarded with shares on the basis of the performance of the company and/or length of service with the company.

Executive stock options – corporations grant stock options to managers, which allow the managers to purchase stock in the future at a specified exercise price. The options will be worthless if the stock price does not rise above this exercise price.

The criteria used to decide the allocation of performance shares will include target earnings per share, return on equity, relative stock price performance or market capitalization of the company.

2. *Direct intervention by shareholders*

In many cases institutional money managers are the major shareholders and they can try to influence management directly or present shareholder-sponsored proposals at the annual stockholders' meeting.

3. *Firing managers*

Stockholders can propose their own board of directors at the annual general meeting or indirectly change managers by putting pressure on them to resign.

4. *Threat of takeover*

Managers will generally lose their position if their corporation is subject to a hostile takeover. This is a major incentive for managers to focus on managing the company in a way that supports the stock price.

46 The Cost of Capital

Learning Outcome Statements (LOS)

46-a	**Explain** and **interpret** the cost of capital used in capital budgeting as a weighted average of the opportunity costs of various types of capital the company targets for use.
46-b	**Calculate** the component costs of 1) debt, 2) preferred stock, 3) retained earnings (three different methods), and 4) newly issued stock or external equity.
46-c	**Define** target (optimal) capital structure and **calculate** a company's weighted-average cost of capital, **calculate** a company's marginal cost of capital and **distinguish** between the weighted-average cost of capital and marginal cost of capital.
46-d	**Explain** the factors that affect the cost of capital, and **distinguish** between those factors that can and cannot be controlled by the company.

Introduction

All capital has a cost and the true cost of capital is not the same as the cash interest paid on debt or dividends paid to shareholders. This Reading deals with various components of capital in a target capital structure and candidates are expected to be able to calculate the cost of each component. A weighted-average calculation of the cost of capital is also presented, as well as the calculation for marginal cost of capital. Calculations are generally relatively simple but do not forget to adjust for tax in the cost of debt as interest is a tax deductible expense. Candidates are also expected to recognize the factors which affect the cost of capital and identify those which are within and beyond the control of the firm.

LOS 46-a

Explain and **interpret** the cost of capital used in capital budgeting as a weighted average of the opportunity costs of various types of capital the company targets for use.

The cost of capital used in budgeting should be the weighted average cost of capital rather than the cost of financing a specific project. This is because, if a company is a going concern, it will need to raise capital in the future, and the cost of this capital will reflect earlier financing decisions.

Example 46-1 Using weighted average cost of financing

A company funds a project using substantial amounts of debt financing. The next time that the company requires financing it may well find the cost of debt is substantially higher reflecting the company's higher gearing, and it will need to resort to equity financing which is generally more expensive. To avoid these issues the correct way to look at the cost of financing a project is to consider the cost as the same as the company's overall cost of funds.

LOS 46-b

Calculate the component costs of 1) debt, 2) preferred stock, 3) retained earnings (three different methods), and 4) newly issued stock or external equity.

Component costs of capital

The component costs of capital that are considered are debt, preferred stock and equity (retained earnings and external or newly issued equity).

These are defined as shown below:

Cost of debt, $k_d(1 - T)$

The cost of debt is calculated *after* tax:

Equation 46-1

$$\text{cost of debt} = k_d(1 - T)$$

where

k_d = interest rate on firm's new debt (in some case the yield to maturity of existing bonds is used)

T = marginal tax rate

The tax savings on interest paid must be deducted since interest payments are tax deductible for a company. Effectively the government is paying part of the cost of debt.

Note – flotation costs are ignored since they are generally very small.

Example 46-2 Cost of debt

If a company can borrow money at 12% and its marginal tax rate is 30% then the after-tax cost of debt is, using equation 46-1:

$$k_d(1-T) = 12\%(1.0-0.3) = 8.4\%$$

Cost of preferred stock (k_{ps})

Equation 46-2

$$k_{ps} = \frac{D_{ps}}{P_n}$$

where

D_{ps} = preferred dividend

P_n = net issuing price, the price after deducting flotation costs

Note – do not adjust for tax since preferred dividend payments are not tax deductible.

Example 46-3 Cost of preferred stock

A company has preferred stock outstanding that trades at $100 and pays a dividend of $8 per share. If the company issued new preferred shares its flotation costs would be 3%.

$$k_{ps} = \frac{\$8}{\$97} = 8.2\%$$

Cost of retained earnings (k_s)

This is the rate of return required by common stockholders and it represents the rate of return they could earn elsewhere if the company paid out retained earnings as dividends. It is the opportunity cost involved in the company retaining the capital. It can be calculated by one of the following three methods:

1. *Capital Asset Pricing Model (CAPM)*

CAPM relates the expected return from a stock to its beta:

Equation 46-3

$$k_s = k_{RF} + \beta(k_M - k_{RF})$$

where

β	=	beta of the stock, its sensitivity to movements in the market
k_M	=	expected market return
k_{RF}	=	risk-free rate

CAPM is covered in more detail in Study Session 12.

Example 46-4 Cost of equity using CAPM

If the risk-free rate of return is 6%, the expected market return is 14% and a company's stock has a beta of 1.1 then the required rate of return is given by:

$$k_s = k_{RF} + \beta(k_M - k_{RF}) = 6\% + 1.1(14\% - 6\%) = 14.8\%$$

2. *Bond-yield-plus-risk-premium approach*

Another more judgmental method to obtain a cost of equity is to add a risk premium to the company's long-term bond yield. Empirically the risk premium has been in the range of 3 to 5%.

Equation 46-4

$$k_s = \text{bond yield} + \text{risk premium}$$

Example 46-5 Cost of equity using bond-yield-plus-risk-premium

A company is perceived as being high risk and the yield on their long-term bonds is 15%. An analyst decides to use a risk premium approach to calculate the cost of equity and uses a premium of 4%.

$$k_s = \text{bond yield} + \text{risk premium} = 15\% + 4\% = 19\%$$

3. *Dividend Valuation Model*

The dividend valuation model states that for a company whose dividends are forecast to grow at a steady rate:

Equation 46-5

$$P_0 = \frac{D_1}{k_s - g} \text{ which can be rearranged to :}$$

$$k_s = \frac{D_1}{P_0} + g$$

where

g	=	expected constant dividend growth rate
D_1	=	next year's dividend
P_0	=	current stock price.

Note that D_1/P_0 is the dividend yield of the stock.

and:

Equation 46-6

$$g = (\text{retention rate}) \times \text{ROE}$$

where

retention rate	=	percentage of a company's earnings that are retained as opposed to being paid out as dividends, this is (1.0 – payout rate)
ROE	=	return on equity.

Here we are assuming that the required rate of return on equity and the expected rate of return are the same.

Example 46-6 Cost of equity using dividend valuation model

A company's current share price is \$100, the last dividend paid was \$4 and dividends are forecast to grow at a constant rate of 3%. Then the required rate of return is given by:

$$k_s = \frac{\$4(1.03)}{\$100} + 3\% = 7.1\%$$

Note: Don't forget to use, D_1, the dividend which will be paid in *one year's* time.

Cost of new equity

The cost of new equity or external equity will be higher due to the flotation costs that arise from the issue of new common stock. The equation above needs to be adjusted as follows:

Equation 46-7

$$k_e = \frac{D_1}{[P_0(1-F)]} + g$$

where

F	=	percentage flotation cost.
$P_0(1 - F)$	=	net price per share received by the company

Example 46-7 Cost of new equity

A company's current share price is \$100, the last dividend paid was \$4 and dividends are forecast to grow at a constant rate of 3%. If the flotation costs are 5% then the cost of new equity is given by:

$$k_e = \frac{\$4(1.03)}{\$100(1.0-0.05)} + 3\% = 7.3\%$$

LOS 46-c

Define target (optimal) capital structure and **calculate** a company's weighted-average cost of capital, **calculate** a company's marginal cost of capital and **distinguish** between the weighted-average cost of capital and marginal cost of capital.

A company's target or **optimal capital structure** is the mix of debt, preferred equity and common equity in its balance sheet that will maximize the company's stock price.

Weighted-average cost of capital (WACC)

This is the weighted average of the component costs of debt, equity and preferred stock. The weights are based on the target capital structure of the company. It is the average cost of each dollar of the company's capital.

Equation 46-8

$$WACC = w_d k_d (1 - T) + w_{ps} k_{ps} + w_s k_s$$

where w_d, w_{ps} and w_s are the weights in the capital structure of debt, preferred and common equity respectively.

The weights should be based on the market values of debt and equity but if these are not available use the book values.

Example 46-8 Weighted-average cost of capital

A company's target capital structure is 60% debt, 40% equity. Equity financing will come from retained earnings. If the after-tax cost of debt is 10% and cost of equity from retained earnings is 14% then:

WACC = 0.60 (10.0%) + 0.40 (14.0%) = 11.6%

The **marginal cost of capital** (MCC) is the weighted average cost of the last dollar of new capital that a firm raised, or the cost of raising another dollar of capital.

Example 46-9 Marginal cost of capital

Using the data in Example 46-8, a company's target capital structure is 60% debt, 40% equity. The after-tax cost of debt is 10% and cost of equity from retained earnings is 14%, but the cost of new equity is 15%. Once retained earnings have been used, the MCC is given by:

MCC = 0.6 (10.0%) + 0.4 (15.0%) = 12.0%

As a firm raises more and more capital the MCC will start to rise. There will be a jump in the MCC when the retained earnings are used up and the firm needs to issue new equity, which will cost more due to flotation costs. This will occur at a **break point**, in this case the retained earnings break point. Additionally the cost of capital will also rise as interest rates rise. Empirical studies show that as more securities are issued in a given period, the higher the required rate of return of investors in these securities.

LOS 46-d

Explain the factors that affect the cost of capital and **distinguish** between those factors that can and cannot be controlled by the company.

Factors than affect the cost of capital

Factors that the firm cannot control

(i) *Interest rates* – if interest rates decline the cost of debt will decline and also, indirectly, the cost of equity will decline. If interest rates rise the cost of debt and equity will similarly rise.

(ii) *Tax rates* – a rise in tax rates reduces the cost of debt and makes it relatively more attractive compared to equity and vice versa.

Factors that the firm can control

(iii) *Capital structure policy* – since the after tax cost of debt is lower than equity, a firm might increase the proportion of debt financing. This would tend to reduce the WACC but using significantly more debt will raise the cost of both debt and equity.

(iv) *Dividend policy* – using external equity is more expensive than using retained earnings therefore changes to dividend policy that affect whether a firm has sufficient internal funds to finance investment will impact on the WACC.

(v) *Investment policy* – if a company changes its investment policy to start investing in more or less risky assets this will affect the future WACC.

46 Questions

1. A company has preferred stock outstanding whose current market price is $85; the par value is $100. The dividend is $8 per annum and the marginal corporate tax rate is 40%. The cost of preferred stock is *closest* to:

A. 4.8%.

B. 5.6%.

C. 8.0%.

D. 9.4%.

---

2. A company has a 10% coupon bond outstanding that is trading in the market at a yield to maturity of 9%. The company's marginal corporate tax rate is 40%. The cost of debt is *closest* to:

A. 5.4%.

B. 6.0%.

C. 9.0%.

D. 10.0%.

---

3. A company has a stock price of $25 and is expected to pay a dividend of $1 one year from now. The growth in dividends is forecast to be 5%. The company's marginal corporate tax rate is 40%. The cost of retained earnings is *closest* to:

A. 2.4%.

B. 4.0%.

C. 5.4%.

D. 9.0%.

4. Company X has bonds outstanding that yield 6% and Company Y has bonds outstanding that yield 8%. The cost of equity is likely to be:

A. lower for Company X than Company Y.

B. higher for Company X than Company Y.

---

5. A company has a target capital structure of 60% debt, 30% common equity and 10% preferred equity. If the after-tax cost of debt is 6%, common equity is 10% and preferred equity is 9%, the weighted-average cost of capital is *closest* to:

A. 6.0%.

B. 7.5%.

C. 8.3%.

D. 10.0%.

47 The Basics of Capital Budgeting

Learning Outcome Statements (LOS)

47-a	**Calculate** and **interpret** payback period, discounted payback period, net present value (NPV), and internal rate of return (IRR), and **evaluate** capital projects using each method.
47-b	**Explain** the effect on shareholders of the adoption of investment opportunities with 1) zero net present values and 2) positive net present values.
47-c	**Explain** the NPV profile, the relative advantages and disadvantages of the NPV and IRR methods, particularly with respect to independent versus mutually exclusive projects, the "multiple IRR problem" and the cash flow pattern that causes the problem, and why NPV and IRR methods can produce conflicting rankings for capital projects.
47-d	**Describe** the role of the post-audit in the capital budgeting process.

Introduction

This is an important section and deals with capital budgeting and evaluation of projects. Four main methods of evaluating whether projects are attractive or not are the payback period, discounted payback period, net present value (NPV), and internal rate of return (IRR). Candidates should know how to evaluate projects using the different methods and identify the advantages and the disadvantages of each method. Using NPV is the preferred method and candidates should understand why the assumption made on the reinvestment of capital is considered more realistic in the NPV than in the IRR method. Calculations are frequently based on the concept of time value of money (NPV and IRR are already covered in Study Session 2) and candidates should practice the calculations using a CFA Institute approved calculator.

LOS 47-a

Calculate and **interpret** payback period, discounted payback period, net present value (NPV), and internal rate of return (IRR), and **evaluate** capital projects using each method.

LOS 47-b

Explain the effect on shareholders of the adoption of investment opportunities with 1) zero net present values and 2) positive net present values.

Capital budgeting is the process of planning expenditures on fixed assets and projects that extend beyond one year.

Projects are often classified into one of the following categories.

- Replacement, when the maintenance of business requires the replacement of equipment.
- Replacement, when cost savings are possible if out-of-date equipment is replaced.
- Expansion of existing products or markets.
- Expansion into new products and markets.
- Safety and/or environmental projects, in many cases these are mandatory projects.
- Others.

Methods for evaluating investment proposals

The four methods of evaluating a project (with respect to the LOS) are summarized below.

1. Payback period

This is the expected number of years needed to recover the cost of investment in a project based on net after-tax cash flows from the project.

Example 47-1 Payback period

The cost of a project is $150 million and the following cash flows are anticipated:

Year	Net Cash Flow ($ million)
1	25
2	50
3	55
4	40
5	60

After three years the project will have paid back $130 million with $20 million remaining to be paid.

Payback = 3 years + 20/40 years = 3.5 years

2. *Discounted payback period*

This is a similar concept to the payback period but it is based on the time taken to recover the investment based on **discounted cash flows,** so the cash flows need to be discounted to their present value. The discount rate used is the project's cost of capital.

Example 47-2 Discounted payback period

The cost of a project is $150 million and the following cash flows are anticipated. The cost of capital is 10%.

Year	Net Cash Flow ($ million)	Discounted Net Cash Flow ($ million)
1	25	22.7
2	50	41.3
3	55	41.3
4	40	27.3
5	60	37.3

Discounted Payback $= 4 \text{ years} + 17.4/37.3 \text{ years} = 4.5 \text{ years}$

The payback period methods are incomplete in the sense that they do not take into account the size of cash flows that will be received after the end of the payback period. Their main value is that they give a feeling for the risk of a project in terms of how long funds will be tied up in the project.

3. *Net present value (NPV)*

To calculate the net present value (NPV) of a project the following steps are needed:

(i) Estimate future cash flows (inflows and outflows) from the project and discount back to the present value using the cost of capital for the project as the discount rate.

(ii) Add up the discounted cash flows to give the NPV.

(iii) If the NPV is positive then accept the project, if negative reject.

Equation 47-1

$$NPV = CF_0 + \frac{CF_1}{(1+k)} + \frac{CF_2}{(1+k)^2} + \ldots\ldots + \frac{CF_n}{(1+k)^n}$$

where

CF_t = expected cash flow in period t

k = project's cost of capital.

Note: These calculations (NPV and IRR) are quick to do using a financial calculator – make sure you get plenty of practice using your calculator before the exam.

Example 47-3 Net present value

The cost of a project is $150 million and the following cash flows are anticipated. The cost of capital is 10%.

Year	Net Cash Flow ($ million)	Discounted Net Cash Flow ($ million)
0	-150	-150.0
1	25	22.7
2	50	41.3
3	55	41.3
4	40	27.3
5	60	37.3
Total		19.9

The NPV is positive indicating that the cash flows from the project are more than enough to pay back the cost of capital used to pay for the project and give a positive return to stockholders.

Or using a financial calculator the keystrokes are:

HP-12C		BA II Plus	
f CLEAR FIN	0.00	CF 2nd [CLR WORK]	CF_0 = 0.00
150 CHS g CF_0	-150.00	150 +/- [ENTER]	CF_0 = -150.00
25 g CF_j	25.00	⇩ 25 [ENTER]	C01 = 25.00
50 g CF_j	50.00	⇩ ⇩ 50 [ENTER]	C02 = 50.00
55 g CF_j	55.00	⇩ ⇩ 55 [ENTER]	C03 = 55.00
40 g CF_j	40.00	⇩ ⇩ 40 [ENTER]	C04 = 40.00
60 g CF_j	60.00	⇩ ⇩ 60 [ENTER]	C05 = 60.00
10 i	10.00	NPV 10 [ENTER]	I = 10.00
f NPV	19.95	⇩ CPT	NPV = 19.95

4. Internal rate of return (IRR)

Calculate the discount rate that will make the present value of the cash flows from the project equal to the present value of the investment costs. This discount rate is the IRR. If it exceeds the cost of capital the project will increase stockholders' wealth. The **hurdle rate** (or cost of capital) is the rate the IRR must exceed if it is to be accepted.

Equation 47-2

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \ldots\ldots + \frac{CF_n}{(1+IRR)^n}$$

where CFt = expected cash flow in period t

IRR = internal rate of return

Example 47-4 Internal rate of return

The cost of a project is $150 million and the following cash flows are anticipated. The cost of capital is 10%.

Year	Net Cash Flow ($ million)
0	-150
1	25
2	50
3	55
4	40
5	60

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \ldots\ldots \frac{CF_n}{(1+IRR)^n}$$

$$0 = -150 + \frac{25}{(1+IRR)} + \frac{50}{(1+IRR)^2} + \frac{55}{(1+IRR)^3} + \frac{40}{(1+IRR)^4} + \frac{60}{(1+IRR)^5}$$

$$IRR = 14.6\%$$

Using a financial calculator the keystrokes are:

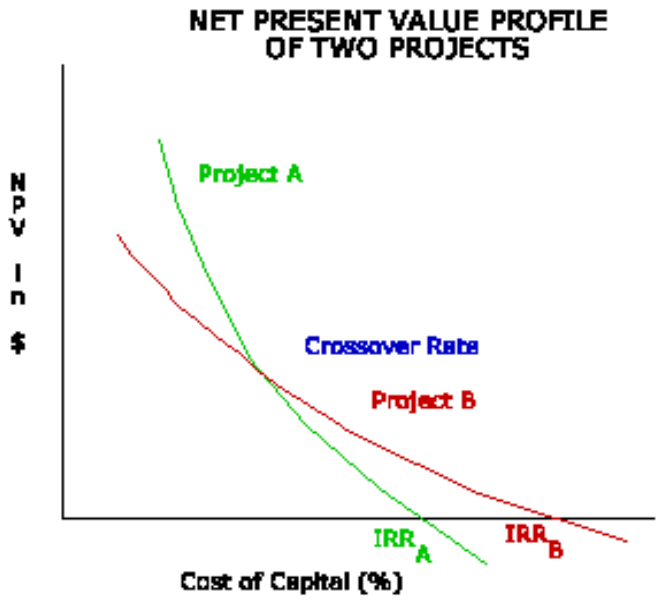
HP-12C		BA II Plus	
f CLEAR FIN	0.00	CF 2nd [CLR WORK]	CF_0 = 0.00
150 CHS g CF_0	-150.00	150 +/- [ENTER]	CF_0 = -150.00
25 g CF_j	25.00	⇩ 25 [ENTER]	C01 = 25.00
50 g CF_j	50.00	⇩ ⇩ 50 [ENTER]	C02 = 50.00
55 g CF_j	55.00	⇩ ⇩ 55 [ENTER]	C03 = 55.00
40 g CF_j	40.00	⇩ ⇩ 40 [ENTER]	C04 = 40.00
60 g CF_j	60.00	⇩ ⇩ 60 [ENTER]	C05 = 60.00
f IRR	14.59	IRR CPT	IRR = 14.59

LOS 47-c

Explain the NPV profile, the relative advantages and disadvantages of the NPV and IRR methods, particularly with respect to independent versus mutually exclusive projects, the "multiple IRR problem" and the cash flow pattern that causes the problem, and why NPV and IRR methods can produce conflicting rankings for capital projects.

The **net present value profile** is the graph showing the relationship between the NPV of a project and the cost of capital.

If we look at two projects, where project A is a long-term project and project B is a short-term project then the NPV of project A tends to be more sensitive to movements in the cost of capital (the cash flows that will be received far into the future will be most influenced by the discounting process).



The **crossover rate** is the discount rate at which the NPV of two projects cross. At a cost of capital above the crossover rate project B is more attractive; with the cost of capital below the crossover rate project A is more attractive.

The NPV lines cross the x-axis when the cost of capital is zero. The point that they cross will be the project's internal rate of return.

If analyzing *independent* projects, NPV and IRR analysis will always give the same recommendation to accept or reject each project (the graph shows that if the IRR is greater than the cost of capital, then the NPV will be positive).

If a firm is analyzing two *mutually exclusive* projects then the NPV and IRR analysis may give different answers.

If the cost of capital is less than the crossover rate, one project will give a higher NPV. When the cost of capital is more than the crossover rate, the other project will give a higher NPV (see graph above). These differences arise when either the cost of the project or the timing of cash flows is different.

The NPV method is considered preferable because it assumes that cash flows are reinvested at the cost of capital, whereas the IRR method assumes that they will be reinvested at the IRR.

A project has non-normal cash flows if negative cash flows occur after positive cash inflows. In this case the IRR method can give more than one solution, or multiple IRRs. Using the NPV method will avoid this situation.

Example 47-5 Multiple IRRs

A project has an initial cost of $10 million, will generate a cash inflow of $20 million in year 1 and a cash outflow of $10 million in year 2.

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2}$$

$$0 = -10 + \frac{20}{(1+IRR)} - \frac{10}{(1+IRR)^2}$$

$$IRR = 0\% \text{ or } 20\%$$

Using a financial calculator will generate an error message

The LOS do not require you to be able to describe or compute MIRRs, although it is included in the reading assignment, so we have included a brief description of MIRR for your information.

Modified internal rate of return (MIRR)

In spite of the arguments for using NPV rather than IRR, IRR is often preferred in the corporate world. This has led to the adoption of MIRR as a method for evaluating projects.

The MIRR is the discount rate that will make the present value of the terminal value of the project equal to the cost. The terminal value (TV) is calculated by summing the future cash inflows which are compounded at the *cost of capital* until the termination of the project. MIRR is considered more accurate since it assumes that the cash flows are reinvested at the cost of capital, which is generally more realistic than the IRR method, which assumes that they are reinvested at the IRR.

Example 47-6 Modified internal rate of return

The cost of a project is $150 million and the following cash flows are anticipated. The cost of capital is 10%.

Year	Net Cash Flow ($ million)
1	25
2	50
3	55
4	40
5	60

Example 47-6 (continued) Modified internal rate of return

The Terminal Value (TV) is given by:

$$= CF_1(1+k)^4 + CF_2(1+k)^3 + CF_3(1+k)^2 + CF_4(1+k) + CF_5$$

$$= 25(1.10)^4 + 50(1.10)^3 + 55(1.10)^2 + 40(1.10) + 60$$

$$= 36.6 + 66.6 + 66.6 + 44.0 + 60.0$$

$$= 273.8$$

$$\text{Cost} = \frac{\text{TV}}{(1+\text{MIRR})^5}$$

$$150 = \frac{273.8}{(1+\text{MIRR})^5}$$

$$\text{MIRR} = 12.8\%$$

When assessing two mutually exclusive projects the MIRR will give the same recommendation as the NPV method as long as the two projects are of equal size and life. If they have a different life, the terminal value for both projects must be calculated using the end date of the longest project. However if they are different sizes of projects the NPV and MIRR methods can give different answers. Overall the NPV method is still considered the better method although the MIRR is an improvement on the IRR method in giving a project's correct rate of return.

LOS 47-d

Describe the role of the post-audit in the capital budgeting process.

The **post audit** process refers to the task of 1) comparing the actual results of a project with those predicted and 2) explaining any differences.

It is important since:

- If managers know that their actions are being monitored they are more likely to improve their forecasting skills.
- Managers will try to improve their operations to ensure that forecasts are met.

Empirical evidence suggests that companies which put heavy emphasis on the post-audit stage are more successful.

48 Cash Flow Estimation and Other Topics in Capital Budgeting

Learning Outcome Statements (LOS)

48-a	**Distinguish** between cash flows and accounting profits and **discuss** the relevance to capital budgeting of the following: incremental cash flow, sunk cost, opportunity cost, externality, and cannibalization.
48-b	**Explain** the importance of changes in net working capital in the capital budgeting process.
48-c	**Determine** by NPV analysis whether a project (expansion or replacement) should be undertaken and **compute** and **interpret** each of the following for an expansion project and a replacement project: initial investment outlay, operating cash flow over a project's life, and terminal-year cash flow.
48-d	**Compare** two projects with unequal lives, using both the replacement chain and equivalent annual annuity approaches.
48-e	**Discuss** how the effects of inflation are reflected in capital budgeting analysis.

Introduction

Estimating the cash flows is a first step in applying NPV and IRR methods and the Reading identifies the cash flows which should be used in capital budgeting. Only incremental cash flows, and not sunk costs, are relevant in the process of capital budgeting and opportunity cost, externality and cannibalization need to be considered. Candidates also need to be able to rank a project, either an expansion or a replacement project, using NPV analysis. This will involve identifying three types of cash flows (initial investment outlay, operating cash flows over the project's life and the terminal year cash flows) and candidates have to avoid common pitfalls such as forgetting to adjust for additional working capital requirements at the beginning and end of projects and the impact of depreciation charges on tax.

LOS 48-a

Distinguish between cash flows and accounting profits and **discuss** the relevance to capital budgeting of the following: incremental cash flow, sunk cost, opportunity cost, externality, and cannibalization.

Defining cash flow

It is important to use cash flows and not accounting profits when evaluating a project, this is because it is necessary to consider the two components of cash flow – the return **on** capital (i.e. profit) plus the return **of** capital (i.e. depreciation).

Additionally, interest expense or financing costs should **not** be included since we are using the cash flow available to pay the cost of debt, which is incorporated in the weighted-average cost of capital being used to discount the cash flows. The text uses after-tax operating income plus depreciation. Adjustments should be made for all non-cash costs but for most companies depreciation is the largest item.

Example 48-1 Net cash flow

Sales	$120 million
Costs (including depreciation of $20 million	$ 50 million
Operating income	$ 70 million
Tax	$ 28 million
Net income	$ 42 million

Net cash flow = net income + depreciation = $42 + $20 = $62 million

When deciding which cash flows to use, you should use **incremental cash flows**. These are the total cash flows that occur as a direct result of taking on a specific project.

Sunk costs

These refer to costs that have already been paid or been committed to, regardless of whether a project is taken on or not. An example might be the cost of a consultancy company preparing a report on the feasibility of a project.

They should **not** to be included as a cost in a capital budgeting decision.

Opportunity costs

These refer to the cash flow that could be generated from an asset if it was not used in the project. For example, if a project is going to use premises that could be used for other purposes by the company.

Opportunity costs should be taken into account in the cash flows used.

Externalities

The impact of a project on other parts of a firm should be taken into account, whether positive or negative. This includes **cannibalization**, when sales of another side of the firm will be switched to the new area if a new project goes ahead.

Shipping and installation costs

Costs relating to the acquisition of equipment used in a project such as shipping and installation costs should be added to the cost of the project.

LOS 48-b

Explain the importance of changes in net working capital in the capital budgeting process.

In most cases a new project will require additional inventories and financing for higher receivables balances. These will partially be offset by higher payables and accruals. The difference is the change in **net working capital**. If it is positive this indicates the need for additional financing and this must be added to the cost of fixed assets at the beginning of the project. At the end of the project inventories will be sold and receivables collected so the net working capital will be returned.

LOS 48-c

Determine by NPV analysis whether a project (expansion or replacement) should be undertaken and **compute** and **interpret** each of the following for an expansion project and a replacement project: initial investment outlay, operating cash flow over a project's life, and terminal-year cash flow.

Cash flows from an expansion project

An expansion project is a project that is expected to increase sales.

When analyzing an expansion project the following steps need to be taken to calculate the incremental cash flows:

1. Estimate the initial investment outlay. This is the cost of assets required plus increase in working capital requirements (if any).
2. Estimate the operating cash flows over the project's life. This is net operating revenue plus depreciation, interest expense is not included.
3. Estimate the terminal-year cash flows. This will include salvage value of equipment (adjusted for tax) and addition of any previous increase in working capital.

Example 48-2 Expansion project

A company is considering a project to expand its manufacturing facilities with the purchase of a piece of machinery from a competitor. The cost of the machinery is $10 million. The machinery will be completely depreciated for tax purposes over three years although the company estimates that the salvage value will be $1 million at the end of the project's three-year life. Additional working capital will be required of $2 million. The additional operating income after tax generated by the piece of machinery is estimated to be $3 million per annum; the tax rate is 40%. The capital budget analysis should be calculated using a weighted-average cost of capital of 15%.

Initial outlay = $10 million + $2 million = $12 million

$ million	Year 0	Year 1	Year 2	Year 3
Cost of new machine	(10.00)			
Increase in net working capital	(2.00)			
Net operating income		3.00	3.00	3.00
Add back depreciation		3.33	3.33	3.33
Operating cash flow		6.33	6.33	6.33
Return of working capital				2.00
Net salvage value*				0.60
Total cash flows	(12.00)	6.33	6.33	8.93
PV of cash flows	(12.00)	5.50	4.79	5.87

* adjust for tax since the salvage value is $1 million and the book value is zero.

The net cash flow for the project is $4.16 million. If the managers have confidence in their estimates this indicates the expansion project should go ahead.

Cash flows from a replacement project

A replacement project is when new asset(s) are purchased to replacing an existing asset(s).

The above calculation for an expansion project needs to be modified to take account of the sale of the old asset:

Initial investment = cost of assets plus increase in working capital requirements (if any) less after tax cash flow from sale of old asset.

Operating cash flows = adjust for additional net operating revenue and any change in depreciation.

Terminal year cash flow = adjust for salvage value of equipment (net of tax) and addition of any previous increase in working capital.

Example 48-3 Replacement project

A company is considering a project to replace a piece of machinery. The cost of the machinery is $10 million. The machinery will be completely depreciated for tax purposes over three years although the company estimates that the salvage value will be $1 million at the end of the project's three-year life. The old machine can be sold for $2 million although its book value is $3 million; depreciation on the old machine was $1 million each year for the remaining three years of its life after which it was estimated to have zero salvage value. Additional working capital will be required of $2 million. The additional net operating income generated by the replacement of the machinery is estimated to be $3 million per annum; the tax rate is 40%. The capital budget analysis should be calculated using a weighted-average cost of capital of 15%.

Initial outlay = $10 million + $2 million = $12 million

$ million	Year 0	Year 1	Year 2	Year 3
Cost of new machine	(10.00)			
Sale of old machine	2.00			
Tax saving on sale*	0.40			
Increase in net working capital	(2.00)			
Increase in operating income		3.00	3.00	3.00
Increase in depreciation		2.33	2.33	2.33
Increase in operating cash flow		5.33	5.33	5.33
Return of working capital				2.00
Net salvage value				0.60
Total cash flows	(9.60)	5.33	5.33	7.93
PV of cash flows	(9.60)	4.63	4.03	5.21

* adjust for tax since the machine will be sold at $1 million below it book value.

The net cash flow for the project is $4.27 million.

LOS 48-d

Compare two projects with unequal lives, using both the replacement chain and equivalent annual annuity approaches.

Projects with unequal lives

Up to now we have compared projects with equal lives. In the replacement project example both machines were assumed to have the same remaining useful life. Now we look at two methods that can be used if we are comparing two mutually exclusive projects with different lives.

Replacement chain approach

This method assumes that each project can be repeated as many times as necessary until they have the same life, and then the NPVs can be compared.

Equivalent annual annuity approach (EAA)

This method calculates the payment each project would make if it were an annuity (calculate NPV and then calculate the EAA, using a financial calculator). Select the project with the highest EAA.

Example 48-4 Projects with different lives

A company is comparing two projects A and B. A has a life of 4 years and B a life of 2 years and the cash flows are shown below. The cost of capital is 8%.

Replacement chain approach

In this case we assume that Project B can be repeated at the end of two years with the same cash flows and costs of capital, the cash flows based on these assumptions are shown in the third column.

	Project A	Project B	Project B extended
Year 0	-30	-12	-12
Year 1	12	8	8
Year 2	10	7	7 – 12 = -5
Year 3	8	-	8
Year 4	8	-	7
NPV	1.92	1.41	2.62
IRR	11.08%	16.67%	16.67%

Initially the NPV of project A ($1.92 million) is higher than B's ($1.41 million) however when we use the replacement chain approach we can see that project B is more attractive.

Example 48-4 (continued) Projects with different lives

Equivalent Annual Annuity Approach

Use a financial calculator to work out the EAA for each project

	Project A	Project B
NPV	1.92	1.41
EAA	0.58	0.79

This means that project A is equivalent to an annuity payment of $580,000 per year for four years and project B to an annuity payment of $790,000 per year over two years. The project with the higher EAA will have a higher NPV if they are both extended to the same life.

The calculator keystrokes for project A are as follows:

HP-12C		BA II Plus	
[f] CLEAR [FIN]	**0.00**	[2nd] [QUIT] [2nd] [CLR TVM]	
1.92 [CHS] [PV]	**-1.92**	1.92 [+/-] [PV]	**PV = -1.92**
8 [ENTER] [i]	**8.00**	8 [I/Y]	**I/Y = 8.00**
4 [ENTER] [n]	**4.00**	4 [N]	**N = 4.00**
0 [ENTER] [FV]	**0.00**	0 [FV]	**FV = 0.00**
[PMT]	**0.58**	[CPT] [PMT]	**PMT= 0.58**

LOS 48-e

Discuss how the effects of inflation are reflected in capital budgeting analysis.

Inflation

Ideally, inflation expectations should be built into the cash flow forecasts since inflation is reflected in the weighted-average cost of capital. If it is not included in the cash flow forecasts there will be a downward bias on the NPV calculation.

49 Risk Analysis and the Optimal Capital Budget

Learning Outcome Statements (LOS)

49-a	**Distinguish** among three types of project risk: stand-alone, corporate, and market.
49-b	**Distinguish** among sensitivity analysis, scenario analysis, and Monte Carlo simulation as risk analysis techniques.
49-c	**Describe** how the security market line is used in the capital budgeting process and **describe** the pure play and accounting beta methods for estimating individual project betas.
49-d	**Discuss** the procedure for developing a risk-adjusted discount rate.
49-e	**Define** capital rationing.

Introduction

Up to now we have assumed that the actual cash flows of a project will match the estimated ones with certainty, but in reality they will not and we need a framework to analyze the risks. In this section we will look into three different types of project risk and we need to be able to distinguish between stand alone, corporate and market risks. Then we investigate three different types of risk analysis techniques which are commonly used, i.e. sensitivity analysis, scenario analysis and Monte Carlo simulation. Finally candidates need to be able to apply the Capital Asset Pricing Model (CAPM) to calculate required returns from projects to compensate for their beta-risk.

LOS 49-a

Distinguish among three types of project risk: stand-alone, corporate, and market.

Three types of risk can be identified when assessing a project:

1. *Stand-alone risk*

In this case the project is seen as independent of a firm's other activities. It is measured by the variability of the expected returns from the project.

2. *Corporate risk*

This considers the impact on the overall firm's activities; it is measured by the effect on the uncertainty of earnings of the firm. Corporate risk is more difficult to measure, so stand-alone risk is more commonly used; generally this will be a good proxy since the three types of risk are highly correlated.

3. Market risk

It is measured by the impact of the project on a firm's beta. For an investor it is the part of risk that cannot be diversified away.

Example 49-1 Types of risk

The example used in the text is General Motors. If General Motors decides to proceed with a major expansion project to produce electric cars the project will have the following risk factors:

Stand-alone risk – high since the project uses new technology.

Corporate risk – the project is expected to do best in a strong economy when car sales are high, this will make the project's performance highly correlated to the performance of General Motor's other business, so the corporate risk is high.

Market risk – the profits are highly correlated with the profits of other corporations so the beta will also be high, so market risk is high.

Investors will tend to be most concerned about corporate risk and market risk (since a firm's beta will be a major determinant of the stock price).

LOS 49-b

Distinguish among sensitivity analysis, scenario analysis, and Monte Carlo simulation as risk analysis techniques.

Measuring stand-alone risk

There are two methods for measuring stand-alone risk discussed:

1. **Sensitivity analysis**: measures how much the NPV of a project changes when a specified variable changes. The higher the sensitivities the higher the risk of the project.

Example 49-2 Sensitivity analysis

A firm is considering a project to build a factory to produce televisions. The most likely scenario is that the factory will produce 1 million televisions a year, which can be sold at $200 each, and costs are estimated to be $180 million a year. The NPV in this case (**base-case NPV**) is $100 million. In sensitivity analysis, different variables are considered such as unit sales price, unit volumes of sales, fixed costs, variable costs, cost of capital etc. For example, if the selling price for the televisions is $190 (5% below the estimate), the NPV is estimated to fall to $30 million, a fall of 70%, indicating that the project is highly sensitive to a small error in the unit price estimate.

2. **Scenario analysis**: different scenarios are assigned probabilities and the dispersion of the NPVs calculated in each scenario is measured, (reference probability distributions which are covered in Study Session 2). The best and worst-case NPV scenarios should be considered.

Scenario analysis has the disadvantage that it considers a number of discrete outcomes. A **Monte Carlo simulation** could be used using a computer program, which allows for a far larger number of outcomes and their probabilities to be analyzed.

LOS 49-c

Describe how the security market line is used in the capital budgeting process and **describe** the pure play and accounting beta methods for estimating individual project betas.

Beta risk

Beta and the Security Market Line (SML) are covered in much more detail in Study Session 12.

The Security Market Line (SML) links the required return for an investment (k_s) to its risk in terms of beta:

$$k_s = k_{RF} + \beta(k_M - k_{RF})$$

This is the same as Equation 46-3.

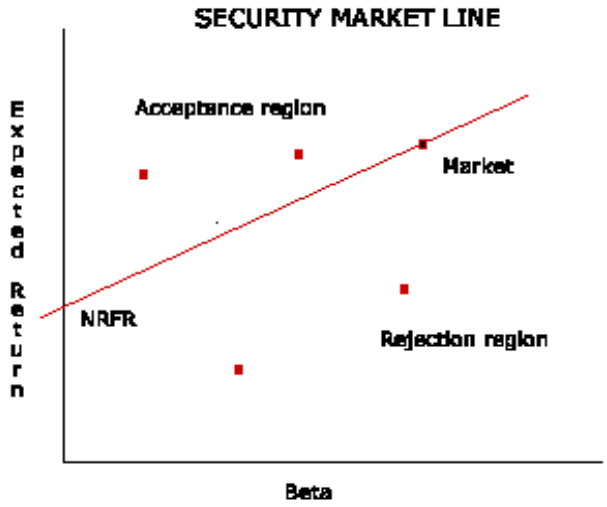
A project, from an investor viewpoint, is going to be attractive if the return earned from the project (which should be used as the discount rate to calculate the NPV of the project) compensates for the beta risk of the project.

Example 49-3 Required rate of return

A company is considering a project, which is estimated to have a beta of 1.2. The market return is 15% and the risk-free rate is 4%. The required return for the project, or **the project cost of capital** (k_P), is given by:

$k_P = 4\% + 1.2(15\% - 4\%) = 17.2\%$

This can be analyzed using the SML. If the project lies above the SML the project's expected rate of return is more than enough to compensate for the risk and the project should be accepted, if it lies below the line it should be rejected.



Measuring beta

Two approaches are discussed:

1. *The pure play method*

First of all, identify companies whose only business is the same as the project being analyzed, then take the average betas of these companies as a proxy for the beta of the project.

2. *The accounting beta method*

If the pure play method cannot be applied then an alternative is to consider a similar project and regress the return of the project against the return on assets for companies in a recognized index (e.g. the S&P Index).

LOS 49-d

Discuss the procedure for developing a risk-adjusted discount rate.

Risk-adjusted discount rates

One way of adjusting for the risk of a project is to change the discount rate used to reflect the risk, e.g. a high-risk project would be discounted at a higher rate than the firm's cost of capital.

To decide the discount rate, other than using CAPM, a firm might take two steps, 1) calculate divisional costs of capital on an operating division basis, 2) classify projects within that division by their riskiness.

LOS 49-e

Define capital rationing.

In theory, a firm should expand operations if marginal revenue exceeds the marginal cost, however in some circumstances there will be a reason to limit their expansion. **Capital rationing** refers to when a firm places a limit on the total size of its capital budget.

50 Capital Structure and Leverage

Learning Outcome Statements (LOS)

50-a	**Describe**, and **state** the impact of changes in factors that influence a company's capi structure decision.
50-b	**Explain** business risk, **discuss** factors that influence business risk, **calculate** and **interpret** the effect of changes in sales or earnings before interest and taxes (EBIT) on earnings per share for companies with different amounts of debt financing, **define** operating leverage, **calculate** and **interpret** degree of operating leverage, and **explain** how it affects a project's or company's expected rate of return.
50-c	**Calculate** the breakeven quantity of sales and **determine** the company's gain or loss at various sales levels.
50-d	**Explain** financial risk, **define** financial leverage, **describe** the relationship between financial leverage and financial risk, and **calculate** and **interpret** degree of financial leverage.
50-e	**Discuss** why the use of greater amounts of debt in the capital structure can raise both the cost of debt and the cost of equity capital and **describe** how changes in the use of debt can cause changes in the company's earnings per share and in the company's stock price.
50-f	**Distinguish** between the value of a company and the value of the company's common stock.
50-g	**Explain** the relationship between a firm's optimal capital structure and the firm's 1) weighted average cost of capital and 2) stock price.
50-h	**Explain** the effect of taxes and bankruptcy costs on the cost of capital, the optimal capital structure, and the Modigliani and Miller (MM) capital structure irrelevance proposition.
50-i	**Compare** the MM capital structure irrelevance proposition with the trade-off theory of leverage.
50-j	**Describe** how a company signals its prospects through its financing choices.

50-k	**Calculate** and **interpret** degree of total leverage.

Introduction

This Reading focuses on optimal capital structures or the balance between debt and equity financing that will maximize a company's share price. Although debt, since interest payments are tax-deductible, appears to be cheaper than equity, the situation is more complex. As a company increases its debt financing, the risk will increase pushing up the cost of both debt and equity. There is an optimal balance that can be achieved. Students are also required to know how to measure a company's operating and financial risk by computing degree of operating and financial leverage which, when multiplied together, will give the degree of total leverage.

Target capital structure

When a firm's management is deciding the target capital structure it must balance the following risk and return factors:

- Using more debt generally leads to a higher return.
- Using more debt increases the risk for stockholders.

The **optimal capital structure** will find a balance between these factors that will maximize the firm's stock price.

LOS 50-a

Describe, and **state** the impact of changes in factors that influence a company's capital structure decision.

Major factors that influence the capital structure include:

1. *Business risk*

If business risk (or risk in the company's operations) is high, the debt ratio should be lower.

2. *Tax position*

The higher the tax rate the cheaper debt is likely to be (since interest on debt is a tax deductible expense).

3. *Financial flexibility*

A firm should adopt a lower risk strategy if it anticipates needing additional funds in the future.

4. *Managerial style*

Aggressive or conservative management will influence the choice of capital structure.

LOS 50-b

Explain business risk, **discuss** factors that influence business risk, **calculate** and **interpret** the effect of changes in sales or earnings before interest and taxes (EBIT) on earnings per share for companies with different amounts of debt financing, **define** operating leverage, **calculate** and **interpret** degree of operating leverage, and **explain** how it affects a project's or company's expected rate of return.

LOS 50-c

Calculate the breakeven quantity of sales and determine the company's gain or loss at various sales levels.

Business and financial risk

Business risk is the risk associated with a firm's assets if it is not using debt. It is defined as the uncertainty in forecasting the future return on assets. This will depend on several factors such as:

- demand variability,
- sales price variability,
- input price variability,
- ability to adjust output prices to reflect changes in input prices,
- percentage of fixed costs (operating leverage).

Financial risk is the additional risk taken by stockholders if a firm uses debt financing.

Operating leverage

Operating leverage reflects the percentage of total costs that are fixed costs. High operating leverage means that a firm's operating income (EBIT) is very sensitive to a change in sales.

A company with high operating leverage will tend to have a high **breakeven point** (the level of sales where revenues equal costs and operating income is zero) reflecting the high fixed cost base.

Breakeven will occur when:

Equation 50-1

$$PQ - VQ - F = 0 \text{ where}$$

P	=	average sales price per unit of output
Q	=	units of output
V	=	variable cost per unit
F	=	fixed operating costs

Example 50-1 Breakeven production levels

Consider two companies, A and B, who are both manufacturing a product that sells for $10. (The example could be applied in the same way to different projects as well as companies). Their cost structures are different as shown in the table below:

	Company A	Company B
Unit price (P)	$10	$10
Variable cost per unit (V)	$8	$5
Fixed costs (F)	$50,000	$200,000

In both cases the units of output (Q) are expected to be 60,000 per annum.

Using Equation 50-1

For A the breakeven point is given by:

$$PQ = VQ + F$$

$$Q = \frac{\$50{,}000}{(\$10 - \$8)} = 25{,}000 \text{ units}$$

For B the breakeven point is given by:

$$Q = \frac{\$200{,}000}{(\$10 - \$5)} = 40{,}000 \text{ units}$$

The table below gives the sensitivity of each company's EBIT to a change in sales:

$'000		Company A		Company B	
Units sold	**Sales**	**Costs**	**EBIT**	**Costs**	**EBIT**
10,000	100	130	(30)	250	(150)
40,000	400	370	30	400	0
60,000	600	530	70	500	100
80,000	800	690	110	600	200
110,000	1,100	930	170	750	350

We can see from the table that:

1. B has a higher expected return at the anticipated sales level of 60,000 units.
2. The breakeven point is lower for A than B.
3. B's operating profit is more sensitive to a change in sales.

Generally:

- Higher operating leverage leads to a higher expected return.
- The risk of the return (in term of the variability of EBIT and ROE) is higher if the operating leverage is higher.

Degree of operating leverage (DOL)

This measures the change in earnings before interest and tax (EBIT) that results from a change in sales.

DOL = percentage change in EBIT/percentage change in sales

Expressing this another way, the DOL at point Q:

Equation 50-2

$$DOL = \frac{Q(P-V)}{Q(P-V)-F}$$

Example 50-2 Degree of operating leverage

Use the previous data for Companies A and B and set Q at 60,000 units

	Company A	Company B
Unit price (P)	$10	$10
Variable cost per unit (V)	$8	$5
Fixed costs (F)	$50,000	$200,000

$$DOL_A = \frac{[60{,}000(\$10-\$8)]}{[60{,}000(\$10-\$8)-\$50{,}000]} = \frac{\$120{,}000}{\$70{,}000} = 1.71$$

$$DOL_B = \frac{[60{,}000(\$10-\$5)]}{[60{,}000(\$10-\$5)-\$200{,}000]} = \frac{\$300{,}000}{\$100{,}000} = 3.0$$

For A, a 33.33% increase in sales to 80,000 units will lead to a 57% increase in EBIT, whereas for B, a 33.33% increase in sales will lead to a 100.0% increase in EBIT (as can be seen in the table in Example 50-1).

LOS 50-d

Explain financial risk, **define** financial leverage, **describe** the relationship between financial leverage and financial risk, and **calculate** and **interpret** degree of financial leverage.

LOS 50-e

Discuss why the use of greater amounts of debt in the capital structure can raise both the cost of debt and the cost of equity capital and **describe** how changes in the use of debt can cause changes in the company's earnings per share and in the company's stock price.

Financial leverage

Financial leverage is the extent to which fixed-income securities are used in a firm's capital structure. Financial risk is the additional risk placed on the stockholders as a result of financial leverage.

Now we extend Example 50-1 to examine the effect of different levels of financing on EPS.

Example 50-3 Effect of debt financing

Use Example 50-1 and look at various financing options for Company B. Assume that there are two alternatives:

1. B has $500,000 of debt at an interest rate of 6% and $500,000 of equity (50,000 shares).
2. B has $1,000,000 of equity (100,000 shares).

The tax rate is 40%

$' 000	Company B with 50% debt and 50% equity financing							
Units sold	**Sales**	**Costs**	**EBIT**	**Interest**	**Pre-tax income**	**Net income**	**ROE**	**EPS**
10,000	100	250	(150)	(30)	(180)	(108)	(21.6%)	($2.16)
40,000	400	400	0	(30)	(30)	(18)	(3.6%)	($0.36)
60,000	600	500	100	(30)	70	42	8.4%	$0.84
80,000	800	600	200	(30)	170	102	20.4%	$2.04
110,000	1,100	750	350	(30)	320	192	38.4%	$3.84

Example 50-3 (continued) Effect of debt financing

$' 000	Company B with 100% equity financing							
Units sold	**Sales**	**Costs**	**EBIT**	**Interest**	**Pre-tax income**	**Net income**	**ROE**	**EPS**
10,000	100	250	(150)	0	(150)	(90)	(9.0%)	($0.90)
40,000	400	400	0	0	0	0	0%	$0
60,000	600	500	100	0	100	60	6.0%	$0.60
80,000	800	600	200	0	200	120	2.0%	$1.20
110,000	1,100	750	350	0	350	210	21.0%	$2.10

We can see from the table that if there is no debt financing:

1. The expected return to stockholders at the anticipated sales level of 60,000 units is higher.
2. If sales are below the target the potential losses for stockholders are much larger.
3. If sales are above expectations the return for stockholders is much higher.

The above example illustrates that generally:

- The expected rate of return is higher for stockholders if debt financing is used.
- Increasing the proportion of debt used increases the risk to the common stockholders.

The analysis above shows that whilst debt is generally cheaper than equity, increasing the debt financing will also increase risk and therefore ultimately the cost of both the debt and equity. The key is to find the balance between debt and equity that is the optimal capital structure for the company.

Degree of financial leverage (DFL)

This measures the percentage change in earnings per share (EPS) that results from a percentage change in EBIT.

Equation 50-3

$$DFL = \frac{\%\text{ change in EPS}}{\%\text{ change in EBIT}} = \frac{EBIT}{EBIT - I}$$

where

I = interest payment

Example 50-4 Degree of financial leverage

Use the previous data for Company B with 50% debt financing, and Q is 60,000:

$$DFL = \frac{EBIT}{EBIT - I} = \frac{\$100,000}{(\$100,000 - \$30,000)} = 142\%$$

A 100% increase in EBIT would lead to a 142% increase in EPS.

LOS 50-f

Distinguish between the value of a company and the value of the company's common stock.

LOS 50-g

Explain the relationship between a firm's optimal capital structure and the firm's 1) weighted average cost of capital and 2) stock price.

Determining the optimal capital structure

The optimal capital structure is the one that maximizes the stock price, and minimizes the weighted-average cost of capital.

Increasing the debt component will reduce costs and increase earnings per share initially but as the level of debt increases, the firm will usually have to pay a higher interest rate on the new debt that it issues to reflect the greater risk of default. This will lead to EPS peaking at a certain level of debt. Also, as the debt level rises, the risk for an investor in the firm's stock increases, this will lead to an increase in beta, which in turn increases the required rate of return from equity and the cost of equity capital. The optimal capital structure may be at a lower level of debt than that which maximizes earnings per share.

LOS 50-h

Explain the effect of taxes and bankruptcy costs on the cost of capital, the optimal capital structure, and the Modigliani and Miller (MM) capital structure irrelevance proposition.

LOS 50-i

Compare the MM capital structure irrelevance proposition with the trade-off theory of leverage.

Capital structure theory

Modigliani and Miller (MM) initially proposed that it was irrelevant how a firm financed its operations (**capital structure irrelevance theory**). However their assumptions, which included the following, were considered unrealistic.

- No brokerage costs.
- No taxation.
- No bankruptcy costs.
- EBIT is independent of the use of debt.
- Investors can borrow at the same rate as corporations.
- Investors have the same information as management about a firm's future investment opportunities.

The next major paper from MM took into account that interest payments on debt were tax deductible and concluded that, given the other assumptions, companies should be 100% debt financed.

This was later amended to take account of the issue that dividend payments and capital gains, from the investor viewpoint, are taxed at a lower rate than income from bonds. Therefore the investors required rate of return from equities is correspondingly lower.

Bankruptcy costs

MM's theory assumed that there were no bankruptcy costs. This is not the case since bankruptcy leads to legal and accounting costs plus the risk that the firm's assets cannot be sold at the same price as if it were a going concern. Even the threat of bankruptcy will be sufficient to bring problems in terms of keeping employees, finding suppliers and maintaining a customer base. The costs of bankruptcy discourage firms from holding excessively high debt levels.

Trade-off theory

This theory followed on from the earlier work and said that firms must balance cheap debt financing against higher interest rates and bankruptcy costs. There will be an optimal capital structure when the marginal tax benefits from debt financing equal the marginal bankruptcy-related costs.

LOS 50-j

Describe how a company signals its prospects through its financing choices.

Signaling theory

On the basis that managers have better knowledge of their firm's prospects than investors (**asymmetric information**) a decision, for example, to raise money through a new share issue gives a signal about the company's prospects.

If management is positive about a company's prospects, it will avoid selling stock to raise capital since this will dilute the benefits to existing stockholders, including management, if the company is successful. On the other hand, if a company has poor prospects it will wish to bring in new stockholders to share the future losses.

LOS 50-k

Calculate and **interpret** degree of total leverage.

Degree of total leverage (DTL)

This measures the percentage change in EPS that results from a percentage change in sales.

Equation 50-4

DTL = DOL x DFL

Example 50-5 Degree of total leverage

The degree of total leverage for company B is given by:

$$DTL = DOL \times DFL = 3.0 \times 1.42 = 4.26$$

51 Dividend Policy

Learning Outcome Statements (LOS)

51-a	**Explain** the relationship between a firm's optimal dividend policy and the firm's stock price.
51-b	**Describe** the dividend irrelevance theory, the "bird-in-the-hand" theory, and the tax-preference theory and **explain** the dividend irrelevance theory in the context of the determinants of the value of the company, and **discuss** the principal conclusion for dividend policy of the dividend irrelevance theory and **describe** how any shareholder can construct his or her own dividend policy.
51-c	**Calculate**, assuming a constant return on equity, a company's implied dividend growth rate, given the company's dividend payout rate.
51-d	**Describe** how managers signal their company's earnings forecast through changes in dividend policy **describe** the clientele effect.
51-e	**Describe** the residual dividend model and **discuss** the model's possible advantages or disadvantages to the company.
51-f	**Describe** dividend payment procedures, including the declaration, holder- of-record, ex-dividend, and payment dates.
51-g	**Describe** stock dividends and stock splits, and **explain** their likely pricing effects and **discuss** the advantages and disadvantages of stock repurchases, and **calculate** and **interpret** the price effect of a stock repurchase.

Introduction

We now move on to the optimal dividend policy and what proportion of earnings a company should pay out to maximize its share price. There are three dividend preference theories you need to be familiar with – the dividend irrelevance theory, the bird-in-the-hand theory and the tax preference theory. Candidates also need to be able to describe dividend payment procedures and the impact of stock dividends and stock splits. Finally the advantages and disadvantages of stock repurchases are discussed.

LOS 51-a

Explain the relationship between a firm's optimal dividend policy and the firm's stock price.

LOS 51-b

Describe the dividend irrelevance theory, the "bird-in-the-hand" theory, and the tax-preference theory and **explain** the dividend irrelevance theory in the context of the determinants of the value of the company, and **discuss** the principal conclusion for dividend policy of the dividend irrelevance theory and **describe** how any shareholder can construct his or her own dividend policy.

Companies, which earn profits, can decide to use the profits to:

1. reinvest in the company's business or acquire new assets,
2. retire debt,
3. pay back funds to stockholders, either as dividends or through stock repurchase programs.

The optimal dividend policy should aim to maximize the company's stock price by balancing investors' requirements for current income against future growth. This will establish the **target payout ratio**, which is the percentage of net income that is paid out as dividends.

There are various theories on the appropriate target payout ratio for dividends:

1. Dividend irrelevance theory (advocated by MM)

This theory says that an investor can combine dividends and buying or selling stock to achieve whatever cash payment they wish to receive from an investment, so the firm's dividend payout policy is irrelevant. This is somewhat simplified since it ignore taxes and transaction costs.

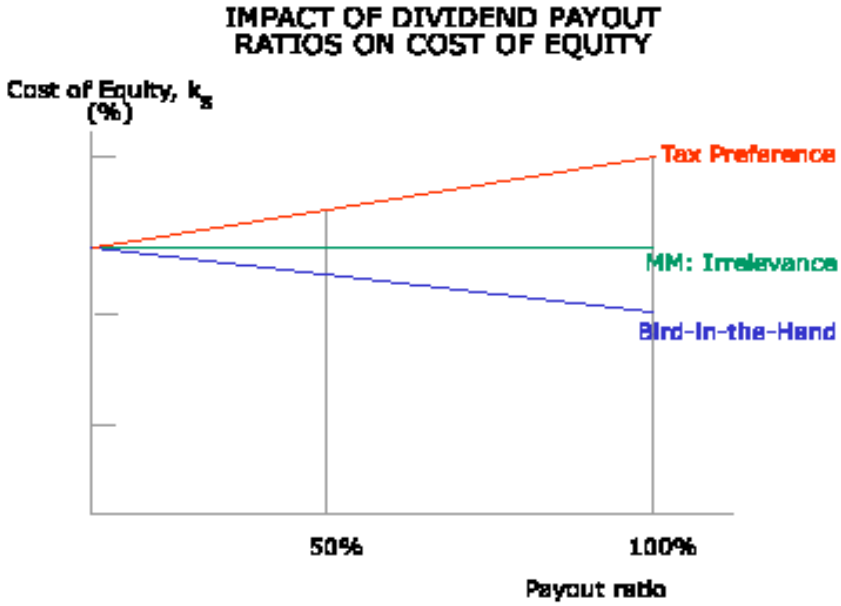
2. Bird-in-the-hand theory

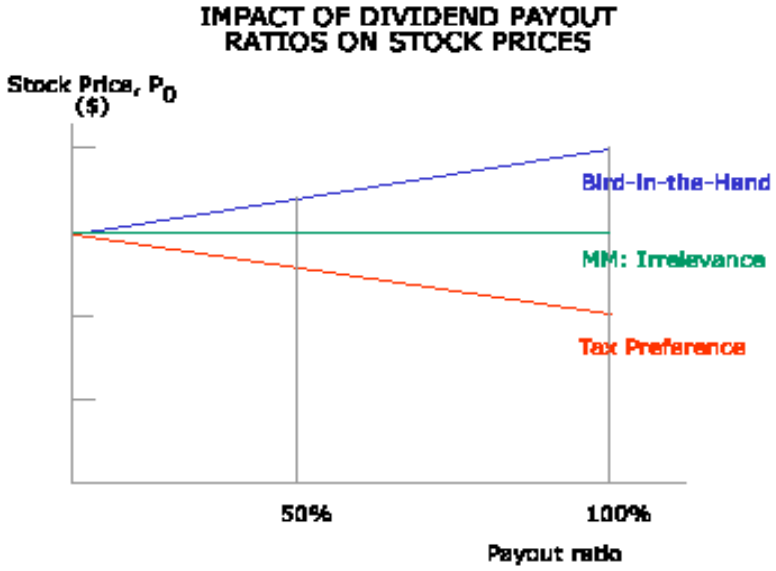
This theory says that a firm's value will be maximized if it sets a high dividend payout ratio. Investors prefer to receive cash today rather than an uncertain capital gain in the future.

3. Tax preference theory

Capital gains taxes are generally lower than taxes on dividend payments, also capital gains tax is paid at a later date (and not at all if the investor dies). These factors argue that investors prefer a low payout ratio.

The charts below illustrate the relationship between stock prices and the cost of equity relative to payout ratios under the different theories.





Empirically there is no clear evidence that investors prefer low or high payout ratios, but they do prefer stable policies.

LOS 51-c

Calculate, assuming a constant return on equity, a company's implied dividend growth rate, given the company's dividend payout rate.

Dividend stability

Investors prefer stable dividends whereas corporations would ideally change the dividends depending on cash available and investment opportunities.

A stable growth rate for dividends is given by g, where:

Equation 51-1

$$g = b \times ROE$$

where

b = proportion of earnings that are retained, which is 1 minus the payout ratio.

ROE = return on equity.

Example 51-1 Dividend growth rates

If a company has a stable return on equity of 15% and a dividend payout ratio of 60%, the dividend growth rate will be:

$$g = (1 - 0.60) \times 15\% = 6\%$$

LOS 51-d

Describe how managers signal their company's earnings forecast through changes in dividend policy **describe** the clientele effect.

Signaling hypothesis

Managers are reluctant to cut dividends and will only increase dividends if they are confident that they can maintain the higher dividend level. Therefore a larger than expected increase in dividends is a positive signal from management over future earnings prospects. This explains the better performance of shares following such an announcement, rather than investor preference for a higher payout ratio.

Clientele effect

The **clientele effect** says that investors have different preferences regarding dividend policies, and certain firms will tend to attract different types of investors.

Establishing dividend policy

When a firm decides the dividend policy it must take into account four factors:

1. Investors' preferences
2. The firm's investment opportunities
3. Its target capital structure
4. The availability and cost of external capital

LOS 51-e

Describe the residual dividend model and **discuss** the model's possible advantages or disadvantages to the company.

The **residual dividend model** says that the actual dividends paid should be retained earnings less funds needed to finance the firm's optimal capital budget. If the firm maintains the optimal capital structure through debt and equity financing, where the equity financing comes from retained earnings, it will minimize the marginal cost of new capital (since it avoids issuing costs for new equity). It is important to note the residual discount model should be used to establish dividend payout ratios over the long term, not just for one year.

LOS 51-f

Describe dividend payment procedures, including the declaration, holder- of-record, ex-dividend, and payment dates.

Dividend payment procedures

Dividends are normally paid quarterly and the procedure is described below:

1. *Declaration date* – This is the date when the directors declare a dividend.
2. *Holder-of-record date* – The stockholders listed as owners at the close of business on this date will receive the dividend.
3. *Ex-dividend date* – Usually in the US this is two days before the holder-of-record date. It is the date that the holder of a stock is no longer entitled to the dividend. If the stock is bought on this date the seller is entitled to the dividend.
4. *Payment date* – The firm pays the dividend (or mails the checks) to the holders of record.

LOS 51-g

Describe stock dividends and stock splits, and **explain** their likely pricing effects and **discuss** the advantages and disadvantages of stock repurchases, and **calculate** and **interpret** the price effect of a stock repurchase.

Non-cash dividends

Stock splits

The number of shares outstanding is increased by giving each stockholder more shares that are worth correspondingly less, e.g. a two-for-one stock split doubles the number of shares outstanding. The rationale for a stock split is usually to reduce the share price to make it more affordable to investors who wish to buy a lot of 100 shares.

Stock dividends

This is a dividend that is paid as additional shares rather than cash, e.g. a 10% stock dividend means that each holder of 100 shares receives an extra 10 new shares. This will also reduce the price of the stock, but by less than a stock split, so a stock dividend tends to be given on a regular basis to maintain a lower stock price.

Empirical findings

An announcement of a stock split or a stock dividend tends to lead to a rise in price of the stock. This is explained by the fact that such an announcement is seen as a positive signal from management. However if earnings or dividends are not subsequently seen to improve then the stock price will fall back again.

Stock repurchases

Stock repurchases have several *advantages* over dividend payments:

- They signal that management thinks that their stock is undervalued.
- Stockholders have a choice whether to sell or not.
- They can remove stock overhanging the stock market.
- Avoids committing management to an increased level of dividends long term.
- They can be used to adjust capital structure.

Disadvantages are:

- Investors may prefer dividends since they are seen as more dependable.
- Stockholders may have insufficient information to make a decision whether to sell stock.
- The firm may pay too much for the stock.

We can look at the price effect of a stock repurchase by working through Example 51-2.

Example 51-2 Price effect of stock repurchase

ABC Corp. has reported a profit of $5 million. There are 2 million shares outstanding, the shares are trading at $25 a share. ABC has surplus cash of $2.8 million and is considering a tender offer to repurchase 100,000 of its shares at $28 per share. The alternative is to use the equivalent amount of money to pay a special dividend of $1.40 per share. The effect of the repurchase on the share price can be calculated as follows:

Current EPS = $5 million/2 million = $2.50

Current P/E ratio = $25/$2.50 = 10 times

EPS after repurchasing 100,000 shares = $5 million/1.9 million = $2.63

Expected market price after repurchase = P/E x EPS = 10 x $2.63 = $26.30

The shareholders either receive the benefit of a $1.30 increase in the stock price (if the P/E remains constant) or a special dividend of $1.40 per share. However if the company could pay significantly less than $28 to buy back shares the repurchase could be the more attractive alternative for shareholders.

STUDY SESSION 12

Equity Investments: Securities Markets

Overview

We now move on to Asset Valuation which makes up a guideline weighting of 30% of the exam questions. In addition to this Study Session on securities markets, we look at equities, bonds, derivatives and alternative investments. We have built up knowledge of investment tools from the preceding Study Sessions and we are ready to examine the ways in which asset classes are analyzed and valued. This is a core part of the Level I material as reflected in the guideline weighting.

This is a short Study Session on security markets with a lot of descriptive, rather than analytical, material. We look at how markets function, then how stock and bond indexes are constructed and finally, we consider the efficiency of capital markets.

Reading Assignments

Investment Analysis and Portfolio Management, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

52. "Organization and Functioning of Securities Markets," Ch. 4

53. "Security-Market Indicator Series," Ch. 5

54. "Efficient Capital Markets," Ch. 6

52 Organization and Functioning of Securities Markets

Learning Outcome Statements (LOS)

52-a	Describe the characteristics of a well-functioning securities market.
52-b	Distinguish between competitive bids, negotiated sales, and private placements for issuing bonds.
52-c	Distinguish between primary and secondary capital markets, and explain how secondary markets support primary markets.
52-d	Distinguish between call and continuous markets, compare and contrast the structural differences among national stock exchanges, regional stock exchanges, and the over-the-counter (OTC) markets, and compare and contrast major characteristics of exchange markets, including exchange membership, types of orders, and market makers.
52-e	Describe the process of selling a stock short and discuss an investor's likely motivation for selling short.
52-f	Describe the process of buying a stock on margin, compute the rate of return on a margin transaction, define maintenance margin and determine the stock price at which the investor would receive a margin call.
52-g	Discuss major effects of the institutionalization of securities markets.

Introduction

This Reading looks at the operation of primary and secondary bond and stock markets. Primary markets are for the issue of new securities to investors and secondary markets for trading between investors. We review the different dealing systems, role of participants in the markets, types of orders and the mechanics of margin transactions.

LOS 52-a

Describe the characteristics of a well-functioning securities market.

Characteristics of a well-functioning market

Availability of information

Timely and accurate information needs to be available for investors to decide what price to pay for a security. This includes information on prices and volumes of dealing.

Liquidity

There are two factors that indicate liquidity.

Price continuity which means that prices do not change significantly between transactions, unless there is major news released.

Depth meaning that there are many buyers and sellers who wish to deal above and below the current price.

Low transaction costs

This is called **internal efficiency**. Investors clearly prefer markets where the transaction costs are a small percentage of the value of a trade.

Prices rapidly adjust to new information

This is called **external efficiency** or **informational efficiency**. Investors prefer markets where the prices reflect supply and demand for the security.

LOS 52-b

Distinguish between competitive bids, negotiated sales, and private placements for issuing bonds.

Primary markets

Primary markets are where governments, municipalities or companies sell new issues of bonds or shares to raise fresh funds.

Treasury bills, notes and bonds are sold by Federal Reserve System auction.

Municipal bonds are sold by one of the following three methods.

1. ***Competitive bid*** – the issue is sold to the underwriting syndicate that submits the bid with the lowest interest rate.
2. ***Negotiation*** – an underwriter is appointed to help prepare the issue and has the exclusive right to sell the issue.
3. ***Private placement*** – the issuer sells the issue directly to a small group of investors.

The underwriter provides three services:

- Origination - design and planning of the issue.
- Risk-bearing - the underwriter takes on the issue at an agreed price and takes the risk that it will not be able to sell the issue on at the same or higher price. Alternatively an investment bank can act on a best-efforts basis.
- Distribution - selling to investors, usually with the assistance of a selling syndicate.

In a negotiated bid the underwriter carries out all three roles. In a competitive bid the issuer may have paid a fee for advice from an investment bank on the design and pricing of the issue, and the risk-bearing and distribution function will probably be taken on by a different underwriter.

Corporate bonds are usually sold as a negotiated transaction through an investment bank acting as an underwriter.

Stock issues fall into two categories:

- Seasoned new issues – issues from companies that already have publicly listed stock outstanding.
- Initial public offerings (IPOs) – when stock is being sold to the public for the first time.

Both types of issue are usually arranged and underwritten by an investment bank, although they can be done on a private placement basis.

LOS 52-c

Distinguish between primary and secondary capital markets, and **explain** how secondary markets support primary markets.

Primary markets

Primary markets are where newly issued securities are sold by issuers, and the issuers receive the proceeds.

Secondary markets

Secondary markets are where trading takes place of bonds or stocks that are already in the public's ownership.

Secondary markets are important because they provide liquidity to the investors who bought issues in the primary market. They also provide pricing information which is used to price securities in the primary market.

LOS 52-d

Distinguish between call and continuous markets, **compare** and **contrast** the structural differences among national stock exchanges, regional stock exchanges, and the over-the-counter (OTC) markets, and **compare** and **contrast** major characteristics of exchange markets, including exchange membership, types of orders, and market makers.

Secondary equity markets

Trading in equities is done on listed securities exchanges and the over-the-counter (OTC) market which includes trading in securities not listed on an exchange.

Looking first of all at securities exchanges there are different types of trading systems. The first is a **pure auction market** where potential buyers and sellers submit bid and ask prices to an independent party who matches orders. This system is price-driven in the sense that the investor who offers to pay the most will be the buyer, and the investor willing to accept the lowest price will be the seller. The other system is a **dealer market** where dealers make a market in stocks (quoting bid-ask prices) and are willing to take positions on their own books. This provides liquidity.

Auction and dealer markets can be either call or continuous markets. In a **call market**, trading for each stock takes place at a specified time. After all information on buy and sell orders has been collected, the exchange will decide the single price at which all transactions will be processed. Call markets are more common in a new exchange when there are only a few stocks listed and a few traders. Also, exchanges can use a call market system to clear a build up of orders that has occurred overnight or after a stock has been suspended.

In a **continuous market** trades occur at any time when the market is open. These are either dealer or auction markets.

Secondary equity markets are classed as (i) national exchanges (ii) regional stock exchanges and (iii) OTC markets.

National stock exchanges

In the U.S. the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX) are considered to be national exchanges due to the number, prestige and geographical diversity of the companies listed, as well as the broad range of investors using the exchanges. Internationally, examples of national exchanges are the Tokyo Stock Exchange and the London Stock Exchange.

There are two trends internationally. The first is that new stock exchanges are being set up in emerging economies. The second trend is the consolidation of the exchanges in mature economies. The Global 24-hour market refers to the fact that it is possible to trade almost continuously in one of the New York, London or Tokyo markets.

Regional stock exchanges

Regional exchanges are important because they have less strict listing requirements. They list smaller local companies that are not big enough to list on the national exchanges. Many countries have one national exchange accounting for the majority of trading and several regional exchanges. The operating procedures are usually the same as in the national exchanges.

OTC markets

This includes trading in stocks not listed on the national and regional exchanges and it also includes trading in listed stocks. There are more stocks traded on the NASDAQ system (the OTC trading system) in the U.S. than the NYSE and AMEX combined, although NASDAQ is not the largest in terms of value of transactions. The OTC market is not a formal organization with membership; any security can be traded if a registered dealer is prepared to make a market in the security.

The OTC market is a negotiated market in the sense that investors negotiate directly with dealers. If an investor wishes to buy shares in a company his broker would look at the prices being offered by dealers.

Dealer	Bid	Ask
1	20.25	20.55
2	20.50	20.75
3	20.30	20.60

The broker will check the prices and will buy shares from Dealer 1 since this is the lowest offering or ask price. If the investor had been a seller they would sell the shares to Dealer 2 who has the highest bid price.

The dealer or market maker will adjust their prices based on their inventory in the stock and their expectations of future price movements.

The **third market** refers to trading in listed stocks outside the exchanges that they are listed on.

Trading in stocks directly between investors without using a broker is referred to as the **fourth market**.

Exchange membership

There are four major categories of members.

Market makers (specialists)

In the U.S. a market maker is called a specialist. Specialists act as brokers and dealers. As a broker they match orders and handle special limit orders. As a dealer they are expected to maintain a fair and orderly market and provide liquidity by buying and selling for their own accounts when necessary.

Commission brokers

These are employees of a member firm who buy and sell securities on behalf of the firm's clients.

Floor brokers

These are independent members who act as brokers for other members, for example when a commission broker is too busy to execute all his own trades.

Registered traders

These are members who buy and sell for their own account. Arguably they have better access to information and can avoid paying commission costs. Their transactions increase market liquidity.

Types of orders

Market order

This is the most common type of order, it is an order to buy or sell a security at the best current price.

Limit order

This order specifies the buying or selling price. It might be for a specific period of time, or might be open-ended.

Stop loss order

This is when the investor gives an order to sell a stock if it falls to a certain price. If the stock does fall to the specified price the order becomes a market order. It will be executed at the best price available, which won't necessarily be exactly the same as the price specified.

LOS 52-e

Describe the process of selling a stock short and **discuss** an investor's likely motivation for selling short.

Short sales

This refers to the sale of stock that is not owned. This is usually done with the intention of buying the stock back later at a lower price. The investor is clearly motivated by the anticipation of a fall in the price. The stock is borrowed from another investor who is given collateral. There are certain restrictions on short sales:

- The price of a short sale must be done at a higher price than the last traded price (an **uptick** trade), or at the same price but the last traded price must be higher than the price of the previous trade (**zero uptick**).
- The short seller must pay any dividends due to the lender of the stock.
- The short seller must deposit margin. The margin can take the form of another unrestricted security that is owned by the short seller.

Sometimes a short seller uses a **stop buy order** to limit a loss on a short sale if the stock price begins to rise.

LOS 52-f

Describe the process of buying a stock on margin, **compute** the rate of return on a margin transaction, **define** maintenance margin and **determine** the stock price at which the investor would receive a margin call.

Margin transactions

When an investor pays for part of the cost of purchasing shares by borrowing, usually from the broker, this is called buying on margin. The **initial margin requirement** is the percentage of the total transaction that must be paid for in cash (**percent margin**).

Buying on margin is effectively a leveraged transaction; the leverage factor is 1/percent margin.

After the initial purchase the proportion of the investor's equity (the market value of the stock less the amount borrowed) to the total market value of stock must not fall below the **maintenance margin level**. If it does fall below this level, a **margin call** will be made, and the investor will be required to deposit additional funds with the broker. The margin call occurs when:

Equation 52-1

value of equity < maintenance margin level x value of stock

Example 52-1 Margin transactions

An investor buys 1,000 shares on margin at a price of $100. The initial margin requirement is 40%, so the investor pays $40,000 of the $100,000 cost in cash and borrows the remaining $60,000. If the stock price rises to $110, the investor's equity is now $50,000 ($110,000 – $60,000) or 45.45% of the market value of the stock.

Return on the $40,000 investment is $10,000 or 25%. The leverage factor is 1/0.40 = 2.5.
(This assumes there is no interest cost in borrowing or trading commission).

If the maintenance margin is 25%, the investor will receive a margin call if the stock price declines to a price below P. P can be found by using Equation 52-1:

value of equity = maintenance margin level x value of stock

$$1{,}000\text{P} - \$60{,}000 = 0.25 \times 1{,}000\text{P}$$

$$\text{P} = \$80$$

So if the price falls to $75, the margin call (M) would be for the amount which will bring the equity back to 25% of the total value of the account value. The equity would be:

$$(\$75 \times 1{,}000) - \$60{,}000 + \text{M}$$

and the value of the account would be: $[(\$75 \times 1{,}000) + \text{M}]$

$$[(\$75 \times 1{,}000) + \text{M}] \times 0.25 = (\$75 \times 1{,}000) - \$60{,}000 + \text{M}$$

$$\$3{,}750 = 0.75\text{M}$$

$$\text{M} = \$5{,}000$$

LOS 52-g

Discuss major effects of the institutionalization of securities markets.

Institutionalization of securities markets

The growing institutionalization of the U.S. markets is shown by the rapid growth in the use of block trades which make up more than half of the volume on the NYSE. Block trades are trades of 10,000 or more shares and therefore almost always originate from financial institutions. The growth in block trades has led to the establishment of block houses who have sufficient capital to handle block trades. The institutionalization has had a number of effects on the market, discussed below.

Negotiated commission rates

The move to allow all commissions to be negotiated in the U.S has had a dramatic effect. Institutions typically only pay commission of 5 cents per share and individuals can access low commission rates by dealing through discount brokers. As a result many small research firms have disappeared as institutions find it cheaper to buy research from the big brokerage firms, and many medium and small-size investment firms have merged or gone out of business.

Influence of block trades

Specialists did not have sufficient capital to commit to block trades and block houses have been set up. Block houses are investment firms that deal in block trades; they are usually well capitalized with good contacts in the institutions.

Impact on stock price volatility

Although there is a belief that block trades are linked to increased price volatility there is little empirical evidence to support this.

Development of National Market System (NMS)

Many institutions are looking for a NMS that would provide a centralized system for reporting of transactions, quotations, and a centralized limit order book. They also want to see greater competition between market makers.

53 Security Market Indicator Series

Learning Outcome Statements (LOS)

53-a	**Distinguish** among the composition and characteristics of the three predominant weighting schemes used in constructing stock market series, **discuss** the source and direction of bias exhibited by each of the three predominant weighting schemes, and **compute** a price-weighted, a market-weighted, and an unweighted index series for three stocks.
53-b	**Compare** and **contrast** major structural features of domestic and global stock indexes, bond indexes, and composite stock-bond indexes.

Introduction

Security market indicator series, also called stock and bond market indexes, are widely used by market participants and investors in order to judge the strength or weakness of the market and measure portfolio performance. In order to use indexes it is important to understand how they are constructed and the implications of the different methods of weighting securities in an index.

Security market indexes

Security market indexes or series are used:

- To measure portfolio performance.
- For the construction of index funds.
- To examine factors that influence aggregate security price movements.
- By technical analysts.
- For beta calculation.

When constructing an index it is important to consider:

- The sample in the index must be representative of the population.
- The weighting given to the individual members in the sample (there are price-weighted, market-value-weighted and unweighted series).
- The mathematical method of calculating the index (arithmetic or geometric averaging or base period weighting).

LOS 53-a

Distinguish among the composition and characteristics of the three predominant weighting schemes used in constructing stock market series, **discuss** the source and direction of bias exhibited by each of the three predominant weighting schemes, and **compute** a price-weighted, a market-weighted, and an unweighted index series for three stocks.

The three main weighting systems used in constructing a series or index are:

Price-weighted series

This is the arithmetic average of current prices divided by a divisor which reflects the number of stocks in the index. The Dow Jones Industrial Average (DJIA) is a price–weighted average and on day t the index is calculated using:

Equation 53-1

$$DJIA_t = \sum_{i=1}^{30} p_{it} / D_{adj}$$

where

$DJIA_t$ = value of the DJIA at day t

p_{it} = closing price of stock i on day t

D_{adj} = adjusted divisor on day t

When there is a stock split the divisor will adjust to ensure the index is the same before and after the split.

Example 53-1 Stock splits and divisor calculator

Look at the example when there are three stocks, A, B and C, used to compute an index and stock A has a four-for-one stock split. The stock prices are shown below, with the index and divisor calculations.

	Share Price before split	Share Price after split
A	$100	$25
B	$50	$50
C	$10	$10
Total	$160	$85
Divisor	3	$85/53.33 = 1.59
Index	53.33	53.33

This means that high-price stocks carry more weight than low-price stocks in a price–weighted series. Adjusting for stock splits tends to have a long-term downward bias as rapidly growing or successful companies have rising stock prices leading to more stock splits. Another example of a price-weighted series is the Nikkei Stock Average.

Market-value-weighted series

This is the total value of shares in the series (current market price x number of shares outstanding) divided by the value of the series at a selected base date, multiplied by the index's beginning value. The index on day t is given by

Equation 53-2

$$\text{Index}_t = \frac{\sum P_t Q_t}{\sum P_b Q_b} \times \text{Beginning Index Value}$$

where

P_t = closing price for stock on day t
Q_t = number of outstanding shares on day t
P_b = closing price for stock on base day
Q_b = number of outstanding shares on base day

A stock split will not have an impact on the index since the market value of the company will not be changed. Examples of market-value-weighted series are the S&P, NYSE, and MSCI indices.

Unweighted index series

An equal dollar investment in each stock in the index is assumed, share price and market capitalization are irrelevant. Examples are the Value Line Indexes. Most academic work uses arithmetically averaged unweighted indices but both the Value Line Indexes and Financial Times Ordinary Share Index use the geometric means of security price moves. The geometric mean will be lower than the arithmetic mean for the same stock movements, the arithmetic mean will give the actual return earned on a portfolio holding the same stocks as the index. They are sometimes referred to as equal-weighted indexes.

Example 53-2 Computing indexes

Consider a market in which there are three stocks A, B and C.

	Number of Shares	Share Price end 2003	Market Cap. end 2003
A	2,000,000	$100	$200 million
B	10,000,000	$50	$500 million
C	100,000,000	$10	$1,000 million
Total		$160	$1,700 million

Price-weighted index

If the divisor is 3, using Equation 53-1

$$\text{Index} = 160/3 = 53.33$$

Example 53-2 continued Computing indexes

Market-value-weighted index

Set the beginning index equal to 100.

Look at the following two scenarios:

Scenario 1. At the end of 2004 the share price of A has doubled and the share prices of B and C have not changed.

Scenario 2. At the end of 2004 the share prices of A and B have not changed, but the share price of C has doubled.

	Scenario 1		Scenario 2	
	Share Price end 2004	**Market Cap. end 2004**	**Share Price end 2004**	**Market Cap. end 2004**
A	$200	$400 million	$100	$200 million
B	$50	$500 million	$50	$500 million
C	$10	$1,000 million	$20	$2,000 million
Total	$260	$1,900 million	$170	$2,700 million

Price-weighted index

Scenario 1

$$\text{Index} = 260/3 = 86.67$$

$$\text{Rise in index} = \left[(86.67 - 53.33)/53.33\right] - 1 = 62.5\%$$

Scenario 2

$$\text{Index} = 170/3 = 56.67$$

$$\text{Rise in index} = \left[(56.67 - 53.33)/53.33\right] - 1 = 6.3\%$$

Market-value-weighted index

Scenario 1 Using Equation 53-2 $\text{Index}_t = \dfrac{\sum P_t Q_t}{\sum P_b Q_b} \times \textit{Beginning Index Value}$

$$\text{Index} = \frac{\$1{,}900}{\$1{,}700} \times 100 = 111.8$$

$$\text{Rise in index} = 11.8\%$$

Scenario 2

$$\text{Index} = \frac{\$2{,}700}{\$1{,}700} \times 100 = 158.8$$

$$\text{Rise in index} = 58.8\%$$

Example 53-2 continued Computing indexes

Unweighted index

	Scenario 1		Scenario 2	
	Share Price end 2004	**Rise %**	**Share Price end 2004**	**Rise %**
A	$200	100%	$100	0%
B	$50	0%	$50	0%
C	$10	0%	$20	100%

Scenarios 1 and 2

Arithmetic mean = (0% + 0% + 100%)/3 = 33.33%

Rise in index = 33.33%

Geometric mean = $[1.00 \times 1.00 \times 2.00]^{1/3} - 1 = 0.26$

Rise in index = 26.00%

Example 53-2 illustrates that:

- The price-weighted index is sensitive to moves in high-price stocks.
- The value-weighted index is sensitive to moves in the share prices of companies with large market capitalizations.

LOS 53-b

Compare and **contrast** major structural features of domestic and global stock indexes, bond indexes, and composite stock-bond indexes.

Bond market series are more complex than equity market series since:

- the universe of bonds is wider
- the universe is constantly changing as bonds mature and new bonds are issued
- volatility changes as duration changes
- collecting bond prices is more difficult

Most of the bond indexes are market-value weighted and include total rates of return (price change plus accrued income plus coupon income reinvested). Domestic bond indexes are produced for both investment grade bonds and high–yield bonds.

Indexes are also produced for global bonds; these tend to be dominated by government rather than corporate issues.

Composite stock-bond indexes measure the performance of all securities in a market with a weighting system that is close to using market values.

54 Efficient Capital Markets

Learning Outcome Statements (LOS)

54-a	**Define** an efficient capital market, **discuss** arguments supporting the concept of efficient capital markets, **describe** and **contrast** the forms of the efficient market hypothesis (EMH): weak, semistrong, and strong, and **describe** the tests used to examine the weak form, the semistrong form, and the strong form of the EMH.
54-b	**Identify** six market anomalies and **explain** their implications for the semistrong form of the EMH, and **explain** the overall conclusions about each form of the EMH.
54-c	**Explain** the implications of stock market efficiency for technical analysis and fundamental analysis, **discuss** the implications of efficient markets for the portfolio management process and the role of the portfolio manager, and **explain** the rationale for investing in index funds.

Introduction

We now consider the efficiency of capital markets and whether all the information available about a security is already reflected in its price. Candidates need to examine the different forms of the Efficient Market Hypothesis (EMH) and the tests which support or disprove the hypothesis. Candidates also have to understand the implications of efficient markets for the portfolio manager and the rationale for the growth in index fund investing.

LOS 54-a

Define an efficient capital market, **discuss** arguments supporting the concept of efficient capital markets, **describe** and **contrast** the forms of the efficient market hypothesis (EMH): weak, semistrong, and strong, and **describe** the tests used to examine the weak form, the semistrong form, and the strong form of the EMH.

LOS 54-b

Identify six market anomalies and **explain** their implications for the semistrong form of the EMH, and **explain** the overall conclusions about each form of the EMH.

Definition

An efficient market, or to be more precise an informationally efficient market, is a market where security prices adjust rapidly to the arrival of new information and therefore current security prices reflect all the information available about the securities.

Assumptions

1. There are a large number of competing, independent, profit-maximizing participants who are analyzing and valuing securities.
2. New information comes to the market in a random fashion; the timing of one announcement is generally independent of others.
3. Investors attempt to adjust the security prices rapidly to reflect new information. Although price adjustments will not always be perfect they are unbiased.

If these assumptions hold then the expected security returns should only reflect the risk of the security. This means all stocks should lie on the market's Security Market Line; their returns are consistent with their risk.

The Efficient Market Hypothesis (EMH) is broken down into three forms as follows:

Weak-form EMH

This says that stock prices reflect all security-market information e.g. price and volume data. The implication is that past rates of return should have no relation to future rates of return.

Semistrong-form EMH

This says that stock prices adjust rapidly to all **public** information released. This includes non-market information such as earnings and dividend announcements, valuation measures etc. This means that basing decisions on information that is already in the public domain will not consistently lead to outperformance on a risk-adjusted basis.

Strong-form EMH

This asserts that stock prices reflect all information from public and private sources. This means that no group of investors has sole access to a certain type of information and can consistently outperform on a risk-adjusted basis. Information has no cost and is available to all investors. The strong-form includes the weak-form and semistrong-form EMH.

The evidence on the EMH is mixed and extensive work has been done to test the validity of the different forms of the hypothesis.

Tests for the weak-form EMH

Tests can be broken down into two categories.

Testing the independence between rates of return

This involves testing for correlation of stock returns and testing for runs. Tests have indicated little correlation between stock returns over time, although more recent tests have found evidence of correlation for small companies. Tests for runs found no evidence of patterns of movement (increases followed by decreases) that could not be explained by random movements.

Testing trading rules

Tests have focused on relatively simple trading rules based on using past market data. There are problems applying rules (some trading rules use subjective interpretation of data and there are unlimited potential trading rules) plus high theoretical trading costs. Generally, but not in all cases, tests support the weak-form hypothesis i.e. buying and selling securities based on trading rules does not outperform a buy and hold policy.

Tests for the semistrong-form EMH

Tests can again be broken down into two categories:

Studies to predict future returns using public non-market information

This includes time-series analysis using valuation measures. There is evidence from these studies that markets are not semistrong-form efficient due to anomalies (see below) which conflict with the markets being efficient.

Event studies

These examine how fast security prices react to public announcements. For example, announcements regarding stock splits, accounting changes, as well as economic news. Generally the findings support the hypothesis, although studies on stock price movement after an exchange listing indicate that there are some short-term opportunities to make an excess return.

Anomalies to the semistrong-form EMH

The following are anomalies that provide evidence that the markets are not semistrong-form efficient. Note that performance is being measured on a risk-adjusted basis relative to the market.

- Stock prices do not respond as rapidly as expected to earnings surprises. There is evidence of abnormal returns 13-26 weeks after an announcement.
- January effect. Investors sell loss-making stocks in December and then reinvest in January, leading to a superior relative performance of security prices in January. This is possibly explained by tax year-end dates in the U.S.
- The weekend effect. Average relative returns between Friday's close and Monday's open are negative for large firms and during Monday's trading are negative for small firms.
- Low P/E (price-earnings ratio) stocks perform better.
- Stocks with high BV/MV (book value to market value) tend to outperform; these are generally classified as value stocks. Outperformance is particularly noted in periods of monetary expansion.

- Small company stocks perform better although the performance is not stable. The differential may be accounted for by higher transactions costs and the risk of smaller companies may not be adequately explained by beta.
- Neglected company stocks perform better. Neglected means stocks that are only followed by a small number of analysts.

These anomalies illustrate that the market is not completely semistrong-form efficient.

Tests for the strong-form EMH

Tests have focused on looking at investors who have access to non-public information or an ability to react to new information before other investors.

Corporate insiders

Corporate insiders, such as company directors, are required to report to the SEC transactions in the stock of the firms where they are insiders. Analysis indicates that insiders achieve above average returns as a result of these transactions.

Stock exchange specialists

Specialists have access to information about unfilled limit orders that is not available to other investors. Specialists appear to be able to make money from selling shares at higher than the purchase price and also from trading in blocks of shares and after unexpected announcements.

Security analysts

Studies have looked at the performance of stocks that have high versus low rankings by Value Line (a well known research and advisory firm in the U.S.). Changes in a stock's ranking are usually reflected very rapidly in the stock's price and it is not possible to obtain excess returns from investing on the basis of these rankings, after taking into account transaction costs.

There is some evidence of the existence of superior analysts who apparently are accessing private information. They appear to have market timing and stock-picking skills.

Professional money managers

These are generally highly trained professionals and although they do not necessarily have access to monopolistic information they have the opportunity to interview the management of listed companies. Studies show that professional managers on average underperform the market, after taking into account fees.

The results from the four groups are mixed but much of the evidence supports the strong-form of the hypothesis. The main exceptions are the results from corporate insiders and specialists. Money mangers did not outperform, so from the point of view of the majority of investors the hypothesis holds.

LOS 54-c

Explain the implications of stock market efficiency for technical analysis and fundamental analysis, **discuss** the implications of efficient markets for the portfolio management process and the role of the portfolio manager, and **explain** the rationale for investing in index funds.

In conclusion the markets appear to be efficient with regard to much of the information available but there are a number of instances where the markets are not efficient.

The evidence that the capital markets are weak-form efficient indicates that technical analysis using historic market information will not lead to outperformance on a risk-adjusted basis, after transaction fees.

Fundamental analysts believe that market valuations and intrinsic valuations can be different, but eventually these differences will be corrected. The EMH suggests that using historic data will not help because prices adjust very quickly to news. However analysts can add value by forecasting economic variables that lead to long-term market movements. Understanding how these variables impact on security returns can lead to superior performance if estimates are both correct and different to the consensus. Also it should be possible to achieve superior returns by exploiting the anomalies to the weak-form of the EMH, e.g. by focusing analysis on neglected companies.

Implications for portfolio managers

If portfolio managers have access to superior analysts then they should use these analysts for recommendations for part of a portfolio, taking into account the risk preferences of the client. Analysts should be asked to focus on mid or small sized stocks that are not so widely followed so there is a greater chance of identifying undervalued stocks. Also they should focus on stocks with high BV/MV.

Portfolio managers who do not have superior analysts should do the following:

(i) Quantify their clients' risk tolerance.
(ii) Construct a portfolio which has the appropriate risk profile and maintain this risk level on an ongoing basis.
(iii) Diversify to eliminate any unsystematic risk by investing globally.
(iv) Minimize costs including taxes, transaction costs and avoid holding illiquid stocks.

The EMH justifies the move to the use of index funds. Index funds have the objective of duplicating the performance of selected market indices at the lowest possible research and trading cost.

STUDY SESSION 13

Equity Investments: Industry and Company Analysis

Overview

This Study Session covers a diverse number of topics related to equity analysis and valuation. It works through stock market analysis, industry analysis and individual security analysis. The emphasis is on fundamental analysis and using discounted cash flows and relative approaches (for example price earnings ratios and price to book value multiples) to value equities. However a later Reading looks at technical analysis and the philosophy and the indicators used by analysts are examined. The Study Session consists of Readings taken from different source texts so the candidate is exposed to a number of different approaches to equity valuation.

Reading Assignments

55. "An Introduction to Security Valuation," Ch. 11, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

56. "Stock-Market Analysis," Ch. 13, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

57. "Industry Analysis," Ch. 14, pp. 493-495, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

58. "Equity: Concepts and Techniques," Ch. 6, pp. 256-273, *International Investments,* 5th edition, Bruno Solnik and Dennis McLeavey (Addison Wesley, 2003)

59. "Company Analysis and Stock Valuation," Ch. 15, pp. 540-544 and 559–577, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

60. "Technical Analysis," Ch. 16, *Investment Analysis and Portfolio Management*, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)

61. "Introduction to Price Multiples," John D. Stowe, Thomas R. Robinson, Jerald E. Pinto, and Dennis W. McLeavey (AIMR, 2003)

55 An Introduction to Security Valuation

Learning Outcome Statements (LOS)

55-a	**Explain** the top-down approach, and its underlying logic, to the security valuation process.
55-b	**Explain** the various forms of investment returns.
55-c	**Calculate** and **interpret** the value of a preferred stock, or of a common stock, using the dividend discount model (DDM)
55-d	**Show** how to use the DDM to develop an earnings multiplier model, and **explain** the factors in the DDM that affect a stock's price-to-earnings (P/E) ratio.
55-e	**Explain** the components of an investor's required rate of return (i.e., the real risk-free rate, the expected rate of inflation, and a risk premium) and **discuss** the risk factors to be assessed in determining a country risk premium for use in estimating the required return for foreign securities.
55-f	**Estimate** the dividend growth rate, given the components of the required return on equity and incorporating the retention rate and current stock price.
55-g	**Describe** a process for developing estimated inputs to be used in the DDM, including the required rate of return and expected growth rate of dividends.

Introduction

In this Reading we focus on the application of discounted cash flow techniques in equity valuation. When valuing equities it is important to remember that the cash flows are not contractually agreed (as they usually are with a bond or money market instrument) so we need to adjust for the uncertainty of cash flows with a discount factor that includes an appropriate risk premium. Discounted cash flow concepts are core to this Reading but we also look at other issues including different valuation approaches and the drivers of a P/E multiple.

LOS 55-a

Explain the top-down approach, and its underlying logic, to the security valuation process.

Approaches to the valuation of securities

There are two general approaches to the valuation process which can be used by both fundamental and technical analysts.

Top-down approach

This is also called the three-step approach. This approach is based on the belief that the return from investing in a stock is heavily dependent on which economy, market and industry the issuer is in. Analysis using a top-down approach follows the steps shown below.

1. *Analyze alternative economies and securities markets*

The objective is to decide the country allocation and the allocation between bonds, equities and cash in each market. Analysts of economies will study a government's fiscal and monetary policies, inflation, interest rates, corporate and consumer expenditure, and exchange rates. Other macro factors include international events such as wars and political changes.

Generally, if a country is expected to move into recession, equity investors would tend to underweight a market (relative to its weight based on market value) and focus on defensive investments. On the other hand, if the economic outlook is positive, they will tend to overweight a market.

2. *Analyze alternative industries*

The next step is to use economic and market analysis to decide which industries will benefit and which will suffer in the expected environment. Other factors to consider are issues such as demographics and the industry's international exposure. These factors will determine which industries should be overweighted and which should be underweighted relative to the market weightings.

Industry analysis is an important step; it is very difficult for a company to perform well if it is operating in an industry that faces difficulties and all companies' profitability will be affected by their industry environment.

3. *Analyze individual companies and securities*

Individual companies are analyzed within the industries selected. This will include analyzing each company's past performance and forecasting its future prospects and then determining its value. Once the value has been compared to the market price you can decide whether it is an attractive investment.

The last objective is to purchase securities that fit in with the other securities in a portfolio; this will involve looking at data such as correlation between the securities. (This is covered in Study Session 18)

The top-down method is preferred by the authors due to its logical process and empirical support. It has been shown that stock prices and a company' earnings are linked to the economic environment and that the rate of return for industries and stocks within the industry are linked.

Bottom-up approach

This is stock picking. Followers of this approach believe that they can select stocks that are under priced and will outperform regardless of the industry and market outlook.

LOS 55-b

Explain the various forms of investment returns.

The next step is to look at the valuation of securities and we first need to explain the different types of return.

Investment returns

The return, or cash flow, can be received by an investor in different forms e.g. earnings, dividends, cash flow, interest payment, capital gains. Valuation models are based on different types of return and more than one model should be used to get an accurate valuation of an investment.

In addition to forecasting the returns themselves, it is necessary to estimate the timing of returns and the growth rate of returns.

We now look at how securities are valued. If the estimated value is greater than the market price, it is a buy signal and if it is lower it is a sell signal.

LOS 55-c

Calculate and **interpret** the value of a preferred stock, or of a common stock, using the dividend discount model (DDM).

Value of preferred stock

The holder of a preferred stock receives a dividend in perpetuity. The value of a preferred stock is given by:

Equation 55-1

$$\text{value} = \frac{\text{dividend}}{k}$$

where

dividend	=	annual dividend paid
k	=	the investor's required rate of return.

Example 55-1 Valuing preferred stock

A preferred stock pays a dividend of $10 a year and trades in the market at $80. If an investor's required rate of return is 12% then the value of the preferred stock to the investor is, using Equation 55-1,

$$\frac{\$10}{0.12} = \$83.33$$

Since the market price of $80 is below the estimated value the investor should consider buying the stock.

There are two main approaches to equity valuation. The first is using discounted cash flow techniques and the second is using relative measures (e.g. price/earnings and price/book value ratios). The first method we look at is the dividend discount model which is when we consider the value of the cash flows (dividends) that are paid to the equity investor.

Dividend discount model

This model values equities as the present value of future dividends to be paid to the investor.

Equation 55-2

$$\text{Value} = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \ldots\ldots + \frac{D_\infty}{(1+k)^\infty}$$

where

k = the required rate of return

D_i = the dividend in period i

If the stock is to be sold at the end of period n, for price P, the equation becomes:

Equation 55-3

$$\text{Value} = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \ldots\ldots + \frac{P + D_n}{(1+k)^n}$$

If it can be assumed that (i) the share is going to be held indefinitely, (ii) the growth rate (g) of dividends is constant and (iii) k is greater than g, then Equation 55-2 can be simplified to:

Equation 55-4

$$\text{Value} = \frac{D_1}{(k-g)}$$

Examples 55-2 Dividend discount model

1. A stock's last dividend was \$5 per share and dividends are expected to grow by 6% per annum indefinitely. If the investors' required rate of return is 12%, the value of the stock is given by

$$\text{Value} = \frac{D_1}{(k-g)} = \frac{\$5(1.06))}{(0.12-0.06)} = \$88.33$$

Note: it is important to use **next** year's dividend in the numerator.

2. An analyst forecasts a company will pay dividends of \$2 in the first year, \$3 in the second year and \$3.50 in the third year. After the third year dividends are forecast to grow at 4% per annum. If an investor's required rate of return is 12% the value of the stock is calculated as follows:

First, calculate the value of the stock at the end of year three, using Equation 55-4.

$$\text{Value} = \frac{D_4}{(k-g)} = \frac{\$3.50(1.04)}{(0.12-0.04)} = \$45.50$$

Using Equation 55-3, the value of the stock today is the sum of the present values of the first three years' dividends plus the present value of the end-year-three value.

$$\text{Value} = \frac{D_1}{(1+k)} + \frac{D_2}{(1+k)^2} + \frac{P+D_3}{(1+k)^3} = \frac{\$2}{(1.12)} + \frac{\$3}{(1.12)^2} + \frac{\$45.50+\$3.50}{(1.12)^3} = \$39.05$$

LOS 55-d

Show how to use the DDM to develop an earnings multiplier model, and **explain** the factors in the DDM that affect a stock's price-to-earnings (P/E) ratio.

Earnings multiplier model (or P/E)

P/E = current market price of stock/expected 12 month earnings per share

Using Equation 55-4, we can estimate the value of the P/E as:

Equation 55-5

$$P/E = \frac{(D_1/E_1)}{(k-g)}$$

So P/E is dependent on:

1. The expected dividend payout ratio, D_1/E_1
2. The estimated required rate of return, k
3. The expected growth rate of dividends, g

Example 55-3 Price-to-earnings ratio

If a firm has a dividend payout ratio of 70%, a required rate of return of 15% and a growth rate of 8% then the estimated P/E is, using Equation 55-5

$$P/E = \frac{(D_1/E_1)}{(k-g)} = \frac{0.70}{(0.15-0.08)} = 10.0$$

Note: As the payout ratio decreases g will increase and the P/E will increase (assuming the ROE is higher than k).

LOS 55-e

Explain the components of an investor's required rate of return (i.e., the real risk-free rate, the expected rate of inflation, and a risk premium) and **discuss** the risk factors to be assessed in determining a country risk premium for use in estimating the required return for foreign securities.

There are two inputs that are used in several valuation methods, the required rate of return and the expected growth rate in earnings; we look at these in turn.

Calculation of k, the required rate of return

The required rate of return will depend on:

1. The economy's real risk-free rate (RRFR).

   This is the minimum rate of return that an investor requires.

2. The expected rate of inflation E(I).

   The nominal risk-free rate (NRFR) takes into account the expected rate of inflation,

   NRFR = [1 +RRFR] [1 + E(I)] - 1

3. A risk premium.

   This reflects the additional return required from investment in different securities: it reflects the risk of each investment.

Country risk premium

When analyzing international investments, it is important to look at the risk components that vary between different countries. The major factors are as follows:

1. Business risk, reflects operating activity and operating leverage.
2. Financial risk, this measures the financial leverage used.
3. Liquidity risk, the U.S. has the most liquid capital markets, many emerging markets are illiquid.
4. Exchange rate risk, uncertainty of returns reflecting exchange rate movements.
5. Country risk, this reflects uncertainty due to factors such as political or economic turbulence in a country.

LOS 55-f

Estimate the dividend growth rate, given the components of the required equity and return on equity and incorporating the retention rate and current stock price.

LOS 55-g

Describe a process for developing estimated inputs to be used in the DDM, including the required rate of return and expected growth rate of dividends.

Estimating the growth rate, g

The growth rate of dividends will depend on the growth in earnings and the percentage of earnings paid out as dividends, as opposed to being retained by the company. Many analysts assume that the payout ratios are relatively stable in which case the growth rate of dividends equals the growth rate of earnings.

The growth rate is determined by the amount of earnings retained and the return on equity that it can generate on these earnings.

Equation 55-6

g = earnings retention rate x return on equity

Example 55-4 Estimating the growth rate

If a firm retains 50% of earnings and has a return on equity of 8% then its long-term growth rate g is given by

g = 0.50 x 0.08 = 0.04 or 4%

Using DuPont analysis we can break down the return on equity (ROE) into three components,

Equation 55-7

ROE = profit margin x total asset turnover x financial leverage

An increase in any of these ratios will increase ROE, and when an analyst estimates ROE he must look at the estimates for each of the three components.

Additionally analysts should look at historic trends for cash flow, earnings and dividends. This might take into account the averages of historic returns, or use linear regression models and log-linear regression models.

56 Stock-Market Analysis

Learning Outcome Statements (LOS)

56-a	**Calculate** the earnings per share (EPS) of a stock market series and the expected P/E ratio (earnings multiplier) of a stock market series, using the series' expected dividend payout ratio, required rate of return, and expected growth rate of dividends.
56-b	**Estimate** and **interpret** the earnings multiplier of a stock market series, **explain** changes in it, and **calculate** the expected rate of return for a stock market series.
56-c	**Explain** how the top-down approach can be used to analyze the valuation of world stock markets.

Introduction

In this Reading we focus on estimating the future price level of a stock market index or series. The method used is to initially estimate the future P/E ratio based on the payout rate, investors' required return and the sustainable growth rate. The second step is to forecast earnings for the index based on sales, profit margins, tax and interest costs. Once these are combined we have an estimate for P, the index level. Again candidates will be expected to know which variables lead to a change in the P/E of an index.

LOS 56-a

Calculate the earnings per share (EPS) of a stock market series and the expected P/E ratio (earnings multiplier) of a stock market series, using the series' expected dividend payout ratio, required rate of return, and expected growth rate of dividends.

If we can estimate the EPS for a stock market series and then estimate the P/E, we will be able to multiply them together to arrive at a price or value for the series. First we look at estimating the EPS, then at estimating the P/E.

The calculation of EPS for a stock market series

The calculation involves the following steps:

1. **Estimate the average sales per share.** This will reflect the estimate for GDP which can be linked to the change in sales using regression analysis.
2. **Estimate the operating profit margin**, defined here as EBITDA (earnings before interest, tax, depreciation and amortization). This will involve estimating the:
   - capacity utilization rate
   - unit labor costs
   - rate of inflation
   - impact of foreign competition

3. **Estimate depreciation per share**. This can be estimated by time-series analysis where depreciation depends on capital expenditure.
4. **Estimate interest expense per share**. This will involve looking at the amount of debt outstanding and the average interest rate paid on the debt.
5. **Estimate the corporate tax rate**. Look at the current tax rate and any government legislation that will lead to changes in the tax rate.

If we wish to estimate the P/E we can use Equation 55-5,

$$P/E = \frac{(D_1/E_1)}{(k-g)}$$

Again the most difficult parameters to estimate are k and g.

Required rate of return, k

In this case k is the NRFR for the time to maturity that is similar to an investor's holding period, plus an equity market risk premium.

Equity risk premium

The premium can be calculated in different ways.

Research by Ibbotson and Sinquefield for the period 1926 to 2001 for the U.S. market suggests that if we use geometric averages of returns from stocks versus Treasury bills the premium is 7.5%. However if we are considering the risk premium against an intermediate government bond (since most investors have a time horizon that is longer than a Treasury bill's) the appropriate long-term historical risk premium is about 6.5%.

However there are problems using a historic risk premium calculated over a very long time period. One criticism is that the bond market volatility has increased relative to equity market volatility so the premium will be lower in the future. Studies indicate the current risk premium should be in the range 2.5% to 6%.

Growth rate of dividends, g

Remember Equation 55-6

g = earnings retention rate x return on equity

These numbers need to be calculated for the market. The annual earnings retention rate is between 45% and 60% for the U.S. market but is quite volatile and heavily influenced by changes in earnings. It is more appropriate for the long-term investor to base estimates on long-term trends rather than short-tem differences.

The return on equity needs to be calculated by considering the individual components (net profit margin, asset turnover and financial leverage) for the market.

LOS 56-b

Estimate and **interpret** the earnings multiplier of a stock market series, **explain** changes in it, and **calculate** the expected rate of return for a stock market series.

Calculation of the earnings multiplier for a stock market series

Using the formula for the earnings multiplier $$P/E = \frac{(D_1/E_1)}{(k-g)}$$

The earnings multiplier is much more volatile than EPS as it is very sensitive to changes in k & g.

There are two ways to calculate the earnings multiplier:

1. **The direction of change approach** - use the current earnings multiplier and estimate the change based on the estimates for the three components (D/E, k and g). Specifically this will involve forecasting the direction and extent of change in:
   - the dividend-payout ratio
   - the real RFR
   - the rate of inflation
   - the risk premium for common stock
   - the earnings retention rate
   - the return on equity
2. **The specific estimate approach** - make specific estimates for the three components (D/E, k and g). Generally an analyst should consider different scenarios to derive optimistic and pessimistic estimates.

The calculation of the expected rate of return on a stock market series.

The expected rate of return is given by:

Equation 56-1

$$E(R_t) = \frac{IV - BV + Div}{BV}$$

where

$E(R_t)$	=	estimated rate of return during period t
IV	=	intrinsic value of the stock market series
BV	=	beginning value of the stock market series
Div	=	expected dividend on the stock market series during the investment horizon

It is expected that the market price will move towards its intrinsic value.

Example 56-1 Expected rate of return

A stock market series is expected to rise from 500 to 550 over one year and the estimated dividend per share over the period is 18. The expected rate of return is:

(550 – 500 + 18)/500 = 13.6%

If an investor's required rate of return is higher than 13.6% they should underweight the index, if it is lower they should overweight the index.

LOS 56-c

Explain how the top-down approach can be used to analyze the valuation of world stock markets.

Valuation of world stock markets

The valuation of international markets follows the same methodology. It uses a top-down approach where the relevant components of a country's economy are forecast first (e.g. GDP, capital investment, inflation, interest rates). The next step is to look at the corporate data, including forecasts for earnings and dividend growth, which leads to market valuation measures being estimated.

57 Industry Analysis

Learning Outcome Statements (LOS)

57	**Describe** how structural economic changes (e.g., demographics, technology, politics, and regulation) may affect industries.

Introduction

In this short Reading we consider the effect of structural changes in the economy on industries, as opposed to cyclical changes which result from ups and downs in the business cycle. Structural changes occur when the economy is going through a major change in the way it functions.

LOS 57

Describe how structural economic changes (e.g., demographics, technology, politics, and regulation) may affect industries.

Structural economic changes

The following are all changes which are having a long-term effect on the U.S. economy.

Demographics

This includes changes in the size of the population, age distribution, geographical distribution, ethnic mix and income distribution. In the U.S. the aging of the population may lead to a shortage of entry level workers leading to higher labor costs. On the other hand, demand in industries which cater to older people, and the savings and financial services industry will benefit.

Lifestyles

In the U.S., fashions, as well as trends towards dual career families, higher divorce rates and so on, impact on many different industries.

Technology

Advances in technology affect both the producers and users of new technologies, as well as reducing demand for 'obsolete' products. Changes in technology drive increased capital expenditure as firms try to use technology to gain a competitive advantage. The retail industry is a particular example; advances in technology have led to major improvements in understanding customer preferences for products on a geographical basis, and also in inventory control.

Politics and regulations

Changes in regulations and tax reflect both economic and social government policies. Clearly changes in regulations can have a major impact on certain industries. The finance and banking industry is particularly subject to changing regulation. Most industries are affected by laws on minimum wages, and tariffs and quotas affect many industries involved in international trade.

58 Equity: Concepts and Techniques

Learning Outcome Statements (LOS)

58-a	**Classify** business cycle stages and **identify**, for each stage, attractive investment opportunities.
58-b	**Discuss**, with respect to global industry analysis, the key elements related to return expectations.
58-c	**Describe** the industry life cycle and **identify** an industry's stage in its life cycle.
58-d	**Calculate** and **interpret** a concentration ratio and a Herfindahl index.
58-e	**Discuss**, with respect to global industry analysis, the elements related to risk, and **describe** the basic forces that determine industry competition.

Introduction

We now look at stocks in the context of their global industry. Whilst the country where a company is domiciled is clearly important, an investor will also need to analyse its competitors on a global basis. This Reading looks at the factors that need to be considered when evaluating a company in a global setting. It starts with an introduction to country analysis and the economic variables that analysts follow. When looking at economic growth it is important to differentiate between business cycles and long-term sustainable growth. Economic growth will feed thought to corporate profits and stock returns.

LOS 58-a

Classify business cycle stages and **identify**, for each stage, attractive investment opportunities.

The business cycle

In the short term, business cycle conditions can be favorable or unfavorable for investments in different asset classes or sectors. However the turning points of business cycles are very difficult to predict as they are determined by many factors in the private and government sector. In an ideal world, an investor would be fully invested in stocks at the trough and in bonds at the peak of the cycle.

The text quotes Calverley (2003, pp. 15-19) for the classification of the different business cycle stages:

1. **Recovery** – the economy is picking up from a slowdown or recession. Buy the country's cyclical stocks and commodities. Buy riskier assets as the recovery is confirmed.
2. **Early Upswing** – confidence has picked up and the economy is gaining momentum. Buy the country's stocks and commercial and residential property.

3. **Late Upswing** – boom mentality is in place. It is not a good time to buy stocks; commodity and property prices are also peaking. It is time to buy the country's bonds, as yields are high, and buy interest rate sensitive stocks.

4. **Economy Slows or goes into Recession** – economy is declining. Hold on the country's bonds which will perform well as the country's interest rates fall, similarly interest rate sensitive stocks will also perform well.

5. **Recession** – monetary policy will be eased but will take time to stimulate the economy. Towards the end of the recession, move into the country's stocks and commodities.

Business cycle synchronization

Global economies are becoming more integrated, so strong economic growth in one country will have a beneficial effect on companies exporting goods to that country helping to stimulate growth in foreign countries. However full synchronization between countries' economies has not happened, and is unlikely to happen, given the importance of national economic factors. There are still benefits to investors who diversify internationally.

Growth theory

This is the study of the factors (including labor, capital and productivity) which lead to different rates of sustainable long-term growth. When analyzing an economy, it is important to establish the source of growth, whether it is input-driven (e.g. from capital inflows from overseas) or efficiency-driven. Increased productivity or efficiency will have a more sustainable impact on growth than input-driven growth.

It is important to look at the relationship between country and industry analysis. For multinational companies the country of domicile may not be particularly relevant as the majority of their sales are in other countries.

LOS 58-b

Discuss, with respect to global industry analysis, the key elements related to return expectations.

Industry analysis and return

Global analysis is performed with the objective of finding companies that can earn on a sustainable basis a return on equity above the required rate of return. This means analysts must focus on sources of growth and sustainable competitive advantage rather than current levels of profits or cash flows. We outline below the key areas to analyse in order to identify investment opportunities.

Demand analysis

Demand is studied by (1) the use of regression equations to help forecast demand and (2) market surveys. Demand forecasts are critical for all capacity and production decisions.

Value creation

The value chain is the process by which raw material is transformed into a product or service. Upstream refers to activities which are close to raw material supply and downstream as being activities close to the consumer. Each transformation in the chain adds value; the amount of value added depends on:

Learning/experience curve – cost per unit declines as a company gains experience.

Economies of scale - average cost declines as output expands.

Economies of scope - as a company moves into related products, experience and reputation with the original product may help demand.

Network externalities – some products and services gain value as more and more customers use them.

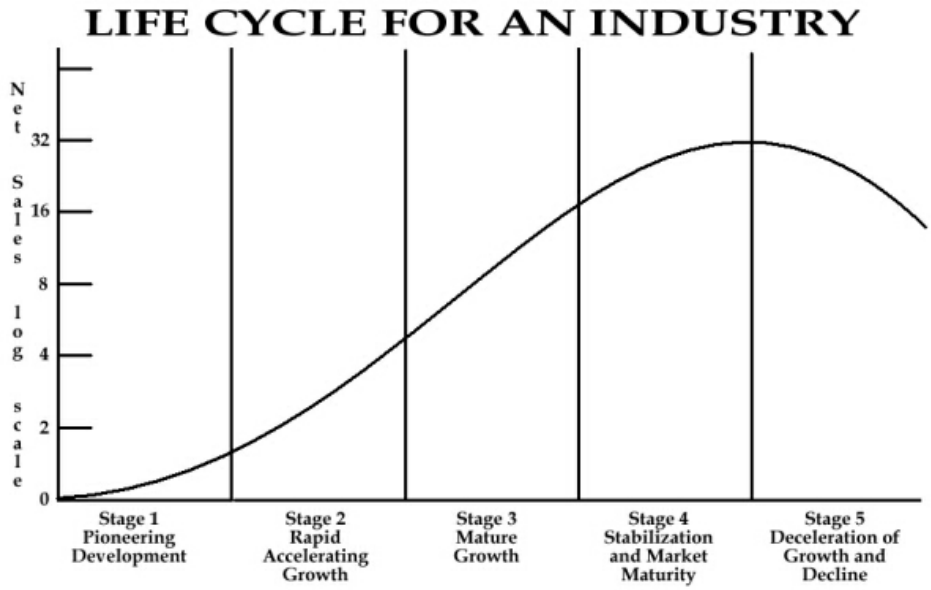
An analyst will be studying the value chain and the position of each company in the chain. Their position will help determine their ability to make profits and over time there will be profit migration between different parts of the value chain.

LOS 58-c

Describe the industry life cycle and **identify** an industry's stage in its life cycle.

Industry life cycle

One popular method of analysis divides the life of an industry into five stages based on the rate of growth in sales.



Pioneering development

This is the start-up stage when an industry has slow sales growth and small profits, or losses. There are probably major development costs.

Rapid accelerating growth

The firms in the industry experience strong sales growth as demand for the products rises rapidly. There is little competition, leading to high profit margins and very rapid profits growth.

Mature growth

During this stage there is higher growth in sales than in the overall economy, but competitors have entered the market and profit margins stabilize.

Stabilization and market maturity

In this stage the industry grows in line with the economy. It becomes highly competitive on a price basis which reduces profit margins, and returns on capital decline to a long-term competitive level.

Deceleration of growth and decline

Sales growth declines because of demand shifts and/or the availability of substitutes. Profit margins fall and the focus is on improving efficiency.

LOS 58-d

Calculate and **interpret** a concentration ratio and a Herfindahl index.

Competitive environment

One of the most important steps in analyzing an industry is to look at the competitive structure of the industry which will determine the ability of firms to earn above-average rates of return.

One method is to look at the N firm concentration ratio which is the combined market share of the largest N firms in the industry. An alternative measure is the Herfindahl index. This is defined by:

Equation 58-1

$$H = M_1^2 + M_2^2 + ... + M_n^2$$

where

H	=	Herfindahl index
M_i	=	market share of ith firm

The Herfindahl index will have a value less than or equal to one, and a large number (above 0.18) indicates that the industry is dominated by a few players (oligopolistic) and a small number (less than 0.1) that the industry is competitive with no dominant participants. Between 0.1 and 0.18 indicates moderate concentration. If there are N firms which all have equal market share then the index is simply 1/N.

The N firm concentration ratio is useful because it is an easily recognized measure of the dominance of the largest firms whereas the Herfindahl index is useful because it includes data on all firms, although it gives a greater weighting to firms with a large market share.

Example 58-1 Assessing the competitive environment

An analyst is comparing two industries A and B. The following data is given on the market shares of the largest participants in the industries. An analyst decides to compare the five firm concentration ratios and the Herfindahl indexes for each industry.

Industry A	Industry B
One firm has 50%	Six firms have 16.67%
Four firms have 5%	
Ten firms have 3%	

Industry A

Five firm concentration ratio is 70%

The Herfindahl index = $M_1^2 + M_2^2 + ... + M_{15}^2 = 0.50^2 + 4(0.05)^2 + 10(0.03)^2 = 0.2690$

Industry B

Five firm concentration ratio is 83.33%

The Herfindahl index = 1/6 = 0.1667

Although the five firm concentration ratio is higher for industry B the Herfindahl index is lower reflecting lower concentration than industry A since industry A is dominated by one participant with 50% of the market.

Competitive advantage

Porter, a leading academic in the area of competition, looked at the factors that give one location a competitive advantage over another. Four factors that can lead to a competitive advantage are:

- Factor conditions such as human capital which could be measured by years of schooling.
- Demand conditions such as size of the domestic market.
- Related supplier and support industries.
- Strategy, structure and rivalry such as management practices and corporate governance.

Competitive strategies

There are three competitive strategies identified by Porter which a firm can use:

- Cost leadership – be the lowest cost producer.
- Differentiation – provide products not provided by the competitors.
- Focus – target a market niche.

Sector rotation

Many investors use the business cycle as an indicator for when certain industries are going to outperform. For example they purchase consumer durables and consumer non durables in a recovery or early upswing since these industries do well in a strong economy. However consumer staples are more defensive and will do better in a recession. This type of strategy can be dangerous - although demand for an industry's products may depend on the stage of the business cycle this may not feed through to higher profits.

LOS 58-e

Discuss, with respect to global industry analysis, the elements related to risk, and **describe** the basic forces that determine industry competition.

Industry analysis and risk

An investor needs to look at potential returns in relation to the risks involved. We now look at the risks in relation to the industry sector. Risks will differ from sector to sector, in some cases the main risk will be the business cycle; in others technological change may pose the greatest risk.

Market competition

Here we need to evaluate the likely success of competitive strategies. In many cases we are looking at firms who are trying to maintain a competitive advantage which will involve deterring new entrants or promoting exit strategies. Using pricing strategies such as predatory pricing (pricing below cost) can help drive competitors out of the market. When evaluating a company, it is important to assess the risk that it will be unable to maintain its competitive advantage.

Value chain competition

Companies must also compete within the value chain. Workers' wages are an example of this; workers are suppliers of a resource and may well demand a higher proportion of potential profits. There are also co-opetition risks; co-opetition refers to cooperation along the value chain. Co-opetition risks include risks that the suppliers of materials may delay delivery or that their distributors may decide to use other producers. Generally suppliers of commodities, rather than differentiated products, will have less ability to extract profits from other participants in the value chain.

Five forces

Porter believed that five factors determined the competitive environment and the importance of each will vary according to the industry. The factors are shown below in some cases slightly modified or extended (ref. Oster):

1. **Rivalry amongst existing competitors**, this includes issues such as foreign competitors, the cost base of the industry and exit barriers. Coordination between participants can reduce rivalry and create excess profits.
2. **Substitutes**, considerations include how similar are the potential substitutes and how are they priced.
3. **Bargaining power of buyers**, if buyers have much larger businesses they have more power than individuals. Standardization of products increases the buyers' power because they can purchase elsewhere. High buyer power tends to reduce profitability for the producer.
4. **Bargaining power of suppliers**, the more suppliers in the industry the less the supplier power. Standardized products reduce supplier power since the supplier does not have a differentiated product. Also watch out for the potential of buyers to integrate backwards and cut out the suppliers.
5. **Threat of new entrants**, this will include considering barriers to entry. The higher the potential profits the more likely it is that new firms will try and enter the industry. High exit costs will discourage new entrants.

Other factors to consider are:

Government participation – governments may decide to subsidize certain companies. Not only does this create a risk of poor profitability for competitors but creates uncertainty over future policy. Other issues are government policies on wages and benefits, and exports and imports.

Risks and covariance – here we are looking at standard deviations of returns for a stock or industry. Part of standard deviation can be diversified away so then we need to look at beta which is related to the covariance between return and the market returns. Betas will vary due to factors such as the business cycle and the competitive environment.

59 Company Analysis and Stock Selection

Learning Outcome Statements (LOS)

59-a	Differentiate between 1. a growth company and a growth stock, 2. a defensive company and a defensive stock, 3. a cyclical company and a cyclical stock, and 4. a speculative company and a speculative stock.
59-b	Describe and estimate the expected earnings per share (EPS) and earnings multiplier for a company.
59-c	Calculate and compare the expected rate of return based on the estimate of intrinsic value to the required rate of return.

Introduction

In this Reading we use the same methodology used in the valuation of a stock market index covered in Reading 56. To value individual stocks, we estimate the earnings multiplier (P/E) and earnings in order to arrive at an estimate for the future price of the stock. Candidates are also expected to be able to differentiate between the definitions for a growth, defensive, cyclical and speculative stock and company.

LOS 59-a

Differentiate between 1. a growth company and a growth stock, 2. a defensive company and a defensive stock, 3. a cyclical company and a cyclical stock, and 4. a speculative company and a speculative stock.

It is important to differentiate between company analysis and stock selection. Company analysis may identify a company that is highly attractive in terms of growth and management. However, when it comes to looking at the valuation of the stock it may be that the market has already discounted the favorable prospects in the share price and the shares are trading above their intrinsic value. In this case the stock should probably be avoided. On the other hand, there may be a company with less attractive prospects where the stock price is trading below its intrinsic value, which makes it a more attractive investment.

Growth companies and growth stocks

Growth companies – these are traditionally companies that have shown above average growth in sales and earnings, although they can also be defined as companies that have the potential to earn a rate of return that is above the required rate of return or cost of capital.

Growth stock – A growth stock is one that has achieved a higher risk-adjusted return than other stocks in the market. Growth stocks are not limited to being stocks of growth companies. They are stocks that at some stage were undervalued by the market but during the adjustment to a fair value exhibited superior performance.

It should be noted that growth companies' share prices have not generally provided superior performance in the past, meaning they are not always growth stocks.

A **defensive** company is one whose earnings are resilient to economic downturn. A defensive stock is one that has a low or negative beta so the stock price is expected to fall by less than the market in a downturn.

Similarly a **cyclical** company is heavily influenced by the business cycle whereas a cyclical stock has a high beta and is expected to rise or fall by more than the market.

A **speculative** company is one where the business is risky but there is the potential for a large gain. A speculative stock is one with a high probability of poor returns and a small probability of spectacular returns.

Value versus growth investing

Value stocks are ones which are undervalued on some measure other than their growth potential, such as a low price/book or price/earnings value. In this comparison we are looking at growth stocks to mean something different to the definition above; in this case we are looking at growth stocks as ones which have above average sales or earnings growth. They will often trade at high price/earnings and price/book values.

LOS 59-b

Describe and **estimate** the expected earnings per share (EPS) and earnings multiplier for a company.

Estimating a company's earnings per share

Once again the earnings per share forecast will depend on the sales and profit margin forecasts.

Estimate sales, look at the company's sales performance with respect to its industry and the economy, as well as factors that will influence the individual company's ability to increase sales e.g. potential to expand capacity.

Estimate the company's profit margin, look at the firm's performance relative to the industry environment, its competitive position, and general company trends.

Estimating a company's earnings multiplier

Two methods can be used to calculate the earnings multiplier:

1. Use macroanalysis to estimate the P/E by looking at the economy and its industry.
2. Calculate the three components of the earnings multiplier; the dividend payout ratio, the required rate of return and growth rate.

LOS 59-c

Calculate and **compare** the expected rate of return based on the estimate of intrinsic value to the required rate of return.

The calculation of the expected rate of return of a stock

One way to make an investment decision is to buy a stock that is trading below its intrinsic value and to sell a stock trading above its intrinsic value. Another approach is to use the intrinsic value to calculate the expected rate of return assuming the market price migrates to the intrinsic value, and add the stock dividend. This can be compared to the investor's required rate of return.

The expected rate of return is given by:

Equation 59-1

$$E(R_t) = \frac{IV - BV + Div}{BV}$$

where

$E(R_t)$	=	expected rate of return during period t
IV	=	estimated intrinsic value of the stock
BV	=	beginning value of the stock (or current market price)
Div	=	expected dividend per share during the holding period

Example 59-1 Expected rate of return

A stock is trading at a market price of $42.00 and an analyst uses discounted cash flow analysis to estimate an intrinsic value of $45.00. The expected dividend per share is $3.50 over the period. The expected rate of return is:

(45.00 – 42.00 + 3.50)/42.00 = 15.5%

If an investor's required rate of return is higher than 15.5% over this period, they should sell the stock; if it is lower they should buy the stock.

60 Technical Analysis

Learning Outcome Statements (LOS)

60-a	**Explain** the underlying assumptions of technical analysis and **explain** how technical analysis differs from fundamental analysis.
60-b	**Discuss** the advantages and challenges of technical analysis.
60-c	**Identify** examples of each of the major categories of technical indicators.

Introduction

This is a broad introduction to technical analysis, the philosophy or assumptions made by technical analysts, and the challenges to their work. Technical analysts differ from fundamental analysts in that they believe prices are driven by both rational and irrational factors. The Reading also looks at the signals technical analysts use to indicate that the market or an individual security price is moving into a new trend.

LOS 60-a

Explain the underlying assumptions of technical analysis and **explain** how technical analysis differs from fundamental analysis.

Technical analysis involves examining past trading prices and volume data to identify trends that can be used to predict future market and security price movements.

Assumptions of technical analysis

The assumptions made by technical analysts include:

1. Prices are decided by supply and demand.
2. Supply and demand are driven by rational and irrational behavior.
3. Prices move in trends that persist for long periods of time.
4. The shifts in supply and demand can be seen in market price behavior.

The main difference between fundamental analysts, technical analysts and followers of EMH is in the time that they believe security prices take to react to news. EMH says that prices react almost immediately to news, fundamentalists believe there is a little longer to make decisions and technical analysts believe that it takes time for a new equilibrium price to be established. Technical analysts also believe that new information that affects supply and demand comes into the market over a period of time rather than at one specific point in time.

LOS 60-b

Discuss the advantages and challenges of technical analysis.

Advantages of technical analysis

- There is no need to analyze financial statements and adjust accounting data for different accounting methods.
- Technical analysis incorporates psychological and fundamental reasons for price moves.
- Technical analysis signals buys and sells without needing to justify why other investors are buying and selling.
- Technical analysts have more time to decide whether a new trend for a stock price is being established.

Challenges to technical analysis

- Results of testing correlations between prices and runs and the use of trading rules, with respect to the weak-form Efficient Market Hypothesis, have shown that technical analysis based on past market data does not provide superior performance.
- If sufficient technical analysts are operating in a market then they will drive price moves. This will lead to technical analysis working, but only in the short term, since if a price move is not based on fundamentals the price will return to its equilibrium.
- If a trading rule is found to be successful, several technical analysts would follow the rule so it is unlikely to continue to generate profits.
- Trading rules are subjective. Different analysts will reach different conclusions when presented with the same market data.

LOS 60-c

Identify examples of each of the major categories of technical indicators.

When referring to technical analysts it is important to differentiate between:

1. **Contrarians** who believe that as the market approaches peaks and troughs, investors will generally become over-bullish or bearish, and
2. Analysts who '**follow the smart money**'; they wish to follow the positive sentiment of sophisticated investors.

Contrary-opinion technical analysts

This group of analysts uses the following indicators to assess what the majority of investors are doing, and then take the opposite view.

1. **Mutual fund cash positions**. The percentage held in cash varies between about 5 and 13%. Contrary-opinion analysts believe that mutual funds generally have a high percentage of cash near the trough of markets so a high cash position is read as a bullish indicator. On the other hand a low cash position would be seen as a bearish indicator.
2. **Investor credit balances in brokerage accounts**. Investors sell stocks and leave the cash balances in brokerage accounts if they expect to reinvest the money in the short term. Therefore if the credit balances increase it is seen as a build up of purchasing power and is a buy signal. Alternatively a decline in credit balances is a sell signal.
3. **Investor advisory opinions**. Based on the view that most investment advisors are trend followers therefore if the 'bearish sentiment index' (bearish opinions/total opinions) is more than 60% this would be seen by technicians as a bullish indicator and if it were lower than 20% technicians would see it as a bearish indicator.
4. **OTC volume versus NYSE volume**. OTC trading is considered to be speculative compared to NYSE trading and the percentage of speculative trading is highest at market peaks.
5. **Put/Call Ratio**. A high ratio is read by technicians to be a bullish indicator, and a low ratio a bearish indicator.
6. **Futures traders bullish or bearish**. Technical analysts will look at the percentage of speculators in stock index futures who are bullish or bearish and then take the opposite view.

Follow the smart money

Technical analysts who wish to **follow the smart money** use the indicators below:

1. **Confidence Index**. This is published by Barron's and is the average yield on the 10 top grade corporate bonds divided by the yield on the Dow Jones average of 40 bonds (with a lower average credit quality). The ratio will be high, approaching 100, when investors are confident and relatively happy to invest in lower grade bonds.
2. **T. Bill - Eurodollar Yield Spread**. When the spread is large, typically at times of international crisis, it shows that investors are keen to invest in Treasury bills as a safe-haven investment.
3. **Debit balances in brokerage accounts**. These represent margin borrowing. An increase could be read as a bullish sign, a decrease as a bearish sign.

Other indicators

These are often used to obtain a view of overall market sentiment by technical analysts.

1. **Breadth of Market**. This measures the number of securities that have risen versus the number that have declined. This can be measured by following the advance-decline series which is the net advances, or declines, relative to the market to see if they move in the same direction. If they move together is shows that the market move is broadly based, if not, it indicates that the market is near a peak or trough.
2. **Short interest ratio**. This is equal to the outstanding short interest/average daily trading volume. A high ratio is considered bullish since potentially the short sellers will need to buy back stock in the market.
3. **Share prices relative to moving average**. If more than 80% of stocks are above the 200-day moving average then the market is overbought. If less than 20% of stocks are above the 200-day moving average then the market is oversold.
4. **Block uptick - downtick ratio**. This is an indicator of institutional sentiment. A low ratio indicates an oversold market and a high ratio indicates an overbought market.

Price and volume analysis

Dow Theory. Prices move in major, intermediate and short-term trends. Followers are hoping to identify the major trends. A major upward trend may be broken by intermediate downward trends but if each peak was higher than the last and upward moves are accompanied by high volumes this would be seen as a bullish signal.

Support and resistance levels are useful in determining price trends. A *support level* is the price range at which a substantial increase in demand for the stock is expected which will reverse a declining trend. A *resistance level* is the price range at which a substantial increase in supply of the stock is expected which will reverse a rising trend.

Moving-average lines. When moving-average lines cross, it can signal a reversal in trend.

Relative strength. Technicians believe that if a stock or industry is outperforming the market it will tend to continue to do so.

Charts

Analysts who are looking for repetition of past trends often use charts; the charts used include bar charts and point-and-figure charts.

Technical analysis of bond markets

Similar trading rules used for bonds are used in equity markets. One problem with bonds is that, since trading is mainly OTC, volume data is not available.

61 Introduction to Price Multiples

Learning Outcome Statements (LOS)

61-a	**Discuss** the rationales for the use of price to earnings (P/E), price to book value (P/BV), price to sales (P/S), and price to cash flow (P/CF) in equity valuation and discuss the possible drawbacks to the use of each price multiple.
61-b	**Calculate** and **interpret** P/E, P/BV, P/S, and P/CF.

Introduction

This Reading discusses four of the most commonly used price multiples or ratios, price to earnings (P/E), price to book value (P/BV), price to sales (P/S), and price to cash flow (P/CF). The multiples are fairly simple to calculate, and readily accessed in newspapers etc. They can be used for comparing a stock to another stock, to an industry or a market. Ratios give a measure of the price of a stock relative to its earnings or assets, or other measure of value. If the characteristics of two companies are very similar the one trading on the lower multiple offers the better value.

We look at each of the four multiples in turn and consider the rationale for using the multiple and how it is defined and calculated.

LOS 61-a

Discuss the rationales for the use of price to earnings (P/E), price to book value (P/BV), price to sales (P/S), and price to cash flow (P/CF) in equity valuation and **discuss** the possible drawbacks to the use of each price multiple.

LOS 61-b

Calculate and **interpret** P/E, P/BV, P/S, and P/CF.

Price to earnings (P/E)

Rationales for using P/E are

- Most analysts see earnings as the main driver of value (followed by cash flow, book value and dividends).
- It is widely recognized and used by investors.
- Empirical research shows low P/E stocks tend to outperform the markets over long periods.

Disadvantages in using P/E include

- Earnings per share (EPS) can be negative, in which case the P/E is meaningless.
- EPS may not reflect ongoing or recurring earnings of the company.
- EPS will reflect management's choice of accounting practices and not be comparable with EPS reported by other companies.

Determining earnings

Whilst the current price of a stock is usually readily available, different EPS can be used to compute the P/E.

Trailing P/E – this is the same as the current P/E, and the EPS used are those for the most recent four quarters.

Leading P/E – this is the forward or prospective P/E, and the EPS used are the next year's expected EPS.

Usually an analyst is looking forward, so a leading P/E is more useful. However if earnings are unpredictable a trailing P/E might be used. Issues to consider in the calculation of EPS are:

- The company's Nonrecurring earnings. Nonrecurring earnings are generally removed by the analysts and underlying earnings are used. Examples of Nonrecurring earnings are extraordinary items, restructuring costs, effects of changes in accounting methods, asset write-downs and merger costs.
- Transitory components due to the industry or business cycle. Business-cycle-adjusted EPS is referred to as normal EPS and it is the EPS that is expected mid-cycle. Normal EPS can be calculated as the average over the last business cycle, or as the average ROE over the last business cycle multiplied by the current book value per share.
- Differences in accounting methods. In order to compare P/Es between two companies, it is important to ensure that the same accounting methods are used (e.g. LIFO versus FIFO), and if not, adjust the accounts so that they are comparable.
- Potential dilution of EPS - use earnings that are diluted to reflect convertibles, options and warrants outstanding.

Earnings yield is E/P; in this case if we rank stocks highest to lowest the most expensive stocks have the lowest E/P and the cheapest the highest. One advantage of looking at E/P is that stocks with negative P/Es can be ranked on the same basis using E/P and the lower the negative E/P the less attractive.

Example 61-1 P/E calculation

ABC Commodities is sensitive to the economic cycle; they have also been through a period of restructuring. You decide that the six years ending 2005 reflect a business cycle for the company and collect the following data, EPS and BVPS in US$.

	2000	2001	2002	2003	2004	2005
Reported EPS	1.25	2.70	6.50	2.25	3.25	1.00
Adjusted* EPS	1.30	2.65	5.50	4.30	3.25	1.00
ROE* %	0.04	0.13	0.22	0.18	0.12	0.03
BVPS						32.00

* Adjusted for Nonrecurring items

The current share price of ABC Commodities is $30.00

In order to calculate the normalized EPS there are two methods that can be used

1. Use the average of the recurring EPS over the six-year period and Normal EPS = (1.30 + 2.65 + 5.50 + 4.30 + 3.25 + 1.00)/6 = 3.00

   P/E = 30.00/3.00 = 10.00

2. Use the average ROE over the period, and multiply by the current book value.

   Average ROE = (0.04 + 0.13 + 0.22 + 0.18 + 0.12 + 0.03)/6 = 0.12

   Normal EPS = 0.12 x 32.0 = 3.84

   P/E = 30.00/3.84 = 7.81

   The P/E using the second method is lower, this is because it is calculated using the current size of the company, rather than on the average size over the last six years.

Price to book value (P/B)

Here we are comparing the price of the shares to the investment the shareholders have made in the company. Book value is shareholders' equity, or total assets minus total liabilities.

Rationales for using P/B are

- Book value is generally a positive number.
- It is more stable than EPS.
- Book value is viewed as appropriate for valuing companies with mainly liquid assets, where the market value is approximately the same as the book value e.g. banks, insurance and finance companies.
- Book value may be appropriate for companies that are not expected to continue to operate as a going concern.
- Empirical research shows low P/B stocks tend to outperform the markets over long periods.

Disadvantages in using P/B include

- Other assets, not included on the balance sheet are often significant, for example human capital.
- It is not a good measure for comparing companies with very different levels of assets being employed.
- Accounting differences between companies will invalidate comparisons between different companies, and especially those in different countries.
- Book value may not reflect the market value of a company's assets, particularly in an inflationary environment.
- Intangible assets, such as goodwill, may be included in the balance sheet which many analysts do not regard as real assets.

Calculation of BV

BV per share is common shareholders' equity divided by the number of common stock shares outstanding.

Some adjustments may be made to book value in order to make it better reflect the value of shareholders' investment.

- **Tangible book value** is book value less reported intangible assets. Whilst goodwill should probably be deducted other items such as patents may be considered individually.
- Adjust for off-balance-sheet assets and liabilities and for difference in fair value and historic cost of assets.
- Adjust to comparable accounting methods.

Price to sales (P/S)

Rationales for using P/S are

- Sales numbers are less subject to accounting manipulation.
- Sales are positive.
- Sales are more stable than EPS.
- P/S is viewed as appropriate for valuing mature, cyclical and zero-income companies.
- Empirical research shows that P/S can be linked to stock performance.

Disadvantages in using P/S include

- A business can generate positive sales without being profitable or generating positive operating cash flow.
- It can not be used for comparing companies with different cost structures.
- There is still potential to manipulate sales figures.

Price to cash flow (P/CF)

Rationales for using P/CF are

- Cash flow is less subject to manipulation by management.
- Cash flow is generally more stable than EPS.
- Using cash flow can avoid the issues of quality of earnings between different companies.
- Empirical research shows that P/CF can be linked to stock performance.

Disadvantages in using P/CF include

- When approximations for cash flow, such as earnings plus non-cash charges, are used then important items such as changes in working capital are often ignored.
- Free cash flow to equity is the preferred cash flow that should be used, but tends to be a more volatile measurement of cash flow.

STUDY SESSION 14

Fixed Income Investments: Basic Concepts

Overview

There are two Study Sessions covering fixed income investments. Study Session 14 provides definitions and descriptions of the main characteristics of different types of fixed income instruments, plus an introduction to the basic concepts behind bond valuation. Study Session 15 looks in greater detail at the methods of analyzing and measuring interest rate risk of fixed income instruments.

Study Session 14 starts with a description of the typical features that define fixed-income securities, i.e. the principal and coupon cash flows and the factors that may affect the regularity of such cash flows. In the second Reading the different types of risks related to investing in bonds are discussed. Interest rate risk is covered in greater detail as interest rates are the main determinant of the price movement of most high-grade bonds. The third Reading familiarises the candidates with the features of a variety of bond sectors, such as government and corporate bonds. The last Reading delves into the concept of yield spread, i.e. the additional yield on a bond relative to a given benchmark, as well as the external factors that may influence the level of yields expected by an investor.

Reading Assignments

Fixed Income Analysis for the Chartered Financial Analyst® Program, 2nd edition, Frank J. Fabozzi (Frank J. Fabozzi Associates, 2004)

62. "Features of Debt Securities," Ch. 1
63. "Risks Associated with Investing in Bonds," Ch. 2
64. "Overview of Bond Sectors and Instruments," Ch. 3
65. "Understanding Yield Spreads," Ch. 4

62 Features of Debt Securities

Learning Outcome Statements (LOS)

62-a	**Explain** the purposes of a bond's indenture, and **describe** affirmative and negative covenants.
62-b	**Describe** the basic features of a bond (e.g., maturity, par value, coupon rate, provisions for redeeming bonds, currency denomination, options granted to the issuer or investor), the various coupon rate structures (e.g., zero-coupon bonds, step-up notes, deferred coupon bonds, floating-rate securities), the structure of floating-rate securities (i.e., the coupon formula, caps and floors) and **define** accrued interest, full price, and clean price.
62-c	**Explain** the provisions for early retirement of debt, including call and refunding provisions, prepayment options, and sinking fund provisions, **differentiate** between a regular redemption price and a special redemption price, **explain** the importance of options embedded in a bond issue, and **indicate** whether such options benefit the issuer or the bondholder.
62-d	**Describe** methods used by institutional investors in the bond market to finance the purchase of a security (i.e., margin buying and repurchase agreements).

Introduction

This Reading looks at the main features and characteristics of different categories of bonds including the types of cash flows paid out by a bond issuer to an investor. We also examine the options given to investors or issuers resulting in the modification of the pattern of the principal and coupon cash flows and various provisions for the early retirement of debt. As with other Readings in this Study Session, many candidates who are not working in the U.S. debt markets will meet a lot of new terminology that they need to become familiar with.

LOS 62-a

Explain the purposes of a bond's indenture, and **describe** affirmative and negative covenants.

Indentures

A bond's indenture is a legal contract that sets forth in great detail the promises of the issuer (also called debtor or borrower) and the rights of the bondholders. Bondholders (also called investors or creditors) will know what to expect from the issuer as long as they hold the bonds. Since the bonds might change hands among investors, to help monitor that the issuer abides by the terms of the indenture, a third independent party needs to be appointed. This third party who acts on behalf of the bondholders is called an **indenture trustee** and is usually a bank.

Covenants

Affirmative covenants require the issuer to perform certain actions. The common ones are:

- to pay the interest and the principal on a timely basis
- to pay all taxes and claims when due
- to maintain that the borrower's properties are in good working order
- to submit periodic reports that the borrower is in compliance with the loan agreement

Negative covenants call upon the issuer not to perform certain actions. The main ones are limitations on taking on additional borrowings that would potentially compromise the ability of the issuer to keep its promises to the current bondholders, unless certain tests are met. These tests may include leverage level, liquidity level, etc.

It is in the bondholders' interest to impose the strictest restrictions on the borrowers, whereas the borrowers would prefer the least restrictive loan agreement. A balance is struck and diligently set out in an indenture. The balance will be a trade-off between interest costs and the restrictions. Failure to adhere to the covenants may be considered a violation or a default situation.

LOS 62-b

Describe the basic features of a bond (e.g., maturity, par value, coupon rate, provisions for redeeming bonds, currency denomination, options granted to the issuer or investor), the various coupon rate structures (e.g., zero-coupon bonds, step-up notes, deferred coupon bonds, floating-rate securities), the structure of floating-rate securities (i.e., the coupon formula, caps and floors), and **define** accrued interest, full price, and clean price.

A **fixed income security** is defined as a financial obligation of an entity (an issuer) to pay a specified sum of money at specified future dates. Generally the financial obligation consists of a promise to pay interest and to repay principal (amount borrowed). The terms **bonds** and **fixed income securities** are often interchangeable.

Maturity or **term to maturity** is the number of years over which the issuer has promised to pay interest and to repay the principal. The **maturity date** of a fixed income security is the date after which the debt will no longer exist and at which time the issuer repays the amount borrowed.

The **par value** of a bond is the amount that the issuer agrees to repay the bondholder by the maturity date. Synonyms are the **principal, face value, redemption value** and **maturity value**. Bonds can have any par value. Bond prices are quoted as a percentage of par, in increments of 1/32.

The **coupon rate**, also called the **nominal rate**, is the annual rate of interest that an issuer agrees to pay. The annual amount of the interest payments is called the **coupon**, where:

Equation 62-1

coupon = coupon rate x par value

In the U.S. it is common practice for the coupons to be paid twice a year (semiannually). Mortgage-backed and asset-backed securities normally pay the coupon monthly, reflecting the payment structure of the underlying assets, i.e. mortgage loans whose borrowers pay monthly installments. In other countries, the frequency of the coupon payments can be quarterly, semiannually, or annually depending upon market practice.

Provisions for redeeming bonds is the agreement by the issuer on how the principal is repaid. Provisions include:

- call and funding provisions
- prepayments
- sinking fund provisions
- index amortizing notes

Further explanation is given in subsequent Readings.

Fixed income securities can be issued in any **currency** as long as it is legal and practical to do so. For instance, a Japanese company can legally issue a British pound-denominated bond in the United Kingdom as long as the regulatory requirements of the issuance are met.

It is common to grant issuers and/or bondholders an option to take an action against the other party; these are called **options granted to the issuer or investor**. These are explained in the subsequent Readings. The exercise of such options such as an early repayment of principal could modify the cash flows of the bonds, which in turn affects the value of the bonds as an investment.

Example 62-1 Par values

The longest maturity of bonds is typically 30 years (this is the case with U.S. Government bonds) or it can be anything from 1 to 100 years. Dollar prices are linked to quoted prices as follows:

Par values

Quoted price	Price per $ par value	Par value	Dollar price
89 ½	0.8950	$5,000	4,475
103 3/32	1.0309375	$100,000	103,093.75

A bond with a 7.5% coupon rate and a par value of $10,000 will pay annual interest of $750, i.e. 0.075 x $10,000, (using Equation 62-1).

Coupon rate structures

Bonds have different coupon rate structures, depending upon the desired cash-flow pattern from the issuers' perspective or other considerations.

Zero-coupon bonds are those where the coupons are not paid out periodically but accrued and realized at the date of maturity. The bonds are sold at a discount that reflects the accrued coupon. Another type is **accrual bonds**, which are similar to zero-coupon bonds in the way that the coupons are accrued and realized at the maturity date, but the difference is that the bonds are issued at par, not at a discount.

Step-up notes are those where the coupon rate is increased over time. There are **single step-up notes** as well as **multiple step-up notes**.

Deferred coupon bonds are those which offer no coupon payments for a specific period, but a lump-sum payment of the accrued interest at a specified later date. Regular periodic payments of the coupons resume after the specified date.

Floating-rate securities, often called **variable-rate securities**, have coupon rates that are reset periodically according to particular rules or reference interest rate.

Example 62-2 Coupons

1. When a zero-coupon bond with a 2-year maturity and par value of $10,000 is quoted at 87½, it means that (100 – 87½) x $10,000 = $1,250 is the compound interest portion.
2. An accrual bond with a 3-year maturity and a 7% coupon paid in arrears and compounded annually, and a par value of $10,000, will at maturity pay $12,250.43 including accrued interest.
3. A bank issues a step-up note with the following schedule:

   6.0% from March 3, 1999 to March 2, 2003

   6.25% from March 3, 2000 to March 2, 2004

   6.5% from March 3, 2001 to March 2, 2005
4. A floating-rate bond is quoted with a coupon formula of: 6-month LIBOR + 125 basis points (semiannual reset), meaning that the coupon rate is 1.25% above the prevailing 6-month LIBOR rate. If the current 6-month LIBOR rate is 6.25% then the coupon rate of the bond for the period until the next reset date will be (6.25% + 1.25%) = 7.5%.

Floating-rate securities

The structure of floating-rate securities, such as the coupon formula and the caps and floors features, and the mechanics of the payments and the coupon rate resetting are now examined.

The typical **coupon formula** is:

Equation 62-2

coupon rate = reference rate + quoted margin

The **reference rate** generally reflects the market conditions, often represented by the risk-free rates in the market such as yields of government bonds or interbank offer rates.

The **quoted margin** is the additional interest rate that the issuer agrees to pay above the reference rate. It indicates the additional compensation that an investor requires. The quoted margin can occasionally be a negative value creating a coupon rate lower than the reference rate.

To protect an issuer from rampant hikes in interest rates, often a maximum limit is set. A **cap** is a maximum rate for a coupon that can be reached regardless of how high the reference rate goes. Caps are naturally unattractive to investors.

Conversely, a **floor** is its minimum, which is in place to protect the investor. If a bond has a cap and a floor, the feature is called a **collar**.

There are various different types of floating-rate securities, which are often structured with the use of derivative instruments. Following is a list of examples:

a. Inverse floaters or reverse floaters

The coupon formula is:

coupon rate = K – L x (reference rate)

where K and L are values specified in the prospectus or the indenture for the issue in such a way that the movement of the resulting coupon rate is opposite to the market move.

b. Dual-indexed floaters

The coupon formula:

coupon rate = (R_1 – R_2) + quoted margin

where R_1 and R_2 are two pre-specified reference rates.

c. Ratchet bonds

The issuer can only adjust the coupon rates downwards based on the coupon formula. Once the coupon rate falls due to the reference rate drop, the coupon rate cannot be adjusted up if the reference rate subsequently rises.

coupon rate = R + quoted margin

where R will always be equal to the lowest recorded reference rate during the life of the issue.

d. Stepped spread floaters

The quoted margin of this type of security can be adjusted up or down at certain intervals during the life of the security as specified in the indenture. The quoted margin will be stepped down if it is expected that the issuer's risk will improve during the course of time, or stepped up if the issuer's risk deteriorates.

coupon rate = reference rate + QM

where QM, the quoted margin, will follow a resetting schedule over the life of the issue.

e. Reset margin determined at issuer discretion

A floating-rate security where the coupon rate can be changed depending on market conditions, so the issue will trade at a pre-determined price, is called an extendible reset bond. The new rate will reflect the market interest rate and the required margin. Unlike a typical floater with a fixed quoted margin, this coupon formula will take into account the dynamics of the market perception of the issuer risk.

coupon rate = reference rate + QM

In this case the sum of the reference rate and QM, the quoted margin, will usually make the issue trade at a minimum of par value.

f. Non-interest rate index floaters

The reference rate in the coupon formula can take a wide variety of indices other than an interest rate or an interest index. With the latest financial engineering techniques, any reference rate can now be used, such as the price of a commodity (e.g. gold or crude oil), the return of an equity index (e.g. S&P 500), or others.

Another popular reference rate is an inflation index. The U.S. Department of Treasury issued Treasury Inflation Protection Securities (TIPS), and other commercial entities have already begun issuing inflation-indexed bonds.

g. Deleveraged floater is a floating rate security with the following coupon formula:

coupon rate = b x (reference rate) + quoted margin

where b is between 0 and 1

h. Drop-lock bonds **change their floating-rate coupons to fixed-rate when certain conditions are met.**

Example 62-3 Floating-rate securities

1. A deleveraged floater is quoted with a coupon formula of: 0.60 x (1-year LIBOR) + 300 basis points and a minimum coupon rate of 6%.
2. An inverse floater has a coupon formula: coupon rate = 10% – 0.8 x (reference rate), so if the reference rate moves up from 5% to 7%, the coupon rate decreases from 6% to 4.4%.
3. A dual-indexed floater may have a coupon rate = (1-year LIBOR – 3-month LIBOR) + 7%. If the 1-year LIBOR is 6.5% and the 3-month LIBOR is 5.5%, the coupon will be 8%.
4. A ratchet bond has a coupon rate = R + 1.5%. When R increases from 6% to 7%, the coupon rate remains at 7.5%, since it stays at the lowest rate.
5. Non-interest rate index floaters: J.P. Morgan issued a 15-year bond that pays the CPI plus 400 basis points. If the CPI is 2.1%, the coupon rate will be 6.1%.

Accrued interest

Accrued interest is the amount of interest that has been earned by the seller of a bond but is paid to the buyer (as the holder of record date for the next coupon payment). It is the interest earned between the previous coupon payment date and the date of the transaction. There are a number of different conventions depending on market practice as to how the accrued interest is calculated. What is important is that at the transaction date both parties know exactly what portion of the coupon belongs to each party.

Full price is when the price of the bond traded includes the accrued interest. It is a convention in the United States that bonds trade at full price, or **dirty price**. **Clean price** is when the price excludes the accrued interest.

LOS 62-c

Explain the provisions for early retirement of debt, including call and refunding provisions, prepayment options, and sinking fund provisions, **differentiate** between a regular redemption price and a special redemption price **and explain** the importance of options embedded in a bond issue, and **indicate** whether such options benefit the issuer or the bondholder.

Early retirement provisions

The issuer may be given the flexibility (a right not an obligation) to retire bonds prior to the stated maturity date. Remember that this is an option that modifies the cash flows of a bond and hence may affect the expected return.

This early retirement would be achieved with:

1. A **call provision** is the right of an issuer to redeem all or part of an outstanding issue prior to the stated maturity date. An example of a call provision is that an issuer may redeem, say, a 10%-coupon bond when the market interest rate declines to a certain level, say, 5%.

The price that the issuer must pay to retire the bond using this call option is called the **call price**. The call price is in most cases higher than par and there is typically a call schedule, i.e. different call prices on different call dates. The higher call price is intended to compensate the investors for the loss of maturity.

Issuers are restricted on the earliest date they can exercise the call option. It is typically a number of years after the issue date, because the investor must be given the assurance that the bond is initially intended as a medium- or long-term instrument, otherwise investors might as well invest in short-term money market instruments. This feature of an issue is called a **deferred call**. The **first call date** is the date when the bond may first be called. The implication of call provisions is that there will be different computed yields for different call dates.

An issuer can call the bond in its entirety or simply in part. When it is called in part, there are two ways that an issuer can select which certificates are to be redeemed, i.e. on a random or on a **pro rata basis**. The pro-rata basis is rare for a public issue due to administrative difficulties. The random selection requires transparency of the process such as publication of the actual serial numbers and how they were selected.

2. A **refunding provision** is the right of the issuer to replace an outstanding issue with another lower coupon. This is different from a call provision because the intention of refunding is to replace the outstanding bond with a similarly structured but lower coupon thus saving the issuer some interest expense. The investors are given the same number of bonds, unlike in a call provision when investors receive cash.

Watch for non-refundable and non-callable provisions. Non-callable means there is absolute protection that an issuer is not permitted to redeem the bond prior to maturity. Non-refundable means that the issuer can only call the bond as long as it is not for refunding purposes, for example to reduce their debt level.

3. A **prepayment option** is similar to a call option in that the issuer may retire a portion of the principal borrowed. However, unlike a call option, there is no pre-specified price associated with the retirement of the debt principal. The term is commonly used and associated with mortgage-backed securities but not generally practiced with corporate bonds. With mortgage-backed securities, the behavior of the individual mortgage borrowers are independent of the legal contract between the issuer and the investor of the securities.
4. A **sinking fund provision** can also be seen as an early retirement option rather than a provision for paying off the bonds. A stipulation in the indenture may require that the issuer retire a specified portion of the bond each year. For example, a 10-year $100 million bond can be retired at $5 million per year so at maturity the outstanding bond is only half of the original principal. Often there is an additional option for the issuer to retire more than the amount specified in the sinking fund provision. This is called **accelerated sinking fund** provision.
5. **Index amortizing notes** are bonds with an *accelerated principal repayment* provision based on a pre-determined reference rate. Like a floating-rate coupon structure, the provision is triggered when the reference rate is met or exceeded but unlike the floating-rate structure the provision applies to the principal not the coupon.

Regular and special redemption prices

Regular redemption prices or **general redemption prices** refer to call prices that are standard, meaning they are commonly above par until the first par call date. As we recall, the call provision is to an issuer's advantage so an investor will be compensated by a higher price than par when the issuer exercises the option.

There are **special redemption prices**, usually at par value, at which the bonds are redeemed when certain regulatory or legal requirements are met. The requirements could be the presence of a sinking fund provision or the event of a legal restructuring of the firm. Generally, the regulatory or legal requirements are very specific and rarely come about in the course of the issuer's normal business.

However, investors are often concerned that the provision of special redemption prices may encourage issuers to use all possible means to call their bonds at par. This is called the **par call problem**.

Embedded options

It is usual to grant issuers and/or bondholders an option to take an action against the other party regarding the money owed, either with the principal or the coupons. Such an option has a significant effect on the behavior of the bond price because of the potential modification of the cash flows that the action may cause. Although not explicitly priced in the market, the option carries implicit economic value and will be reflected in the prices of the bonds.

These options are called **embedded options**, to distinguish them from the bare options, i.e. stand-alone options that are traded in the markets.

The presence of options embedded in a bond issue makes it more difficult to project the cash flows of the bond. Sophisticated modeling will be required to value a bond with embedded options, which has to take into account the projected changes in interest rates and the paths they take during the life of the security, and the economic conditions that will encourage the issuer to benefit from exercising the options.

The options will have value to either the issuer or investor depending upon to whom the option is favorable, described below.

1. **Embedded options granted to issuers**
   - call provisions
   - the right to prepay a portion of the principal in excess of the scheduled principal repayment
   - an accelerated sinking fund provision
   - caps on a floating-rate bonds

From the issuer perspective, the call provisions, prepayment options and accelerated sinking funds are valuable when interest rates fall. When exercised, the issuers no longer have to pay the higher coupon rates and can replace the outstanding bonds with those with a lower coupon rate.

2. **Embedded options granted to investors**
   - conversion privileges, e.g. the option to convert bonds to equities
   - put provisions, i.e. the right of investors, at their discretion, to demand repayment from the issuer
   - floors on floating-rate bonds

From the investor perspective, a put option is beneficial when interest rates rise. The investor benefits from being able to sell back the bond at a specified price that is higher than the prevailing market price at the higher level of interest. A conversion option is likewise valuable when the stock price is strong so the investor can take advantage of the upside price movement.

LOS 62-d

Describe methods used by institutional investors in the bond market to finance the purchase of a security (i.e., margin buying and repurchase agreements).

A **repurchase agreement** is the sale of a security with a commitment by the seller to buy it back at a pre-determined price on a pre-determined future date. The price is called the **repurchase price** and the date the **repurchase date**. The difference between purchase and repurchase price reflects an implied interest rate, which is called the **repo rate**. This is a form of collateralized borrowing, i.e. a borrowing using securities as collateral. The main motivation is to obtain funding with a lower cost than bank financing.

Another type of collateralized borrowing is **margin buying**, although it is more prevalent in common stock investment (both retail and institutional) and retail bond investment. The difference is that the funds borrowed to purchase the security are provided by the broker who obtains the money from a bank. The interest rate charged by the bank is called the call money rate. To the investor, the broker adds a service charge on top of the call money rate. The main motivation is to gain exposure to an investment but pay only a fraction of the purchase cost.

There is not one single repo rate used in repurchase agreements because of the variety of transactions. Certain securities used for collateral are in demand and difficult to obtain. Such collateral is called **hot collateral**, otherwise it is called **general collateral**. Hot collateral can obtain a lower repo rate.

63 Risks Associated with Investing in Bonds

Learning Outcome Statements (LOS)

63-a	**Explain** the risks associated with investing in bonds (e.g., interest rate risk, call and prepayment risk, yield curve risk, reinvestment risk, credit risk, liquidity risk, exchange rate risk, volatility risk, inflation risk, and event risk).
63-b	**Identify** the relationship among a bond's coupon rate, the yield required by the market, and the bond's price relative to par value (i.e., discount, premium, or equal to par).
63-c	**Explain** how features of a bond (e.g., maturity, coupon, and embedded options) affect the bond's interest rate risk.
63-d	**Identify** the relationship among the price of a callable bond, the price of an option-free bond, and the price of the embedded call option.
63-e	**Explain** the interest rate risk of a floating-rate security and why such a security's price may differ from par value.
63-f	**Compute** and **interpret** the duration of a bond, given the bond's change in price when interest rates change, the approximate percentage price change of a bond, given the bond's duration, and the approximate new price of a bond, given the bond's duration and new yield level, **explain** why duration does not account for yield curve risk for a portfolio of bonds, **explain** how the yield level impacts the interest rate risk of a bond.
63-g	**Explain** the disadvantages of a callable or prepayable security to an investor.
63-h	**Identify** the factors that affect the reinvestment risk of a security and **explain** why prepayable amortizing securities expose investors to greater reinvestment risk than nonamortizing securities.
63-i	**Describe** the various forms of credit risk (i.e., default risk, credit spread risk, downgrade risk) and **describe** the meaning and role of credit ratings.
63-j	**Explain** why liquidity risk is important to investors even if they expect to hold a security to the maturity date.
63-k	**Describe** the exchange rate risk an investor faces when a bond makes payments in a foreign currency.
63-l	**Describe** inflation risk and **explain** why it exists.

63-m	**Explain** how yield volatility affects the price of a bond with an embedded option and how changes in volatility affect the value of a callable bond and a putable bond.
63-n	**Describe** the various forms of event risk (e.g., natural catastrophe, corporate takeover/restructuring, and regulatory risk) and the components of sovereign risk.

Introduction

Investors in bonds face a number of risks when buying bonds. Numerous different risks are listed in this Reading, but the main risks to focus on are interest rate risk, credit risk, reinvestment and prepayment risk. Candidates are introduced to the concept of duration: duration measures the interest rate risk of a bond or portfolio of bonds. Duration will be covered in more detail in the next Study Session.

LOS 63-a

Explain the risks associated with investing in bonds (e.g., interest rate risk, call and prepayment risk, yield curve risk, reinvestment risk, credit risk, liquidity risk, exchange rate risk, volatility risk, inflation risk, and event risk).

Risks in bond investment

The major risks to bond investors are listed below:

1. Interest rate risk.
2. Call and prepayment risk.
3. Yield curve risk.
4. Reinvestment risk.
5. Credit risk.
   a. default risk
   b. credit spread risk
   c. downgrade risk
6. Liquidity risk.
7. Exchange rate risk (currency risk)
8. Volatility risk.
9. Inflation risk.
10. Event risk.
    a. natural catastrophe risk
    b. corporate restructuring risk
    c. regulatory change risk
    d. political change risk

LOS 63-b

Identify the relationship among a bond's coupon rate, the yield required by the market, and the bond's price relative to par value (i.e., discount, premium, or equal to par).

The inverse relationship that exists between changes in interest rates and bond prices is best explained mathematically in the subsequent Readings. However the following example will explain it descriptively:

Example 63-1 Effect of yield changes

Suppose a bond with a 10-year maturity and coupon rate of 7% is sold at par value (100% price). When an investor buys the bond he will obtain a 7% yield.

Assuming that, due to changes in market conditions, the yield for a 10-year bond of similar creditworthiness (quality) has now increased to 7.5%. If there is another issuer who wants to issue a 10-year bond, it must be priced to yield 7.5% to match the market conditions. So the coupon rate of the new bond will have to be 7.5% in order to be sold at par.

Now if the investor who bought the 7% coupon bond wants to sell it, he must sell it to yield 7.5% otherwise why should anybody buy a 10-year bond yielding 7% if there are bonds of the same maturity and quality yielding 7.5% available in the market? Since this is a fixed-rate bond, investors cannot force the issuer to raise the coupon rate from 7% to 7.5%, so the bond must be sold at a certain price other than the original par value so that the yield will be 7.5%. By calculation it turns out that the bond will have to be sold at 96.5259%, i.e. less than par value. In the bond market this is referred to as the bond being at a discount.

The opposite is true. Suppose that the yield changes to 6%. The price of the 7% coupon bond will be 107.4387%, which is at a premium.

Example 63-1 illustrates that between interest rates (yields), coupon rates and bond prices, the following relationships hold:

1. If the coupon rate = yield, then **price = par value**.
2. If the coupon rate < yield, then price < par value (**discount**) or

If the coupon rate > yield, then price > par value (**premium**).

3. If interest rates increase, then the price of a bond decreases.

If interest rates decrease, then the price of a bond increases.

LOS 63-c

Explain how features of a bond (e.g., maturity, coupon, and embedded options) affect the bond's interest rate risk.

Interest rate risk

The degree of sensitivity of a bond price to interest rate changes is called the **interest rate risk**. A bond is said to be more sensitive to interest rate changes when a small change in the interest rates creates a relatively large swing in the bond price, and vice versa. Interest rate sensitivity is a function of the bond's maturity, the bond's coupon and the presence of an embedded option in the bond.

In the next Study Session, the mathematical calculations of bond values will better explain these effects. The link between interest rate risk and the characteristics of a bond can be described as follows:

1. **The interest rate risk increases with a longer maturity.**
   Intuitively, we would say that we could predict the future better in the short term than the long term. So the longer the maturity, the higher the uncertainty between now and the maturity date therefore the higher the risk becomes.
2. **The interest rate risk increases with a lower coupon rate.**
   We could intuitively also say that the lower the coupon an investor receives the less the cash cushion he has to offset future uncertainty.
3. **The interest rate risk depends on the embedded options:**
   a. When interest rates decline, the interest rate risk decreases with an embedded call option
      The probability of the issuer calling the bond when interest rates decline becomes higher, so the price of the bond will converge to the call price and become less sensitive to small changes in interest rates.

   b. When interest rates increase, the interest rate risk decreases with an embedded put option
      Likewise the probability of the investor demanding repayment of the bond when interest rates increase becomes higher, so the price of the bond will converge to the put price and then become less sensitive to small changes in interest rates.

LOS 63-d

Identify the relationship among the price of a callable bond, the price of an option-free bond, and the price of the embedded call option.

The relationship between the price of a callable bond, an option-free bond and the price of the embedded call option is as follows:

Equation 63-1

Price of callable bond = price of option-free bond – price of embedded call option.

The implication of this relationship is that the price of the callable bond would have to be lower than the equivalent noncallable bond since the issuer holds the right to exercise the option. The call option is valuable to the issuer at the expense of the investor.

All other factors held constant, the higher the market yield level of a bond, the lower the price sensitivity. The mathematical model will be explained in more detail in the next Study Session, but an illustration is provided below. This feature is called 'tapering off' and refers to a bond having lower price sensitivity at a higher level of interest rates.

Example 63-2 Interest rate risk

A bond has a 6% coupon and 15-year maturity and is traded at par, giving a 6% yield. If the required yield is increased by 100 basis points to 7%, the price of the bond will fall to 90.8040, a decrease of 9.1960%.

If the same bond was traded at a 10% yield, the price would be 69.2551. If the required yield were to be increased by 100 basis points, the price would be 63.6656, a decline of 8.0708%.

The higher market yield leads to lower sensitivity.

LOS 63-e

Explain the interest rate risk of a floating-rate security and why such a security's price may differ from par value.

Common sense would tell us that all floating-rate securities should always be traded at par value as the coupon rates continually adjust to changing market yields.

There are however three reasons why a floating-rate security price may differ from par.

1. Coupons are reset at pre-specified intervals; say every six months or annually. Prices will adjust to the prevailing yield level until the next resetting date. This is the time lag effect. It is more obvious with the longer time between resetting dates.
2. The quoted margin is generally fixed during the life of the security. However, investor's perception of the issuer's risk may change during the life of the bond. Changing risk perception will lead to a changing level of risk premium. Risk premium is reflected in the margin, so the bond price may change due to the change in the level of the quoted margin, while the reference rate remains constant.

3. Many floating-rate securities have a cap. When the cap is reached while the market interest rates are still moving upwards, the bond price will behave like a fixed-rate bond, as the coupon will be fixed at the cap rate. The security price will have to adjust down; this type of risk is called the **cap risk**.

LOS 63-f

Compute and **interpret** the duration of a bond, given the bond's change in price when interest rates change, the approximate percentage price change of a bond, given the bond's duration, and the approximate new price of a bond, given the bond's duration and new yield level, **explain** why duration does not account for yield curve risk for a portfolio of bonds, **explain** how the yield level impacts the interest rate risk of a bond.

Interpretation of duration

The most important interpretation of the duration of a bond is how sensitive is the price of the bond to changes in market interest rates. The estimate of the percentage change in the bond price for a 100 basis points (1%) change in the interest rate is called **duration**.

Different bonds have different durations. Depending upon the investment strategy, an investor may look for bonds with higher (long) or lower (short) durations. A more accurate calculation is made using calculus or a bond-pricing model. A reliable valuation model is a pre-requisite to accurate calculation of duration.

Computation of duration

The formula for duration is:

Equation 63-2

$$\frac{\text{price if yields decline} - \text{price if yields rise}}{2 \times (\text{initial price}) \times (\text{change in yield in decimals})}$$

Example 63-3 Duration

Let us look at the bond in Example 63-2, which trades at a price of 90.8040 yielding 7.0%.

If yields decline by 50 basis points, price = 95.2545

If yields rise by 50 basis points, price = 86.6281

Change in yield in decimals = 0.005

The duration = (95.2545 – 86.6281)/(2 x 90.8040 x 0.005) = 9.50

The interpretation is that for every 100 basis points interest rate change, the price of the bond will change by 9.50%.

Remember that the bond price will go up when the interest rate goes down. This inverse relationship means that if the interest rate increases by 100 basis points, then the price of the bond would decline by 9.50%, and vice versa.

Example 63-4 Price and duration

Looking at the bond in Example 63-2 with duration of 9.50, what happens to the price of this bond if the yield rises by 150 basis points?

The answer is that the percentage change will be 150/100 x 9.50% = 14.25%.

So the dollar price will change by the same percentage to be 90.8040 x (100% - 14.25%) = 77.8644 (Remember that bond prices decline when yield increases).

Using a bond-pricing model, the price of the bond is 79.0262 at that yield, showing that the duration is a reasonable (linear) approximation of the percentage change of the price although not completely accurate.

Often traders use the term **dollar duration**, i.e. the translation of the percentage change to monetary value. For instance, if the nominal value of the bond in the above example is $1,000,000 then the dollar duration will be the dollar equivalent of the 9.50%, i.e. $95,000. It says that for every 100 basis point change in the yield, the value of the bond will change by $95,000.

Yield curve risk

There are various interest rates in the market. Interest rates differ from each other depending upon the maturities and the credit risks of the fixed-income securities.

When these different interest rates/yields are plotted against their respective maturities, the graphical description is called the **yield curve**. The yield curve is subject to change in the form of parallel shifts, i.e. when every interest rate in the yield curve changes by the same amount and the same direction, or nonparallel shifts, where the interest rates in the yield curve do not change by the same amount and/or direction.

A bond portfolio consists of a variety of bonds with different maturities and coupon rates. The different patterns of interest rate changes will affect the value of the individual bonds in the portfolio differently. The risk that affects a bond portfolio due to different patterns of the changes of the various interest rates in the economy is called the **yield curve risk**.

Because of this, a single duration number is not sufficient to explain the interest rate risk of a portfolio of bonds. A **rate duration**, which is defined to be the sensitivity of the change of bond price with respect to a particular (spot) rate, is a more useful measure.

The following is a table, which illustrates yield curve risk.

1. *Effect of a parallel shift of +50 basis points of the yield curve*

Bond	Coupon	Maturity	Original yield	Par value	New yield	New bond price
X	6.00%	2	6.00%	100.00	6.50%	99.08
Y	6.25%	5	6.25%	100.00	6.75%	97.91
Z	6.75%	10	6.75%	100.00	7.25%	96.49
Total				**300.00**		**293.48**

2. *Effect of a non-parallel shift of the yield curve*

Bond	Coupon	Maturity	Original yield	Par value	New yield	New bond price
X	6.00%	2	6.00%	100.00	5.50%	100.93
Y	6.25%	5	6.25%	100.00	6.75%	97.91
Z	6.75%	10	6.75%	100.00	6.50%	101.82
Total				**300.00**		**300.66**

The 'New yield' columns of both tables show the different types of the yield curve shifts. In table (1) the yields increased uniformly by 50bp while in table (2) they all moved differently. The resulting new bond prices are also correspondingly different thus showing the different total sensitivity of the portfolio to the change of the yield curve.

In practice, only select key maturities are of interest, such as 2-year, 5-year, 15-year, etc. The rate duration for each of the key maturities is called a **key rate duration**. A portfolio with a 5-year rate duration of 2.5 means that the portfolio value will change by 2.5% for a 100 basis points change in the 5-year yield.

LOS 63-g

Explain the disadvantages of a callable or prepayable security to an investor.

A **call provision** may be included in a bond, i.e. the right of the issuer to retire all or part of the issue before the stipulated maturity date. The main disadvantages of a callable or prepayable security for investors are:

1. The cash flow pattern will be uncertain.
2. Since bonds are generally called when market interest rates have fallen, investors will face reinvestment risk.
3. Price compression will often occur, i.e. the price appreciation potential will be less than for the comparable option-free bonds.

LOS 63-h

Identify the factors that affect the reinvestment risk of a security and **explain** why prepayable amortizing securities expose investors to greater reinvestment risk than nonamortizing securities.

Reinvestment risk

Reinvestment risk occurs when:

- The yields of reinvestment opportunities are lower than the original yield.
- The computation of the yield depends on the reinvestment rate of the coupon payments.

Prepayable amortizing securities

Prepayable amortizing securities expose investors to greater reinvestment risks because the proceeds of principal repayment, coupon, and prepayments might only be able to be reinvested at a lower yield, particularly during a declining interest rate environment.

The targeted yield may not be achieved since the yield-to-maturity calculation *assumes* that the reinvestment yield is the same as when the bonds were purchased.

LOS 63-i

Describe the various forms of credit risk (i.e., default risk, credit spread risk, downgrade risk) and **describe** the meaning and role of credit ratings.

Credit risk

There are three types of credit risk:

1. ***Default risk***
   This is when an issuer fails to meet the obligation of interest and principal payments. A single delay in an interest payment on the coupon payment date is considered a default. An investor does not necessarily lose the whole amount of the principal and accrued interest when a default occurs. The percentage amount recoverable in a case of a default is called the **recovery rate**. Based on the historical data on default rates and recovery rates of outstanding bonds in the market, credit rating agencies evaluate and classify the creditworthiness of the issuers or issues.
2. ***Credit spread risk***
   This is when the yield spread of a particular issue or sector widens against the risk-free benchmark causing the price of the bond to decline (usually due to macroeconomic factors). Similar to floating-rate securities, fixed-rate bonds are priced by two components: (1) the yield of a risk-free bond with a similar maturity and (2) a premium above the yield of the similar risk-free bond.

This premium is similar to a quoted margin, i.e. the price of the credit risk. It is the compensation required by the investor for taking on an additional credit risk vis-à-vis the risk-free bond. This premium can increase or decrease depending upon the market's perception of the credit risk.

3. *Downgrade risk*
   This is when a rating agency (e.g. Standard & Poor's, Moody's or Fitch) decides the individual creditworthiness of a bond has deteriorated. The credit spread will widen due to the downgrade which will lead the bond price to decline. The rating agencies' opinions on individual issues are very influential in the bond market.

Credit ratings

A **credit rating** is a measure of potential default risk by an issuer related to a particular bond issue. An investor looks into a credit rating symbol to give him or her an idea of the ability of an issuer to meet the payment obligation of the principal and interests as stipulated in the indenture. A credit rating symbol is a summary of a more complex analysis on a company.

Credit ratings make the jobs of an analyst easier because he or she can focus on bonds of interest. Credit ratings also help the market determines the prices the bonds according to market perception of the risks.

There are three main credit rating agencies in the U.S.: Standard and Poor's, Moody's Investors Service, Inc. and Fitch.

LOS 63-j

Explain why liquidity risk is important to investors even if they expect to hold a security to the maturity date.

Liquidity risk

This is the risk which is faced by investors when they are forced to sell a bond at a price below its true value perhaps due to a temporary imbalance of supply and demand for the individual bond. The market liquidity of an issue is reflected by the size of the bid-ask spread quoted by dealers. The wider the bid-ask spread, the less liquid is the issue in the market. Market liquidity should not be confused with the financial liquidity of the issuer as a going concern.

Liquidity risk is important to investors who mark their portfolios to the market, regardless of whether they intend to hold a security to maturity or sell it the next day. Mark-to-market is an exercise to revalue the portfolio based on the current market prices of the individual securities that make up the portfolio.

Liquidity risk changes over time according to the market environment, as illustrated below:

Sector	Bid-ask spread (% of price)	
	Typical	Distressed
Treasuries		
Bills	0.002	0.005
On-the-run notes and bonds	0.003	0.006
Off-the-run notes and bonds	0.006	0.009
Corporate bonds		
A-rated finance	0.120	0.500
B-rated industrials	0.500	5.000
Mortgage-backed securities		
Fixed-rate	0.060	0.250

(Fabozzi, 2000)

Newly introduced fixed-income structures or instruments generally have wide bid-ask spreads because of the limited number of investors and market makers. As the new structures or instruments become more popular, the bid-ask spreads narrow as liquidity improves.

Often a market sector becomes unpopular and is avoided by investors and market makers. In such a case, the bid-ask spread may widen considerably. An example of this is the derivative mortgage market when an important player, say a hedge fund, collapses creating a dramatic widening in the bid-ask spreads as the dealers withdraw from the market.

LOS 63-k

Describe the exchange rate risk an investor faces when a bond makes payments in a foreign currency.

Exchange rate risk

This is also called **currency risk**; it is the risk that the currency of the investment moves adversely against the home currency causing the local currency value of coupon payments and the principal repayment to decrease.

Example 63-5 Exchange rate risk

A British pound-denominated bond has a 7% annual coupon and matures in three years. It was purchased at the par value of £100,000 when the exchange rate was $/£ = 1.50. The coupon and principal cash flows are as follows.

	Coupon 1	Coupon 2	Coupon 3	Principal
Amount in £	£7,000	£7,000	£7,000	£100,000
Exchange rate	$/£ = 1.60	$/£ = 1.55	$/£ = 1.45	
Amount in $	$11,200	$10,850	$10,150	$145,000

The investor received a declining US$ coupon income because of the depreciation of the US$.

In practice, diversification across currencies is often recommended to reduce exchange rate risk.

LOS 63-l

Describe inflation risk and **explain** why it exists.

Inflation risk

This is the risk that the purchasing power of income from bonds is reduced due to the erosion in their value by inflation. The identical amount of coupon paid out on different coupon payment dates will decrease in value according to the prevailing inflation rate. It exists because inflationary pressure is almost always present in different economies. Investing in inflation protection bonds can mitigate this type of risk.

Example 63-6 Inflation risk

If a bond investor receives a coupon rate of 10% and the inflation rate (CPI) is 6%, the investor's purchasing power due to the coupon will only increase by 4%.

LOS 63-m

Explain how yield volatility affects the price of a bond with an embedded option and how changes in volatility affect the value of a callable bond and a putable bond.

Volatility risk

Changes in the expected volatility of yield change the value of embedded options in a bond. Option theory says that the value of an option is directly related to the level of volatility. Therefore when the volatility of the expected yield rises, the value of the embedded option will rise. Equation 63-1 stated:

Price of callable bond = price of option-free bond – price of embedded call option

So, in the case of a callable bond, its price will fall when yield volatility increases, as the value of the embedded option is subtracted from the price of the option-free bond.

Equation 63-3

Price of putable bond = price of option-free bond + price of embedded put option

Conversely with a putable bond, its price will rise with an increase in the level of expected yield volatility.

LOS 63-n

Describe the various forms of event risk (e.g., natural catastrophe, corporate takeover/restructuring, and regulatory risk) and the components of sovereign risk.

Event risk

This risk occurs very infrequently but with a serious impact on the issuer's ability to honor its debt obligation. There are four main factors:

1. **Natural catastrophe risk**, including the risk of an earthquake, hurricane, floods or industrial accidents. This type of event will lead to a downgrade but is normally confined to individual issuers.
2. **Corporate restructuring risk**, such as occurred with RJR Nabisco's bonds during the leverage buyout (LBO) wave in the 1980s. Investors demanded an additional yield of 250 basis points after the LBO of RJR Nabisco was announced. The announcement subsequently affected the whole sector as investors temporarily withdrew from the market.
3. **Regulatory change risk**. An example was the passing of the Financial Institutions Reform, Recovery and Enforcement Act (FIRREA) in 1994. The legislation drastically limited the exposure of the Savings and Loans industry to non-investment grade bonds. As a result the ensuing divestments from such bonds created a collapse in the market. Prices declined by 20% to 25% without any fundamental change in their creditworthiness.

Sovereign risk is the risk that an investor assumes when investing in securities issued by foreign governments. Changes in political circumstances or in economic policies might affect the capacity and ability of the issuer to pay the coupons or principal. Sovereign risk can either be caused by **inability** or **unwillingness** to pay. In most cases foreign governments default on their obligations due to unfavorable economic conditions that adversely affect their ability to pay rather than due to their one-sided repudiation of the debts.

64 Overview of Bond Sectors and Instruments

Learning Outcome Statements (LOS)

64-a	**Describe** the different types of international bonds (e.g., Eurobonds, global bonds, sovereign debt).
64-b	**Describe** the types of securities issued by the U.S. Department of the Treasury (e.g. bills, notes, bonds, and inflation protection securities), **differentiate** between on-the-run and off-the-run Treasury securities, **discuss** how stripped Treasury securities are created, and **distinguish** between coupon strips and principal strips.
64-c	**Describe** a mortgage-backed security, and **explain** the cash flows for a mortgage-backed security, **define** prepayments and **explain** prepayment risk.
64-d	**Describe** the types and characteristics of securities issued by federal agencies (including mortgage passthroughs and collateralized mortgage obligations).
64-e	**State** the motivation for creating a collateralized mortgage obligation, **describe** the types of securities issued by municipalities in the United States, and **distinguish** between tax-backed debt and revenue bonds.
64-f	**Describe** insured bonds and prerefunded bonds.
64-g	**Summarize** the bankruptcy process and bondholder rights, **explain** the factors considered by rating agencies in assigning a credit rating to a corporate debt instrument, and **describe** secured debt, unsecured debt, and credit enhancements for corporate bonds.
64-h	**Distinguish** between a corporate bond and a medium-term note.
64-i	**Describe** a structured note, **explain** the motivation of their issuance by corporations, **describe** commercial paper, and **distinguish** between directly-placed paper and dealer-placed paper and **describe** the salient features, uses and limitations of bank obligations (negotiable CDs and bankers acceptances).
64-j	**Define** an asset-backed security, **describe** the role of a special purpose vehicle in an asset-backed securities transaction, **state** the motivation for a corporation to issue an asset-backed security, and **describe** the types of external credit enhancements for asset-backed securities.
64-k	**Describe** collateralized debt obligations.
64-l	**Contrast** the structures of the primary and secondary markets in bonds.

Introduction

This Reading starts with a description of the different types of international bonds and then moves on to look at the U.S. bonds that are available in the market. It describes the characteristics of different categories of Treasury securities and corporate bonds including bankruptcy issues and credit ratings. We also look at the differences between corporate bonds, MTNs and commercial paper. The structure of asset-backed securitisation is described in this Study Session as well as of collateralized debts. Again this Reading contains a lot of detail and new terms; candidates will have to make the required effort to remember the key expressions.

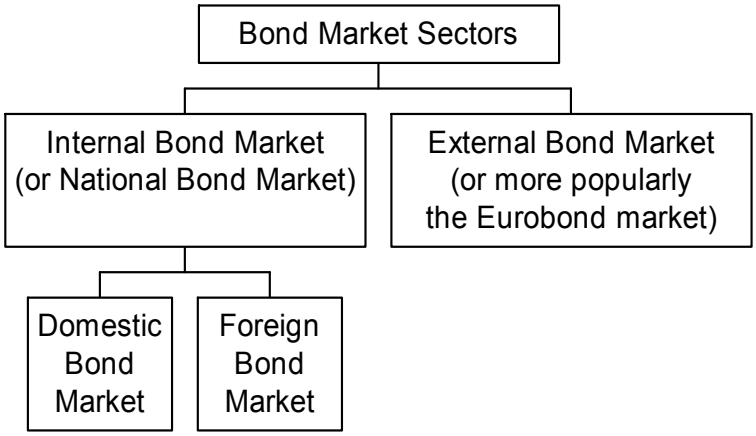
LOS 64-a

Describe the different types of international bonds (e.g., foreign bonds, Eurobonds, global bonds, sovereign debt).

International bonds

The bond market sectors are classified into the following:

Overview of the Sectors of the Bond Market



(Fabozzi, 2004)

The **foreign bond market** is part of the **internal bond market**, also called the **national bond market**. The internal bond market is divided into the domestic bond market and foreign bond market. The Eurobond market, which is popularly known as the **external bond market**, is also called the **international bond market** or the **off-shore bond market**.

Under this classification, international bonds are grouped under the sector of external bond market. These are generally classified as:

1. **Eurobonds**

   These are bonds that have the following features:

   - underwritten by international syndicates
   - offered simultaneously to investors in a number of countries
   - outside the jurisdiction of any single country
   - issued in unregistered form

   They are classified based on the currency of issue so U.S. Dollar denominated bonds are called Eurodollar bonds and the Japanese Yen denominated are called Euroyen bonds.

2. **Global bonds**

   These are securities that are traded both in the foreign bond market of one or more countries and the Eurobond markets. The main requirements of a global bond offering are that the issue size is large (in excess of US$1 billion) and the issuer has a high credit rating.

3. **Sovereign debt**

   These are bonds that are issued by central governments of countries around the world. These bonds can be issued and traded in either the internal or the external bond market. The pricing and the demand for the bonds depends on the creditworthiness of the individual governments.

LOS 64-b

Describe the types of securities issued by the U.S. Department of the Treasury (e.g. bills, notes, bonds, and inflation protection securities), **differentiate** between on-the-run and off-the-run Treasury securities, **discuss** how stripped Treasury securities are created, and **distinguish** between coupon strips and principal strips.

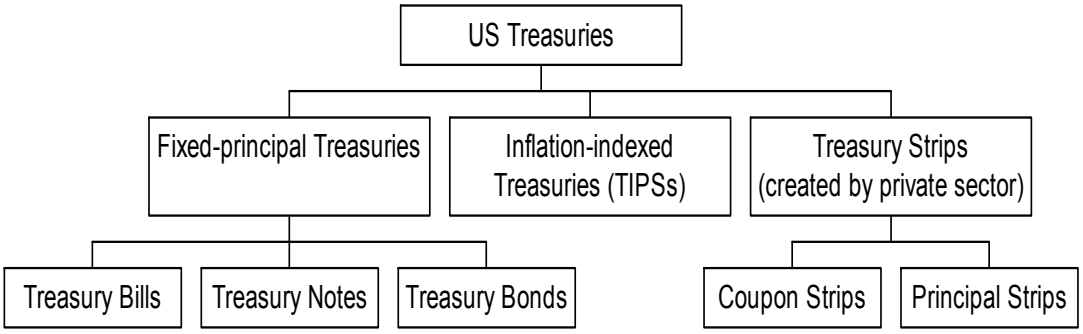
United States Treasury securities

The U.S. Department of Treasury securities are considered to have no credit risk, implying that the U.S. Government will not go bankrupt or cease to honor its financial obligations. They often serve as a benchmark for risk-free securities.

Treasury issues are categorized into three types, i.e. **fixed-principal securities**, **inflation-indexed securities** and **Treasury STRIPS**.

(Fabozzi, 2004)

Overview of US Treasury Debt Instruments



1. *Fixed-principal securities*

a. **Treasury bills** are discounted securities that mature at par and are priced to reflect the prevailing yield. The terms to maturity are under 1 year, i.e. 3-month (91 days), 6-month (182 days) and 1-year (364 days). They are popularly known as T-bills.

b. **Treasury notes** are fixed-principal securities with maturity of more than 1 year and no longer than 10 years.

c. **Treasury bonds** are fixed-principal securities with initial maturities longer than 10 years.

Treasury notes and bonds are generally noncallable save for a few exceptions.

2. *Inflation-indexed securities*

Treasury Inflation Protection Securities (TIPS) are Treasury notes and bonds that carry fixed coupons but have the feature of an **inflation-adjusted principal**. The inflation index used is the City Average All Items Consumer Price Index for All Urban Consumers (CPI-U).

The adjustment for inflation is applied to the principal of TIPS and is computed semi-annually at coupon settlement dates. The inflation index is published daily.

Example 64-1 Inflation protection securities

A TIPS bond has a principal of $1,000,000, coupon 3.5% and maturity 30 years. The inflation index is CPI-U, and it was bought on June 30, 2000.

On January 1, 2001 the CPI-U is 3% annualized and on June 30, 2001 is 2.8%.

What would be the coupons on these dates?

The principal on January 1, 2001 will be adjusted by the 3% annual inflation rate, or 1.5% semiannually, to:

1.015 x $1,000,000 = $1,015,000.

The coupon for the semiannual coupon period will be:

0.0175 x $1,015,000 = $17,762.50.

The principal on June 30, 2001 will be inflation-adjusted to:

1.014 x $1,015,000 = $1,029,210.

The coupon will be:

0.0175 x $1,029,210 = $18,011.18.

As can be seen in Example 64-1, the income continuously reflects the inflation-adjusted principal. In the case of deflation, there is a clause for the redemption to be the larger of the inflation-adjusted principal and par value.

3. **Treasury STRIPS**

The Treasury Department does not issue zero coupons, but it recognizes their market demand and has set up the Treasury's Separate Trading of Registered Interest and Principal Securities (STRIPS). Individual coupons and the principal of a bond are stripped and they are treated and registered as individual securities. These securities only have a single cash flow at maturity and therefore behave like zero coupons.

Coupon strips are created from stripping the coupons and **principal strips** are from the principal payment. They are distinguished from each other due to tax reasons.

Often banks independently offer stripped Treasury products. Please look at Example 64-2 below for further details.

On-the-run and off-the-run Treasury securities

Since U.S. Treasury securities are continuously issued, the most recently auctioned is called an on-the-run issue. These on-the-run issues are important because they best reflect the prevalent interest rate environment and are most liquid right after the moment of issue.

Those that are replaced by new on-the-run issues are called off-the-run issues. As time moves on and bonds approach their respective maturities, there is often more than one off-the-run issue with approximately the same remaining term to maturity as the on-the-run one.

How stripped Treasury securities are created

The U.S. Treasury does not issue zero-coupon bonds but there is plenty of demand for risk-free zero-coupon bonds. Zero-coupon bonds can be created from a coupon security. Each and every cash flow from the coupons and principal are treated as securities. They are effectively zero-coupon instruments as each cash flow has a maturity value (the amount of the coupon or principal) and a maturity date (coupon date or redemption date).

Since 1985, a program called Separate Trading of Registered Interest and Principal Securities (STRIPS) was launched to facilitate the creation and trading of zero-coupon instruments.

Example 64-2 Stripped Treasury securities

A $10 million Treasury note with maturity of 5 years and semiannual coupon of 10% will generate 10 coupon cash flows and 1 principal repayment. The first security created from the first coupon will have a term to maturity of 6 months; the second will have 12 months and so on. Each one of them has a maturity value of $500,000. The principal will be a 5-year zero coupon with a maturity value of $10 million. The cash flows are best illustrated as follows:

Security
Par: $10 million
Coupon: 10%, semiannual
Maturity: 5 years

Cash flows

Coupon: $500,000 Receipt in: 6 months	Coupon: $500,000 Receipt in: 12 months	Etc …	Coupon: $500,000 Receipt in: 5 years	Principal: $10 million Receipt in: 5 years

Zero coupons securities created

Maturity value: $500,000 Maturity: 6 months	Maturity value: $500,000 Maturity: 12 months	Etc …	Maturity value: $500,000 Maturity: 5 years	Maturity value: $10 million Maturity: 5 years

The market distinguishes between zero-coupon instruments created from the cash flow of a coupon and those from the cash flow of the principal. The former are called **coupon strips** and the latter **principal strips**. The coupon strips are identified with 'ci' and the principal strips with 'np' or 'bp'.

The distinction has to do with different taxation treatment of coupons and principals by foreign tax authorities as applied to non-U.S. entities.

LOS 64-c

Describe a mortgage-backed security, and **explain** the cash flows for a mortgage-backed security, **define** prepayments and **explain** prepayment risk.

LOS 64-d

Describe the types and characteristics of securities issued by federal agencies (including mortgage passthroughs and collateralized mortgage obligations).

Mortgage-backed securities

Mortgage loans are loans that are secured by collateral of a certain property. A classic example is a home loan which is when a family borrows money from a bank to purchase a home and the collateral is the property itself, be it a house or an apartment. The bank, who is the lender, is given the right to foreclose (lien) the property if the borrower is not satisfying the obligation, i.e. missing the monthly installment payments.

When these mortgage loans are pooled together, a new type of security can be formed by combining the cash flows generated by the underlying loans. The new security is called a **mortgage-backed security** (MBS) which includes pass-through securities, **collateralized mortgage obligations** (CMOs) and **stripped mortgage-backed securities**.

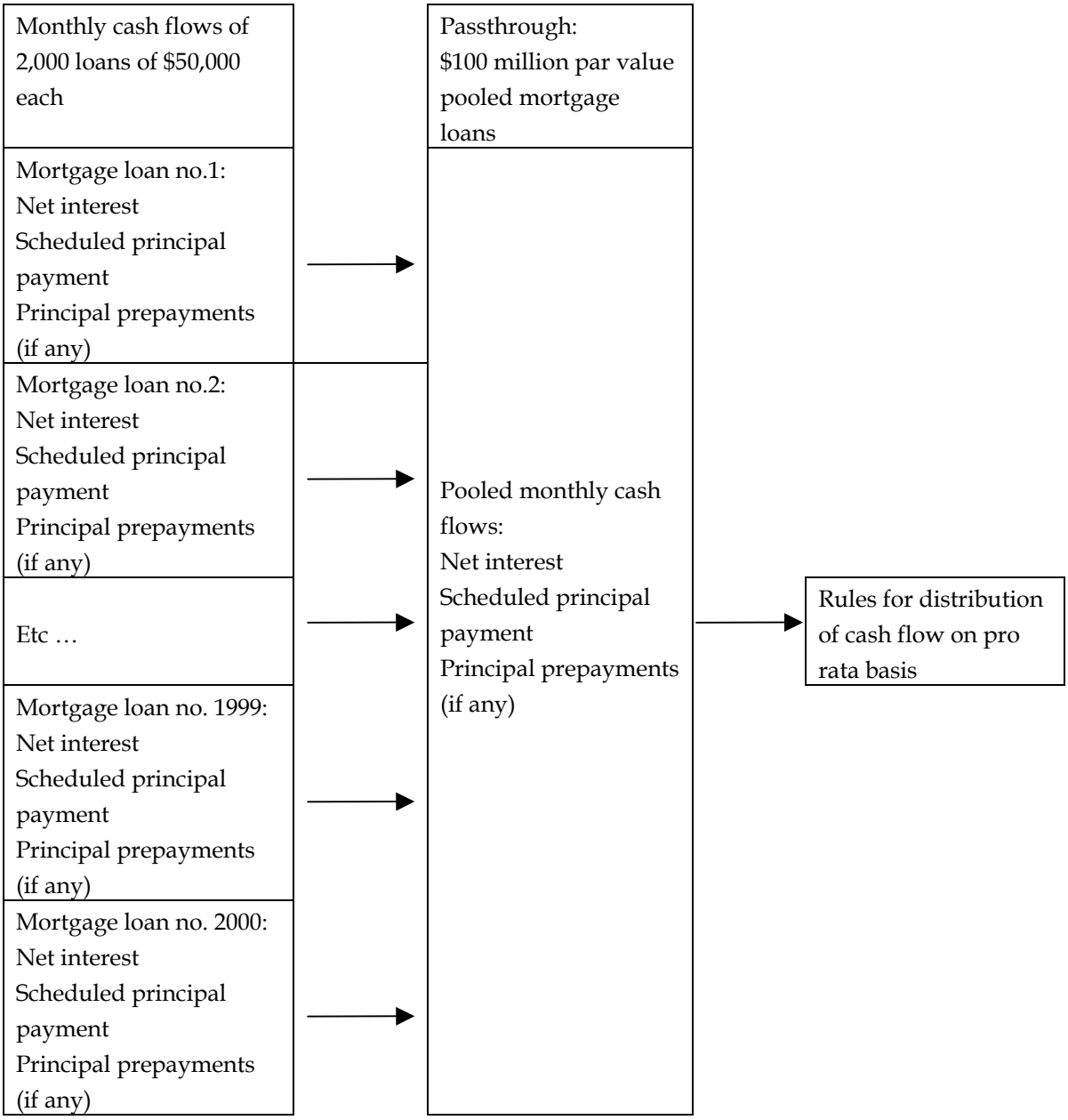
Cash flows for mortgage-backed securities

In a pass-through, the pooled cash flow pattern mimics the underlying pool of mortgage loans. This consists of:

- net interest
- scheduled principal repayment
- prepayments

The cash flow is distributed on a pro rata basis to the holders of the pass-through MBSs. CMOs and stripped MBSs are derivatives of MBSs since they are constructed from a pool of MBSs.

The cash flows are best illustrated as follows:



Prepayments and their risk

Prepayment is the repayment of a portion or all of the outstanding balance of the principal that is made ahead of the scheduled date.

Prepayment risk is the risk that the outstanding balance of the principal is paid off prior to the scheduled date. This decrease in outstanding principal will consequently reduce the amount of scheduled interest to be received in the future. If the principal payment is made *after* the scheduled date it is called a default.

Curtailment is a prepayment that is not for the full amount of the outstanding balance of the principal.

Federal agency securities

Depending upon the issuers, federal agency securities can be categorized as:

1. **Federally related institutions**, which are arms of the federal government, such as Government National Mortgage Association (Ginnie Mae), Tennessee Valley Authority (TVA). They do not normally issue securities directly to the marketplace although, with a few exceptions, they carry the full faith and credit of the U.S. government.
2. **Government sponsored enterprises (GSEs)**, which are privately owned but publicly chartered so their investors are exposed to credit risk. These institutions issue securities directly to the market place.

The GSEs issue two types of securities:

(i) **Agency debentures**, which are uncollateralized debt issued by a GSE. The repayment depends on the ability of the entity to generate sufficient cash flow to meet the obligation.

(ii) **Agency mortgage-backed securities**, which are securities that are backed by mortgage loans. The cash flow generated by the mortgage loans will be the primary source of repayment of the coupon and principal.

LOS 64-e

State the motivation for creating a collateralized mortgage obligation, **describe** the types of securities issued by municipalities in the United States, and **distinguish** between tax-backed debt and revenue bonds.

Motivation for creating a collateralized mortgage obligation

Both a **mortgage pass-through security** and a **collateralized mortgage obligation** are securities that are backed by a pool of mortgage loans. The pool of mortgage loans will generate the cash flows that will be passed on to the holders of the securities. The main difference is that with a mortgage pass-through security there is *no* modification of the cash flows. In other words, whatever is received from the pool of mortgage loans will be distributed pro rata to the security

holders, less legitimate servicing and other fees. The cash flow of a unit of participation will reflect scheduled principal repayment, net interest and prepayments of the loan pool.

A collateralized mortgage obligation on the other hand **modifies** the cash flows by following more than one distribution rule that are applied to the different **tranches**. A tranche is a class of bond that is part of the obligation having a unique distribution rule. The sum of all the cash flows passed on to the tranches (inclusive of servicing fees, and other legitimate outflows) should be equal to the total cash flows generated by the pool of mortgage loans. A holder of two different tranches from the same CMO will however see two different patterns of cash flows.

This approach is taken with the motivation to redistribute the prepayment risk to different tranches to meet the different risk tolerances of investors. Certain investors prefer minimal or no variability of the cash flow streams (i.e., lower prepayment risk) and are consequently willing to receive a lower coupon rate, while some investors prefer the opposite.

CMO structures allow the design of different tranches reflecting the different allocations of prepayment risk. A single issue of a CMO could satisfy a variety of investors at the same time.

Municipal bonds

Municipal bonds are issued by local governments or related bodies to investors in the state who are usually exempt from paying tax on the bond. The bonds are categorized based on the sources of repayment as follows:

1. Tax-backed debt
   - general obligation debt
   - appropriation-backed obligations
   - debt obligations supported by public credit enhancement programs
2. Revenue bonds
3. Special bond structures
   - insured bonds
   - prerefunded bonds
4. Municipal derivative securities

General obligation debt is the broadest type of tax-backed debt. It is backed by the general taxing powers of the issuers.

Appropriation-backed obligations are the obligations of agencies or authorities of several states and carry a potential state liability to make up shortfalls if they occur. The appropriation must obtain the state legislature's approval but the moral obligation is there.

General obligation and revenue bonds

General obligation bonds are the broadest definition of tax-backed debt. They are municipal securities that are backed by some form of tax revenues. The issuer can be a state, a county, a special district, a city, a town or a school district that is given the right to levy taxes or some other form of taxing power.

Revenue bonds are issued by entities that pledge the revenues from specific enterprises to the bondholders. These enterprises have the capacity to generate revenues from the completed projects themselves. Revenue bonds include utility revenue bonds, transportation revenue bonds, housing revenue bonds, higher education bonds, and health care revenue bonds.

LOS 64-f

Describe insured bonds and prerefunded bonds.

Insured bonds are additionally backed by insurance policies from commercial insurance companies. The insurance company will take over the payments to the bondholders in case of default.

Prerefunded bonds are escrowed or collateralized by a portfolio of U.S. government securities. The cash flows of the collateral match the obligations of the issuers. This is the safest type of municipal bond.

LOS 64-g

Summarize the bankruptcy process and bondholder rights, **explain** the factors considered by rating agencies in assigning a credit rating to a corporate debt instrument, and **describe** secured debt, unsecured debt, and credit enhancements for corporate bonds.

Bankruptcy

In the U.S. the Bankruptcy Reform Act of 1978 governs the bankruptcy process. It contains the rules for corporations that are about to be either liquidated or reorganized.

Liquidation means that all the assets are distributed according to claims of the creditors and finally to the shareholders if any assets are left. After liquidation, the legal corporate entity is dissolved and no longer exists. **Reorganization** means that a new corporate entity will emerge at the end of a bankruptcy proceeding. The process will often involve some creditors being paid back in cash, not necessary in full, and some receiving securities in the new company.

Once a petition of bankruptcy is filed, a company will be given protection from its creditors. The petition can be filed by the company itself as a **voluntary bankruptcy** or by its creditors as an **involuntary bankruptcy**. The status of the company will be a 'debtor-in-possession' and allowed to continue its business operations under the supervision of the court. This provides some time for the company to decide whether to reorganize or go into liquidation as well as time to execute the ensuing reorganization or liquidation plan.

The equity holder's claims are subordinated to those of the creditors. In liquidation, the distribution of the proceeds will follow the **absolute priority rule** to the extent assets are available. There is typically a seniority ranking of the debts in a company. The senior debts are paid off in full first before the more junior debts are paid.

The equity holder receives whatever is left, if anything at all. This rule generally holds in liquidation. In reorganization, there will typically be a variety of schemes offered to the creditors making it unusual to uphold the absolute priority rule.

Credit ratings

In assessing credit risk, rating agencies look into the following factors to determine credit quality:

Character

Rating agencies assess the quality of the management in terms of integrity and reputation. Are they professionally competent and do they keep their word? Many cases of default are not caused the company's *inability* to pay but more by *unwillingness* to pay for one reason or another.

Capacity

Rating agencies assess the ability of the issuer to generate sufficient cash flow to meet the interest payments and principal repayment. If the company's cash flow generation is declining, it is a cause for concern.

Collateral

The quality and value of the assets pledged to back up the debt are assessed. Often the quality and value of the pledged assets deteriorate during the life of a debt so they are no longer sufficient to back up the debt. Rating agencies have to feel reassured that the collateral value provides the expected level of protection in case of a default.

Covenants

Rating agencies review the limitations and restrictions currently imposed on the borrower to assess the level of protection for the investors. These covenants are spelled out in the indenture documents of the outstanding debt. Rating agencies will assess the position of the debt being reviewed vis-à-vis the other outstanding ones.

Secured debt

A debt is secured when an identifiable asset is pledged as a main source of repayment of the debt. The creditors are given a lien, i.e. a right to repossess a property in case of a default. The investors of secured debt will have a priority claim over the pledged property, meaning they will be in the queue ahead of other creditors.

Unsecured debt

These are often called **debenture bonds**. The general creditors have a claim on all the remaining assets that are not pledged to the secured creditors. It does not mean that for unsecured debt, the creditors have no claim at all on the assets but in this case it is subordinated, meaning the claim comes later in the queue.

The credit rating of corporate bonds can be enhanced by a **third party guarantee**. This says that if the issuer is unable to honor its obligation, the third party guarantor will step in and assume the obligation.

The obligation of the third party and the events that trigger it are clearly spelled out in the indenture. The third party that provides such **credit enhancement** can be the parent company or an unrelated entity such as a bank.

LOS 64-h

Distinguish between a corporate bond and a medium-term note.

Medium-term notes (MTNs) are debt instruments that are shelf-registered with the Securities and Exchange Commission, and are issued continuously with a variety of maturities, usually between 9 months and 30 years. Shelf-registered means that the issuer has the flexibility to design the coupon formula and maturities to satisfy its funding requirements as long as certain guidelines and covenants are met.

The difference between MTNs and corporate bonds are:

1. MTNs are issued continuously while corporate bonds typically have a single offering period.
2. Issuers file shelf registration with the Securities and Exchange Commission for MTN issuance while corporate bonds have regular registration.
3. Method of distribution: MTNs are typically distributed on a 'best-efforts basis' while corporate bonds are often underwritten. 'Best effort basis' here means that the dealer is only responsible to sell how much he or she can in the market.

MTN programs generally suit larger corporations with good credit standing where there is strong demand for their paper. The strength of the demand allows them the flexibility in terms of deciding the timing, size and structures of their debt programs.

LOS 64-i

Describe a structured note, **explain** the motivation of their issuance by corporations, **describe** commercial paper, and **distinguish** between directly-placed paper and dealer-placed paper and **describe** the salient features, uses and limitations of bank obligations (negotiable CDs and bankers acceptances).

Structured notes

MTNs which are coupled with transactions in the derivative markets are called **structured notes**. The derivative transactions may involve swaps, options, futures, forward, caps and floors. This combination results in customized risk/return features.

Common structured notes include: deleveraged floaters, dual-indexed floaters, step-up notes, range notes and index amortization notes.

Motivation of issuing a structured note

From the issuer's point of view, structured notes might appeal to a broader investor's base.

From the investor's perspectives the notes offer a desired risk/return characteristic or an opportunity to gain exposure to specific markets.

Commercial Paper

Commercial paper (CP) is a short-term unsecured promissory note that is usually in the form of a zero-coupon instrument. The maturity is typically less than 270 days with 50 days maturity being the most common. It is a convenient short-term funding tool for a corporation as it does not require SEC registration if the maturity is less than 270 days. Investors are generally comfortable with short-term unsecured papers issued by highly rated companies.

Directly-placed vs. Dealer-placed paper. The issuers of CPs can be financial or non-financial companies. Financial companies, such as banks and leasing companies, usually issue their CPs as **directly-placed paper**, i.e. the debt instruments are sold directly to the investors without the need of a broker, dealer or other intermediary.

Non-financial companies, such as industrial firms, more often appoint intermediary agents to sell their papers, hence the term **dealer paper**. The reason that the agents are needed is that as non-financial entities these issuers may not be directly involved in the financial markets.

The uses and limitations of bank obligations

In addition to commercial papers and medium term notes, investors can consider investing in bank obligations, such as **negotiable certificates of deposit** and **bankers acceptances**.

Certificate of deposits are financial assets issued by banks indicating that a specific sum of money (minimum of $100,000) is deposited with the issuing banks that will mature on a specific date in the future. There are no limits of the tenor of CDs and they often cannot be cashed-in before the maturity date or a penalty may be incurred. Negotiable certificates of deposit (NCD) are, unlike CDs, tradable in the secondary market. NCDs are normally issued in the denomination of $1 million and upwards.

Bankers acceptances are short-term credit investments created by a non-financial firm and guaranteed by a bank. They are traded at a discount, like Treasury bills, and treated as a money market instrument.

Bank obligations are part of the money markets and carry the credit risk of the issuing or guaranteeing banks.

LOS 64-j

Define an asset-backed security**, describe** the role of a special purpose vehicle in an asset-backed securities transaction, **state** the motivation for a corporation to issue an asset-backed security, and **describe** the types of external credit enhancements for asset-backed securities.

Asset-backed securities

Asset-backed securities can be defined as securities that are collateralized by an identifiable pool of receivables.

Take an example of a construction company, ABG Ltd., which undertakes a variety of construction projects for large companies. Assuming that the construction company is rated BBB and its customers are all rated AAA, let us look at the balance sheet of ABG Ltd. Its receivables from its customers are all payables of AAA companies. These payables are generally of a longer-term nature because most construction projects are paid by installments. If those receivables are taken out from ABG Ltd.'s balance sheet, they can be pooled and structured as a security that can probably be rated higher than ABG itself. The investors will have direct claim to the receivables, bypassing the balance sheet of ABG Ltd. The higher the rating of a security, the lower the interest rate will be.

The major types of assets that have been securitized are, for example,

- auto loans and leases
- credit cards and other consumer loans
- commercial assets such as aircrafts, equipment leases, trade receivables
- home equity loans

Special purpose vehicles

The asset securitization scheme described above will require a legal separation of the receivables from the balance sheet of ABG Ltd. This legal separation ensures that once the receivables are identified and isolated, they can no longer be claimed back by the issuer.

The usual method is for ABG Ltd. to legally and irrevocably sell the receivables to a separate legal entity, which in turn will issue the securities. The legal entity is called a **special purpose vehicle** or **special purpose company**. The entity is legally structured in such a way that the creditors to ABG Ltd. will have no claim to the receivables sold to the SPV. This concept is called **bankruptcy remote**.

Motivation for asset securitization

The main motivation for asset securitization is to obtain funding which is lower in cost than the corporation's credit rating allows. As we recall, the cost of funding depends on the credit rating. The higher the credit rating, the lower the funding cost.

By legally isolating the receivables from the corporation, the credit rating of the pool of securitized receivables can be determined independently from the rating of the corporation itself. An opportunity arises if the creditworthiness of the customers from which the receivables originate were collectively higher than that of the corporation. It would be technically possible to obtain a higher credit rating for the pool of securitized assets hence creating a lower interest rate.

External credit enhancement

There are three common types of **external credit enhancement**:

1. ***A corporate guarantee***
   This is when a separate entity agrees to provide cover for the financial obligations of the issuer in case of a default.
2. ***A letter of credit***
   This is a similar form of guarantee but extended by a financial institution such as a bank.
3. ***Bond insurance***
   The investor is protected by insurance policies underwritten by commercial insurance companies.

LOS 64-k

Describe collateralized debt obligations.

Collateralized debt obligations are classified as asset-backed securities which are backed by a pool of bonds, loans, and other assets. CDOs do not specialize in one type of debt and the following are the most common types of underlying debt:

- U.S. domestic investment-grade and high-yield corporate bonds
- U.S. domestic bank loans
- Emerging market bonds
- Special situation loans and distressed debt
- Foreign banks loans
- Asset-backed securities
- Residential and commercial MBSs.
- Other CDOs

Similar to CMOs, CDOs are structured into tranches and notes, each with varying seniority and risk/return characteristics.

The asset manager of a CDO is responsible for managing the portfolio of assets based on certain rules and restrictions as stipulated in the issuing documents.

There are two categories of CDOs based on the motivation and purpose of the sponsor. If the motivation is to earn the spread from the various fixed-income instruments held in the CDO, they are referred to as **arbitrage transactions**. If the purpose is to manage exposure of the balance sheet due to regulatory requirements which are often faced by banks, then they are referred to as **balance sheet transactions**.

LOS 64-1

Contrast the structures of the primary and secondary markets in bonds.

Primary vs. secondary markets in bonds

1. Primary market structure

The primary market is where newly issued securities are distributed to buying investors.

The market players are

- Issuers
- Investment bankers
- Buying investors

Investment bankers perform one or more of the following (a) advising the issuer on terms and timing of the issue, (b) buying the securities from the issuer and (c) distributing the issue to the investing public.

When the investment bankers buy all the securities from the issuer before reoffering them to the investing public, it is called **underwriting**. A **firm commitment** is an underwriting done at a set price. **Best efforts arrangements** are when investment bankers only sell the securities as they find buyers.

There are variations to the firm commitment or best efforts arrangement. A **bought deal** is a mechanism whereby the terms, pricing and the size of the issue are accepted by the issuer within a specified time, a day or even a few hours. Generally the issue has been pre-sold to the investors. An **auction process** is where the pricing of a particular issue is auctioned to interested parties. The winner is the one with the most attractive pricing to the issuer, i.e. lowest yield/coupon rate.

2. *Secondary market structure*

The secondary market is where an investor sells or buys previously issued securities from other investors.

The market players are

- Selling investors
- Brokers
- Buying investors

The issuer s are no longer directly involved in the transactions however they are obliged to continually provide relevant periodic information as required by the regulatory authorities. Based on this information and other news and relevant analyses, the market decides a consensus price on the traded securities.

A bond trades in an **over-the-counter** market or on an **exchange**. Traditionally bonds trade over-the-counter with the broker-dealers as market makers. In recent years there has been a trend toward electronic bond trading. Such trading is a continuing trend due to declining profitability in bond market trading and is increasing risk. There are two major types of electronic trading systems: **dealer-to-dealer** and **exchange systems**.

The dealer-to-dealer can be single- or multiple-dealer system. In a single system the bond price quotations are shown on the computer screen together with the identity of the dealer. It is a computerization of the traditional customer-dealer market making mechanism. The multiple-dealer system shows the quotations from several identified dealers which is an advantage to the customer.

The exchange system takes in the bids and offers from the customers and the dealers on an anonymous basis. There two forms of the system: **continuous trading** and **call auction**. The former is for the more liquid securities as the trading takes place during the day and the latter is more for a less liquid ones.

65 Understanding Yield Spreads

Learning Outcome Statements (LOS)

65-a	**Identify** the interest rate policy tools available to a central bank (such as the U.S. Federal Reserve or the European Central Bank).
65-b	**Describe** a yield curve and the different yield curve shapes observed, **explain** the basic theories of the term structure of interest rates (i.e., pure expectations theory, liquidity preference theory, and market segmentation theory) and **describe** the implications of each theory for the shape of the yield curve; **explain** the different types of yield spread measures (e.g., absolute yield spread, relative yield spread, yield ratio), and **compute** yield spread measures given the yields for two securities.
65-c	**Explain** why investors may find a relative yield spread to be a better measure of yield spread than the absolute yield spread, **distinguish** between an intermarket and intramarket sector spread, and **describe** a credit spread and **discuss** the suggested relationship between credit spreads and the economic well being of the economy.
65-d	**Identify** how embedded options affect yield spreads.
65-e	**Explain** how the liquidity of an issue affects its yield spread relative to Treasury securities and relative to other issues that are comparable in all other ways except for liquidity and **describe** the relationships that are argued to exist among the size of an issue, liquidity, and yield spread.
65-f	**Compute** the after-tax yield of a taxable security and the tax-equivalent yield of a tax-exempt security.
65-g	**Define** LIBOR and why it is an important measure to funded investors who borrow short term.

Introduction

The Reading starts with looking at how interest rates are determined and the tools that are available to central banks to set the level of interest rates. Theories concerning the shape of the yield curve are also explained.

A yield spread is the additional yield over and above that offered by the risk-free benchmark security, to compensate investors for taking additional risk. The Reading investigates the different kind of risks associated with the different kinds of yield spreads and the factors that may affect the behavior of the yield spread such as the presence of embedded options, the liquidity of an issue or even the size of an issue.

LOS 65-a

Identify the interest rate policy tools available to a central bank (such as the U.S. Federal Reserve or the European Central Bank).

A central bank, such as the Federal Reserve, has the following tools available to manage the level of interest rates in an economy:

- open market operations
- the discount rate
- bank reserve requirements
- verbal persuasion to bankers to increase or decrease lending

An open market operation is when the Fed injects funds into the market or withdraws funds from it. Injecting funds is done by buying U.S. Treasury securities from the market while withdrawing funds is performed by selling Treasury securities into the market. These actions influence the level of the **fed fund rate**, the interest rate that banks lend to and borrow from each other. The discount rate is the interest rate at which banks can borrow on a collateralized basis at the Fed's discount window.

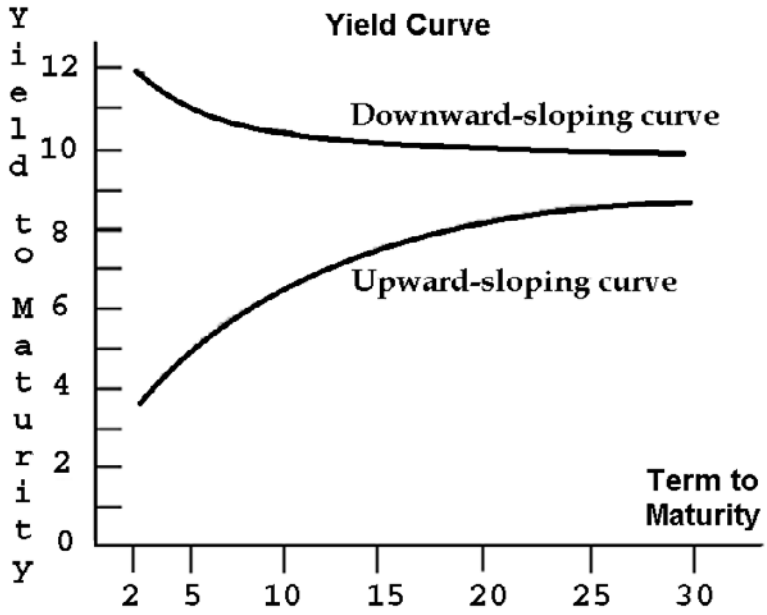
Changing bank reserve requirements and verbal persuasion are less commonly used.

LOS 65-b

Describe a yield curve and the different yield curve shapes observed, **explain** the basic theories of the term structure of interest rates (i.e., pure expectations theory, liquidity preference theory, and market segmentation theory) and **describe** the implications of each theory for the shape of the yield curve; **explain** the different types of yield spread measures (e.g., absolute yield spread, relative yield spread, yield ratio), and **compute** yield spread measures given the yields for two securities.

The relationship between the interest rates (yields) and time to maturity for any class of similar-risk securities is called the **term structure of interest rates**. The graphical description is called the **yield curve**.

The yield curve can take different 'shapes' including upward sloping, downward sloping and flat, as shown below:



Each 'shape' indicates a different interest rate environment as a result of macroeconomic cycles or policies. There are two factors that complicate the relationship between yield and maturity:

1. The yields of on-the-run issues can be distorted by high demand and high liquidity due to their being sought as hot collateral.
2. Although they have similar maturities, the on-the-run and off-the-run securities may be different with respect to their profiles of interest rate risk.

Therefore when the market mentions the interest rates used to value a security it refers to another relationship, i.e. the relationship between the yield on zero-coupon securities and their maturity. **Spot rates** are yields on zero-coupon securities. **Treasury spot rates** are the yields of zero-coupon securities synthetically created from Treasury securities.

The seven on-the-run Treasury securities are the 3-month, 6-month and 1-year T-bills, the 2- and 5-year T-notes and the 10- and 30-year T-bonds. Since there are only 7 on-the-run securities, an interpolation is required to arrive at yields for other maturities.

Basic theories of term structure of interest rates

There are three main theories which explain the shape of the yield curve.

1. ***Pure expectations theory***

   The theory explains the shape of the yield curve by investor expectations of future short-term interest rates. There is a link between interest rates and investor expectations about future inflation: the higher the expected inflation, the higher the interest rate demanded by investors.

2. **Liquidity preference theory**

   Investors want to be compensated for the risk of holding a long-term bond because they are subject to higher price volatility when interest rates change during the holding period, since the longer the duration, the higher the price volatility. The required compensation is in the form of higher yields.

3. **Market segmentation theory**

   This theory suggests that the debt market is segmented into maturity sectors, and that the supply and demand for funds within each maturity segment determines interest rates. For example certain groups of institutional investors (e.g. pension funds, insurance companies) may have demand for long-term bonds, due to their liabilities, which outstrips the supply of available bonds. This in turn pushes the prices of the bonds up hence driving down the interest rates in this segment of the yield curve. The yield curve changes according to the relationship between the supply and demand within all maturity segments and the segments are independent from each other.

Implications of the theories

The implications for the shape of the yield curve are described below.

1. ***Pure expectations theory***

   A rising term structure or upward-sloping yield curve indicates that the market expects short-term yields to rise in the future.

Shape of yield curve	Implication according to pure expectations theory
Upward sloping	Rates expected to rise
Downward sloping	Rates expected to decline
Flat	Rates not expected to change

2. *Liquidity preference theory*
   A normal curve is upward sloping indicating that there is a maturity premium, although the upward slope could be a result of investors' expectations that interest rates are going to rise.

   A downward-sloping curve is explained by the theory that the expectation is that there will be lower short-term rates in the future.

3. *Market segmentation theory*
   The implication of this theory is that any shape of the yield curve is possible since the shape is independently determined within each sector.

All of the three theories work in conjunction to explain the shape of a yield curve.

Yield measures

Yield spread is the additional yield over and above the benchmark Treasury issue with the same remaining term to maturity.

Spread sectors are the sectors in the bond market that offer a yield spread to Treasury securities. Most sectors are spread sectors.

The securities in the spread sectors are called **spread products**.

Equation 65-1

Absolute yield spread = yield on bond A – yield on bond B

Equation 65-2

$$\text{Relative yield spread} = \frac{\text{yield on bond A} - \text{yield on bond B}}{\text{yield on bond B}}$$

Equation 65-3

$$\text{Yield ratio} = \frac{\text{yield on bond A}}{\text{yield on bond B}}$$

In many cases bond B is the benchmark on-the-run Treasury issue.

Example 65-1 Yield spread measures

Assume bond A yields 8.5% and the on-the-run Treasury security yields 6.95%. Using Equations 65-1, 65-2 and 65-3:

Absolute yield spread	=	8.5% - 6.95% = 1.55% or 155 basis points
Relative yield spread	=	(8.5% – 6.95%)/6.95% = 0.223 = 22.3%
Yield ratio	=	8.5%/6.95% = 1.22

LOS 65-c

Explain why investors may find a relative yield spread to be a better measure of yield spread than the absolute yield spread, **distinguish** between an intermarket and intramarket sector spread, and **describe** a credit spread and **discuss** the suggested relationship between credit spreads and the economic well being of the economy.

The **relative yield spread** is a better measure than the **absolute yield spread** since the magnitude of the yield spread is affected by the actual level of interest rates (yields of the on-the-run Treasury securities).

Example 65-2 Relative yield spread

Assume that the on-the-run Treasury security yield drops to 5.75% and the absolute yield spread remains the same at 155 basis points.

The relative yield spread will be 27.0%. The yield ratio becomes 1.27.

The important question is not the yield spread measure per se but rather the specific factors that cause the yield spread between two fixed income securities.

Bonds are classified based on the type of issuer. The different types of issuer indicate the different risk and reward profiles that are offered to investors.

The major sectors of the bond market in the United States are the:

- U.S. government sector
- U.S. government agencies sector (GSEs)
- corporate sector
- mortgage sector
- asset-backed sector
- foreign sector (also called Yankees).

Each sector can be further broken down into sub-sectors with common economic characteristics. The grouping based on these common characteristics provides a picture of the nature of the issuer, as it is a key feature of a debt obligation.

Sub-sectors within the corporate sector are, for example, industrial companies, utility companies, finance companies and banks. Within the sub-sectors are further subdivisions.

Intermarket and intramarket spread

Intermarket sector spread is the yield spread that occurs between two distinguishable sectors, for instance between the bank sector and the industrial sector.

Intramarket sector spread is the yield spread that occurs between two issuers within a sector, for instance between Ford and General Motors, both from the automotive sector.

The factors that are responsible for the intermarket and intramarket yield spreads can be identified as follows:

- the comparative credit risks between the two issues
- the presence of any embedded options
- the market liquidity of an issue
- the taxability of the interest

Credit spread

Credit spread, sometimes referred to as **quality spread**, is the yield spread which reflects the credit risk of an issue against the corresponding Treasury issue that is identical in maturity and has no embedded option.

Credit spreads change with the change in economic prospects. During an economic contraction or a recession, the credit spreads are expected to widen. This is because it is anticipated that the corporate issuers will have a tighter cash flow as sales revenues decline. The widening of the spread can also be caused by a 'flight to quality'; investors switch to risk-free Treasury securities and sell the corporate bonds at lower prices as they are concerned about corporate default.

Another way is to look at yield spreads of cyclical versus non-cyclical industries. It is argued that during an economic expansion, the cyclical industry will benefit more so the improvement of the cash flow is more significant than that of a non-cyclical industry.

LOS 65-d

Identify how embedded options affect yield spreads.

Embedded options affect yield spreads in the following ways:

- If the embedded options are favoring the issuer, the investors require a higher yield spread to compensate for it.
- If the options are favoring the investors, they are happy to accept a lower yield spread.

Nominal yield spreads are the reported yield spreads that are raw, meaning that they have not taken into consideration the value of the embedded option.

Option-adjusted spreads are the preferred calculation as they take into account the valuation of the embedded option.

Recall Equation 63-1:

Price of callable bond = price of option-free bond – price of embedded call option

Therefore, rearranging the equation

Price of option-free bond = price of callable bond + price of embedded call option

It can be explained as follows: when a yield spread of a callable bond is quoted we must look at the yield spread **without** the value of the embedded option. We subtract the option value from the reported yield spread resulting in a lower figure for an option-adjusted spread. Since yields move inversely to prices, the higher the price the lower the yield. From Equation 63-3 we can see that the converse is true for putable bonds, the option-free bond yield is higher.

Example 65-3 Option-adjusted spread

A callable bond is quoted with a nominal spread of 161 basis points (bp) over its equivalent Treasury bond. However, its option-adjusted spread is considerably less, e.g. 63 bp. The difference reflects the valuation of the embedded option.

LOS 65-e

Explain how the liquidity of an issue affects its yield spread relative to Treasury securities and relative to other issues that are comparable in all other ways except for liquidity and **describe** the relationships that are argued to exist among the size of an issue, liquidity, and yield spread.

The yield spreads of non-Treasury securities (the spread sector) versus the benchmark Treasury securities of similar characteristics (maturity, coupon, etc) often vary due to market liquidity.

A clear case is between the on-the-run and off-the-run corporate bonds. On-the-run bonds are normally more liquid than equivalent off-the-run issues and enjoy lower repo rates as they are sought after in the market. This higher level of market liquidity is reflected in the reported yields.

The relationship between the size of an issue, liquidity and yield spread

The relationship between the size of an issue, yield spreads and liquidity is as follows:

The higher the issue size the higher the liquidity hence the yield spread is tighter.

A global bond offering is generally larger in size than a comparable local offering and attracts a wider base of investors. The probability that the bonds will trade among the investors, thus creating liquidity, will be higher as well. This liquidity will cause a tighter yield spread.

LOS 65-f

Compute the after-tax yield of a taxable security and the tax-equivalent yield of a tax-exempt security.

The **after-tax** yield on a taxable bond is computed as follows

Equation 65-3

After-tax yield = pre-tax yield x (1 – marginal tax rate)

Or, we can also find the **taxable-equivalent yield** or **tax-equivalent yield** offered on a bond issue which gives the same after-tax yield as a tax-exempt issue.

Equation 65-4

$$\text{Taxable-equivalent yield} = \frac{\text{tax-exempt yield}}{(1 - \text{marginal tax rate})}$$

Example 65-4 Tax and yields

Suppose a New York Municipal bond is offered at a tax-exempt yield of 5.25% per annum. The taxable-equivalent yield for an investor in a marginal tax bracket of 36% will be:

5.25% /(1 - 0.36) = 5.25/0.64 = 8.23%

LOS 65-g

Define LIBOR and why it is an important measure to funded investors who borrow short term.

LIBOR stands for the London interbank offered rate, i.e. the short-term borrowing rate benchmark in the international markets outside the U.S.

There are seven currencies whose LIBOR rates based on varying maturities are determined for every London business day by the British Bank Association.

Many of funded investors, i.e. institutional investors who borrow short-tem funds to finance fixed-income investments such as commercial banks, leasing companies, etc., obtain LIBOR-based funding. They pay LIBOR rates for the borrowing plus a certain spread. The spreads vary from one institution to another reflecting the creditworthiness of the each of the institutions as determined by the market.

STUDY SESSION 15

Fixed Income Investments: Analysis and Valuation

Overview

This Study Session moves on to more interesting material and some key topics are covered; not only are they important for the Level I exam, but they provide a foundation for Level II and Level III fixed income topics.

We start to analyse and value bonds. In the first Reading, we look at different valuation methods, including the arbitrage-free valuation free approach. In the second Reading, we examine different ways of measuring yield and candidates need to be comfortable switching between spot and forward rates. The next concept that is looked at in more depth than in the previous Study Session is duration, which measures a bond's interest rate sensitivity. Candidates need to understand the differences between alternative definitions of duration, be able to calculate effective duration for option-free bonds, and work out the movement in price of a bond due to a specified change in interest rates. Convexity is also covered; it is used to obtain a closer approximation of the interest rate sensitivity of a bond.

Reading Assignments

Fixed Income Analysis for the Chartered Financial Analyst® Program, 2nd edition, Frank J. Fabozzi (Frank J. Fabozzi Associates, 2004)

66. "Introduction to the Valuation of Debt Securities," Ch. 5
67. "Yield Measures, Spot Rates, and Forward Rates," Ch. 6
68. "Introduction to the Measurement of Interest Rate Risk," Ch. 7

66 Introduction to the Valuation of Debt Securities

Learning Outcome Statements (LOS)

66-a	**Describe** the fundamental principles of bond valuation.
66-b	**Identify** the types of bonds for which estimating the expected cash flows is difficult and **explain** the problems encountered when estimating the cash flows for these bonds.
66-c	**Determine** the appropriate interest rates for valuing a bond's cash flows, **compute** the value of a bond, given the expected annual or semi-annual cash flows and the appropriate single (constant) or multiple (arbitrage-free rate curve) discount rates, **explain** how the value of a bond changes if the discount rate increases or decreases and **compute** the change in value that is attributable to the rate change, and **explain** how the price of a bond changes as the bond approaches its maturity date and **compute** the change in value that is attributable to the passage of time.
66-d	**Compute** the value of a zero-coupon bond, **explain** the arbitrage-free valuation approach and the market process that forces the price of a bond toward its arbitrage-free value, **determine** whether a bond is undervalued or overvalued, given the bond's cash flows, appropriate spot rates or yield to maturity, and current market price, **explain** how a dealer can generate an arbitrage profit.

Introduction

The Reading covers the fundamentals of valuing a bond. It starts with the general principle of valuation, that the value of a financial asset is the present value of its expected future cash flows. The steps in the valuation process are examined, starting with estimating the cash flows, determining the appropriate discount rates and discounting the expected cash flows. The difficulties often come with correctly estimating the cash flows and with selecting the appropriate discount rates. Candidates are expected to be able to compute the value of a bond using a discounted cash flow approach.

The Reading also investigates the price volatility of bonds (interest rate sensitivity) and the factors that affect volatility. Bonds, like any other assets can be mispriced. We learn how to calculate the intrinsic value of bonds and how dealers can take advantage of any mispricing.

LOS 66-a

Describe the fundamental principles of bond valuation.

Bond valuation

The fundamental principle of valuation is that the value of any financial asset is the present value of the expected cash flows which is the same as the sum of the present values of each expected cash flow.

The three steps in valuing a financial asset are:

Step 1: **Estimate** the expected cash flows.

To estimate the cash flows for a bond with options see LOS 66-b.

Step 2: **Determine** the discount rate or rates.

The interest rate(s) that are chosen as discount rate(s) must be appropriately selected. Using multiple interest rates that incorporate the relevant risk premium is now the norm.

Step 3: **Calculate** the present value of each of the cash flows using the discount rate(s) and take the sum of these to arrive at a value for the bond.

A bond's cash flow is simply the cash that is expected to be received in the future from investment in a bond. This cash flow consists of coupon and principal.

LOS 66-b

Identify the types of bond for which estimating the expected cash flows is difficult and **explain** the problems encountered when estimating the cash flows for these bonds.

Sometimes it is difficult to estimate the expected cash flows, in terms of the amount and the timing, if the bond has the following features:

1. There are **embedded options** that allow the issuers or the investors to alter the contractual date of principal repayment, such as callable bonds, putable bonds, mortgage-backed securities, etc.
2. The coupon formula includes a **resettable coupon rate** or depends on some **variable value(s)** such as reference rates, exchange rates and market indices, e.g. floating rate notes, index floaters, etc.
3. There is an **option for the investor**, at his discretion, to convert or exchange the bond into another type of security, such as common stock, e.g. convertible bonds, exchangeable bonds.

The difficulty in estimating the cash flows lies in the ability to forecast the economic and market factors that the reference rates depend upon, such as interest rates, market indices, etc., and also to predict with reasonable certainty the reaction of borrowers and issuers to such changes. With mortgage-backed securities, for instance, one cannot determine with certainty how many percent of the underlying mortgages will prepay when the mortgage interest rate falls by a certain amount.

LOS 66-c

Determine the appropriate interest rates for valuing a bond's cash flows**, compute** the value of a bond, given the expected annual or semi-annual cash flows and the appropriate single (constant) or multiple (arbitrage-free rate curve) discount rates, **explain** how the value of a bond changes if the discount rate increases or decreases and **compute** the change in value that is attributable to the rate change, and **explain** how the price of a bond changes as the bond approaches its maturity date and **compute** the change in value that is attributable to the passage of time.

The appropriate interest rate in valuing a bond

The **discount rate** is the interest rate that is used to discount the cash flows in Step 2 of the valuation process. The discount rate should be at least the **risk-free rate**, i.e. the yield available in the market that reflects a default-free cash flow. In the United States, the yields of the Treasury Securities represent the default-free discount rates.

Higher discount rates than the risk-free rate indicate that there exists an element of additional risk. The **risk premium**, or the difference between the discount rate and the risk-free rate, signifies the additional risk. This premium is the additional compensation given to an investor for the risk taken. A single discount rate can be used but using multiple rates to discount a bond is preferred.

Computation value of a bond given expected cash flows and appropriate discount rate

Now, let us look at an example of valuing a bond based on the steps given in LOS 66-a.

Example 66-1 Bond valuation

Consider a bond with a 12% coupon, payable annually in arrears, a 3-year maturity and $1,000 principal value. The discount rate used is 10%.

Step 1 The cash flow schedule will be as follows:

End of year 1: First coupon of the bond will be 12% x $1,000 = $120

End of year 2: Second coupon of the bond will be 12% x $1,000 = $120

End of year 3: Third and last coupon of the bond will be 12% x $1,000 = $120

plus the repayment of the principal of $1,000, totalling $1,120.

Step 2: The discount rate is given to be 10%.

Step 3: Compute the present values of the cash flows:

Year 1: $120/(1.1)^1 = $109.09

Year 2: $120/(1.1)^2 = $99.17

Year 3: $1,120/(1.1)^3 = $841.47

The value of the bond is $109.09 + $99.17 + $841.47 = $1,049.74.

How the value of a bond changes with the discount rate's increase or decrease

What happens when we alter the discount rate in calculating the bond value in Example 66-1?

1. Assume the discount rate is now 11%. The bond value will be:
   $120/(1.11)^1 + $120/(1.11)^2 + $1,120/(1.11)^3 = $1,024.44
2. Assume the discount rate is now 9%. The bond value will be:
   $120/(1.09)^1 + $120/(1.09)^2 + $1,120/(1.09)^3 = $1,075.94

We can see that:

If the discount rate *increases*, the present value is *lower* and, conversely, if the discount rate *decreases*, the present value is *higher*.

We can also compute the effect on the price of the bond when the discount rate changes.

If the discount rate increases by 1.0% (100 basis points) the security value declines by $1,049.74 - $ 1,024.44 = $25.30

Alternatively, if the rate drops by 100 basis points, the value of the bond goes up by $1,075.94 - $1,049.44 = $26.50

The effect is not a linear one, i.e. the effect of an increase of the discount rate is not the same as that of a decrease of the same amount.

Pull to par value

What happens to the price of the bond when it approaches maturity?

Using the bond in Example 66-1, the bond price at the end of year 1 with 2 cash flows remaining can be computed as:

Year 2: $\$120/(1.1)^1 = \$109.09$

Year 3: $\$1{,}120/(1.1)^2 = \$925.62$

So, the value is: $1,034.71.

The bond price at the end of year 2 with 1 cash flow remaining can be computed as:

Year 3: $\$1{,}120/(1.1)^1 = \$1{,}018.18.$

The price of the bond, with the discount rate unchanged, will move towards its par value. This characteristic is called "**pull to par value**".

The effect of passage of time

Similarly we can calculate the effect of passage of time on the bond price:

Year 2: the price declines by: $1,049.74 - $1,034.71 = $15.03

Year 3: the price declines by: $1,034.71 - $1,018.18 = $16.53

Again, the effect of the change is not linear. Both the changes of the bond price due to the change in discount rate and the passage of time are not linear, i.e. they are convex.

LOS 66-d

Compute the value of a zero-coupon bond, **explain** the arbitrage-free valuation approach and the market process that forces the price of a bond toward its arbitrage-free value, **determine** whether a bond is undervalued or overvalued, given the bond's cash flows, appropriate spot rates or yield to maturity, and current market price, **explain** how a dealer can generate an arbitrage profit.

Zero-coupon bonds

In valuing a zero-coupon bond, the calculation is more straightforward since there are no coupon payments prior to maturity.

The present value is simply the maturity value discounted by the discount rate over the number of years to maturity. However in practice, the formula is aligned to the pricing of semiannual coupon bonds, so the formula for the value is:

Equation 66-1

$$\frac{\text{Maturity value}}{(1+ i/2)^{\text{no.of years x 2}}}$$

where

i = the annual interest rate

Example 66-2 Value of a zero-coupon bond

A 4-year zero-coupon bond with a maturity value of $1,000 discounted at a 9% interest rate is priced at:

$\$1,000/(1 + 0.09/2)^{4 \times 2} = \$703.19$.

Arbitrage-free valuation approach

The preferred valuation method for bonds is called the **arbitrage-free valuation approach**, meaning there is no arbitrage opportunity in the pricing of a bond since the market price is the same as the 'theoretical' or intrinsic price.

For each of the cash flows of a Treasury bond, the discount rate will be the **theoretical rate** that the U.S. Treasury would have to pay if it issued a zero-coupon bond with a maturity date equal to the maturity of the cash flow. This zero-coupon Treasury rate is called **Treasury spot rate**. The value of a bond using the Treasury spot rates as the multiple discount rates is called the **arbitrage-free value**.

Market forces will assure that the prices of Treasury bonds do not depart materially from their arbitrage-free values. When a bond is undervalued, the price will be bid up until the fair valuation is reached. Likewise when a bond is overvalued, there will be dealers in the market who will short sell the bond so the price will come down to its fair value.

Under or overvaluation

To determine whether a bond is mispriced, i.e. either undervalued or overvalued, we compare its current market price and its arbitrage-free value (or theoretical value).

Consider a 4-year Treasury bond with an 8% coupon discounted at 6%. A Treasury spot curve is given in the data below:

Period	Cash flow	Discount rate	Present value (1)	Spot rate	Present value (2)	Arbitrage profit
1	$4	6%	$3.8835	3.0000%	$3.9409	$0.0574
2	$4	6%	$3.7704	3.3000%	$3.8712	$0.1008
3	$4	6%	$3.6606	3.5053%	$3.7968	$0.1362
4	$4	6%	$3.5539	3.9164%	$3.7014	$0.1475
5	$4	6%	$3.4504	4.4376%	$3.5843	$0.1339
6	$4	6%	$3.3499	4.7520%	$3.4743	$0.1244
7	$4	6%	$3.2524	4.9622%	$3.3694	$0.1170
8	$104	6%	$82.0986	5.0650%	$85.1414	$3.0428
			$107.0197		$110.8797	$3.8600

The discount rates and spot rates are annual rates. To obtain the semiannual discount rate take one-half of the annual rate. For example in the first period, using a discount rate of 6%, the present value (1) is given by $4/(1 + 0.03) = $3.8835. If the spot rate is 3.0% the present value (2) is given by $4/(1 + 0.015) = $3.9409.

Here the market value as presented in the Present value (1) column, $107.0197, is lower than the arbitrage-free value as shown in Present value (2) column, $110.8797. The difference is $3.86. Since the market value is lower that the arbitrage-free value, the bond is *undervalued*.

Generating an arbitrage profit

If a Treasury bond is priced lower than its **arbitrage-free value**, a dealer can buy it and strip it into zero-coupon bonds and sell them to make a profit. Breaking apart a coupon bond into individual zero coupon bonds is called **stripping**.

Conversely, if the bond is priced higher than the arbitrage-free value, a dealer can buy a set of strips to create a synthetic bond and sell them as a bond at a profit. This process is called a **reconstitution**, the opposite of stripping.

The value of the bond using spot rates is also called the arbitrage-free value of the bond, which is $110.8797. In this case it is higher than the market value of $107.0197 (at a 6% discount rate) providing an arbitrage opportunity to make a profit of $3.86. So a dealer could buy the bond and strip it into a package of zero-coupon bonds and pocket the difference in value when he sold off all of the zero-coupon bonds.

67 Yield Measures, Spot Rates and Forward Rates

Learning Outcome Statements (LOS)

67-a	**Explain** the sources of return from investing in a bond (i.e., coupon interest payments, capital gain/loss, reinvestment income).
67-b	**Compute** the traditional yield measures for fixed-rate bonds (e.g., current yield, yield to maturity, yield to first call, yield to first par call date, yield to refunding, yield to put, yield to worst, cash flow yield), **explain** the assumptions underlying traditional yield measures and the limitations of the traditional yield measures.
67-c	**Explain** the importance of reinvestment income in generating the yield computed at the time of purchase, and **calculate** the amount of income required to generate that yield and **discuss** the factors that affect reinvestment risk.
67-d	**Compute** the bond equivalent yield of an annual-pay bond, and **compute** the annual-pay yield of a semiannual-pay bond.
67-e	**Compute** the theoretical Treasury spot rate curve, using the method of bootstrapping and given the Treasury par yield curve and **compute** the value of a bond using spot rates.
67-f	**Explain** the limitations of the nominal spread and **differentiate** among the nominal spread, the zero-volatility spread, and the option-adjusted spread for a bond with an embedded option, and **explain** the option cost.
67-g	**Explain** a forward rate, and **compute** the value of a bond using forward rates **and explain** and **illustrate** the relationship between short-term forward rates and spot rates and **compute** spot rates given forward rates, and forward rates given spot rates.

Introduction

Yields are the main measure of investment performance of bonds. Here we look into a variety of yield measures and in what circumstances they are used. We also investigate the reinvestment risk, i.e. the risk that might prevent an investment from generating its expected yield or yield to maturity. We then explore what spot and forward rates are, how they are derived and why they are important. Candidates are expected to be able to value bonds using these different discount rates.

LOS 67-a

Explain the sources of return from investing in a bond (i.e., coupon interest payments, capital gain/loss, reinvestment income).

There are three sources of return from a bond investment:

1. The coupon payments.
2. Any capital gain or loss when the bond is sold or matures; as demonstrated in Reading 66, bonds can increase and decrease in price depending on the movement of interest rates.
3. Income from reinvestment of the interim cash flows; this is mainly from the reinvestment of the coupons although, in the case of amortizing securities, can be from the scheduled principal repayments.

LOS 67-b

Compute the traditional yield measures for fixed-rate bonds (e.g., current yield, yield to maturity, yield to first call, yield to first par call date, yield to refunding, yield to put, yield to worst, cash flow yield), **explain** the assumptions underlying traditional yield measures and the limitations of the traditional yield measures.

Yield measures

Yield measures vary; the most important ones are:

1. *Current yield*

This is calculated based on the current market price.

Equation 67-1

$$\text{current yield} = \frac{\text{annual dollar coupon interest}}{\text{current price}}$$

2. *Yield to maturity*

This is the discount rate that will make the present value of the cash flows equal to the market price plus accrued interest. Since the cash flows of a typical bond occur semiannually, the discount rate is the semiannual yield.

The convention is to double the semiannual yield to arrive at the bond equivalent yield (BEY).

The following relationships hold:

Bond selling at	Relationship
Par	Coupon rate = current yield = yield to maturity
Discount	Coupon rate < current yield < yield to maturity
Premium	Coupon rate > current yield > yield to maturity

3. ***Yield to first call***
This is similar to yield to maturity, but it is calculated until the first call date using all the coupon payments and the call price as the cash flows, plus accrued interest.

4. ***Yield to first par call date***
This is calculated to the first par call date using all the coupon payments and the par price as the cash flows, plus accrued interest.

5. ***Yield to put***
This is similar to yield to maturity, but it is calculated to the put date using all the coupon payments and the put price as the cash flows, plus accrued interest.

6. ***Yield to worst***
When a bond has several call and put dates, the yields can be calculated to each of these dates as well as the yield to maturity. The lowest yield is called the yield to worst.

7. ***Cash flow yield***
With mortgage-backed or asset-backed securities, the cash flow contains uncertainty of early prepayments on the underlying pool of loans. The basis on which **prepayments** are made needs to be taken into account. The rate at which the borrowers prepay is called the **prepayment rate**.

Example 67-1 Traditional yield measures

1. **Current yield**
A bond has 6 years to maturity, an 8% coupon and a current price of $98.75, what is the current yield?

If the par value is $100, the annual coupon payment will be 8% x $100 = $8.

The current quoted price is $98.75, so the current yield is $8/$98.75 = 8.10%

2. **Yield to maturity**
A bond has a 10% semiannual coupon, 5 years to maturity and the following price-yield relationship:

Example 67-1 (continued) Traditional yield measures

Semiannual interest rate	5.0%	5.1%	5.2%	5.3%	5.4%
Present value	100.00	99.23	98.47	97.72	96.97

The bond pays a $5 coupon every 6 months, so when the semiannual interest rate in the market is 5%, the bond is priced at par. When the semiannual interest rate in the market is 5.1% the price of the bond is $99.23, at 5.2% the price is $98.47, and so on (calculated using a financial calculator).

The following calculations are based on the bond below:

Coupon = 10%
Maturity = 5 years
Not callable for the first 2 years
First call date in 2 years, call price $103
First par call date in 3 years (call price $100)
First put date in 4 years at $101
The price of the bond is $110.75

3. **Yield to first call**
The calculation produces a 2.84% semiannual yield or a BEY of 5.68% if the bond is called at the end of 2 years at a call price of $103.

4. **Yield to first par call**
The calculation produces a 3.01% semiannual yield, or a BEY of 6.02% if the bond is called at the end of 3 years with a par call price, i.e. $100.

5. **Yield to put**
The calculation produces a 3.54% semiannual yield, or a BEY of 7.08% for the yield to first put at the end of 4 years at $101.

6. **Yield to worst**
The semiannual yield to maturity, assuming no put or call options are exercised is 3.69%, or a BEY of 7.38%.

The yield to worst in this example is the yield to first call of 5.68%.

Underlying assumptions in traditional yield measures

The traditional yield to maturity calculation makes the following two major assumptions:

1. The coupon payments are reinvested at the rate equal to the yield to maturity
2. The bond is held to maturity

Remember in Study Session 11 the calculation of internal rate of return (IRR) assumed reinvestment of cash flows at the IRR. The yield to maturity is the IRR of the bond.

Similarly the **cash flow yield** calculation makes the following two major assumptions:

1. The projected cash flows are reinvested at the cash flow yield.
2. The securities are held until the final payoff of the loans based on some prepayment assumption. (Note: Since the securities are an amortizing type, the timing of the full amount of principal repayment cannot be known with certainty as it is dependent on the probability of prepayment).

LOS 67-c

Explain the importance of reinvestment income in generating the yield computed at the time of purchase, and **calculate** the amount of income required to generate that yield, and **discuss** the factors that affect reinvestment risk.

As stated above, the yield to maturity is achieved only if the income is reinvested at the rate equal to the yield to maturity.

If the cash flows cannot be reinvested at the rate equal to the yield to maturity then there is **reinvestment risk**. If the bond is not held to maturity, it may have to be sold for less than its purchase price. This is **interest rate risk**.

In both cases the actual yield obtained will be different to the expected yield to maturity. Following is an illustration of how reinvestment income plays a role in generating the yield computed at the time of purchase (expected yield to maturity).

Example 67-2 Reinvestment income

Let us take the case of a bond with a 10% coupon (payable semiannually) yielding 10% with a remaining term to maturity of 4 years, priced at par of $1,000.

The future value of the bond at the date of maturity	$1,000 x $(1.05)^8$	=	$1,477.46
The return of principal		=	$1,000.00
The total dollar return		=	$ 477.46
Without reinvestment income	4 x $100	=	$ 400.00
Capital gain		=	$ 0.00
Dollar return without reinvestment income		=	$ 400.00

The dollar shortfall = $477.46 - $400.00 = $77.46, was obtained from the reinvestment of the coupons at 10% for 4 years, as follows:

First coupon	$50 x 1.05^7 - $50	=	$20.36
Second coupon	$50 x 1.05^6 - $50	=	$17.01
Third coupon	$50 x 1.05^5 - $50	=	$13.81
Fourth coupon	$50 x 1.05^4 - $50	=	$10.76
Fifth coupon	$50 x 1.05^3 - $50	=	$7.88
Sixth coupon	$50 x 1.05^2 - $50	=	$5.13
Seventh coupon	$50 x 1.05^1 - $50	=	$2.50
Eighth coupon	$50 x 1.05^0 - $50	=	$0.00
Total			$77.46

We show here that the reinvestment income of $77.46 is crucial in making the realized yield to be 10%, i.e. equal to the yield to maturity.

If the coupons cannot be invested at a 10% yield, than the reinvestment income will be lower and therefore the realized yield will be lower than 10%.

Factors that affect reinvestment risk

Factors that affect reinvestment risk are **maturity** and **coupon rates**:

1. The longer the time to maturity the more the bond is dependent on the reinvestment income.
2. The higher the coupon rate the more the bond is dependent on the reinvestment income.

Zero-coupon bonds do not have reinvestment risk. For bonds bought at a premium, the reinvestment income is more important that ones bought at par. This is because the reinvestment income is needed to compensate for the capital loss made due to the amortization of the premium. In contrast, for bonds bought at a discount dependence on the reinvestment income is less.

LOS 67-d

Compute the bond equivalent yield of an annual-pay bond, and **compute** the annual-pay yield of a semiannual-pay bond.

It is common practice to pay the coupons semiannually in the U.S., while the annual payment of coupons is often the norm internationally.

Equation 67-2

The **bond equivalent yield (BEY)** of an annual-pay bond is:

$$= 2\left[(1 + \text{yield on annual-pay bond})^{0.5} - 1\right]$$

Another way, which is more commonly used with Eurobonds or in Europe, is to quote yield on an annual basis, i.e.:

Equation 67-3

Yield on an annual basis or **annual-pay yield** is linked to BEY as follows:

$$= \left[(1 + \text{yield on a bond-equivalent basis}/2)^2 - 1\right]$$

Example 67-3 Bond-equivalent yield and annual-pay yield

1. Given the annual-pay yield is 9%, the BEY yield is:

   $2[(1 + 0.09)^{0.5} - 1] = 8.81\%$

   The BEY is always lower than the annual-pay yield due to the compounding effect in the annual-pay yield calculation.

2. Given the BEY of 9%, the annual-pay yield is $[(1 + 0.09/2)^2 - 1] = 9.20\%$

   The annual-pay yield is always higher.

LOS 67-e

Compute the theoretical Treasury spot rate curve, using the method of bootstrapping and given the Treasury par yield curve and **compute** the value of a bond using spot rates.

Valuing a bond using **spot rates** is straightforward, since each cash flow is discounted using a corresponding spot rate.

Recall from Reading 66 that a zero-coupon Treasury rate is called a Treasury spot rate.

Example 67-4 Valuation using spot rates

Given the 1-year spot rate is 3.56%, 2-year spot rate is 4.01% and 3-year spot rate is 4.87%, the value of a 6% annual coupon bond with remaining term to maturity of 3 years and par value of \$1,000 will be:

$\$60/1.0356 + \$60/(1.0401)^2 + \$1,060/(1.0487)^3$

$= \$57.9374 + \$55.4627 + \$919.0773$

$= \$1,032.48$

If not all the spot rates are available across the maturity spectrum, it is possible to construct a **theoretical spot curve**, i.e. what the spot rates would be if there are zero-coupon bonds available to represent the maturity spectrum.

LOS 67-h

Compute the theoretical Treasury spot rate curve, using the method of bootstrapping and given the Treasury par yield curve.

One way of building a theoretical spot rate curve is by a method called bootstrapping. See Example 67-5 for a bootstrapping calculation.

Example 67-5 Bootstrapping

Period	Years	Annual yield to maturity (BEY) %	Price	Spot rate (BEY) %
1	0.5	4.00		4.0000
2	1.0	4.30		4.3000
3	1.5	4.65	100	4.6606
4	2.0	4.75	100	4.7618
etc.	etc.	etc.	100	etc.
30	15.0	7.00	100	etc.

In the first two periods, the rates are given for Treasury bills so these are already spot rates.

We will use the notation z_m as one-half the theoretical m/2 year spot rate.

Period 3

First we calculate z_3 which is one half the theoretical 1.5 year spot rate.

We can see in the table that z_1 is 2.00% and z_2 is 2.15% (half the six-month and one-year spot rates respectively).

The yield to maturity of a bond which is priced at 100 is the same as its coupon rate. Therefore we can say that the price of the bond (100) is equal to the coupons of 4.65/2 = 2.325 discounted back at the appropriate spot rates over the one and a half year period.

$$100 = \frac{2.325}{1+z_1} + \frac{2.325}{(1+z_2)^2} + \frac{102.325}{(1+z_3)^3}$$

$$100 = \frac{2.325}{1.02} + \frac{2.325}{(1.0215)^2} + \frac{102.325}{(1+z_3)^3}$$

$$95.4924 = \frac{102.325}{(1+z_3)^3}$$

$$z_3 = 1.023303 - 1 = 2.3303\%$$

The spot rate on a BEY basis is 4.6606%

Example 67-5 (continued) Bootstrapping

Period 4

Using the same method to calculate z_4.

$$100 = \frac{2.375}{1+z_1} + \frac{2.375}{(1+z_2)^2} + \frac{2.375}{(1+z_3)^3} + \frac{102.375}{(1+z_4)^4}$$

$$100 = \frac{2.375}{1.02} + \frac{2.375}{(1.0215)^2} + \frac{2.375}{(1.0233)^3} + \frac{102.375}{(1+z_4)^4}$$

$$93.1791 = \frac{102.375}{(1+z_4)^4}$$

$$z_4 = 1.023809 - 1 = 2.3809\%$$

The spot rate on a BEY basis is 4.7618%

Continue using the same method for the remaining periods.

LOS 67-f

Explain the limitations of the nominal spread and **differentiate** among the nominal spread, the zero-volatility spread, and the option-adjusted spread for a bond with an embedded option, and **explain** the option cost.

The **nominal spread** is traditionally calculated as the difference between a bond's quoted yield and the benchmark Treasury bond's yield, or in other words the premium over its benchmark yield.

Example 67-6 Nominal spread

The nominal spread between a T-bond with a remaining life to maturity of 5 years, a coupon rate of 6% and yielding 6.12%, and a bond with the same remaining life, a coupon rate of 8% and yielding 8.25%, would be:

8.25% - 6.12% = 2.13%

Recent findings show that there are limitations of nominal spread:

1. The yield fails to take into account the term structure of the spot rates, i.e. it is only relative to one point on the yield curve. It is important to understand the behavior of the spread across the yield curve.

2. In the case of embedded options, such as call and put options, expected interest rate volatility may alter the cash flows of the bond rendering of little worth the information carried by the spread.

Nominal spread is traditionally the difference between a bond's quoted yield and its benchmark Treasury bond's yield, or in other words the premium over its benchmark yield.

The **zero-volatility spread**, also called the **Z-spread** or **static spread** is the spread over the entire Treasury spot rate curve for a non-Treasury bond, if the bond is held until maturity, unlike the nominal spread that is only relative to one point on the yield curve. The Z-spread represents the non-Treasury risk premia relative to the Treasury spot rate curve, due to credit risk, liquidity risk, embedded options risk, etc.

Option-adjusted spread (OAS) is a spread measure that takes into account the embedded option in the security. The calculation is model dependent and assumes that the interest rate has a volatility that is non-zero. Z-spread assumes otherwise and therefore is also called zero-volatility OAS.

The difference between the two spreads is the **option cost**.

Equation 67-4

Option cost = Z-spread – OAS

Forward rates

Forward rates are the implied market's expectations of future short-term rates and are derived from an extrapolation of the spot rate curve. In short they are the market consensus of future interest rates.

For example from the spot rate curve we can calculate the

- 6-month forward rate 3 years from now
- 3-year forward rate 6 months from now, etc.

A spot rate can be calculated from forward rates, e.g. a two-year spot rate is a product of the one-year spot rate and the one-year forward rate one year from now.

We next look at calculating the value of a bond using forward rates.

Example 67-7 Bond valuation using forward rates

Using the bond in Example 67-4, the value of an annual 6% coupon bond with remaining term to maturity of 3 years and par value of $1,000 is using spot rates:

Year	Spot rate	Cash flow	PV of Cash flow
1	3.56%	$60	$57.9374
2	4.01%	$60	$55.4627
3	4.87%	$1,060	$919.0773
			$1,032.48

For Year 1, the PV is derived from $60/(1.0356) = 57.9374, for year 2 the PV = $60/(1+0.041)^2 = $55.4627, etc.

Using forward rates:

Year	Spot rate	Forward rate	Cash flow	PV of Cash flow
1	3.56%	3.56%	$60	$57.9374
2	4.01%	4.64%	$60	$55.3683
3	4.87%	6.43%	$1,060	$919.0773
				$1,032.38

In year 1, the forward rate is the same as the spot rate. In year 2, the 1-year forward rate is 1 year from now is calculated to be 4.64%, the PV of the cash flow is:

$60/[(1.0356)(1.0464)] = $55.3683.

In year 3 the 1-year forward rate 2 years from now is given to be 6.61%, so the PV of the cash flow will be:

$1,060/[(1.0356)(1.0464)(1.0643)] = $919.0773

There should be no difference, other than rounding errors, in the result of the computation of the value of the bond.

LOS 67-g

Explain a forward rate, and **compute** the value of a bond using forward rates **and explain** and **illustrate** the relationship between short-term forward rates and spot rates and **compute** spot rates given forward rates, and forward rates given spot rates.

Short-term forward rates and spot rates are related through the formula:

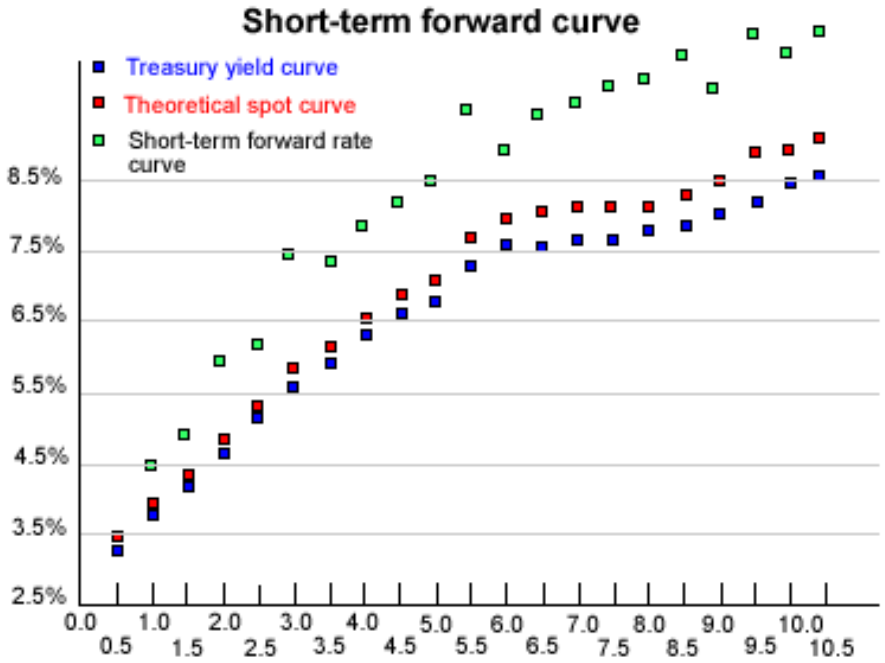
Equation 67-5

$$ {}_1f_m = \frac{(1+z_{m+1})^{m+1}}{(1+z_m)^m} - 1 $$

${}_1f_m$ is the notation used for determining the 6-month forward rate m (6-month) periods from now. To get the 6-month forward rate on a BEY basis we need to double the answer.

So, the 6-month forward rate 3 years from now will be 2 x ${}_1f_6$

The market observes at any point of time how the Treasury yield curve, Treasury theoretical spot curve and short-term forward rate curve plot against each other. An example is shown below:



Notice that the short-term forward rates lie above the spot rates and the yields. This is generally true when the yield curve is upward sloping.

To compute spots rates from forward rates use the following formula:

Equation 67-6

$$ z_T = [(1+z_1)(1+{}_1f_1)(1+{}_1f_2)(1+{}_1f_3)...(1+{}_1f_{T-1})]^{1/T} - 1 $$

Example 67-8 Spot and forward rates

Using the bond in Example 67-5

Period	Years	Annual yield to maturity (BEY) %	Price	Spot rate (BEY) %
1	0.5	4.00		4.0000
2	1.0	4.30		4.3000
3	1.5	4.65	100	4.6606
4	2.0	4.75	100	4.7618
etc.	etc.	etc.	100	etc.
30	15.0	7.00	100	etc.

We can use Equation 67-5 to calculate the 6-month forward rate 6 months and 1 year from now

$$ {}_1f_1 = \frac{(1+z_2)^2}{(1+z_1)^1} - 1 $$

$$ = \frac{(1.0215)^2}{(1.02)} - 1 $$

$$ = 2.3002\% $$

Therefore the 6-month forward rate 6 months from now is double this, 4.6004%

$$ {}_1f_2 = \frac{(1+z_3)^3}{(1+z_2)^2} - 1 $$

$$ = \frac{(1.023303)^3}{(1.0215)^2} - 1 $$

$$ = 2.6919\% $$

The 6-month forward rate 1 year from now is double this, 5.3838%

Using Equation 67-6 we can check the 1.5 year spot rate

$$ z_3 = [(1+z_1)(1+{}_1f_1)(1+{}_1f_2)]^{1/3} - 1 $$

$$ = (1.02)(1.02300)(1.02692)^{1/3} - 1 $$

$$ = 2.3303\% $$

The annual rate is double this, 4.6606%.

68 Introduction to the Measurement of Interest Rate Risk

Learning Outcome Statements (LOS)

68-a	**Distinguish** between the full valuation approach (the scenario analysis approach) and the duration/convexity approach for measuring interest rate risk, and **explain** the advantage of using the full valuation approach.
68-b	**Compute** the interest rate risk exposure of a bond position or of a bond portfolio, given a change in interest rates.
68-c	**Demonstrate** the price volatility characteristics for option-free bonds when interest rates change (including the concept of "positive convexity"), **demonstrate** the price volatility characteristics of callable bonds and prepayable securities when interest rates change (including the concept of "negative convexity"), **describe** the price volatility characteristics of putable bonds.
68-d	**Compute** the effective duration of a bond, given information about how the bond's price will increase and decrease for given changes in interest rates and **compute** the approximate percentage price change for a bond, given the bond's effective duration and a specified change in yield.
68-e	**Distinguish** among the alternative definitions of duration (modified, effective or option-adjusted, and Macaulay), **explain** why effective duration, rather than modified duration or Macaulay duration, should be used to measure the interest rate risk for bonds with embedded options, **describe** why duration is best interpreted as a measure of a bond's or portfolio's sensitivity to changes in interest rates, **compute** the duration of a portfolio, given the duration of the bonds comprising the portfolio and **discuss** the limitations of the portfolio duration measure.
68-f	**Discuss** the convexity measure of a bond and **estimate** a bond's percentage price change, given the bond's duration and convexity measure and a specified change in interest rates.
68-g	**Differentiate** between modified convexity and effective convexity.
68-h	**Compute** the price value of a basis point (PVBP), and **explain** its relationship to duration.

Introduction

This is perhaps the most important topic in bond risk analysis: interest rate sensitivity which is also known as price volatility. As the name suggests, it revolves around the relationship between price and yield of a bond.

Firstly we look at the different approaches of measuring the interest rate sensitivity, either using a full valuation approach or using duration/ convexity measures. Then we explore the behaviour of the price volatility of a bond either with or without the presence of embedded options. Candidates are expected to be able to calculate the price change of a bond when the duration is known. We also look at different types of duration and their limitations, and the convexity of a bond and its importance.

LOS 68-a

Distinguish between the full valuation approach (the scenario analysis approach) and the duration/convexity approach for measuring interest rate risk, and **explain** the advantage of using the full valuation approach.

To measure interest rate risk, the obvious approach is the **full valuation** method. Each bond in the portfolio is revalued under different interest rate scenarios and the resulting total losses/gains of the portfolio are calculated.

Another approach is the **duration/convexity** approach where the sensitivity figures are determined and the total loss/gain is calculated using the sensitivity figures.

The main advantage of the full valuation approach is that it can account for non-parallel shifts in the yield curve, namely changes in interest rates that are not uniform across the maturity spectrum.

LOS 68-b

Compute the interest rate risk exposure of a bond position or of a bond portfolio, given a change in interest rates.

Example 68-1 Interest rate risk exposure

Look at the interest rate exposure for a parallel shift in the yield curve for the following bond:

Bond:	8% coupon, 4 years to maturity
Price:	105.2097
Yield:	6.5%
Par value:	$1,000,000
Market value of position:	$1,052,097

Yield increase	Price	Market value	Percentage change
50bp	103.4370	$1,034,370	-1.69%
100bp	101.7007	$1,017,007	-3.34%
200bp	98.3341	$983,341	-6.54%
300bp	95.1032	$951,032	-9.61%

LOS 68-c

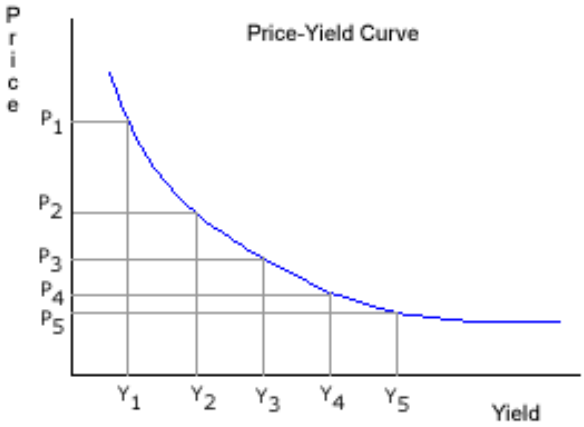
Demonstrate the price volatility characteristics for option-free bonds when interest rates change (including the concept of "positive convexity"), **demonstrate** the price volatility characteristics of callable bonds and prepayable securities when interest rates change (including the concept of "negative convexity"), **describe** the price volatility characteristics of putable bonds.

Convexity

Looking at the bond in Example 68-1

Yield	Price	Price change (from previous price)	Percentage change
9.00	96.7021	3.2979	-3.4104
8.00	100.0000	1.7007	-1.7007
7.50	101.7007	1.7363	-1.7073
7.00	103.4370	0.8817	-0.8542
6.75	104.3187	0.8852	-0.8198
6.51	105.1739	0.0358	-0.0340
6.50	105.2097	-	-
6.49	105.2455	0.0358	0.0340
6.25	106.1100	0.8645	0.8214
6.00	107.0197	0.9097	0.8573
5.50	108.8679	1.8482	1.7270
5.00	110.7552	1.8873	1.7336
4.00	114.6510	3.8958	3.5157

This relationship can be presented in the following graph, if the yield increases from Y_1 to Y_2 then the price falls from P_1 to P_2 and so on:

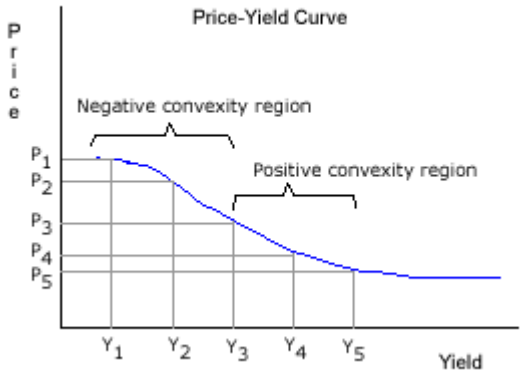


A particular characteristic shown by the relationship is called the **positive convexity**, which means:

1. The percentage price change for a given yield change is not the same for all bonds.
2. For small changes in yield, the percentage changes are roughly the same, whether the yield increases or decreases.
3. For a large change in yield, the percentage price change is not the same for an increase in yields as it is for a decrease in yields.
4. For a large change in yield, the percentage price increase is greater than the percentage price decrease.

Price volatility characteristics

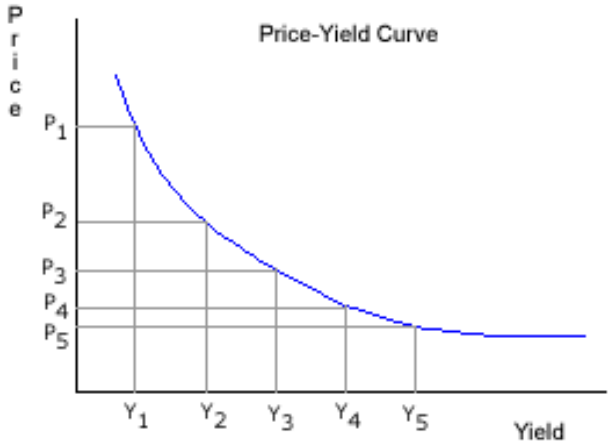
For bonds with embedded call options, we can observe **negative convexity**. Negative convexity is the 'tapering off' feature of the price curve that for the same amount of yield decrease, the increase in price is progressively less. This is caused by the higher probability of prepayments or the bond being called when interest rates decline. So the price of the security gravitates toward par or its call price instead of going to a premium. This is also known as **price compression**.



In this illustration, the call price or par is P_1. When the yield reaches Y_1 the issuer is likely to call the bonds so the price will not go higher than P_1. Negative convexity only appears at lower yields, as at higher yields the bond behaves like an option-free bond.

Price volatility characteristics of putable bonds

When a bond contains an embedded put option, the opposite behaviour from one with a call option is shown. As yields increase, the decrease in price is progressively less. This behaviour appears at higher yields, as at lower yields the bond behaves like an option-free bond.



That behaviour can be illustrated in the graph above. The put price has been set at P_4. As the yield increases toward Y_4, the price will be sliding toward P_4. When the yield reaches Y_4, it is very likely that the bondholders would request the issuer to repay the principal at P_4. If the yield drops to Y_5, the price will not reach P_5 because the bonds would have been put back to the issuer at the price P_4.

LOS 68-d

Compute the effective duration of a bond, given information about how the bond's price will increase and decrease for given changes in interest rates and **compute** the approximate percentage price change for a bond, given the bond's effective duration and a specified change in yield.

Calculating effective duration

The effective (sometime called option-adjusted) duration formula can be expressed as:

Equation 68-1

$$\text{duration} = \frac{V_- - V_+}{2(V_0)(\Delta y)}$$

where Δy = change in yield in decimals, e.g.100 basis points is 0.01

V_0 = initial price

V_- = price if yield declines by Δy

V_+ = price if yield increases by Δy

Example 68-2 Duration

Consider the bond in Example 68-1. The table of price changes due to changes in yields is given. Take Δy = 50 basis points for the bond at a 6.50% yield, when the price is 105.2097.

$$\text{duration} = \frac{V_- - V_+}{2(V_0)(\Delta y)} = \frac{(107.0197 - 103.4370)}{2(105.2097)(0.005)} = 3.4053$$

This measure says that the price of the bond will change by 3.4053% for a 100 basis points change. At the yield of 7.50% the price is $101.7007 (a 3.3352% change) and at 5.50% the price is $108.8679 (a 3.4771% change). Note that the price increase is larger which agrees with the characteristics of positive convexity.

Approximate Percentage Price Change

We can also compute the approximate percentage price change, given the duration measure and the change in the yield. The formula:

Equation 68-2

Approx. percentage price change = - duration x Δy x 100

where

Δy = change in yield in decimals

Example 68-3 Approximate percentage price change

Using the bond in Example 68-2, let us take a 25 basis point change in yield, then

Approx. percentage price change = 3.4053 x 0.0025 x 100

= 0.8513%

The prices in the table show a 0.8469% change for a 25 bp increase and a 0.8557% change for 25bp decrease, therefore Equation 68-2 gives a good approximation of the price change.

LOS 68-e

Distinguish among the alternative definitions of duration (modified, effective or option-adjusted, and Macaulay), **explain** why effective duration, rather than modified duration or Macaulay duration, should be used to measure the interest rate risk for bonds with embedded options, **describe** why duration is best interpreted as a measure of a bond's or portfolio's sensitivity to changes in interest rates, **compute** the duration of a portfolio, given the duration of the bonds comprising the portfolio and discuss **explain** the limitations of the portfolio duration measure.

Types of duration

We need to distinguish between the different types of duration.

Modified duration assumes no changes in the expected cash flows.

Effective duration can be used for bonds which have embedded options. At Level I we do not cover the model for valuing V- and V+ when there are uncertain cash flows due to options; we simply apply the formula (Equation 68-1) to an option-free bond.

The relationship between the Macaulay (generic) duration and the modified duration is as follows:

Equation 68-3

$$\text{Modified duration} = \frac{\text{Macaulay duration}}{(1 + \text{yield}/k)}$$

where

k = number of periods, or payments, per year

Macaulay duration is defined to be the weighted-average time to receive the cash flows, the weighting being the present values of the cash flows as a percentage of the bond's full price.

Equation 68-4

$$\text{Macaulay duration} = \sum_{i=1}^{n} \frac{t \times PVCF_t}{k \times \text{Price}}$$

where

k	=	number of periods, or payments, per year
n	=	number of periods until maturity
t	=	period in which the cash flow is expected to be received
PVCFt	=	present value of the cash flow in period t discounted at the yield to maturity
Price	=	bond's price (total present values of all cash flows)

(Note – the LOS suggests that you are probably **not** required to memorize Equation 68-4).

The difference in the duration calculation between the **modified duration** and **effective duration** of bonds with embedded options can be dramatic.

The source text book mentions two examples: a callable bond could have a modified duration of 5 but an effective duration of 3, while a CMO could have a modified duration of 7 and an effective duration of 20!

Effective duration versus modified duration or Macaulay duration

Effective duration is considered a better measure since it takes into account the expected alteration of cash flows due to a change in yields.

Duration has been described in more than one way:

1. Interest rate sensitivity.
2. First derivative of the price-yield function of the bond.
3. The weighted-average number of years to receiving the present value of the cash flows.

The most important interpretation is point (1) above which tells investors the effect of changing interest rates on the value of their investments. The other interpretations are mathematical concepts and often not valid for more complex instruments.

For example, certain derivative instruments such as an interest-only security might have a duration measure of -4. This implies that for a 100 basis points rate increase the price of the bond will increase by 4%. A weighted-average number of years calculation cannot explain negative duration.

Why duration is best interpreted as a measure of a bond's or portfolio's sensitivity to changes in interest rates?

Let us look at how each of the three descriptions of duration can be applied:

1. A portfolio duration of 4.5 indicates that the value of your portfolio will change by approximately 4.5% when interest rates change by 1% or 100 basis points.
2. A portfolio duration of 4.5 is the first derivative of the price-yield function, or slope of the price-yield curve, for the bonds in the portfolio.
3. A portfolio duration of 4.5 means that the weighted-average number of years to receive the present value of the portfolio's cash flows is 4.5 years.

The first interpretation obviously makes better practical sense in investment analysis although there is nothing wrong conceptually with the other two.

Compute the duration of a portfolio

The duration of a portfolio is the weighted average of the durations of each of the bonds comprising the portfolio where the weighting is the market values. The calculation can be mathematically expressed as follows:

Equation 68-5

$$D_P = w_1D_1 + w_2D_2 + w_3D_3 + ... + w_kD_k$$

where

w_i = market value of bond i/market value of the portfolio

D_i = duration of bond i

K = number of bonds in the portfolio

Example 68-4 Portfolio duration

Given bonds with the following market values:

	Market price	Par amount	Market value	Duration
Bond A	98.825	$1 million	$988,250.00	5.5
Bond B	100.250	$2 million	$2,005,000.00	7.8
Bond C	104.500	$1 million	$1,045,000.00	9.3
			$4,038,250.00	

The portfolio duration =

($988,250/$4,038,250) x 5.5 + ($2,005,000/$4,038,250) x 7.8 + ($1,045,000/$4,038,250) x 9.3 = 1.35 + 3.87 + 2.41

= 7.63

The limitations of the portfolio duration measure

A critical assumption made when using Equation 68-5 for the portfolio duration is that the yields of all the bonds must change by the same amount. In other words, the yield curve makes a parallel shift. In reality, the yields of bonds in a portfolio do not move in parallel.

Different yield changes will affect individual bonds differently so a single duration measure is not sufficient to explain interest rate sensitivity.

LOS 68-f

Discuss the convexity measure of a bond and **estimate** a bond's percentage price change, given the bond's duration and convexity measure and a specified change in interest rates.

Convexity

An important concept is presented here: **convexity**, which explains the non-linear behavior of the interest rate sensitivity (duration) for large moves in interest rates.

If we look at the bond in Example 68-1, the price of the bond for 150 and 250 basis points moves are:

Yield	Price	Price change	Percentage change
9.00	96.7021	-8.5076	-8.0863
8.00	100.00	-5.2097	-4.9517
6.51	105.1739	-0.0358	-0.0340
6.50	105.2097	-	-
6.49	105.2455	0.0358	0.0340
5.00	110.7552	6.5455	5.2709
4.00	114.6510	9.4413	8.9738

Had the price movement been linear, the bond prices at 9.00% yield would have been 96.2597 and at 4% would have been 114.1597.

Equation 68-6

The difference can be explained by: $$\text{convexity} = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y)^2}$$

where

Δy	=	change in yield in decimals
V_0	=	initial price
V_-	=	price if yield declines by Δy
V_+	=	price if yield increases by Δy

From our example

$$\text{Convexity measure} = \frac{107.0197 + 103.4370 - 2(105.2097)}{2(105.2097)(0.005)^2}$$

$$= 7.0906$$

How do we use the convexity measure to adjust the percentage price change?

Equation 68-7

Convexity adjustment to percentage price change

= Convexity measure x $(\Delta y)^2$ x 100

Examples 68-5 Convexity adjustment

1. From the data above when yields move from 6.5% to 4%,

   Estimated change using duration – 3.4053 x – 0.025 x 100 = 8.5133

   Convexity adjustment 7.0906 x $(.025)^2$ x 100 = 0.4432

   Total estimated percentage price change = 8.9565

   This is close to the observed 8.9738% change in the above price table.

2. Another example of the total estimated price change in percentage terms is:

   Duration = 4.5670%

   Convexity = 81.0935

   Yield increases by 300 basis points

   Estimated change using duration – 4.5670 x 0.03 x 100 = –13.7010

   Convexity adjustment 81.0935 x $(.03)^2$ x 100 = 7.2984

   Total estimated percentage price change = –6.4026

   In this case convexity is large and we are considering a big move in interest rates, therefore the convexity adjustment is significant.

Convexity measures are not quoted in a standard scaling; namely they may be derived from slightly different formulas although they convey the same concept. Convexity measures are meaningful only in the context of an adjustment to the price change. Bonds that exhibit **price compression** have negative convexity measures.

LOS 68-g

Differentiate between modified convexity and effective convexity.

Analogous to that of the duration, convexity can take either form of **modified** or **effective** convexity. Effective convexity is applicable when the cash flows are expected to change when the yield changes.

LOS 68-h

Compute the price value of a basis point (PVBP), and **explain** its relationship to duration.

The **price value of a basis point** (PVBP), also called the **dollar value of a 01** (DV01), is the absolute value of the change in the price of a bond for a 1 basis point change in yield.

Example 68-6 Price value of a basis point

Given an initial price of 125.3900 of a bond having duration of 20.9994, the PVBP is:

20.9994 x 0.0001 x 125.3900 = $0.2633

The relationship is straightforward. Dollar duration is based on 1% or 100 basis point change, while PVBP is on 0.01% or one basis point. PVBP is simply a special case of dollar duration as described in Session 14.

STUDY SESSION 16

Derivative Investments

Overview

This is a long STUDY SESSION and provides an introduction to the characteristics and pricing of the different types of derivatives – forwards, futures, options and swaps. Some of the calculations are reasonably demanding but candidates should make every attempt to comprehend the material and make the necessary calculations. Derivatives are a key topic and will be important at Level II and III when you will explore further how they are used by managers to hedge risk or alter risk–return characteristics of portfolios to meet client objectives.

The first Reading is a general overview of derivatives; all the concepts are revisited in later Readings. The next four Readings examine the characteristics of forwards, futures, options and swaps in more detail and candidates will become familiar with the main contracts based on different underlying assets. The final Reading looks at how options can be used to manage risk.

Reading Assignments

Analysis of Derivatives for the CFA® Program, Don Chance (AIMR, 2003)
69. "Derivative Markets and Instruments," Ch. 1
70. "Forward Markets and Contracts," Ch. 2, pp. 25-37
71. "Futures Markets and Contracts," Ch. 3, pp. 81-103
72. "Option Markets and Contracts," Ch. 4, pp. 159-194
73. "Swap Markets and Contracts," Ch. 5, pp. 269-285
74. "Risk Management Applications of Option Strategies," Ch. 7, pp. 411-429

69 Derivative Markets and Instruments

Learning Outcome Statements (LOS)

69-a	**Define** a derivative and **differentiate** between exchange-traded and over-the-counter derivatives.
69-b	**Define** a forward commitment, **identify** the types of forward commitments and **describe** the basic characteristics of forward contracts, futures contracts, and swaps.
69-c	**Define** a contingent claim and **identify** the types of contingent claims.
69-d	**Describe** the basic characteristics of options and **distinguish** between an option to buy (call) and an option to sell (put).
69-e	**Discuss** the purposes and criticisms of derivative markets.
69-f	**Explain** the concept of arbitrage and the role it plays in determining prices and in promoting market efficiency.

Introduction

This is an introductory reading which looks briefly at the two categories of derivatives, forward contracts and contingent claims, and how they are traded: OTC or on an exchange. It gives an introduction to the terminology used in forwards, futures, swaps and options markets and outlines the main concepts. All of the terms are covered in more detail later in the Study Session.

LOS 69-a

Define a derivative and **differentiate** between exchange-traded and over-the-counter derivatives.

Definition of a derivative

A derivative is a financial instrument that provides a return that depends on the price of another underlying asset.

A derivative has a finite life and usually the payoff or return on the derivative is decided at the expiry date.

Exchange-traded versus over-the-counter derivatives.

Exchange-traded derivatives have standard terms and are traded in an organized derivatives market or exchange. Over-the-counter derivatives are ones which are traded between two parties outside the exchange.

LOS 69-b

Define a forward commitment, **identify** the types of forward commitments and **describe** the basic characteristics of forward contracts, futures contracts, and swaps.

Definition of forward commitment

Derivatives are either forward contracts or contingent claims. Forward contracts or commitments are ones where two parties agree to do a transaction at a later date at a price decided at the start. We will look at exchange-traded contracts which are called futures contracts and over-the-counter contracts which consist of forward contracts and swaps.

Forward commitments

Forward contract – a contract is agreed at one point in time, the performance is in line with the terms of the contract and settlement occurs at a subsequent time. The forward contracts discussed are ones which involve an exchange of one asset for another with the price agreed in the initial contract. Forwards are often non-standardized contracts and are traded in unregulated markets, so the parties bear the counterparty risk, i.e. that the party who bears a loss as a result of the transaction defaults on the payment.

Futures contract – futures are a form of forward contract since one party agrees to accept or deliver an underlying asset, or cash equivalent, to another party, at a future expiration date, at a price determined at the beginning of the contract. A futures contract differs from a forward contract since it has standardized contract terms and is traded through an exchange. The contract is effectively guaranteed by the **clearinghouse** (a financial institution associated with the futures exchange). A deposit (margin) must be deposited at the clearinghouse by futures traders.

Swap – this is an agreement between two parties (the counterparties) to exchange a series of cash flows over a period of time (the **tenor**) in the future. It is effectively a series of forward contracts. These cash flows are often dependent on exchange rates (**currency swaps**) or interest rates (**interest rate swaps**). The swap market is largely unregulated and parties must take into account counterparty risk.

LOS 69-c

Define a contingent claim and **identify** the types of contingent claims.

Contingent claims

Whereas a forward contract is binding on both parties, the other category of derivatives is contingent claims. They are often referred to as options and here a payoff occurs only if a specific event takes place.

LOS 69-d

Describe the basic characteristics of options and **distinguish** between an option to buy (call) and an option to sell (put).

Options - these are either call options or put options. The holder has the right to buy (a call option) or sell (a put option) an underlying asset at a pre-specified price (the **exercise price** or **strike price**) up to/at a certain date. It is important to differentiate between a future where the holder has the obligation to buy or sell and an option where the holder has the choice whether to buy or sell. The seller of the option is the **option writer**; he/she receives a payment from the buyer but is obliged to buy or sell the underlying asset if the holder of the option wishes to do so. The payment is the option price, sometimes called the **option premium**.

Options can be either exchange-listed or over-the-counter. If they are exchange-listed they are standardized contracts and guaranteed by the exchange, whereas with over-the-counter options there is the possibility that one party will default.

Several types of financial instruments contain options and are forms of contingent liabilities. These include convertible bonds where the holder can decide whether to participate in a rise in the underlying stock price, callable bonds where the issuer can buy back the bond prior to maturity and asset-backed securities where the borrower holds a prepayment option.

LOS 69-e

Discuss the purposes and criticisms of derivative markets.

Purposes of derivative markets

- **Price discovery**

Futures prices provide useful information on the price of the underlying asset (the current price of the underlying asset is called the spot price). A short-term futures price is sometimes used as a proxy for the spot price.

Options prices provide information about the volatility of the underlying security.

- **Risk management**

An important use of derivatives is to control risk including removing certain types of risk from investment.

- **Market completeness**

This means that all potential payoffs can be obtained by trading securities available in the market. The inclusion of derivatives in a market adds to the different risk/return combinations available.

- **Speculation**

Speculation is taking on risk in pursuit of additional profit.

- **Trading efficiency**

Investing in a derivative can be a more attractive alternative than investing in the underlying instrument. This might be a result of greater liquidity or lower transaction costs in the derivatives market.

Criticisms of derivative markets

- Many of the criticisms of derivatives stem from their complexity, which leads to commentators misunderstanding their role, or investors purchasing derivatives without understanding the risks involved.
- Derivatives are often seen as legalized gambling. This is an unfair criticism since derivatives have the benefit of making financial markets work better and provide a means for people to manage risk, whereas it is difficult to argue that gambling improves society as a whole.

LOS 69-f

Explain the concept of arbitrage and the role it plays in determining prices and in promoting market efficiency.

An **arbitrage** is when it is possible to trade and generate a riskless profit, without needing to make a net investment in the security being arbitraged. This opportunity might occur if the same security was priced differently in different stock markets or derivatives were mispriced. The text assumes that there are no arbitrage opportunities (the **no-arbitrage principle**) since arbitrage opportunities will not exist in an efficient market.

70 Forward Markets and Contracts

Learning Outcome Statements (LOS)

70-a	**Discuss** the differences between the positions held by the long and short parties to a forward contract in terms of delivery/settlement and default risk.
70-b	**Describe** the procedures for settling a forward contract at expiration, and **discuss** how a party to a forward contract can terminate a position prior to expiration and how credit risk is affected by the way in which a position is terminated.
70-c	**Differentiate** between a dealer and an end user of a forward contract.
70-d	**Describe** the characteristics of equity forward contracts.
70-e	**Describe** the characteristics of forward contracts on zero-coupon and coupon bonds.
70-f	**Explain** the characteristics of the Eurodollar time deposit market, **define** LIBOR and Euribor, and **describe** the characteristics of forward rate agreements (FRAs).
70-g	**Calculate** and **interpret** the payment at expiration of an FRA, **explain** each of the component terms, and **describe** the characteristics of currency forward contracts.

Introduction

We now look one-by-one at the different types of derivatives. We start with forwards. A forward contract is a commitment between two parties to do a transaction at a later date with the price and terms set in advance. It is assumed that no money changes hands at the beginning of the contract. In addition to describing the characteristics of forward contracts and how they are settled, candidates need to be familiar with the payments made at expiration on contracts where the underlying is a bond, equity or equity index, interest rate or currency rate.

LOS 70-a

Discuss the differences between the positions held by the long and short parties to a forward contract in terms of delivery/settlement and default risk.

Long and short parties

A forward agreement is between two parties, one is the buyer (called the long) and the other the seller (the short), who agree to do a transaction at a future date at a specified price. No money changes hands when the agreement is made. A forward transaction locks in the price, so the parties are unaffected by price changes between the date when the contract is agreed and the expiry of the contract. An example of an investment manager using forwards would be if a manager has to meet redemptions from a fund and will need to sell U.S. securities in two months' time. He could enter into a forward transaction today where he takes a short position thereby locking in the sale price of the securities.

LOS 70-b

Describe the procedures for settling a forward contract at expiration, and **discuss** how a party to a forward contract can terminate a position prior to expiration and how credit risk is affected by the way in which a position is terminated.

Expiration

On expiry of the contract there are two ways that the parties can settle.

- **Delivery**, the long accepts delivery of the underlying asset and pays the agreed price to the short.
- **Cash settlement**, the long and short exchange the net payment, the difference between the agreed price and the current price of the underlying asset. These contracts are called nondeliverable forwards.

In either case both parties are subject to default risk, the party who has made a profit bears the risk that the other party does not settle.

Termination of a contract

Usually both parties enter into a forward contract on the basis that they will hold it through to expiry. However, there are situations where one party will wish to terminate the contract prior to expiry. The party can go into the market and enter into an offsetting contract. For example, if the party who wishes to terminate the contract had a long position, they could enter into a new contract with the same underlying asset and expiry date, this time taking the short position. This will remove the net exposure to the asset.

Alternatively the party could look at entering into a second contract with the same party to avoid having two sets of counterparty risk outstanding. In this case, the contracts will be cancelled and the parties will exchange the present value of the value of the contract at expiry.

Example 70-1 Terminating contracts

An investor has a long position to purchase an asset at $100. He decides he wishes to terminate the contract but the prices in the forward market have moved and when he takes a short position to deliver the same asset at the same expiry date the price is $105. If he takes on the short position, then at expiry the investor will pay $100 for the asset (if it is for delivery) and sell the asset for $105, netting a profit of $5.

If the short position was taken with the same counterparty they would cancel the contracts and the investor receive the present value of $5.

LOS 70-c

Differentiate between a dealer and an end user of a forward contract.

The two types of participants in the forward markets are dealers and end users. The dealers are usually major investment banks. The end users may simply be taking positions in a market or asset in anticipation of a price move but more often they are using forwards to hedge out the risk of an existing position. The end user will go into the market and look for the best bid-ask prices being quoted by dealers. The dealer is taking on the risk from the end user; they will in turn try to pass on this risk by entering into another derivative or spot transaction, with another end user or with another dealer. The dealer is aiming to make a profit on the spread between the different prices that he is quoting in the market.

LOS 70-d

Describe the characteristics of equity forward contracts.

We now look at the different types of forward contracts. They are categorized on the basis of the underlying asset to the contract.

Equity forwards

These are contracts for the purchase of individual stocks, a portfolio of stocks or a stock index.

Example 70-2 Equity forward

An investment manager wishes to gain $1,000,000 exposure to the S&P Index but will not have cash available in the fund for another 3 months. She decides to lock in the purchase price today and takes a long position in a forward contract. The price given by the dealer for the contract is 1,150. If at expiry of the contract the index has fallen by 5% to 1092.50, the manager will need to pay the dealer (assuming cash settlement) $1,000,000 x 0.05 = $50,000.

Equity forwards make payments based on the return of the index or price movement of the stock, which does not include dividends, unless a total return index is specifically referred to.

LOS 70-e

Describe the characteristics of forward contracts on zero-coupon and coupon bonds.

Bond forwards

A forward contract on a bond or bond index is similar to an equity forward. However there are some differences; a forward contract on a bond must expire before the bond matures and a forward contract must specify what happens if a bond defaults (and how a default is defined). Also, if a bond has an embedded option or convertibility, this must be considered in the terms of the contract.

If we look at the forward contract for a risk-free zero-coupon bond, in this case a Treasury bill, the prices are quoted in terms of the discount rate. The interest is deducted from the face value of the bill and is calculated based on a 360-day year (e.g. if a 180-day T-bill is selling at a discount of 3%, its price will be $1.00 – 0.03(180/360) = $0.985.

Forward contracts on coupon bond prices are usually quoted with accrued interest, and prices are often quoted by stating the yield.

LOS 70-f

Explain the characteristics of the Eurodollar time deposit market, **define** LIBOR and Euribor, and **describe** the characteristics of forward rate agreements (FRAs).

Before we look at interest rate forwards (called forward rate agreements or FRAs), we need to examine the underlying interest rates.

Eurodollar time deposits

The main instrument used for time deposits is the Eurodollar, which is a dollar deposited outside the U.S. The main market for Eurodollar time deposits is in London. Banks borrow from each other and the lending rate is called the London Interbank Offer Rate (LIBOR). Interest rates are based on a 360-day year but interest is added-on to the face value (unlike the discount method used for T-bills). If a bank borrows $1,000,000 at 3% for 180 days it will need to repay $1,000,000 + 0.03(180/360) = $1,015,000.

Rates are also quoted for other currencies including Euroyen and Eurosterling. Euribor and the less commonly used EuroLIBOR are interest rates on euro deposits.

LOS 70-g

Calculate and **interpret** the payment at expiration of an FRA, **explain** each of the component terms, and **describe** the characteristics of currency forward contracts.

This is a contract where the underlying is an interest rate payment made in US dollars or another currency at a relevant rate for that currency. In this case the party with the long position will benefit if rates rise and the short position will lose.

The payoff is calculated based on the difference between the underlying rates adjusted for the number of days the instrument has to maturity, which is then discounted back to reflect the fact that the payment is to be made at expiry.

The formula for the payoff for the party with the long position is:

Equation 70-1

$$\text{Notional Principal } x \left[\frac{(\text{underl. rate at expiry} - \text{forward contract rate})(\text{days in underl. rate}/360)}{1 + \text{underl. rate at expiry (days in underlying rate}/360)}\right]$$

Example 70-3 FRA

A dealer quotes on a 90-day FRA, where the underlying is 180-day dollar LIBOR, at a rate of 4%. The end user is looking for rates to fall and takes a short position, with a notional principal of $1 million.

At expiration the rate on 180-day LIBOR is 5%. To calculate the payoff use Equation 70-1.

$$\$1{,}000{,}000\left[\frac{(0.05-0.04)(180/360)}{1+0.05(180/360)}\right] = \$1{,}000{,}000\left(\frac{0.005}{1.025}\right) = \$4{,}878$$

The end user pays $4,878 to the dealer; his anticipation that rates would fall was incorrect.

FRAs are available for a number of different maturities; non-standard contracts are called *off the run*. The FRA market uses terminology that refers to the periods in months, a n x m contract expires in n months and the interest is paid on the underlying time deposit m months after the initial contract. So in the Example 70-3, the contract is 3 x 9: it is a 90-day contract and the interest calculated on an underlying deposit maturing 90 + 180 days from the initial contract.

Currency forwards

Currency forwards are widely used in the investment business and also by banks and corporations to manage currency risk.

Example 70-4 Currency forward

A French manufacturer will receive US$500,000 from a customer in six months' time, but wishes to lock in the exchange rate that it uses to convert the dollars into euro. They go to a dealer who quotes a six-month forward rate of $1.10. This would allow the manufacturer to convert US$500,000 to €454,545.45. Of course if the US dollar weakens over the six months the manufacturer will have benefited from locking into the rate, but if the US dollar strengthens they would still have to settle at the relatively unfavorable rate agreed in the contract.

71 Futures Markets and Contracts

Learning Outcome Statements (LOS)

71-a	**Identify** the institutional features that distinguish futures contracts from forward contracts and **describe** the characteristics of futures contracts.
71-b	**Differentiate** between margin in the securities markets and margin in the futures markets.
71-c	**Describe** how a futures trade takes place.
71-d	**Describe** how a futures position may be closed out (i.e., offset) prior to expiration.
71-e	**Define** initial margin, maintenance margin, variation margin, and settlement price.
71-f	**Describe** the process of marking to market and **compute** the margin balance, given the previous day's balance and the new futures price.
71-g	**Explain** price limits, limit move, limit up, limit down, and locked limit.
71-h	**Describe** how a futures contract can be terminated by a close-out (i.e., offset) at expiration, delivery, an equivalent cash settlement, or an exchange-for-physicals.
71-i	**Explain** delivery options in futures contracts.
71-j	**Distinguish** among scalpers, day traders, and position traders.
71-k	**Describe** the characteristics of the following types of futures contracts: Treasury bill, Eurodollar, Treasury bond, stock index, and currency.

Introduction

We next turn to futures contracts which are in many ways similar to forward contracts except that they are exchange traded and have standardized contracts. This has some important implications including the requirement for an investor using futures to deposit margin. Candidates will be expected to know the characteristics of futures contracts and be able to compute margin payments and the pricing of different types of contract.

LOS 71-a

Identify the institutional features that distinguish futures contracts from forward contracts and **describe** the characteristics of futures contracts.

Futures versus forwards

A futures contract is dealt on a recognized exchange and there are a number of ways in which futures and forwards differ:

- A forward transaction is a private transaction whereas a futures transaction is reported to the futures exchange, the clearing house and often a regulatory authority.
- A forward transaction is customized whereas in a futures transaction all the terms (expiry, underlying asset etc.), with the exception of the price, are set by the exchange.
- Since futures contracts are standardized they can be traded more easily in the secondary market making them more liquid than forward cataracts.
- The clearinghouse of a futures exchange guarantees that trades settle, by acting as the counterparty to both sides of a futures transaction. In a forward transaction each party takes on the risk that the other party will default.
- A futures contract is **marked to market**, also called daily settlement, which means that gains and losses to each party's position is calculated daily and credited or debited to their account.
- In most markets, futures contracts are regulated by the government.

An exchange will set the expiration dates; these are often set at three month intervals, e.g. March, June, September and December. Many contracts are only available for a maximum period of one year, although some are for longer. The exchange also sets which specific day of the month is the expiry day.

In the U.S., trading of futures in an exchange takes place in the trading **pit** by a system of open outcry or by electronic trading. The hours of trading, the contract size and the minimum price movement are also set by the exchange.

As in the case of forward transactions, a party to a futures transaction takes either a long or short position. If a party wishes to close or terminate a position prior to expiry he can enter the market and do an offsetting order (this feature means that futures contract are fungible), for example the holder of a long position can go into the market and take a short position in exactly the same contract. Because the clearinghouse acts as the counterparty for the settlement of each transaction, the two transactions can be offset.

	**LOS 71-b** **Differentiate** between margin in the securities markets and margin in the futures markets.
	LOS 71-e **Define** initial margin, maintenance margin, variation margin, and settlement price.
	LOS 71-f **Describe** the process of marking to market and **compute** the margin balance, given the previous day's balance and the new futures price.

Margin requirements

Margin requirements make the futures market safer since they provide an assurance that traders will be able to meet their financial obligations. This is different to a margin in the securities market which refers to a loan being made.

Before a trader enters into a futures transaction he must deposit funds with a broker. These funds are called the **initial margin** and the dollar amount per contract is usually set by the clearinghouse. This is a deposit against future liabilities and once a transaction is settled it is returned, with interest that has accrued, to the trader.

Each day the contract is marked-to-market. If a trader starts to lose money on a transaction and the value of his equity with the broker falls to the **maintenance margin** level (often around 75% of the initial margin) he will receive a **margin call**, and will need to deposit sufficient funds (the **variation margin**) to bring the account back *to the initial margin level*. This is the process of daily settlement or marking to market. Alternatively, if a trader is making profits they can withdraw funds as long as the account's equity value stays above the initial margin.

The clearinghouse collects margin payments from clearing members only, so if a broker is not a member it will clear all trades with a clearing member.

	**Example 71-1 Margin requirements** The initial margin requirement for a futures contract is $10 which is deposited with the broker. The maintenance margin requirement is $8. A trader takes a long position in 100 contracts. Assuming no excess margin is withdrawn, the table below shows the margin position as the futures price moves:

Example 71-1 (continued) Margin requirements

Day	Beginning balance in margin account	Additional funds deposited in the margin account	Futures price	Gain/loss (futures price change x 100 contracts)	Ending balance
0	0	$1,000	$10		$1,000
1	$1,000	0	$12	$200	$1,200
2	$1,200	0	$9	− $300	$900
3	$900	0	$7	− $200	$700
4	$700	$300	$8	$100	$1,100
5	$1,100	0	$10	$200	$1,300

Initially the trade deposits $1,000 representing the $10 initial margin for each of the 100 contracts. On day 4 the balance in the margin account has fallen below the maintenance margin level so the trader is required to deposit an additional $300 variation margin to bring it back to the initial margin requirement.

LOS 71-g

Explain price limits, limit move, limit up, limit down, and locked limit.

Limit moves

In some futures markets, there are price limits, which is the maximum permitted price move in the day, usually expressed in dollar rather than percentage terms. If the price is stuck at one of the limits it is called a **limit move**. If, for example, the price is moving upwards and the maximum permitted price is reached this is called a **limit up**. If a transaction cannot take place because it is stuck at one of the limits this is a locked limit.

LOS 71-c

Describe how a futures trade takes place.

LOS 71-d

Describe how a futures position may be closed out (i.e., offset) prior to expiration.

LOS 71-h

Describe how a futures contract can be terminated by a close-out (i.e., offset) at expiration, delivery, an equivalent cash settlement, or an exchange-for-physicals.

Terminating a futures position

A futures contract can be terminated in three ways:

1. Delivery or cash settlement.
2. Offset - a reversing trade where a party sells exactly the same contract that was originally bought (or vice versa).
3. Exchange-for-physicals. This is when two traders privately agree to exchange the physical good underlying the futures transaction prior to the delivery date.

LOS 71-i

Explain delivery options in futures contracts.

Delivery options

A futures contract can specify cash settlement or delivery. In the case of cash settlement at the expiration day the margin accounts are marked to market. If the contract is for delivery, that actual delivery may take place a number of days after the contract expiration. In some cases the holder of the short position will have a choice on the exact asset being delivered and the location of delivery (frequently this is the case with commodity contracts).

LOS 71-j

Distinguish among scalpers, day traders, and position traders.

Members of a futures exchange

A futures exchange is owned by its members, who hold seats. Each member is acting as a floor trader (called locals) or broker (called futures commission merchants or FCMs).

Floor traders are market makers quoting bid and ask prices for contracts and they provide the liquidity in the market. There are different types of floor traders.

Scalpers – they hold positions in futures for extremely short time periods and attempt to profit from the spread between bid and ask prices.

Day traders – they hold positions longer than a scalper but close out all their positions at the end of each day.

Position traders – they hold positions overnight. Position traders and day traders try to anticipate the direction of the market.

FCMs are executing transactions on behalf of other parties from outside the exchange.

LOS 71-k

Describe the characteristics of the following types of futures contracts: Treasury bill, Eurodollar, Treasury bond, stock index, and currency.

Financial and currency futures

Treasury bill futures

This is priced based on a 90-day $1,000,000 T-bill. It is priced as a discount instrument (see Reading 70).

Equation 71-2

The pricing of the futures is:

$$1-\left(\frac{\text{rate}}{100}\right)\left(\frac{90}{360}\right)$$

This is different from the IMM index which is the reported and publicly available price based on 100 minus the rate.

Example 71-6 T-bill future

If the rate priced into the futures contract is 5% then the quoted price is 100 - 5.00 = 95.00. Using Equation 71-2 the actual futures price is:

$$\$1{,}000{,}000\left[1-\left(\frac{\text{rate}}{100}\right)\left(\frac{90}{360}\right)\right]=\$1{,}000{,}000\left[1-\left(\frac{5}{100}\right)\left(\frac{90}{360}\right)\right]=\$987{,}500$$

For convenience the IMM price is often used to calculate the gain or loss on a futures position by traders, since every basis point move in the IMM index is equivalent to a $25 move in the futures price (in Example 71-6 it is 500 basis points which is equivalent to $12,500).

Eurodollar futures

See Reading 70 for information on LIBOR. The futures contract is based on a $1 million notional principal of 90-day Eurodollars, so in Example 71-6 the price of a Eurodollar future with a rate of 5%, would be the same, $987,500. The quoted price and actual futures price differ as in the case of T-bill futures. Note that here we are quoting on a discount interest basis rather than on an add-on basis.

The minimum tick size, or price movement is $25 and there are monthly expirations for the closest two months and then March, June, September and December expiry dates.

Treasury bond futures

This is based on delivering a Treasury bond with a maturity of at least fifteen years, and any coupon. If it is callable, then the first call date must be more than fifteen years after the delivery date. The holder of the short position has an advantage in that he can select between a number of bonds to deliver; however the exchange adjusts by a conversion factor the amount of money the holder of the long position must pay. The conversion factor is based on the coupon of the bond being delivered versus a hypothetical 6% coupon bond. Despite the adjustment there will always be a **cheapest-to-deliver** bond, the one where the amount received on delivery exceeds the market price by the largest margin.

Treasury bond futures have quarterly expiry dates. Prices are quoted in points and 32nds, so a price of $96\frac{15}{32}$ is equal to 96.4688.

There are also contracts available on Treasury notes.

Stock index futures

Some of the most popular futures contracts are those quoted on stock market indexes, such as the S&P 500 Stock Index. The price is based on the index level adjusted by a multiplier. For the S&P futures the multiplier is $250, so a futures price of 1,100 gives an actual price of $250 x 1,100 = $275,000.

Stock index futures expire at quarterly intervals although trading is concentrated in the contracts that are closest to expiry.

Currency futures

Different contracts have different sizes and quotations; most expire quarterly. For example the euro contract covers €125,000 and a futures price of $1.1050 is equivalent to a contract price of 125,000 x $1.1050 =$138,125.00.

72 Option Markets and Contracts

Learning Outcome Statements (LOS)

72-a	**Identify** the basic elements and **describe** the characteristics of option contracts.
72-b	**Define** European option, American option, moneyness, payoff, intrinsic value, and time value and **differentiate** between exchange-traded options and over-the-counter options.
72-c	**Identify** the different types of options in terms of the underlying instruments.
72-d	**Compare** and **contrast** interest rate options to forward rate agreements (FRAs).
72-e	**Explain** how option payoffs are determined, and **show** how interest rate option payoffs differ from the payoffs of other types of options.
72-f	**Define** interest rate caps and floors.
72-g	**Identify** the minimum and maximum values of European options and American options.
72-h	**Explain** how the lower bounds of European calls and puts are determined by constructing portfolio combinations that prevent arbitrage, and **calculate** an option's lower bound.
72-i	**Determine** the lowest prices of European and American calls and puts based on the rules for minimum values and lower bounds.
72-j	**Describe** how a portfolio (combination) of options establishes the relationship between options that differ only by exercise price.
72-k	**Explain** how option prices are affected by the time to expiration of the option.
72-l	**Explain** put-call parity for European options, given the payoffs on a fiduciary call and a protective put.
72-m	**Explain** the relationship between American options and European options in terms of the lower bounds on option prices and the possibility of early exercise.
72-n	**Explain** how cash flows on the underlying asset affect put-call parity and the lower bounds of option prices.
72-o	**Identify** the directional effect of an interest rate change on an option's price.
72-p	**Describe** the impact of a change in volatility on an option's price.

Introduction

This Reading examines options. Options are quite different from forwards and futures since the holder of an option has the right, but not the obligation, to buy or sell an underlying asset. Also the option buyer must pay the option seller for this right or option at the beginning of the contract. In addition to covering definitions and characteristics of options, candidates have to be able to calculate option payoffs, understand lower bounds for option prices and put-call parity. Some of the formulas and calculations look somewhat intimidating but the concepts behind the formulae are not difficult and the candidate should attempt to master the concepts to help them memorize the formulae.

LOS 72-a

Identify the basic elements and **describe** the characteristics of option contracts.

A **call option** gives the holder the right to buy at a pre-specified price (called the **exercise price**, **strike price** or **striking price**) and a **put option** the right to sell at the exercise price. For example, the owner of a call option has a choice whether to exercise the option or not. Whatever they do they pay the price of the option (the **option premium**) and if they decide to exercise the option they must pay the exercise price to the option seller in order to buy the underlying asset. On the other hand the seller, or writer, of the call option keeps the premium but is obliged to sell the underlying asset to the option holder if he decides to exercise the option.

An option has an expiry or **expiration date**, and an option that has not been exercised by this date expires worthless. If the holder of a call option decides to exercise he must pay the exercise price and will be delivered the underlying asset or an equivalent cash sum. If the holder of a put exercises the option he will deliver the underlying asset, or cash equivalent, and receive the exercise price.

Options can be traded on exchanges or over-the-counter. Note that if they are dealt over-the-counter, the credit risk is unilateral since only the option writer can default.

The most common exchange traded options in the U.S. are stock options, index options, foreign currency options and options on futures.

LOS 72-b

Define European option, American option, moneyness, payoff, intrinsic value, and time value and **differentiate** between exchange-traded options and over-the-counter options.

An **American option** can be exercised at any time prior to or at expiration, a **European option** at expiration only. So for equivalent options, an American option is worth more, since in certain situations it may be advantageous to exercise the option prior to expiry.

A call option is **in-the-money** if the stock price is higher than the exercise price, **out-of-the-money** if the stock price is lower than the exercise price and **at-the-money** if the stock price is equal to the exercise price (and the opposite holds for put options). Options that are far in-the-money are called **deep-in-the-money** and far out-of-the-money are called **deep-out-of-the-money**.

Examples 72-1 Moneyness

1. A call option on a stock has an exercise price of $50 and the stock is trading in the market at $55. The option is $5 in-the-money, since the immediate exercise of the option would give a cash inflow of $5 (ignoring transaction costs).
2. A put option on a stock has an exercise price of $30 and the stock is trading in the market at $35. The option is $5 out-of-the-money.

Intrinsic value

The value of a call option at expiry is either zero or the stock price (S) minus the exercise price (X). This is the **intrinsic value** of the option, the value of the option if it was exercised immediately. If the intrinsic value is positive, the option is in-the-money. If it is zero then the option is out-of-the-money or at-the-money.

A put option will have a value at expiration of Max [0, (X– S)]; this is the intrinsic value. Prior to expiration an option will usually trade at a market price above its intrinsic value. The difference between the price and the intrinsic value is the **time value**.

Over-the-counter options

These are customized contracts (price, exercise price, time to expiry etc are decided by the two parties), and the parties are usually institutional rather than retail investors. The option buyer runs the risk the writer will default, and sometimes will require collateral. The markets are essentially unregulated.

Exchange-traded options

The exchange standardizes all the terms of the option contract; only the price is decided by the participants. Usually there are options available with an exercise price close to the trading price of the underlying asset. The exchange decides which companies (in the case of stock options) will be listed for options trading. The participants in the exchange are usually either market makers or brokers.

As in the case of futures, the transactions are guaranteed by the clearing house. The clearing house also has to protect itself against the writers defaulting so the premium paid is deposited in the option writer's margin account and the writer must deposit additional money in the account. The amount will depend on whether the option is in or out-of-the money and whether the writer has hedged the risk.

Since the contracts have standardized terms, an option holder can go to the market and sell the same contract and the positions will be cancelled.

Generally at expiry an in-the-money option will be exercised and out-of-the-money options will expire unexercised. Most exchange-traded options require actual delivery of the stock rather than cash settlement; in this case the decision to exercise will take into account the transaction costs involved with trading the stock or settling in cash.

LOS 72-c

Identify the different types of options in terms of the underlying instruments.

Financial options

We now look at the different types of financial options available. They are categorized in terms of the underlying instrument.

Stock options

These are options (sometimes called equity options) on individual stocks and are popular in the market.

Index options

These are options on stock indices, such as the S&P 500 Index, which are for cash settlement (based on a multiplier times the index level).

Bond options

Bond options are not popular with the retail investor and most of the trading is between institutions in the over-the-counter market. They can be for actual delivery or for cash settlement and are based on a notional principal which is quoted in terms of the face value of the bond.

Example 72-2 Bond options

An investor buys a call option with $10 million face value on a bond with an exercise price of $1.02 per $1.00 par value. The expiration day must be well before the maturity date of the bond. If the buyer of the call option exercises it when the bond price is $1.04 then the seller pays the buyer (1.04 – 1.02) $10,000,000 which equals $200,000, if it is cash settlement.

LOS 72-d

Compare and **contrast** interest rate options to forward rate agreements (FRAs).

LOS 72-e

Explain how option payoffs are determined, and **show** how interest rate option payoffs differ from the payoffs of other types of options.

Interest rate options

We will consider options on LIBOR as an example of interest rate options. Note that there is not an underlying financial instrument but an interest rate that is used to calculate the payoff.

First of all let us look back at LOS 17-1 when we discussed FRAs. In the case of FRAs the payoff is based on the discounted spot rate of a LIBOR payment. Interest rate options are options where the underlying asset is an interest rate so rather than an exercise price we have an **exercise rate** or **strike rate**. An FRA is a commitment to make and receive an interest rate payment at a later date and the payment is made immediately the contract expires. An interest rate option is the right to make one interest payment and receive another.

An interest rate call is an option where the holder has the right to make a known interest rate payment and receive an unknown payment. An interest rate put is an option where the holder has the right to make an unknown interest rate payment and receive another known payment. Interest rate options and FRAs have a notional principal. The options are usually European style and settle for cash. They are often dealt in by the same dealers that make prices in FRAs.

The payoff on an interest rate call is given by:

Equation 72-1

$$\text{Not. principal} \times \left[\text{Max}\left(0, \text{underlying rate at expir.} - \text{exercise rate}\right) \times \frac{\text{(days in underlying rate)}}{360}\right]$$

Example 72-3 Interest rate options

Using the same data as in Example 70-3, we will now consider an option expiring in 90 days where the underlying is 180-day dollar LIBOR, at an exercise rate of 4% with a notional principal of $1 million. At expiration the rate on 180-day LIBOR is 5% and the call option is in-the-money. The payoff will be:

$$\$1{,}000{,}000(0.05 - 0.04)\left(\frac{180}{360}\right) = \$5{,}000$$

The payoff is **not** made immediately but in 180 days' time.

LOS 72-f

Define interest rate caps and floors.

When interest rate options are being used for hedging, for example to hedge the risk on a floating rate loan, then the buyer is purchasing a series of interest rate options. This series of call options is called an **interest rate cap**, or a cap. A series of interest rate put options is called an **interest rate floor**, or floor. An interest rate cap is defined as a series of call options on an interest rate, with each option expiring at the date on which the rate on the floating rate loan will be reset; each option has the same exercise rate. Each call option is a **caplet**. Similarly each component of an interest rate floor is a **floorlet**. The price of the interest rate cap or floor is just the sum of the constituent options.

An interest rate collar is a combination of a long cap and short floor or vice versa.

Currency options

A currency option gives the holder the right to buy or sell an underlying currency at a fixed exercise rate, which is an exchange rate.

Example 72-4 Currency options

A U.S. company is going to require €100 million to fund its European operations in six months' time. It is concerned that the euro will strengthen against the US dollar and it decides to buy a call option on the euro; the exercise price is $1.30 per euro.

If the euro expires above $1.30, at say $1.40, then the company exercises its option to buy €100 million at $1.30.

If the euro expires below $1.30, at say $1.20, then the company buys €100 million at the market rate of $1.20 and lets the option lapse.

A call on the euro is equivalent to a put on the dollar. If the dollar declines they can use the option to sell dollars at a rate of 1/1.30 = 0.77. If the dollar rises the company can sell at the market rate.

Options on futures

This is an option where the underlying is a futures contract; a call option gives the holder the right to go long of the futures at a fixed price and a put option the right to go short. The fixed futures price is the exercise price. There are arbitrage opportunities and in some cases the options are essentially an option on the spot price of the underlying asset (when the options and futures expire on the same date).

Example 72-5 Options on futures

An option is based on a Eurodollar futures contract. An investor buys a call option which has an exercise price of 95.00 and is priced at $6.00. The underlying futures price is 96.00. The contract size is $1 million. So a buyer of the call option pays 0.06 x $1,000,000 = $60,000 for the right to buy the futures contract at a price of 95.00. If, when the option expires, the futures price is 97 the investor would exercise the option and receive a long futures position at a price of 95; since the futures price is 97 his margin account is credited with the difference of 2.00, or 0.02 x (90/360) x $1 million equals $5,000, since the future is based on a 90-day Eurodollar rate. The party on the short side will be charged the $5,000 gain that the long position has made.

LOS 72-g

Identify the minimum and maximum values of European options and American options.

Option pricing

We now look at the pricing and valuation of options. Options always have a positive value for the holder up until expiration.

The notation used throughout is:

S_0, S_T	=	price of underlying asset today, price of underlying asset at time T
X	=	exercise price
r	=	risk-free rate
T	=	time to expiration, expressed as number of days divided by 365
c_0, c_T	=	price of European call option today and at expiry
C_0, C_T	=	price of American call option today and at expiry
p_0, p_T	=	price of European put option today and at expiry
P_0, P_T	=	price of American put option today and at expiry

Looking first at the value at expiration, or the **payoff**, of a long call position we can see that if the underlying price is less than the exercise price, the option will lapse with zero value. If the underlying price is higher than the exercise price then the long call position has a value equal to (S_T – X). The short position will have a value which is the negative of the value of the long position.

At expiration both European and American options have the same payoff; they are the same instruments at this point, so:

Equations 72-2

$c_T = \text{Max}[0, S_T - X]$ and $C_T = \text{Max}[0, S_T - X]$

Example 72-6 Value of a call option at expiration

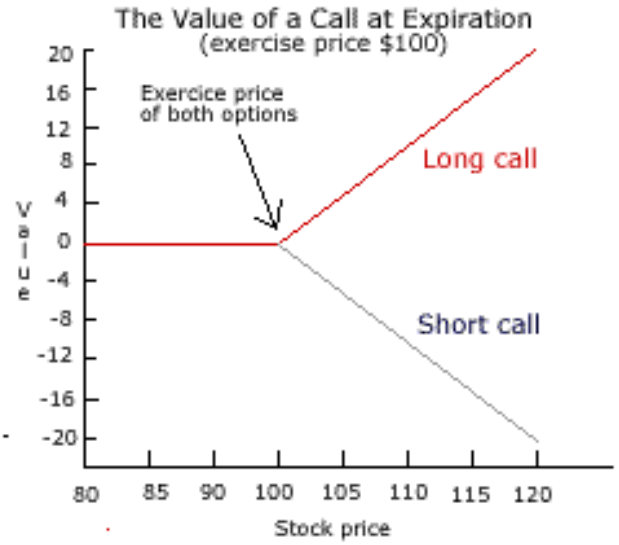
The value of a call option at expiration, if the exercise price is $100, is illustrated in the graph below.

If, for example, the stock price is $110 at expiry, the payoff on a long call position is:

Max [0, S_T – X] = Max [0, $110 - $100] = $10, and for a short call is -$10.

If the stock price is $80 the payoff for a long or short call is:

Max [0, S_T – X] = Max [0, $80 - $100] = $0



With a put option if the underlying price is higher than the exercise price, the option will lapse with zero value. If the underlying price is lower than the exercise price then the long put position has a value equal to $(X - S_T)$. At expiration:

Equations 72-3

$p_T = \text{Max}[0, X - S_T]$ and $P_T = \text{Max}[0, X - S_T]$

Example 72-7 Value of a put option at expiration

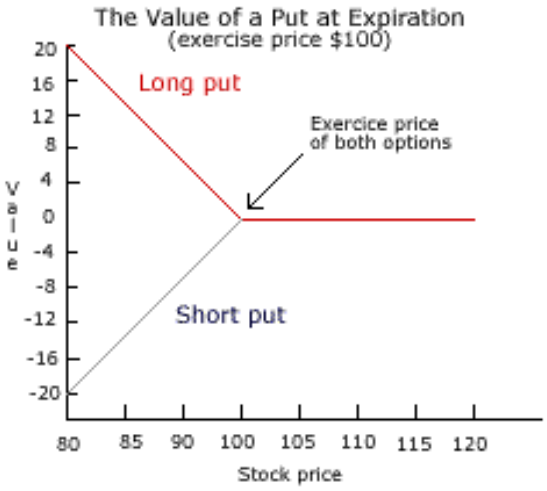
The value of a put option at expiration when the exercise price is $100 is illustrated in the graph below.

If the stock price is $110 at expiry the payoff on a long or short put position is:

$\text{Max}[0, X - S_T] = \text{Max}[0, \$100 - \$110] = \$0$

If the stock price is $80 the payoff for a long put is:

$\text{Max}[0, X - S_T] = \text{Max}[0, \$100 - \$80] = \$20$ and for a short put is -$20.



LOS 72-h

Explain how the lower bounds of European calls and puts are determined by constructing portfolio combinations that prevent arbitrage, and **calculate** an option's lower bound.

LOS 72-i

Determine the lowest prices of European and American calls and puts based on the rules for minimum values and lower bounds.

Lower bounds

Since an American option can be exercised at any time, the lower bound of its value is its intrinsic value; otherwise it could be exercised for an immediate gain. However for a European option the lower bound is a function of the present value of the exercise price, since we cannot exercise until the expiry date. So:

Equation 72-4

$c_0 \geq \text{Max}[0, S_0 - X/(1+r)^T]$ $\quad$ $p_0 \geq \text{Max}[0, X/(1+r)^T - S_0]$

$C_0 \geq \text{Max}[0, S_0 - X]$ $\quad$ $P_0 \geq \text{Max}[0, X - S_0]$

An American call must always be worth at least as much as a European call so we can say that

Equation 72-5

$C_0 \geq \text{Max}[0, S_0 - X/(1+r)^T]$

but the lower bound for an American put is higher than a European put so we cannot adjust the formula for the put which remains, $P_0 \geq \text{Max}[0, X - S_0]$.

Note that the concept of intrinsic value and time value is not strictly applicable for a European call since European calls cannot be exercised until expiry, so prior to that the concept of intrinsic value does not exist.

Example 72-8 Lower bounds

Options are available for an underlying asset which has a price of 30, the risk-free rate is 4% and T = 0.25. The lower bounds for calls and puts, with exercise prices of 25 and 35 can be calculated for European and American options as follows:

	European	American
X = 25	$c_0 \geq$ Max [0, 30 – 25/(1.04)$^{0.25}$] = 5.24 $p_0 \geq$ Max [0, 25/(1.04)$^{0.25}$ - 30] = 0	$C_0 \geq$ Max [0, 30 – 25/(1.04)$^{0.25}$] = 5.24 $P_0 \geq$ Max [0, 25 – 30] = 0
X = 35	$c_0 \geq$ Max [0, 30 – 35/(1.04)$^{0.25}$] = 0 $p_0 \geq$ Max [0, 35/(1.04)$^{0.25}$ - 30] = 4.66	$C_0 \geq$ Max [0, 30 – 35/(1.04)$^{0.25}$] = 0 $P_0 \geq$ Max [0, 35– 30] = 5

LOS 72-j

Describe how a portfolio (combination) of options establishes the relationship between options that differ only by exercise price.

Exercise price

Let us consider the case where we have two call options with the same terms except for the exercise prices. The first is a European call with an exercise price X_1 and the second a European call with an exercise price X_2, which is larger than X_1. We will refer to these as $c_0(X_1)$ and $c_0(X_2)$ respectively. If we look at a portfolio where we buy $c_0(X_1)$ and sell $c_0(X_2)$ we can calculate the value at expiration, for the three possible prices of the underlying S_T as follows:

	Value at expiration		
	$S_T \leq X_1$	$X_1 < S_T < X_2$	$S_T \geq X_2$
$c_0(X_1) - c_0(X_2)$ =	0	$S_T - X_1$	$S_T - X_1 - (S_T - X_2) = X_2 - X_1$

In all three cases the value is zero or positive, so we can conclude that the value of $c_0(X_1)$ is higher than $c_0(X_2)$.

A call option with a lower exercise price has a higher or equal value to one with a higher exercise price. This holds for both European and American calls.

Using the same methodology we can show that **the value of a put with a higher exercise price has a higher or equal value to one with a lower exercise price**.

LOS 72-k

Explain how option prices are affected by the time to expiration of the option.

Time to expiry

Now we look at two call options with the same terms except for the time to expiry. The first is a European call with a time to expiry T_1 and the second a European call with a longer time to expiry T_2. We will refer to these as $c_0(T_1)$ and $c_0(T_2)$ respectively.

When the first option expires it has a value of Max $[0, S_{T1} - X]$ and at this point the call with a longer time to expiry will have a value of at least Max $[0, S_T - X/(1 + r)^{T2-T1}]$; this is worth at least as much as the shorter-term call. The same will be true for American call options.

We have shown that **longer-term calls are worth at least as much as shorter-term calls**. This is intuitively correct, as the longer you can hold the option the more chance there is of making money.

For European put options, the case is not so clear because if you exercise a put you receive money which can earn interest. However, usually a longer-term put will be worth more and all longer–term American put options are worth more than shorter-term ones (which can be exercised at any time so there is no penalty in waiting to expiration).

LOS 72-l

Explain put-call parity for European options, given the payoffs on a fiduciary call and a protective put.

Put-call parity

Next we look at the relationship between call and put options. A fiduciary call is defined as a European call option plus a risk-free bond that matures on the expiration day and has a face value equal to the exercise price. We also look at the value of a protective put which is a European put plus the underlying asset. We show in the table below that the payoff from a fiduciary call and a protective put is the same whether the underlying price is above or below the exercise price at expiry.

	Value at expiration	
	$S_T \leq X$	$S_T > X$
$\mathbf{c_0 + X/(1 + r)^T}$	$0 + X = X$	$S_T - X + X = S_T$
$\mathbf{p_0 + S_0}$	$X - S_T + S_T = X$	$0 + S_T = S_T$

Therefore we can see that the fiduciary call and the protective put have the same value. This is called **put-call parity** and it is expressed by the equation:

Equation 72-6

$$c_0 + X/(1 + r)^T = p_0 + S_0$$

Note that this equation only holds for European options, not for American options.

Re-ordering the equation we can see that:

$$c0 = p0 + S0 - X/(1 + r)T$$

The right-hand side of the equation is the equivalent to a call and is referred to as a **synthetic call**. Alternatively we can rewrite the equation as:

$$p_0 = c_0 - S_0 + X/(1 + r)^T$$

and the right-hand side is now a **synthetic put**.

Arbitrage opportunities

If Equation 72-6 does not hold, there is an opportunity for arbitrage. The side that is overpriced should be sold and the side that is underpriced should be purchased. At expiry a risk-free gain will be realized.

Example 72-9 Put-call parity

A one-year call option exists which is priced at $5, has an exercise price of $50 and the underlying is priced at $45. The one-year risk-free rate is 5%. The put with the same expiry and underlying is priced at $4.

Using Equation 72-6

$c_0 + X/(1 + r)^T$ = \$5 + \$50/(1.05) = \$52.62

$p_0 + S_0$ = \$4 + \$45 = \$49.00

The fiduciary call is overpriced so there is an arbitrage opportunity. We should write the call and borrow sufficient to buy the put and the stock. This will generate a gain of $3.62 and at expiry there will be no net payout.

LOS 72-m

Explain the relationship between American options and European options in terms of the lower bounds on option prices and the possibility of early exercise.

Early exercise of American options

Generally it would not be logical to exercise an American option early; it is more attractive to sell the option to another investor than exercise it. By exercising the option you lose the time value of the option and only realize the intrinsic value.

For a call option the exception is if the underlying is making a cash payment such as a dividend or an interest payment. In this case if the dividend is high enough it may be worth more than the time value. In this case the American option is worth more than the European option.

For a put option an example of when it is attractive to exercise early is if the underlying stock's issuer is going bankrupt. In this case it is better to exercise today and be able to earn interest on the proceeds.

LOS 72-n

Explain how cash flows on the underlying asset affect put-call parity and the lower bounds of option prices.

Cash flows on the underlying asset

In the case that there are cash flows on the underlying assets we need to adjust the lower bounds for option values that were given in Equations 72-4. We need to restate the underlying price by the present value of the cash flows. If we call the present value of the cash flows over the life of the option PV(CF, 0, T):

Equations 72-7

$$c_0 \geq \text{Max}\{0, [S_0 - PV(CF, 0, T)] - X/(1 + r)^T\}$$

$$p_0 \geq \text{Max}\{0, X/(1 + r)^T - [S_0 - PV(CF, 0, T)]\}$$

LOS 72-o

Identify the directional effect of an interest rate change on an option's price.

Interest rates

The other factors that influence option prices are interest rates and volatility.

When interest rates increase this will increase call option prices, and decrease put option prices.

This is because when interest rates are high, it is relatively more attractive to buy a call option today but delay paying for the underlying to a later date. However, if interest rates are high it is relatively more attractive to sell the underlying today (and earn interest on the proceeds) than hold a put option to sell it in the future.

LOS 72-p

Describe the impact of a change in volatility on an option's price.

Higher volatility increases option prices since there is a greater possibility of the underlying price rising and the call option holder having an increased profit on the upside, or for a put option the holder having an increased profit due to the downside movement. Volatility is a more critical variable than interest rates in the pricing of options.

73 Swap Markets and Contracts

Learning Outcome Statements (LOS)

73-a	**Describe** the characteristics of swap contracts and **explain** how swaps are terminated.
73-b	**Define** and **give** examples of currency swaps and **calculate** and **interpret** the payments on a currency swap.
73-c	**Define** and **give** an example of a plain vanilla interest rate swap and **calculate** the payments on an interest rate swap.
73-d	**Define** and **give** examples of equity swaps and **calculate** and **interpret** the payments on an equity swap.

Introduction

This is the last Reading which examines the characteristics of a specific type of derivative. We look at swaps which are essentially a series of forward rate agreements. The two parties agree to exchange payments; usually at least one party will make a payment which is dependent on a variable such as an interest rate or equity index level. Candidates should be able to calculate the payments for currency, interest rate and equity swaps.

LOS 73-a

Describe the characteristics of swap contracts and **explain** how swaps are terminated.

Swap contracts

In a swap agreement the counterparties agree to exchange a sequence of cash flows over a period in the future. One party (or sometimes both parties) is usually agreeing to make payments that depend on the price of a random outcome such as the level of interest rates, currency rates or commodity prices. These payments are referred to as variable or floating. The party paying the floating rate is called the floating- or variable-rate payer, the other party the fixed-rate payer.

Each date when payments are made is called a settlement date and the time between the settlement dates is the **settlement** period. If payments are being made in the same currency they will be **netted** off against each other.

The swaps market is virtually unregulated and offers privacy for the counterparties entering into a transaction; however the parties take on the risk that the other party defaults on the transaction.

Termination of swaps

If a party wishes to terminate a swap prior to the termination or expiration date, there are a number of alternatives:

- A swap has a market value; this can be calculated and if both parties agree, the payment is made by the party holding the negative market value to the other and this will terminate the swap.
- A party can enter into a separate and offsetting swap agreement with another party. If, for example the party is making floating-rate rate payments, they could enter into another swap where they receive floating-rate payments. This can be designed to eliminate the interest rate risk but default risk will remain with both counterparties.
- The swap could be sold to another party, although they will need the permission of the first counterparty.
- Use a swaption; this is an option to enter a swap agreement, and could be used to enter an offsetting swap agreement.

LOS 73-b

Define and **give** examples of currency swaps and **calculate** and **interpret** the payments on a currency swap.

Currency swaps

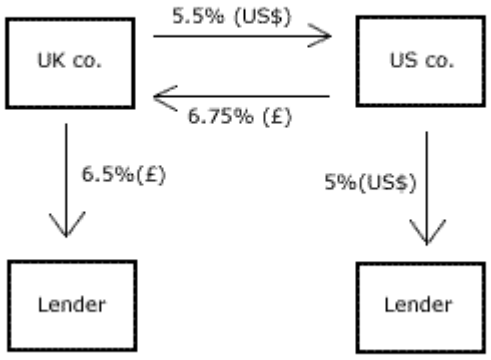
In a plain vanilla currency swap, each party holds one currency that they wish to convert to the other party's currency. In this case the principal is swapped and then paid back at the end of the tenor of the swap. Each party will pay interest on the currency it receives from the other party. The payments can be fixed or floating rate according to the swap agreement, but in a plain vanilla currency swap one party would pay a floating rate on dollars and the other a fixed rate on the foreign currency. Payments might be annual or for a shorter period, in which case the number of days between settlement dates is usually divided by 360, e.g. semi-annual interest is calculated using 180/360. The payments are usually made in arrears.

Example 73-1 Motivation for currency swap

A U.S. company can borrow dollars at 5% in the U.S. but must pay 7% to borrow pounds sterling in the U.K. A U.K. company can borrow pounds sterling at 6½% in the U.K. but must pay 6% to borrow dollars in the U.S. The U.S. company has a comparative advantage in borrowing funds in the U.S. and the U.K. company has a similar comparative advantage in borrowing in the U.K. If the U.S. company needs to borrow pounds sterling and the U.K. company needs to borrow dollars, then both companies can benefit from entering into a fixed-for-fixed currency swap. If, for example, the interest rates were agreed at 5½% on the dollars and 6¾% on the pounds sterling this would reduce the cost of borrowing for both parties.

US company	UK company
pays 5% to lender in U.S. for US dollars	pays 6½% to lender in the U.K. for pounds sterling
swaps US dollars for pounds sterling receives 5½% for dollars from the U.K. company pays 6¾ % for pounds sterling to the U.K. company	swaps pounds sterling for US dollars pays 5½% for dollars to the U.S. company receives 6¾% for pounds sterling from the U.S. company

The Comparative Advantage Fixed-for-Fixed Currency Swap
(Exchange of Currencies at Initiation)



Currency swap payments

Here we look at an example where two parties are effectively exchanging a fixed-rate loan in US dollars to a fixed-rate loan in Swiss Francs. There are many variations on this type of swap; for example floating-rate interest rates could have been used.

Example 73-2 Currency swap payments

Two parties, X and Y, enter into a three-year currency swap agreement with a principal of $10,000,000. X wants to borrow dollars and Y wants to borrow Swiss Francs. The exchange rate when the agreement is signed is $1 = SF 1.70 and U.S. interest rates are fixed at LIBOR, which is 5%. The interest rate to be paid on the Swiss Francs is fixed at the one-year Swiss Franc rate which is 3%. After one-year LIBOR moves up to 6½% and at the end of the second year to 7%. Payments would be as follows:

Year	X pays Y	Y pays X
0	SFr 17,000,000	$10,000,000
1	5% x $10,000,000 = $500,000	3% x SFr 17,000,000 = SFr 510,000
2	6½% x $10,000,000 = $650,000	3% x SFr 17,000,000 = SFr 510,000
3	$10,000,000 + (7% x $10,000,000) = $10,700,000	SFr 17,000,000 + (3% x SFr 17,000,000) = SFr 17,510,000

LOS 73-c

Define and **give** an example of a plain vanilla interest rate swap and **calculate** and **interpret** the payments on an interest rate swap.

Interest rate swaps

In a plain vanilla interest rate swap, one party agrees to pay a series of fixed-rate interest rate payments and the other party to pay a series of floating rate payments, over a period of time called the **tenor** of the swap. The payments are based on the interest rate calculated on a **notional principal**. The notional principal does *not* change hands.

Payments are usually determined in advance and paid **in-arrears**, which means that the floating-rate payments are decided by the floating rate benchmark (e.g. LIBOR) at the previous settlement date. Usually only the difference between the two payments, the **net payment**, is made.

Interest rate swap payments

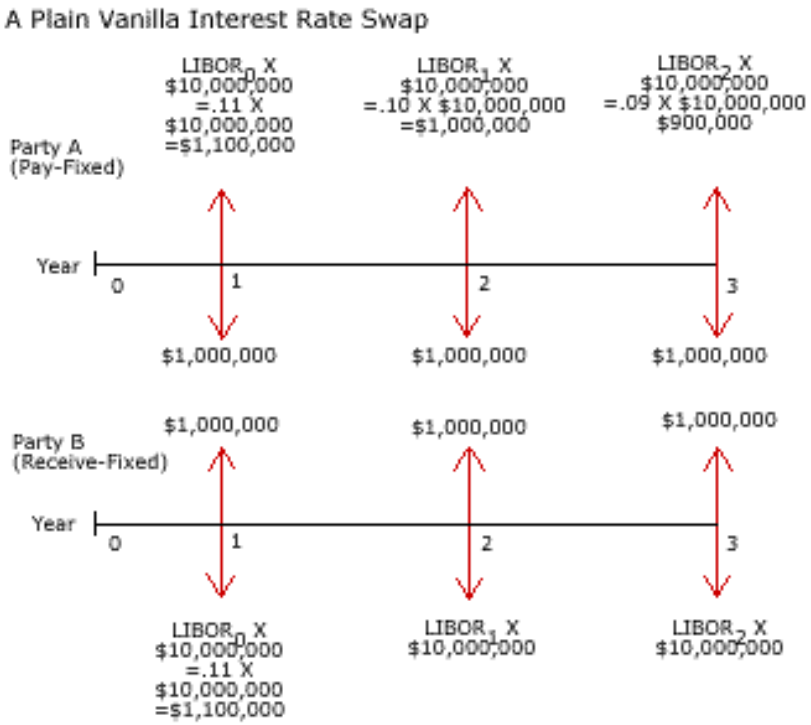
In this example we look at a plain vanilla swap where the payments are the same as if party A had issued a fixed-rate bond and party B a floating-rate bond.

Example 73-3 Interest rate swap payments

Two parties, A and B, enter into a three-year plain vanilla interest rate swap agreement. A agrees to pay a fixed rate of 10% and B agrees to pay the LIBOR rate, on a notional principal of $10 million. LIBOR was 11% when the agreement was signed, stands at 10% at the end of the first year, and stands at 9% at the end of the second year. If payments are made in arrears the payments will be as follows:

Year	LIBOR	A pays 10% fixed rate	B pays LIBOR	Net payment
0	11%			
1	10%	$1,000,000	$1,100,000	B pays A $100,000
2	9%	$1,000,000	$1,000,000	no payment
3	n/a	$1,000,000	$900,000	A pays B $100,000

This could also be illustrated by the cash flow diagram shown below:



LOS 73-d

Define and **give** examples of equity swaps and **calculate** and **interpret** the payments on an equity swap.

Equity swaps

In this case, the variable is the return on a stock or stock index. Since the return from a stock can be negative, we could have one party paying a fixed rate plus an equity-related payment. Another difference between equity swaps and interest rate and currency swaps is that the stock prices are only known at the end of the settlement period. Equity swaps are often structured to include both dividends and capital gains.

Equity swap payments

Equity swaps are often used by investment managers to adjust their exposure to an equity market without having to buy or sell the underlying securities.

Example 73-4 Equity swap payments

ABC Asset Management is running a fund whose returns are linked to the performance of the S&P Index. It has a US$100 million cash inflow and it decides to use a swap agreement to gain exposure to the market. It enters into a one-year agreement with XYZ investment bank where XYZ agree to pay the return on the S&P Total Return Index and ABC will pay a fixed rate of 5% on a notional principal of US$100 million. The payments are to be made quarterly with the first payment on the last day in March and the payments will be based on the actual day count/365 basis.

The S& P Index return is calculated over each quarter (based on the change between the beginning and end of the quarter) and the payments are calculated as follows

Year	ABC pays 5% fixed rate	S&P Index return	XYZ pays	Net payment
March 31st	$100m x 5% x 90/365 = $1,232,877	+10%	$10,000,000	XYZ pays $8,767,123
June 30th	$100m x 5% x 91/365 = $1,246,575	+3%	$3,000,000	XYZ pays $1,753,425
Sep. 30th	$100m x 5% x 92/365 = $1,232,878	-12%	($12,000,000)	ABC pays $13,232,878
Dec. 31st	$100m x 5% x 92/365 = $1,260,274	+1%	$1,000,000	ABC pays $260,274

74 Risk Management Applications of Option Strategies

Learning Outcome Statements (LOS)

74-a	**Determine** the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the strategies of buying and selling calls and buying and selling puts, and **explain** each strategy's characteristics.
74-b	**Determine** the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the covered call strategy and the protective put strategy, and **explain** each strategy's characteristics.

Introduction

This is a brief introduction to how derivatives, in particular options, can be used to manage risk. Options allow the holder to capture much of the upside if prices move in one direction and limit their losses if prices move in the other direction making them attractive for portfolio managers meeting specific client risk-return objectives. In this Reading we look at strategies that are frequently used by equity managers and candidates need to be able to interpret the relevant payoff diagrams as well as calculate profits, losses and breakeven prices.

LOS 74-a

Determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the strategies of buying and selling calls and buying and selling puts, and **explain** each strategy's characteristics.

We are now going to look at some of the investment strategies that can be implemented using options. We will use the same notation as we used in Reading 72.

S_0, S_T = price of underlying asset today, price of underlying asset at time T

X = exercise price

r = risk-free rate

T = time to expiration, expressed as number of days divided by 365

c_0, c_T = price of European call option today and at expiry

p_0, p_T = price of European put option today and at expiry

We will only look at European options, since we are looking at the return for a strategy up to the expiration date; the calculations are the same for American options.

Profit on call options

Taking into account the cost of the option, the premium P, the profit made from the **long call position** is:

Equation 74-1

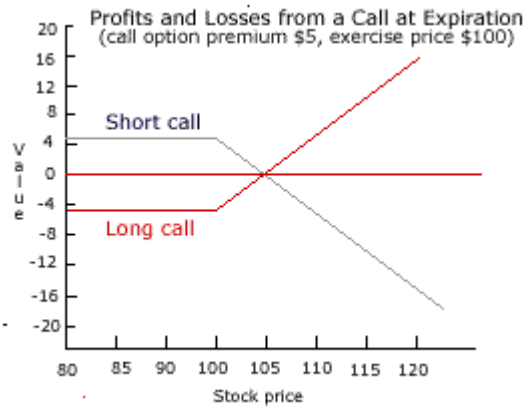
Profit = Max [0, S_T – X] – c_o

Options are a **zero-sum gain** in the sense that the profit made by the purchaser of the option will be equal to the loss made by the option writer (or vice versa), so the profit made from the **short call position** is

Profit = c_o – Max [0, S_T – X]

Example 74-1 Profit and loss on a call option

The profit and loss on a call option at expiration when the exercise price is \$100 and the premium is \$5 is illustrated in the diagram below. Note that for the long position there is unlimited upside but the maximum loss is limited to the premium.



In Example 74-1 the breakeven is \$105.

Equation 74-2

Breakeven will occur when:

0 = S_T – X – c_o

when:

S_T = X + c_o

Profit on put options

Equations 74-3

When we take into consideration the option premium, the profit on a **long put position** is:

$$\text{Profit} = \text{Max}[0, X - S_T] - p_o$$

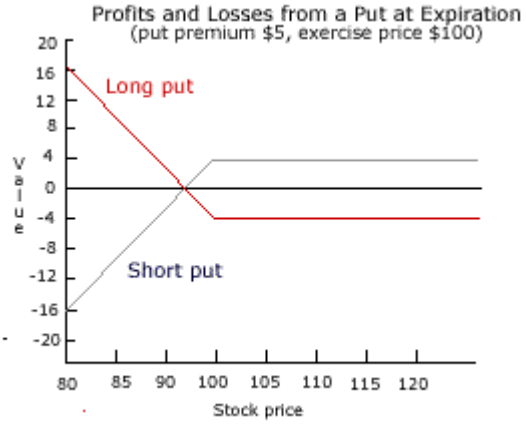
And on a **short put position** the profit is given by:

$$\text{Profit} = p_o - \text{Max}[0, X - S_T]$$

The corresponding diagram for a put option is shown in Example 74-2.

Example 74-2 Profit and loss on a put option

The profit and loss on a put option at expiration when the exercise price is \$100 and the premium is \$5 is illustrated in the diagram below. For the long position there is large potential upside (\$95 in the case that the price of the underlying goes to zero) but the maximum loss is limited to the premium.



In Example 74-2 the breakeven is \$95.

Equation 74-4

Breakeven will occur when:

$$0 = X - S_T - p_o$$

when:

$$S_T = X - p_o$$

Examples 74-3 Calculating the profit and loss from option positions

1. The value of an asset is \$50 and an investor purchases a call option with a value of \$6 and an exercise price of \$52. The price at which the investor will breakeven is given by:

   $S_T = X + c_o = \$52 + \$6 = \$58$

   The breakeven point is \$58 and if the price rises above this there will be a profit.

2. A trader writes a put option on a stock with an exercise price of \$40 and a premium of \$5. If the stock falls to \$38, at the expiration date the profit made by the trader is given by:

   Profit = \$5 - Max [0, (\$40 – \$38)] = \$3

LOS 74-b

Determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the covered call strategy and the protective put strategy, and **explain** each strategy's characteristics.

Covered call

A **covered call** is when an investor owns the underlying asset and writes a call option on the asset. The investor will receive income in the form of the premium paid to them by the buyer of the option. However, in the case that the stock price rises to above the exercise price plus the premium, the investor is worse off than if they had not written the call; they will lose the potential capital gain on the underlying asset.

Equation 74-5

The profit on a covered call is:

$S_T - S_0$ (the profit on the underlying) plus c_o - Max [0, $S_T - X$] (the profit on a short call)

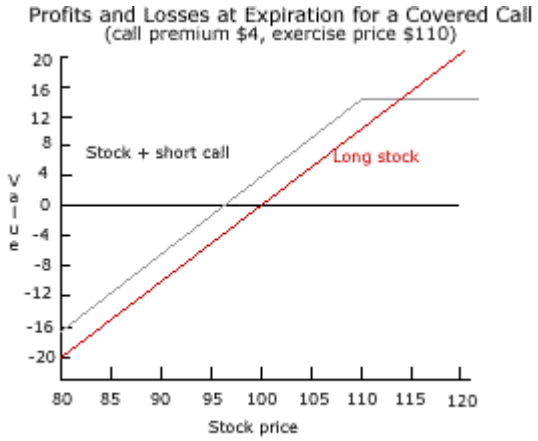
Profit = $S_T - S_0 + c_o$ - Max [0, $S_T - X$]

Equation 74-6

Breakeven will occur when X is greater than S_T, and the option is not exercised so it will occur when: $S_T = S_0 - c_o$

Example 74-4 Covered call

The profit and loss diagram is shown below for a covered call with an exercise price of $110 and premium of $4. The initial price of the stock is $100.



Breakeven is when $S_T = S_0 - c_o = \$100 - \$4 = \$96$.

Example 74-5 Value of a covered call

An investor holds 1,000 shares in ABC Corp. which has a current market price of $58. The investor sells 1,000 call options on the shares at a premium of $5 and exercise price of $60. In the case that ABC shares (i) rise to $80 (ii) fall to $50, calculate the value of the combined portfolio at the expiration date.

The value of the combined value of the portfolio is:

(i) (1,000 x $80) + 1,000{premium - maximum [0, (S – X)]}

= $80,000 + 1,000($5 - $20)

= $65,000

(ii) (1,000 x $50) + 1,000{premium - maximum [0, (S – X)]}

= $50,000 + 1,000($5 - $0)

= $55,000

If the investor had not sold the option then the value of the shares would be higher in the first case (the call option has capped his capital gain) and lower in the second case since he has the benefit of the premium income.

Protective put

This is sometimes called **portfolio insurance**. It is an investment strategy which uses hedging to protect the value of a portfolio from falling below a certain level. It is executed by combining holding an asset and buying a put option on the asset.

In the case that (i) the asset price falls below the exercise price, then the value of the combined position will fall by the cost of the put option, since losses on the asset will be offset by the payoff on the put option; (ii) the asset rises above the exercise price, then the value of the position will rise in line with the asset, less the cost of the put option, since the option lapses worthless. The cost of the put option is essentially the cost of insuring the portfolio.

The profit can be calculated using Equation 74-7

Equation 74-7

$$\text{Profit} = S_T - S_0 - \{\text{Max}[0, X - S_T] - p_o\}$$

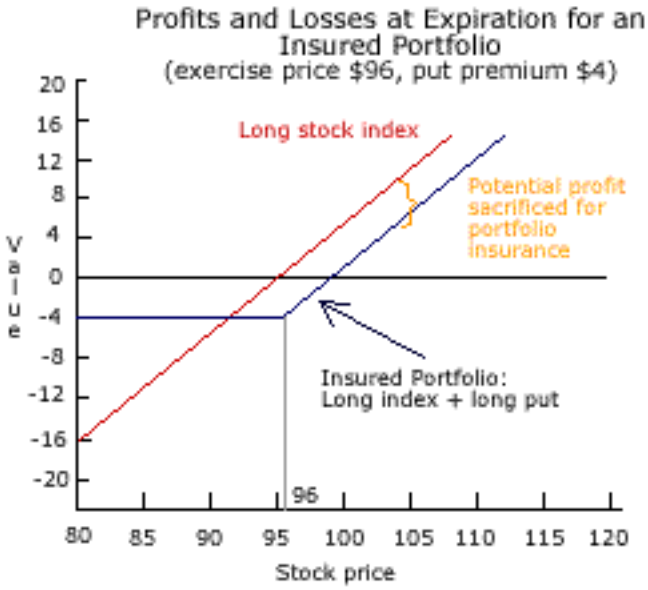
and breakeven is when:

Equation 74-8

$$S_T = S_0 + p_o$$

Example 74-6 Portfolio insurance

The diagram below shows the payoff for an insured portfolio, which combines a long position in the index and a put option on the index. The initial level of the index is \$96, the exercise price \$96 and the premium \$4. In this case the breakeven is when the index is \$96 + \$4 = \$100.



STUDY SESSION 17

Alternative Investments

Overview

This is a short Study Session that gives a brief introduction to alternative investments. 'Alternative investments' refer to a variety of investments, including real estate and venture capital, that complement the 'traditional' asset classes such as stocks, bonds and other instruments traded in the financial markets. It is also often used to refer to alternative strategies which may use traditional assets but have different objectives such as targeting absolute returns. Hedge funds, for example, use alternative strategies.

The Study Session looks at the characteristics of alternative investments including risk and return and how investments are valued. The Study Session is based on just one Reading and it works through a range of different investments: open and closed-end funds, exchange traded funds, real estate, venture capital, hedge funds, closely-held companies and finally commodities.

Reading Assignments

International Investments, 5th edition, Bruno Solnik and Dennis McLeavey (Addison Wesley, 2004)
75. "Alternative Investments," Ch. 8

75 Alternative Investments

Learning Outcome Statements (LOS)

75-a	**Distinguish** between an open-end and a closed-end fund.
75-b	**Explain** how the net asset value of a fund is calculated.
75-c	**Explain** the nature of various fees charged by investment companies.
75-d	**Distinguish** among style, sector, index, global, and stable value strategies in equity investment.
75-e	**Distinguish** among exchange traded funds (ETFs), traditional mutual funds, and closed-end funds.
75-f	**Explain** the advantages and risks of ETFs.
75-g	**Describe** the forms of real estate investment.
75-h	**Explain** the characteristics of real estate as an investable asset class.
75-i	**Describe** the various approaches to the valuation of real estate.
75-j	**Calculate** the net operating income (NOI) from a real estate investment.
75-k	**Calculate** the value of a property using the sales comparison and income approaches.
75-l	**Calculate** the after-tax cash flows, net present value, and yield of a real estate investment.
75-m	**Explain** the various stages in venture capital investing.
75-n	**Discuss** venture capital investment characteristics and the challenges to venture capital valuation and performance measurement.
75-o	**Calculate** the net present value (NPV) of a venture capital project, given the project's possible payoff and conditional failure probabilities.
75-p	**Discuss** the descriptive accuracy of the term "hedge fund" and **define** hedge fund in terms of objectives, legal structure, and fee structure, and**describe** the various classifications of hedge funds.
75-q	**Discuss** the benefits and drawbacks to fund of funds investing.
75-r	**Discuss** the leverage and unique risks of hedge funds.
75-s	**Discuss** the performance of hedge funds, the biases present in hedge fund performance measurement, and **explain** the effect of survivorship bias on the reported return and risk measures for a hedge fund data base.

75-t	**Explain** how the legal environment affects the valuation of closely held companies.
75-u	**Describe** alternative valuation methods for closely held companies and **distinguish** among the bases for the discounts and premiums for these companies.
75-v	**Discuss** distressed securities investing and the similarities between venture capital investing and distressed securities investing.
75-w	**Discuss** the role of commodities as a vehicle for investing in production and consumption.
75-x	**Discuss** the motivation for investing in commodities, commodities derivatives, and commodity-linked securities.
75-y	**Discuss** the sources of return on a collateralized commodity futures position.

Introduction

Alternative investments differ from traditional investments; they tend to be less liquid, to be in inefficient markets and require longer holding periods. Often investing in them involves particular legal or tax considerations. The main features of alternative investments are:

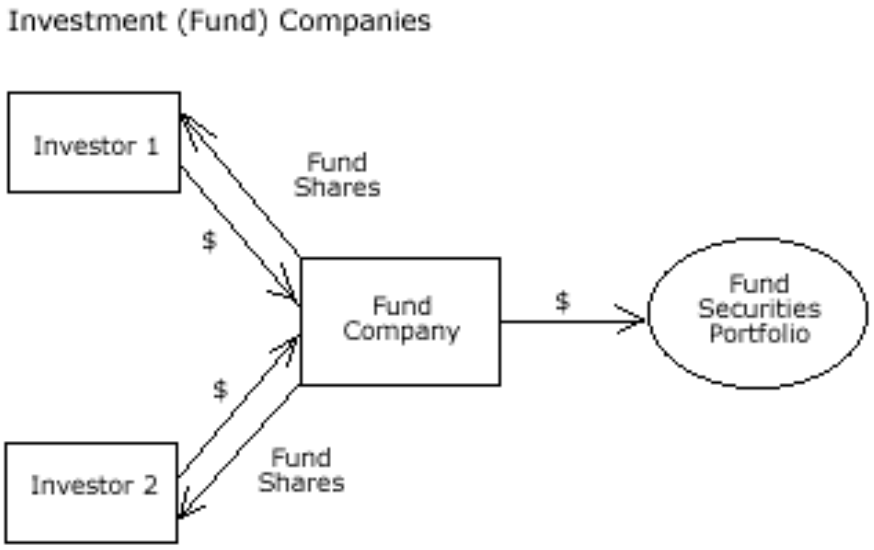
- Illiquidity.
- Difficulty in determining current market values.
- Limited historical risk and return data.
- Extensive investment analysis required.

The main attraction of alternative investments is the potential for earning a higher alpha than is available in more efficient markets. Recall that alpha is the excess risk-adjusted return.

Candidates will be expected to be familiar with the unique characteristics and advantages and disadvantages of investing in each asset. They will also need to be able to apply appropriate methods to value real estate and venture capital investments.

Investment companies

An investment company is a financial intermediary that pools investors' funds and invests them on their behalf giving a proportional share of the pooled fund performance to each investor. The investments can be in any specified asset class or combination of asset classes. An investment management company is appointed by the directors of the investment company to do the actual management of the investments.



Open-end investment companies offer a redemption feature. However closed-end funds issue shares that are traded in the secondary market.

LOS 75-a

Distinguish between an open-end and a closed-end fund.

Closed-end investment company

A closed-end investment company does not offer new shares or redeem shares except through a new share offering or a stock repurchase. Shares are dealt in the secondary market and the investor pays the market price plus regular trading commission. Closed-end funds usually trade at a different price, at a premium or more commonly a discount, to their NAVs.

Open-end investment company (mutual fund)

An open-end investment company continues to buy and sell shares after the initial offering. A managed or load fund is when the offering price is the NAV plus an initial charge called a **front-end load.** The redemption price is usually the NAV, but can be the NAV less a redemption fee or a **back-end load.** This fee is often charged if the shares are sold in less than a specified period of time, to discourage the investors from selling their shares too quickly. A no-load fund has no initial sales charge so the offering price is the NAV.

LOS 75-b

Explain how the net asset value of a fund is calculated.

Net asset value (NAV)

Shares in investment companies are valued based on their NAV. The NAV per share is a company's assets minus liabilities divided by the number of shares outstanding. The asset value is calculated using the market value of the securities held; liabilities will include items such as fees payable to the investment manager. Fees are charged on an annual basis and for an unmanaged fund all or some of the set up costs will be passed on by selling the shares initially at a price higher than NAV. Open-end funds also charge purchase and redemption fees.

LOS 75-c

Explain the nature of various fees charged by investment companies.

Fees

To summarize the different types of fees charged are:

1. Front-end load or sales charge – commission charged at the time of purchase.
2. Redemption fees or deferred sales charge – a charge to exit the fund.
3. Annual expenses – ongoing expenses throughout the life of the fund, which generally consist of:
   - Distribution fees, fees paid to the party who arranged the initial sales on a continuing basis.
   - Management fees, the fees paid to the investment manager(s).
   - Other expenses, such as custodian fees.

Example 75-1 shows how fees are calculated.

Example 75-1 Investment company fees

We will look at a mutual fund that has issued 3 classes of shares. Each class holds the same underlying portfolio of securities but the expense structures differ.

	Class A	Class B	Class C
Front-end fees	4%	None	None
Redemption fees	None	5% in the first year but declining by 1% point each year thereafter	1% for the first 3 years only
Annual expenses			
Distribution fees	0.30%	0.30%	0.30%
Management fees	0.75%	1.00%	1.00%
Other expenses	0.20%	0.20%	0.20%
	1.25%	1.50%	1.50%

1. What would be the ending value for each of the classes of shares if an investor invests $1 for a period of 5 years, assuming the fund grows by 8% annually?

2. What would the investor receive if he decides to redeem the shares after 2 years?

Answer

1. Fund A. Due to the front-end fee of 4%, only $0.96 from the $1 will be available to invest. At the end of 5 years, $1 invested in the fund will be worth $0.96 x $(1.08)^5$ x $(1 - 0.0125)^5$ = $1.3246, or a return of 32.46%.

   Fund B and Fund C will have the same return since the annual expenses are the same and there is no front-end fee for either of them. At the end of 5 years, $1 invested in the funds will be worth $1 x $(1.08)^5$ x $(1 - 0.015)^5$ = $1.3624, or a return of 36.24%.

2. Fund A. There is no redemption fee, so the investment in the fund after 2 years will be worth $0.96 x $(1.08)^2$ x $(1 - 0.0125)^2$ = $1.0919, or a return of 9.19%.

   Fund B, after 2 years the redemption fee will be 4%, i.e. a decline of 1% point from 5%. The investment in the fund after 2 years will be worth $1 x $(1.08)^2$ x $(1 - 0.015)^2$ x (1 - 0.04) = $1.0864 or a return of 8.64%.

   Fund C, after 2 years the redemption fee will be 1%. The investment in the fund after 2 years will be worth $1 x $(1.08)^2$ x $(1 - 0.015)^2$ x (1 - 0.01) = $ 1.1204 or a return of 12.04%.

LOS 75-d

Distinguish among style, sector, index, global, and stable value strategies in equity investment.

Investment companies mainly invest in equities although they can invest in a wide range of asset classes. Different equity investment strategies include:

Style – for example growth versus value, or large versus small capitalization stocks.

Sector – investment is focused in a certain industrial sector.

Index fund – the objective is to perform in line with a specified index, perhaps by owning all the shares in the index with the same weighting as their representation in the index.

Global – invest in securities from around the world (an international fund only invests in securities from outside the home market).

Stable value – invests in short-term fixed income securities and guaranteed return investment contracts.

LOS 75-e

Distinguish among exchange traded funds (ETFs), traditional mutual funds, and closed-end funds.

Exchange traded funds (ETFs)

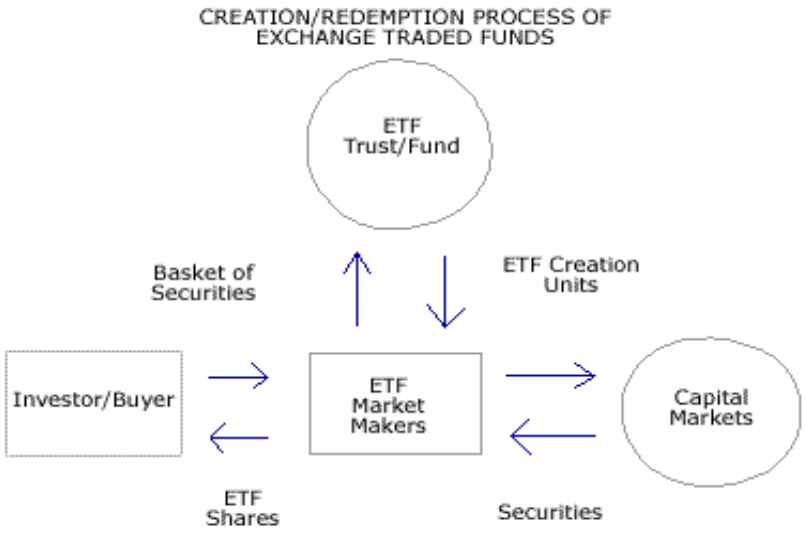
Exchange traded funds are funds that trade on a stock market and investors can buy shares in the fund. The investor is buying shares in an open-end fund or unit investment trust that holds a portfolio of shares which are selected to track the performance of an underlying index (for example an equity, fixed-income or sector index). Usually an ETF is an open-end fund with a choice of three legal structures:

1. Managed investment company, the most flexible structure in that shares or derivatives can be used to match the underlying index performance.
2. Unit investment trust, a slightly more restrictive structure which only allows investment in the underlying securities in the index and dividends received must be held until they are paid out to investors.
3. Grantor trust, which is not a recognized investment company so investors indirectly own an unmanaged basket of securities.

In-kind creation and redemption

A special feature of ETFs is the creation and redemption process. Creation and redemption units are for large multiples of ETF shares, say 50,000 shares, and they can be traded by ETF market makers or authorized participants.

When there is demand for ETF shares, the market makers will deposit with the trustees of a fund a portfolio of the underlying shares used to track the index and in return will receive a creation unit or block of ETF shares which they can sell to the end investors. To redeem shares, the market maker will return a large block of ETF shares and will receive a portfolio of the underlying shares in the index.



Source: Solnik, et al, 2004

This process is quite different from the redemption of an open-end fund and means that no capital gain (or loss) is realized in the fund since the underlying shares are not sold to meet redemptions. This can have tax advantages for the remaining holders of the ETF shares. Redemption for cash is discouraged for small ETF shareholders by time delays and additional fees. Individual shareholders will prefer to sell their shares in the market, and the share price will stay close to the NAV. If it moves away arbitragers can use the in-kind creation and redemption process to make a risk-free gain which will bring the prices back in line with the NAV.

LOS 75-f

Explain the advantages and risks of ETFs.

Advantages of ETFs

ETFs are attractive to investors for a number of reasons:

Diversification

Investors gain exposure to a diversified portfolio of stocks or bonds represented by the underlying index. ETFs can also be sold short or bought on margin.

Continuous trading

ETFs trade throughout the trading day, whereas mutual funds usually only trade based on the once-a-day closing prices.

Improved risk management

Futures and options often trade with the same underlying indexes so the ETFs can be used for risk management.

Transparency

The constituents of the fund are published daily.

Cost effectiveness

There are no load fees and the expense ratio (which includes management and custody fees) is lower than for actively managed funds.

Avoidance of significant premium/discount

The price stays close to the NAV. This is not the case with closed-end funds which often trade at a significant discount to their NAVs.

Tax-saving

The capital gains tax liability is lower within the fund due to in-kind redemptions.

Immediate dividend reinvestment

Dividends received by the fund are usually reinvested immediately so there is no cash drag.

Disadvantages of ETFs

Narrow-based index

In some markets there are only ETFs available for the large capitalization stock indexes.

Intra-day trading

Investors with long time horizons do not need intra-day trading.

Bid-ask spread

If the volume of trading in ETFs is low then the bid-ask spread can be wide.

Cost efficiency

For large investors it may be more cost or tax efficient to invest directly or have an actively managed portfolio.

Risks

The risk will depend on the type of ETF and the index it is tracking, but potential risks are:

- Market risk – the NAV will reflect moves in the underlying market.
- Asset class/sector risk – if the index is for a specific sector it may underperform the wider market.
- Trading risk – the bid-ask spread might widen or the price move away from NAV, particularly if there is low liquidity in the shares.
- Tracking error risk – this arises if the share price performance deviates from the index performance.
- Derivative risk – if the ETF uses derivatives this introduces additional risks such as counterparty risk.
- Currency and country risk – for ETFs investing in international markets.

ETFs are used in many ways by investment managers, for implementing asset allocation, and gaining exposure to new markets, managing cash inflows, and managing portfolio risk.

Real estate

LOS 75-g

Describe the forms of real estate investment.

Real estate is a tangible asset and covers land and buildings, including offices, industrial, retail as well as residential properties. First we look at the different types of real estate investment.

Forms of real estate investment

Free and clear equity

This is sometimes called 'fee simple' and means full ownership of a property for an indefinite period of time. The owner has the right to lease out the property or resell the property.

Leveraged equity

This refers to the same ownership rights but subject to debt or a mortgage and a requirement to transfer ownership of the equity in case of a default on the debt.

Mortgages

These are mortgage loans, and are a real estate investment vehicle in the form of a debt investment. The holder will receive interest, scheduled repayments of the debt and possibly prepayments which give uncertainty over the cash flows.

Aggregation vehicles

These are collective vehicles giving investors access to a diversified portfolio of real estate investments.

Real estate limited partnerships (RELPs) are syndicates that invest in different types of property. The manager is a general partner and takes unlimited liability whereas the other investors are limited partners. Real estate investment trusts (REITs) are closed-end investment companies that invest in various types of real estate and real estate mortgages. Equity REITs invest in property using leverage whereas mortgage REITs make construction loans and mortgage loans to real estate investors. REITs pay out the majority of their income as dividends and are similar to a bond investment.

LOS 75-h

Explain the characteristics of real estate as an investable asset class.

Characteristics of real estate

Investing in real estate is quite different from buying securities in a financial market. Its characteristics are:

- Properties are immovable and indivisible (indivisible means that you usually cannot sell just part of the investment).
- Each property is unique and not directly comparable to other properties.
- Property is relatively illiquid.
- There is no central market place so it is difficult to assess the market value of a property.
- Real estate investment involves high transaction costs and management fees.
- The real estate market is inefficient and information is not freely available.

LOS 75-i

Describe the various approaches to the valuation of real estate.

LOS 75-j

Calculate the net operating income (NOI) from a real estate investment.

LOS 75-k

Calculate the value of a property using the sales comparison and income approaches.

Valuation of real estate

There are four main methods used to appraise the value of real estate.

1. Cost approach

This approach is used for new buildings; it says that the value of a property is at most the cost of the land and the construction of the buildings at current prices.

2. *Sales comparison approach*

This involves looking at selling prices of similar properties as a benchmark. A related method is hedonic price estimation, which means that the major characteristics of the property are identified and then the value is calculated based on the properties' exposure to these characteristics. See Example 75-2 for a calculation of a property value using this method.

Example 75-2 Sales comparison approach

A real estate appraiser has identified three factors that affect house prices in an area: the number of rooms, size of the plot and distance from the railway station. Using data collected on recent house sales he has used regression analysis, with the selected characteristics as the independent variables, to produce the following data:

Characteristic	Units	Slope coefficient in euro per unit
Intercept		80,000
Number of rooms	Number	25,000
Size of plot	Square meter	40
Distance from railway station	Kilometer	– 5,000

A house has 10 rooms, a plot of 1,000 square meters and is 5 kilometers from the station.

The appraisal price is: 80,000 + (10 x 25,000) + (1,000 x 40) + (5 x – 5,000) = 80,000 + 250,000 + 40,000 – 25,000

= Euro 345,000

3. *Income approach*

This approach calculates a property's value as the present value of income that will be received from the property using a perpetuity discount model. Income is defined as net operating income (NOI) which is gross potential rental income less vacancy losses, operating expenses and property taxes.

More specifically, if we assume a constant annual net operating income:

Equation 75-1

$$\text{Appraisal value} = \frac{\text{NOI}}{\text{Market cap rate}}$$

The market cap (or capitalization) rate reflects the rate of return required by investors and is based on benchmark transactions (for a single or several comparable transactions).

Equation 75-2

$$\text{Market cap rate} = \frac{\text{Benchmark NOI}}{\text{Benchmark transaction price}}$$

Example 75-3 Income approach

An investor is considering purchasing an office building as an investment, and the following information has been collected. The figures are on an annual basis.

Gross potential rental income	$1,000,000
Estimated vacancy and collection losses	5%
Insurance and taxes	$80,000
Utilities	$30,000
Repairs and maintenance	$60,000
Depreciation	$70,000
Interest on proposed financing	$90,000

NOI = gross potential rental income minus expenses

= $1,000,000 – (0.05 x $1,000,000) - $80,000 - $30,000 - $60,000 = $780,000

Note the expenses for this calculation do not include depreciation (it is assumed that repairs will maintain the building in good condition indefinitely) and interest expense.

A similar office building had NOI of $400,000 and sold for $3,200,000.

Using Equation 75-2: Market cap rate = $400,000/$3,200,000 = 12.5%

Using Equation 75-1, we can apply this market cap rate to give an appraisal value for the office building of:

Appraisal value = $780,000/0.125 = $6,240,000

LOS 75-l

Calculate the after-tax cash flows, net present value, and yield of a real estate investment.

4. Discounted after-tax cash flow approach

This method looks at the underlying factors that determine real estate values and the value from the individual investor's viewpoint. This means that issues such as borrowing costs and the investor's tax position can be incorporated into the valuation, as well as expectations of factors that determine real estate prices.

This method discounts after-tax cash flows by the required rate of return. After-tax cash flows are the annual cash flows earned on an investment, net of expenses, debt payments and taxes. Depreciation of a building is important since for tax purposes it is a non-cash cost that can reduce tax payments.

The net present value (NPV) is the present value of the cash flows generated by the property less the initial investment in the property. If it is a positive number it indicates it is a good investment, a negative number suggests it is a bad investment.

Example 75-4 Discounted cash flow approach

An investor is considering buying a house that he will rent out. The cost of the house is $350,000. He will finance 80% of the purchase price with a mortgage on which he will make annual payments $18,000, of which $14,000 represents interest and is tax deductible. He forecasts that he can sell the house at the end of three years for $400,000 net of selling expenses and tax. His net operating income per annum is $24,000. He will make tax savings on the deprecation of $5,000 per annum on the building. His marginal tax rate is 30%.

The after-tax cash flow is the same for the first two years.

After-tax net income

= (NOI – depreciation – interest)(1 – tax rate)

= ($24,000 - $5,000 - $14,000)(0.70) = $3,500

After-tax cash flow

= after-tax net income + depreciation – principal payment on mortgage

= $3,500 + $5,000 - $4,000 = $4,500

In the third year we must add the $400,000 cash inflow from the sale of the house, and deduct the mortgage that must be repaid, which will be the amount borrowed less the principal repayments ($280,000 – $12,000) so the after-tax cash flow is:

$4,500 + $400,000 -$268,000 = $136,500.

The initial investment (I) is 20% of the purchase price. If the investor's required rate of return (r) is 12% the NPV is calculated as:

$$NPV = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} - I$$

$$= \frac{\$4,500}{1.12} + \frac{\$4,500}{1.12^2} + \frac{\$136,500}{1.12^3} - \$70,000$$

$$= \$4,018 + \$3,587 + \$97,158 - \$70,000$$

$$= \$34,763$$

This is positive so it is an attractive investment from the point of view of this investor.

To calculate the IRR we can use a financial calculator. It is the rate of return that will make the NPV = 0

IRR = 28.85%

Venture capital

LOS 75-m

Explain the various stages in venture capital investing.

Venture capital is a form of private equity, which is equity that is not traded on exchanges. Venture capital covers investment from investing in start-ups through to the exit via an IPO or buyout. Typically investors have long time horizons and are attracted to venture capital by the possibility of making very high returns on a successful investment (although many investments will end in failure). Investment is usually through a limited partnership so the liability is limited to the size of the investment.

Stages in venture capital investing

Seed financing, for product development and market research: the product is still at the 'idea' stage.

Early-stage financing for companies moving towards commercial manufacturing.

- **Start-up financing**, for product development and initial marketing; this is usually before the company's products are being sold commercially.
- **First-stage financing**, for initial commercial manufacture and sales.
- Up to this point financing is referred to as **formative-stage financing.**
- **Later-stage financing**
- **Second-stage financing**, for initial expansion of the company.
- **Third-stage financing**, for major expansion, product improvement and/or marketing.
- **Mezzanine (or bridge) financing**, for a company that expects to go public in the near future.

LOS 75-n

Discuss venture capital investment characteristics and the challenges to venture capital valuation and performance measurement.

Characteristics of venture capital investments

- Illiquidity – the main exit routes are IPOs or the arrangement of a buyout; there is usually no short-term exit route.
- Long-term commitment – investors who can afford to make long-term investments can expect to be rewarded with a liquidity risk premium.
- Difficulty in determining current market value – since there is little trading of venture capital investments it is difficult to establish market values.
- Limited historical risk and return data – a result of there being little trading data.

- Limited information – it is difficult to assess the prospects of the companies in terms of cash flow forecasts etc.
- Entrepreneurial/management mismatches – entrepreneurs often don't make good managers and as a company grows different management skills are needed.
- Fund manager incentive mismatches – it is important that the fund managers are rewarded based on the performance of their investments.
- Lack of knowledge of how many competitors to a start-up company exist – since information on competitors with similar ideas may be difficult to find.
- Vintage cycles – when funds available for investment in venture capital are high the expected returns will fall, also poor financial conditions may make finding financing difficult for venture capital firms.
- Extensive operations analysis and advice may be required – it is important that venture capital managers can help entrepreneurs by applying their financial and operating knowledge and skills.

The main exit routes for the venture capital investor are trade sales (sales or mergers for cash or stock of the acquiring company) or IPOs where shares are issued for public trading. Other exit routes are write-offs and voluntary liquidations which may result in a payout to investors; also some companies will go bankrupt. In other cases the entrepreneur buys out the venture capital investors.

Challenges in valuing venture capital investments

Valuation is made difficult because of the uncertainty of future cash flows. Even if entrepreneurs have an innovative and potentially successful product they may lack the management experience to make it a success, and even then it is difficult to tell how long it will take to achieve that success. Some of these risks can be diversified by holding a portfolio of different venture capital investments. Valuing a venture capital investment will involve:

- Estimating the payoff at time of exit if the venture is successful.
- Estimating the time it will take to exit.
- Assessment of the probability of failure.

Challenges to performance management

Performance of venture capital investments is usually done by estimating the internal rate of return (IRR) using forecast cash flows and an end-of-period valuation. Some of the challenges to performance measurement include:

- The difficulty in determining precise valuations with no market values; valuations might be based on applying an average historical IRR to the managers' average investment costs for current investments.
- Lack of meaningful benchmarks by which to measure the performance.
- The long time period needed to reliably assess the performance.

LOS 75-o

Calculate the net present value (NPV) of a venture capital project, given the project's possible payoff and conditional failure probabilities.

Example 75-5 NPV of a venture capital project

An investor is looking at investing $1 million in a project, where the expected payout is $10 million at the end of five years. The investor's cost of equity for the project is 10%. However there is a significant risk of failure and the probability of failure in any year is given in the table below. The probability is based on the condition that the project has survived the previous year.

Year	1	2	3	4	5
Probability of failure	0 .40	0 .35	0 .25	0 .20	0 .20

The probability that the project survives throughout the five years is given by the product of the individual probabilities it survives each year, which is:

(1 – 0.40) (1 – 0.35) (1 – 0.25) (1 – 0.20) (1 – 0.20) = 18.7%

If the project survives the present value is: $10 million/$(1.10)^5$ - $1 million = $5.2 million

If the project fails the present value is: – $1 million.

The expected NPV is the weighted average of the two NPVs, which is:

0.187($5.2 million) + 0.813(– $1 million) = $159,400

This is a positive NPV so the project is attractive.

LOS 75-p

Discuss the descriptive accuracy of the term "hedge fund" and **define** hedge fund in terms of objectives, legal structure, and fee structure, and **describe** the various classifications of hedge funds.

Hedge funds

The original concept of a hedge fund was to bet against the market using derivative instruments, such as futures, short selling, etc.

Today its definition in terms of investment objectives is to **search for absolute returns**. While the recent trend in the wider investment management industry has been to focus on investment performance relative to pre-assigned benchmarks, e.g. an investment manager tries to outperform the S&P 500 Index, hedge funds have reacted against this trend. They are essentially isolating a specific bet to generate alpha. It is more appropriate to name them isolation funds.

The most common legal structure is limited partnership (in the U.S.) or an offshore corporation. The legal structure gives the fund managers the freedom to implement a variety of strategies such as taking long and short positions in an asset, using derivative instruments, and leveraging the fund without restrictions. In the U.S. the limited partnership structure is under section 3 (c) (1) of the Investment Company Act, therefore exempt from most SEC regulations.

The fee structure generally consists of a base management fee plus an incentive fee. The base management fee is a percentage of the value of assets under management, typically 1% to 3%. The incentive fee is usually in the range of 15% to 30% of total profits. Often the incentive fee is only triggered when the performance is above the risk-free rate and sometimes includes a 'high water mark' clause stating that following a year of decline, the fund must recover the losses before the incentive fee kicks in.

Example 75-6 Net return calculation

A new hedge fund has a base management fee of 2% and an incentive fee of 25% of profits above the risk-free rate.

If the risk-free rate is 5% and the total return of the fund is 45%, what would be the net return after fees?

Answer

Fee = 2% + 25% x (45% – 5%) = 2% + 10% = 12%

The net return = 45% – 12% = 33%.

Types of hedge fund

The classification of hedge funds is somewhat arbitrary due to the variety and the diversity of fund strategies, but we look at some of the commonly used classifications below.

Long/short funds

These are the traditional type of hedge fund and represent a large proportion of hedge fund assets. They often take long and short positions in common stocks based on their forecast returns, and often have long and short market exposure. The funds often use leverage and currently operate in many markets around the world. A subgroup within this classification is funds with a systematic short bias, also known as dedicated short funds or short-seller funds.

Market-neutral funds

These funds attempt to hedge against a general market move by a combination of long/short positions. The bets are on mispricing of individual securities within some market segment. The market-neutral long-short strategy means that the total value of long positions is offset by an equivalent value of short positions to give a net zero market exposure (**dollar neutrality**). This strategy also creates **beta neutrality**. Various techniques that are used include:

- Equity long/short.
- Fixed-income hedging.
- Pairs trading.
- Warrant arbitrage.
- Mortgage arbitrage.
- Convertible bond arbitrage.
- Closed-fund arbitrage.
- Statistical arbitrage.

Note that the term 'arbitrage' or 'neutral' in their labels does not mean that the strategy is riskless because there is no such thing as a perfect hedge. Losses can occur if the model is imperfect and can be severe due to the high leverage used.

Global macro funds

These funds bet on the direction of markets, interest rates, currencies, commodities or macroeconomic variables. The funds tend to use derivatives extensively and be highly leveraged. Subgroups in this category are:

- **Futures funds** (or managed futures funds), which take long or short positions using futures contracts.
- **Emerging-market funds**, which take bets on all type of securities in emerging markets. These markets are generally less efficient and less liquid compared to major developed markets. Volatility is fairly high, as prices are highly influenced by economic and political factors.

Event-driven funds

These funds bet on some event specific to a company or security that has significant effect on the pricing of the security. The resulting price fluctuations create opportunities that can be exploited. There are a number of subgroups, namely:

- **Distressed securities funds**. These funds invest in debt and/or equity securities of companies facing financial distress which are in the bankruptcy reorganization stage, or emerging from reorganization, or likely to announce bankruptcy. The funds take long positions if the managers believe that the financial situation will improve, or short positions if they believe that the financial conditions will deteriorate.

- **Risk arbitrage in mergers and acquisitions**. These funds take advantage of the discounted pricing of the target company prior to or when a merger or acquisition is announced. The funds simultaneously buy the stock (take a long position) in the target company and sell short (take a short position) the stock of the acquiring company. If the merger or acquisition goes through, this strategy will create a profit since generally the acquired stock price will rise and the acquiring one will fall after the completion of the merger or acquisition. There is however also a chance that the merger or acquisition fails, perhaps for regulatory reasons, creating large losses when the bets are funded by high leverage.

LOS 75-q

Discuss the benefits and drawbacks to fund of funds investing.

Fund of funds

A fund of funds (FOF) is created for both small and institutional investors who wish to invest in hedge funds. A FOF invests in a number of hedge funds allowing investors to have access to funds which normally require a large minimum size of investment.

Benefits of FOF

- **Retailing**. With the same money, an investor can access a large number of hedge funds instead of a single hedge fund.
- **Access**. An investor can be given access to funds that are already closed to new investments.
- **Diversification**. A FOF can invest in a number of hedge funds that are diversified across different markets.
- **Expertise**. Investors often choose a FOF because they believe that the managers of a FOF have expertise in selecting the hedge funds. The information about hedge funds is often difficult to obtain and managers are expected to have intimate knowledge of the hedge funds selected.
- **Due diligence process**. The due diligence process may be too time consuming for an institutional investor when selecting hedge funds, considering the secretive nature and complex investment strategies of the funds. The FOF will have performed the specialized due diligence on behalf of the investors.

Drawbacks of FOF

- **Fees**. Fees are charged by the manager and administrator of the FOF in addition to those charged by each of the hedge funds.
- **Performance**. The future performance of the FOF cannot be relied on due to the selection process of the individual hedge funds. They are mainly selected on the basis of past performance.

- **Diversification is a two-edged sword**. The expected return on a portfolio of hedge funds may be lower, but the fees remain high.

LOS 75-r

Discuss the leverage and unique risks of hedge funds.

Use of leverage

Arbitrage profits are generally very small so hedge funds use leverage to magnify the profits, but it also magnifies the losses. Hedge funds managers create leverage by:

- Borrowing external funds to invest, or selling short by more than the equity capital of the fund.
- Borrowing through brokerage margin accounts.
- Using derivatives that require posting margins rather than buying the cash securities out right.

The leverage ratio often runs from 2:1 to 10:1 or even to 100:1 depending upon the assets held and strategies used. There have been cases of much higher ratios: the Long Term Capital Management hedge fund at one time registered a ratio of 500:1.

Prudent hedge funds now determine the upper limit of permitted leverage but allow the managers considerable flexibility within the limit.

Unique risks

- **Liquidity risk**. Lack of liquidity in thin or illiquid markets is a known factor. But it may also appear under extreme market conditions, even in major markets where the presence of liquidity is normally expected.
- **Pricing risk**. Particular pricing risk occurs with over-the-counter complex securities. The broker-dealers might price them conservatively during periods of high volatility leading to a higher level of margin calls. This higher level of margin calls may cause a severe cash drain on the hedge funds.
- **Counterparty credit risk**. Hedge funds will face counterparty credit risk as they deal with brokers, dealers and other financial institutions when trading or buying on margin.
- **Settlement risk**. This risk is associated with the failure of any counterparty involved in the transaction to deliver the money or security at the settlement date. This risk is often higher in emerging or less developed markets.
- **Short squeeze risk**. The risk when short sellers must close their positions when prices are rising.
- **Financing squeeze**. Sometimes due to margin calls or marking positions, the funds are forced to raise additional cash when their borrowing capacity is reached. They might have to reduce their leveraged positions at a loss.

LOS 75-s

Discuss the performance of hedge funds, the biases present in hedge fund performance measurement, and **explain** the effect of survivorship bias on the reported return and risk measures for a hedge fund data base.

Performance of hedge funds

The performance of hedge funds creates a strong case for investing.

- The net returns after fees are usually higher than equity or bond market returns.
- The risk level, as measured by the volatility of returns, is lower than equity investments.
- The Sharpe ratio of hedge funds during 1996-2002 was higher than that of equity and bond investments.
- The correlation with conventional investments is generally low although still positive.

Net return and risk of hedge funds and conventional investments
January 1996 – September 2002, annualized

	HFR fund weighted composite	HFR fund of funds	EACM 100	CSFB/ Tremont	S&P 500	LehmanGov /Corp Bond Index
Annualized return	10.92%	8.29%	9.96%	11.55%	5.86%	7.24%
Standard deviation	8.59%	7.00%	4.93%	9.34%	17.49%	3.99%
Sharpe ratio	0.74	0.54	1.10	0.75	0.08	0.68
Correlation with HFR fund weighted composite	1.00	0.91	0.88	0.77	0.73	-0.11
Correlation with HFR fund of funds	0.91	1.00	0.94	0.91	0.56	-0.04
Correlation with EACM 100	0.88	0.94	1.00	0.88	0.52	0.01
Correlation with CSFB/Tremont	0.77	0.91	0.88	1.00	0.51	0.13
Correlation with S&P 500	0.73	0.56	0.52	0.51	1.00	-0.04
Correlation with Lehman Gov/Corp Bond Index	-0.11	-0.04	0.01	0.13	-0.04	1.00

CSFB/Tremont, EACM and HFR are hedge fund indexes

Source: Solnik, et al, 2004

The reported performance data of hedge funds is subject to a number of biases. Additionally since the hedge fund industry does not adhere to rigorous performance standards, unlike publicly listed funds, extreme caution must be taken when analyzing the performance data.

Survivorship bias

In the investment industry, only the successful funds present their performance track record in order to seek new investors. The unsuccessful ones tend to fade away and either not be reported or taken away from the data base. It is also often the case that managers only report the better performing ones from all the hedge funds under management. Additionally, hedge funds with high volatility of returns tend to disappear leaving the ones with strategies that have low volatility in the data base. There is no guarantee that these low volatility strategies will produce equivalent results in the future.

Other biases

- Hedge fund managers decide themselves whether to submit their funds for inclusion in a data base; they will not do so of they have a poor track record.
- Smoothed pricing – since some assets trade infrequently, estimates of fair value are made, and this tends to smooth out the price movements.
- Many managers use options or follow option-like strategies, so returns are not symmetric. Using standard deviation or Sharpe ratios may underestimate the risk of large losses.
- Past risk measures may not be a good indicator of future risk. Incentive fees and high water marks encourage managers to take higher risks if their recent performance has been poor.

LOS 75-t

Explain how the legal environment affects the valuation of closely held companies.

Closely held companies

Closely held companies are organized under different legal structures, such as tax-advantaged corporations, general partnerships, limited partnerships, and sole proprietorships. These different legal forms have different tax implications. Depending upon the jurisdiction, a variety of definitions of valuations is in use, such as intrinsic value, fundamental value and fair value, with different legal interpretations. There has been a lengthy argument for and against using projected cash flows as a basis of valuation versus using recently received cash flows. Valuation of closely held companies requires extensive knowledge of the law and the purpose of the valuation.

LOS 75-u

Describe alternative valuation methods for closely held companies and **distinguish** among the bases for the discounts and premiums for these companies.

Alternative valuation methods include:

The **cost approach**. This approach simply determines what it would cost to replace all the assets of the company.

The **comparables approach**. This approach looks at the valuation relative to a benchmark value. The benchmark value may be of similar companies that are actively traded, or the average or median value of such companies.

The **income approach**. Discounting the future economic stream of income is considered to be one of the most appropriate approaches to valuation.

Analysts often apply discounts or premiums to the valuation of closely held companies. The bases for the discounts and premium are as follows:

- **Marketability discount**. Closely held companies are as a rule not actively traded, therefore investors must be compensated for the illiquidity. The base of a comparable market value is firstly established, and then an appropriate marketability discount is applied.
- **Minority interest discount**. The base value is the value arising from ownership of all rights of control. The minority discount is then applied.
- **Control premium**. The base is the minority ownership, i.e. without rights of control, and then the control premium is applied.

LOS 75-v

Discuss distressed securities investing and the similarities between venture capital investing and distressed securities investing.

The definition of distressed securities is securities of companies who have filed for or are on the verge of filing for bankruptcy court protection, or who are seeking out-of-court debt restructuring. The valuation of this type of security is very complex requiring legal, financial and operational analysis.

Analysts must appreciate the differences in the positions between bondholders and stockholders in term of hierarchy of claims. Bondholders have a priority of claims over the stockholders. Distressed security investing may mean investing in the bonds of the company with a view to being an equity holder when the reorganization is completed.

There are similarities between distressed securities and venture capital investing:

- The investments are illiquid.
- They require a long time horizon to realize a profit.
- They require participation of investors in directing the companies.
- They offer possibilities of mispricing.
- They are laden with business volatilities and/or high leverage.

LOS 75-w

Discuss the role of commodities as a vehicle for investing in production and consumption.

Investing in commodities, such as crude oil, gold, grain, cattle or metals, is investing directly in the production and consumption of an economy instead of in the stocks of the companies who process them.

Indirect ways to invest in commodities include:

- Futures contracts.
- Bonds indexed on some commodity price.
- Stocks of the companies producing the commodity.

LOS 75-x

Discuss the motivation for investing in commodities, commodities derivatives, and commodity-linked securities.

The motivation for investing in commodities and commodities' derivatives are:

For passive investors:

- Risk diversification benefits, commodities' returns have negative correlation with stock and bond returns.
- Positive correlation with inflation, so they provide a good inflation hedge.

For active investors

In addition to the benefits described above for passive investors, active investors are also looking for the following:

- Superior performance in periods of economic growth.
- Superior returns due to an active timing strategy.

LOS 75-y

Discuss the sources of return on a collateralized commodity futures position.

A collateralized position in commodity futures is a long position in futures for a given amount of underlying exposure and simultaneously investing the same amount in government securities such as Treasury bills. The return therefore comes from the interest income from the Treasury bills plus the change in futures price.

The risk of managed futures can be achieved through:

- Diversification.
- Liquidity monitoring, because illiquid contracts might be included when the universe is large.
- Volatility dependent allocation, where weights in different contracts depend on the historical or implied volatility.
- Qualitative techniques such as VaR and stress tests.
- Risk budgeting on various aggregation levels to detect undesired concentration.
- Limits on leverage.
- Use of derivatives to eliminate unwanted currency risk.
- Care in model selection and avoiding biases.

The sole return from investing directly in commodities is from the price increase. Investors can now invest in securities, bonds and equity whose return is indexed to the price of commodities. By investing in these commodity-linked securities, an investor can achieve both a return from the increase in value of the securities due to the commodity link, plus income.

STUDY SESSION 18

Portfolio Management

Overview

At Level I, portfolio management only accounts for one Study Session and a guideline weighting of 5% of the examination questions. However the concepts covered here are an important foundation for both Level II and especially Level III when the syllabus centres on portfolio management.

This Study Session starts with a review of the relationship between risk and return and the components of risk and return. The next section moves on to client policy statements and setting risk and return objectives. These topics are revisited many times in Level III. In the last two Reading Assignments, candidates are introduced to modern portfolio theory including how to structure portfolios to obtain the optimal risk and return trade-off. This is followed by an introduction to capital market theory and the Capital Asset Pricing Model (CAPM) which formally links the return of a security or portfolio to its systematic or beta risk.

Reading Assignments

Investment Analysis and Portfolio Management, 7th edition, Frank K. Reilly and Keith C. Brown (South-Western, 2003)
76. "The Investment Setting," Ch. 1, pp. 16–29
77. "The Asset Allocation Decision," Ch. 2
78. "An Introduction to Portfolio Management," Ch. 7
79. "An Introduction to Asset Pricing Models," Ch. 8, pp. 237–256

76 The Investment Setting

Learning Outcome Statements (LOS)

76-a	**Explain** the concept of required rate of return and **discuss** the components of an investor's required rate of return.
76-b	**Differentiate** between the real risk-free rate of return and the nominal risk-free rate of return and compute both return measures.
76-c	**Explain** the risk premium and the associated fundamental sources of risk, and why these sources are complementary to systematic risk.
76-d	**Define** the security market line and **discuss** the factors that cause movements along, changes in the slope of, and shifts of the security market line.

Introduction

This Reading Assignment looks at basic concepts and how risk and return are related in investment. Investors' required returns are derived from the real risk-free rate, plus an inflation premium and a premium for taking on risk. We also consider the difference between risks that can be diversified away in a portfolio and systematic risk which cannot be diversified. The security market line (SML) graphically links the required return to the systematic risk and candidates need to know which factors will lead to a move in the SML.

LOS 76-a

Explain the concept of required rate of return and **discuss** the components of an investor's required rate of return.

LOS 76-b

Differentiate between the real risk-free rate of return and the nominal risk-free rate of return and compute both return measures.

Required rate of return

The **required rate of return** is the minimum rate of return an investor needs to receive to compensate for deferring consumption. Different assets provide a wide range of different returns, and returns change significantly over time.

The three components of the required rate of return are (1) the real risk-free rate (2) the expected rate of inflation and (3) the risk premium. These are defined as follows:

1 **Real risk-free rate** (RRFR) – this is the interest rate assuming there is no inflation and there is certainty regarding receipt of cash flows. It is the pure time value of money. There is a positive relationship between this and the real growth rate in the economy since the opportunities to use money are greater in an expanding economy.

2 **Expected rate of inflation** – this is linked to the nominal risk-free rate (NRFR) as follows:

Equation 76-1

$$\text{RRFR} = \frac{(1 + \text{NRFR})}{(1 + \text{Exp. rate of inflation})} - 1$$

The NRFR is a stated money market yield such as the return on Treasury bills in the U.S.

Example 76-1 Nominal and real rates of return

If the nominal rate of return on T-bills is 6%, and the rate of inflation is 2%, then the RRFR is given by

$$\text{RRFR} = \frac{(1 + \text{NRFR})}{(1 + \text{Exp. rate of inflation})} - 1 = \frac{1.06}{1.02} - 1 = 0.0392 \text{ or } 3.92\%$$

The NRFR will also be affected by the supply and demand for capital e.g. a tight monetary policy will in the short run reduce the supply of capital and increase interest rates.

LOS 76-c

Explain the risk premium and the associated fundamental sources of risk, and why these sources are complementary to systematic risk.

LOS 76-d

Define the security market line and discuss the factors that cause movements along, changes in the slope of, and shifts of the security market line.

3 **Risk premium** - this is the excess return that must be paid to compensate for the uncertainty of the return being achieved. Different *sources* of risk, which are called fundamental sources of risk, associated with an investment include:

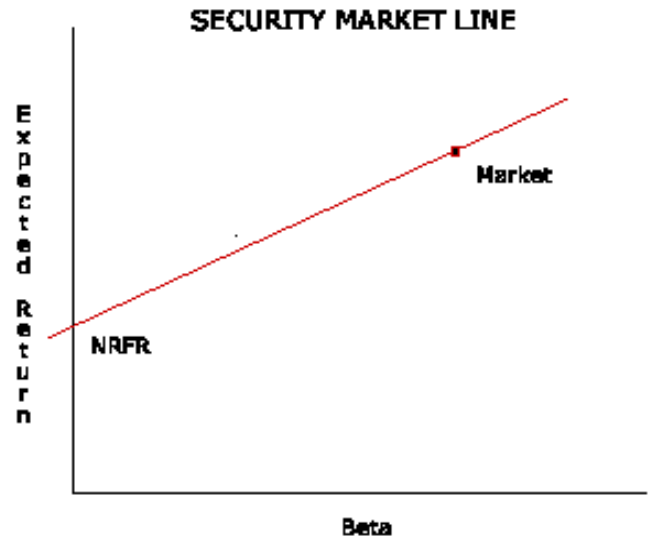
- business risk – the uncertainty of a firm's income flows due to the firm's type of business.
- financial risk – the uncertainty caused by the way a firm finances its activities.
- liquidity risk – the uncertainty over how long it will take to liquidate an investment and the price that will be received.
- exchange rate risk – the uncertainty of return created by buying a security in a foreign currency.
- country risk – this incorporates both political risk and the risk of a major change in the economic environment in a country.

Total risk is measured as the standard deviation or variance of returns, and is a function of the fundamental sources of risk shown above. Other measures of risk are the coefficient of variation of returns and the covariance of returns with the market return (beta).

Systematic risk

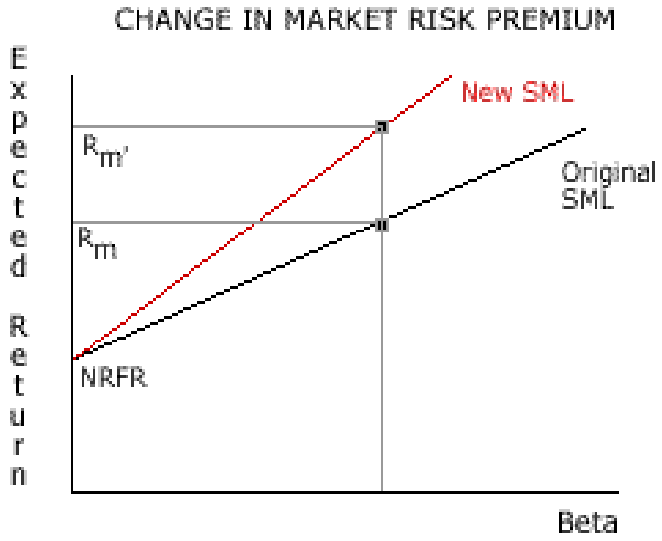
The risk premium of an asset can be expressed as a function of its market risk, this is **systematic risk**. Systematic risk has been shown to be linked to an asset's fundamental risk, and the two measures are viewed as being complementary. In some cases high business risk will lead to high systematic risk. On the other hand, some fundamental risk factors for an asset may not be closely related to the market's risk, resulting in the asset having a high standard deviation of returns but low systematic risk.

The **security market line** (SML) measures expected return relative to systematic risk (represented by beta).

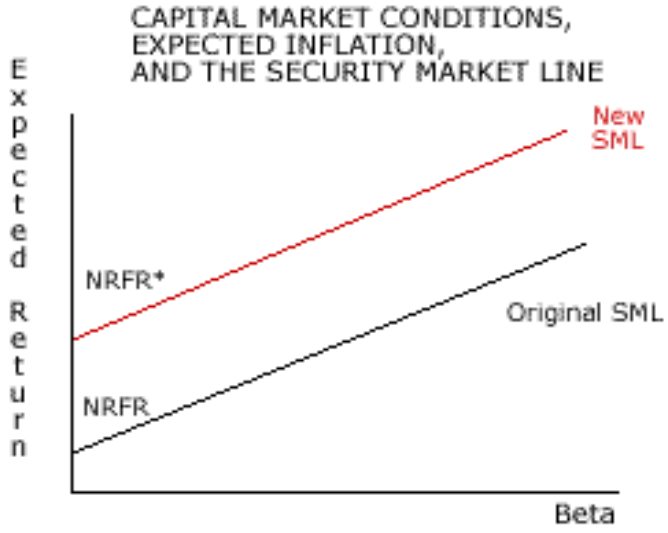


Investors select investments at different points along the line depending on their assessment of the risk of the investment.

A **change in slope of the SML** indicates that investors are requiring a higher, or lower, reward for taking a market risk. This means that the risk premium of the market has changed.



A **shift in the SML** indicates that there has been a change in a factor that affects all investments such as growth or inflation expectations.



77 The Asset Allocation Decision

Learning Outcome Statements (LOS)

77-a	**Describe** the steps in the portfolio management process and **explain** the need for a policy statement.
77-b	**Explain** why investment objectives should be expressed in terms of risk and return and **list** the factors that may affect an investor's risk tolerance.
77-c	**Describe** the return objectives of capital preservation, capital appreciation, current income, and total return and **describe** the investment constraints of liquidity, time horizon, tax concerns, legal and regulatory factors, and unique needs and preferences.
77-d	**Describe** the importance of asset allocation, in terms of the percentage of a portfolio's return that can be explained by the target asset allocation and list reasons for the differences in the average asset allocation among citizens of different countries.

Introduction

Asset allocation is the process of deciding how to divide an investor's assets between different countries and asset classes. The asset allocation decision is extremely important since it, rather than stock selection, is the key factor in determining the performance of a portfolio. Studies show that the asset allocation policy accounts for about 90% of funds' performance. Candidates need to understand how determining a client's objectives and constraints and the subsequent asset allocation decision fit in to the overall investment process.

Asset allocation for individual investors

Risk and return requirements will depend on which *phase of the life cycle* the individual is in, namely:

- *Accumulation*. Individuals are using income for their immediate needs, such as house purchases, but are also saving for longer-term commitments such as children's schooling. Net worth will be low but time horizon is long so investors are often looking for high-risk investments.
- *Consolidation*. Earnings are higher than expenses so saving is usually for retirement. There is a medium to long-term time horizon so moderate risk investments are appropriate.
- *Spending*. Usually when individuals retire, it indicates a move towards safer investments but still a need to maintain the *real* value of capital so equity investments are still a component of their investment portfolio.
- *Gifting*. Any excess assets are used to set up charitable trusts, or to assist family and friends.

LOS 77-a

Describe the steps in the portfolio management process and **explain** the need for a policy statement.

Portfolio management process

Asset allocation is only one part of the portfolio management process. The portfolio management process can be broken down into four steps:

1. *Formulate a policy statement* that includes the investment objectives and constraints for each client.
2. *Analyze current and expected economic, political and social conditions.* Investment strategy is dynamic; it reflects changes in the economy, politics, financial markets etc.
3. *Construct the portfolio*. Meet the investor's requirements with the minimum level of risk.
4. *Monitor the portfolio and make adjustments*. Changes will made to reflect the changes in market conditions and any changes in the policy statement. Also portfolio performance needs to be evaluated.

The policy statement is needed because it:

- Allows the investor to formulate his expectations and requirements which will help set realistic financial goals. This process will help the investor understand the characteristics of financial markets and the risks of investing in them.
- Helps the portfolio manager construct a portfolio which will meet the client's requirements.
- Provides information needed to judge the portfolio manager's performance. Typically the policy statement will set a **benchmark**, which will reflect the objectives of the client and which performance can be measured against.

LOS 77-b

Explain why investment objectives should be expressed in terms of risk and return and **list** the factors that may affect an investor's risk tolerance.

Objectives

The main objectives are concerned with

1. Return requirements
2. Risk tolerance

If an investor expresses his expectations only in terms of returns, there is a danger that a high target return leads to a portfolio manager investing in higher risk assets, and the risk may not be acceptable to the client.

The factors that will influence an individual's risk tolerance include

- Psychological make-up
- Insurance cover
- Cash reserves
- Family situation including number of dependents
- Age and time horizon
- Current net worth and income expectations

LOS 77-c

Describe the return objectives of capital preservation, capital appreciation, current income, and total return and **describe** the investment constraints of liquidity, time horizon, tax concerns, legal and regulatory factors, and unique needs and preferences.

Investor return objectives

For private investors, return objectives may be specified in terms such as capital preservation, capital appreciation, current income and total return.

Capital preservation - this is generally for risk-averse investors or short-term funds who want to minimize the risk of loss, usually in real terms. This means they want to achieve a return that is equal to or above the inflation rate.

Capital appreciation – this is usually for longer-term investors where growth in value of the assets in real terms is the priority, perhaps to build a retirement fund. Under this strategy growth usually comes from capital gains.

Current income – this is often for investors who are focusing on income rather than capital gains. Perhaps income from the portfolio is needed to pay for living expenses.

Total return – this is usually for long-term investors and they are looking for growth in value of a portfolio to come from both capital gains and reinvestment of income.

In addition to setting out the investor's objectives the policy statement should include constraints that impact on the investments made in the portfolio. These can be put into five categories:

Constraints

1. Liquidity
2. Time horizon
3. Tax
4. Legal and regulatory factors
5. Unique needs and preferences

Example 77-1 Individual investor constraints

An individual investor needs to consider the follow types of issues:

Liquidity. Short-term requirements for major expenses including paying tax bills, the potential loss of employment, the possibility of unexpected bills or medical expenses.

Time horizon. Often reflects the age of the investor and position in the life cycle. Longer time horizons generally imply greater risk tolerance and vice versa.

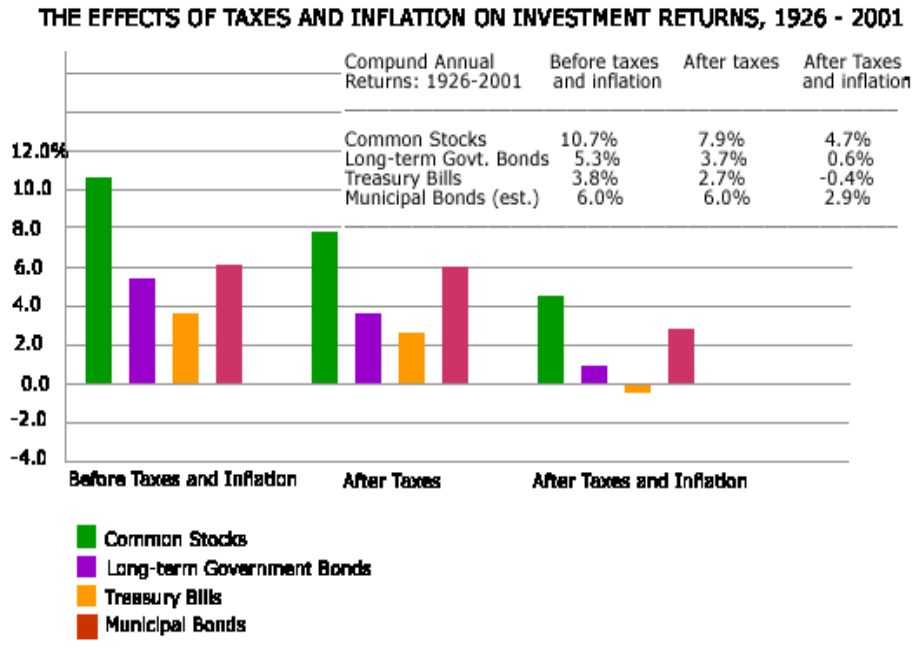
Tax. Consider the investor's liabilities to capital gains and income taxes.

Legal. Consider whether the funds are in a trust, the role of fiduciary, and securities trading regulations.

Unique needs and preferences. Include socially conscious investing, or restricting investments based on religious beliefs.

Data show that equities are the only financial asset that performs significantly better than inflation over the long term, this is after adjusting for taxation. Although equity performance is more volatile, it is recommended that if the investor's objectives include capital appreciation or capital protection over a long time period, equities should be a major component of the portfolio.

The following chart illustrates the returns from different asset classes and the effect of taxes and inflation on returns.



LOS 77-d

Describe the importance of asset allocation, in terms of the percentage of a portfolio's return that can be explained by the target asset allocation and list reasons for the differences in the average asset allocation among citizens of different countries.

Importance of asset allocation

Several studies have been done to assess the importance of asset allocation. Studies made in the 1970s through to the 1990s consistently showed that the target asset allocation policy accounts for about 90% of funds' performance. Using time series regression the R squared between fund returns and target asset allocation returns were around 0.90, so for a single fund 90% of the variation in returns is explained by the market return.

The process of asset allocation is similar across different countries but the percentage allocated to different asset classes is not consistent. The example in the source text was the asset allocation of pension funds, where the percentage allocated to equities in 1998 ranged from 8% to 79%.

The reasons for differences in asset allocation are

Social and demographic issues – these include the average age of investors and cultural preferences for risky or conservative investments.

Economic environment – inflation expectations are particularly important, high inflation favors investment in equities.

Political issues – regulations may limit investment in certain assets (these often apply to insurance companies and pension funds).

Tax rates may make certain asset classes more attractive.

78 An Introduction to Portfolio Management

Learning Outcome Statements (LOS)

78-a	**Define** risk aversion and **cite** evidence that suggests that individuals are generally risk averse.
78-b	**List** the assumptions about individuals' investment behaviour of the Markowitz Portfolio Theory.
78-c	**Compute** expected return for an individual investment and for a portfolio.
78-d	**Compute** the variance and standard deviation for an individual investment.
78-e	**Compute** the covariance of rates of return, and **show** how it is related to the correlation coefficient.
78-f	**List** the components of the portfolio standard deviation formula, and **explain** which component is most important to consider when adding an investment to a portfolio.
78-g	**Describe** the efficient frontier and **explain** its implications for an investor willing to assume more risk.
78-h	**Define** optimal portfolio and **show** how each investor may have a different optimal portfolio.

Introduction

Now we move on to analyzing risk and return in more detail, not just for individual securities but also for portfolios. Candidates should be comfortable using the equations for computing portfolio return and risk (variance or standard deviation), covariance and correlation. This leads on to studying the Markowitz efficient frontier which determines which portfolios offer an investor the best trade-off between risk and return. This in turn paves the way for the capital market theory covered in the next Reading Assignment.

LOS 78-a

Define risk aversion and **cite** evidence that suggests that individuals are generally risk averse.

Risk aversion

Modern portfolio theory assumes that investors are risk averse and given the choice of investing in two assets with the same expected rates of return they will invest in the one with the lowest risk. This means that there will be a positive relationship between return and risk.

Evidence of risk aversion

Insurance – people are willing to pay a premium to avoid the risk of a future loss.

Bond pricing – investors who hold bonds with higher credit risk require a higher rate of return.

However there is contrary evidence that people are willing to pay (have a negative expected return) to take on risk if there is a chance of a big gain. An example of this is people buying lottery tickets. In these cases we are usually looking at small amounts of money being invested.

LOS 78-b

List the assumptions about individuals' investment behaviour of the Markowitz Portfolio Theory.

Markowitz developed models to measure portfolio risk which led to the importance of portfolio diversification being recognized. There are several underlying assumptions behind the models.

- Investors look at each alternative investment as being represented by a probability distribution of expected return over a holding period.
- Investors maximize one-period utility; their utility curves demonstrate diminishing marginal utility of wealth.
- Investors estimate risk based on variability of expected returns. Investors base decisions solely on risk and return considerations.
- For a given level of risk, investors prefer high returns to low returns. For a given level of expected return, investors prefer low risk to high risk.

An asset or portfolio is considered to be **efficient** if no other asset or portfolio has a better risk/return trade-off.

We are going to use variance, or standard deviation, as the measure of risk.

LOS 78-c

Compute expected return for an individual investment and for a portfolio.

Expected return of a portfolio

Expected portfolio return = weighted average of expected returns of securities in the portfolio

Equation 78-1

$$E(R_{port}) = \sum_{i=1}^{n} w_i E(R_i)$$

where

w_i = percent of portfolio in asset i

$E(R_i)$ = expected rate of return of asset i

Example 78-1 Expected portfolio return

Two securities have expected returns of 8% and 12% respectively. A portfolio is invested with 40% in the first security and 60% in the second. The expected portfolio return is given by:

$$\begin{aligned} &E(R_{port}) \\ &= w_1 E(R_1) + w_2 E(R_2) \\ &= (0.40 \times 8\%) + (0.60 \times 12\%) \\ &= 10.4\% \end{aligned}$$

LOS 78-d

Compute the variance and standard deviation for an individual investment.

Risk of an individual investment

Although there are various risk measures including the range of returns and semi-variance risk, here we are defining risk as **variance** (σ^2) or **standard deviation** (σ).

Equation 78-2

$$\sigma^2 = \sum_{i=1}^{n} [R_i - E(R_i)]^2 P_i$$

where

P_i = probability of return R_i occurring for asset i

$E(R_i)$ = expected rate of return of asset i

Example 78-2 Risk of an individual investment

The possible rates of return for an asset are shown in the table below:

Possible rate of return	Probability
4%	0.25
10%	0.50
16%	0.25

The expected return is given by:

$$E(R_{port}) = 0.25(4\%) + 0.50(10\%) + 0.25(16\%) = 10\%$$

The variance is given by:

$$\sigma^2 = \sum_{i=1}^{n} [R_i - E(R_i)]^2 P_i = (4\% - 10\%)^2 0.25 + (10\% - 10\%)^2 0.50 + (16\% - 10\%)^2 0.25 = 0.001$$

The standard deviation is 4.24%

LOS 78-e

Compute the covariance of rates of return, and **show** how it is related to the correlation coefficient.

Risk of a portfolio of assets

Risks are not additive, so when calculating the risk of a portfolio of assets we need further information. In addition to the standard deviation of the individual assets we also need to know the **covariances**, which measures of how closely two assets move together relative to their mean values.

Covariance is 'standardized' to give the **correlation coefficient**. The correlation coefficient lies between −1 and +1. The correlation coefficient, r_{xy} between two variables x and y is given by

Equation 78-3

$$r_{xy} = \frac{cov_{xy}}{\sigma_x \sigma_y}$$

where

cov_{xy}	=	covariance between the returns of x and y
σ_x	=	standard deviation of returns of x
σ_y	=	standard deviation of returns of y

If r_{xy} is +1, this is perfect positive correlation. It means that there is a perfect linear relationship between the returns from the two assets. The stocks move together in a perfectly linear manner.

If r_{xy} is 0, the returns are not linearly correlated.

If r_{xy} is –1, this is perfect negative correlation. If one return is above its mean then the other will be below the mean by a comparable amount.

Example 78-3 Correlation

If the standard deviations of the returns of two assets are 5% and 10%, and the covariance of the returns is 18 then the correlation coefficient is

$$r_{xy} = \frac{cov_{xy}}{\sigma_x \sigma_y} = \frac{18}{5 \times 10} = 0.36$$

Note that in the examples standard deviations are expressed in percentage terms, so 5%, rather that 0.05 is used.

This means that the two assets have a moderately low positive correlation.

LOS 78-f

List the components of the portfolio standard deviation formula, and **explain** which component is most important to consider when adding an investment to a portfolio.

Standard deviation of a portfolio

Markowitz provided the general formula for portfolio risk as follows:

Equation 78-4

$$\sigma^2_{port} = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} w_i w_j \, cov_{ij}$$

where

σ_i	=	standard deviation of returns of asset i
σ_j	=	standard deviation of returns of asset j
w_i	=	weighting of asset i in the portfolio
cov_{ij}	=	covariance between the returns of assets i and j

Note – the LOS does not require candidates to calculate portfolio standard deviation although candidates do need to know the components of the formula.

The formula shows that if a new asset is added to a portfolio, the total portfolio risk will *strongly reflect the covariance of this asset with the other assets in the portfolio*. The variance of returns of the individual asset will be a less important factor.

For a two-asset portfolio the equation that gives the risk of the portfolio is shown below:

Equation 78-5

$$\sigma^2_{port} = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 r_{12} w_1 w_2 \sigma_1 \sigma_2$$

(replacing cov_{12} with $r_{12}\sigma_1\sigma_2$)

Example 78-4 Portfolio risk

The standard deviations of the returns of two securities are 5% and 10%, with expected returns of 8% and 12% respectively. A portfolio is invested with 40% in the first security and 60% in the second security. Looking at the three cases where the correlation coefficient between the returns of the assets are (1) 1.0 (2) 0 and (3) −1.0, the expected return and standard deviation of the combined portfolio are calculated as follows, using Equations 78-1 and 78-5.

(1)

$$E(R_{port}) = w_1 E(R_1) + w_2 E(R_2) = (0.40 \times 8\%) + (0.60 \times 12\%) = 10.4\%$$

$$\sigma_{port}^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2$$

$$\sigma_{port} = w_1\sigma_1 + w_2\sigma_2 = (0.40 \times 5\%) + (0.60 \times 10\%) = 8.0\%$$

When the correlation is 1, the expected return is 10.4% and the standard deviation of returns is 8.0%.

(2)

$$\sigma_{port}^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 = 0.0004 + 0.0036 = 0.004$$

$$E(R_{port}) = 10.4\% \qquad \sigma_{port} = 6.3\%$$

When the correlation is 0, the expected return is 10.4% and the standard deviation of returns is 6.3%.

(3)

$$E(R_{port}) = 10.4\%$$

$$\sigma_{port}^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 - 2w_1w_2\sigma_1\sigma_2$$

$$\sigma_{port} = |w_1\sigma_1 - w_2\sigma_2| = |(0.40 \times 5\%) - (0.60 \times 10\%)| = 4.0\%$$

When the correlation is −1, the expected return is 10.4% and the standard deviation of returns is 4.0%.

Example 78-4 shows that:

- The lower the correlation between two assets the lower the risk of the portfolio (other things being equal).
- If the correlation between assets is low, or negative, then portfolios can be selected so that the risk of the portfolio is less than the risk of either asset.
- If the correlation is –1, risk can be eliminated if the assets are weighted so that:

$w_1\sigma_1 - w_2\sigma_2 = 0$.

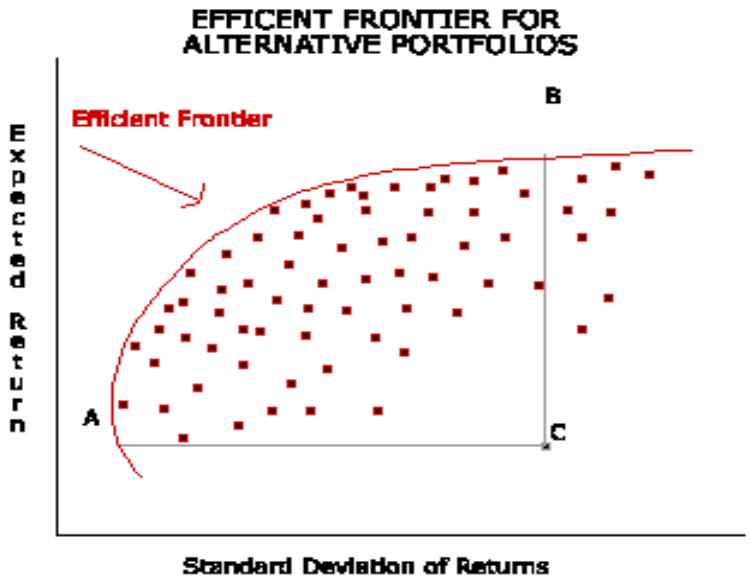
LOS 78-g

Describe the efficient frontier and **explain** its implications for an investor willing to assume more risk.

The efficient frontier

Continuing this analysis we can see that for a multiple asset portfolio, if alternative portfolios were plotted on a graph with expected returns measured against risk (standard deviation) then the possible portfolios would fall on and under a curve. This curve is the **efficient frontier**. This is the set of portfolios that offer the maximum rate of return for any given level of risk.

If the expected returns, standard deviations of returns and covariance between returns for a set of assets are known it is possible to construct an efficient frontier.



Portfolios A and C have the same level of expected return but A is lower risk, therefore portfolio A is more attractive then portfolio C. Similarly portfolios B and C have the same level of risk, but B offers a higher expected return; therefore portfolio B is more attractive. Portfolios A and B both lie on the efficient frontier; for their levels of risk they offer the highest return.

The curve will flatten as risk increases; this is because adding more risk leads to diminishing levels of additional return.

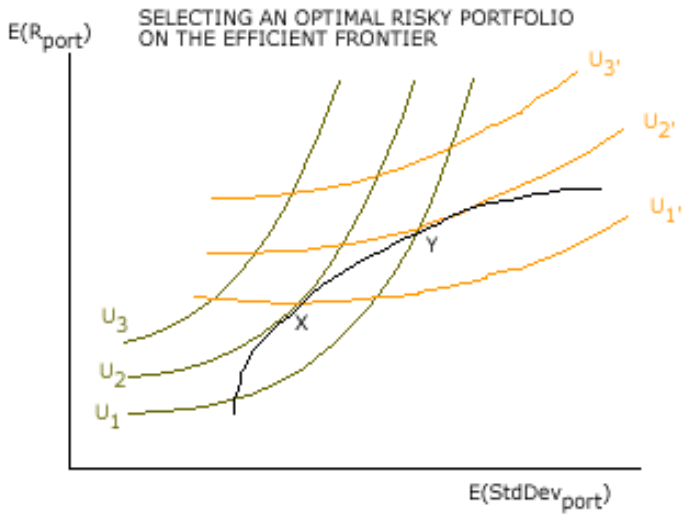
LOS 78-h

Define optimal portfolio and **show** how each investor may have a different optimal portfolio.

In order to decide which portfolio on the efficient frontier meets each investor's objectives we can consider the investor's utility curves.

Utility curves

Each investor has a set of utility curves (an infinite number of 'parallel' curves) that represent the trade-off between risk and return. Each point on a single curve is equally attractive to the investor. The steeper the utility curves the more risk averse the investor. The **optimal portfolio** for each investor will be the point where the utility curves are tangential to the efficient frontier.



79 An Introduction to Asset Pricing Models

Learning Outcome Statements (LOS)

79-a	**List** the assumptions of the capital market theory.
79-b	**Explain** what happens to the expected return, the standard deviation of returns, and possible risk-return combinations when a risk-free asset is combined with a portfolio of risky assets.
79-c	**Identify** the market portfolio and **describe** the role of the market portfolio in the formation of the capital market line (CML).
79-d	**Define** systematic and unsystematic risk and **explain** why an investor should not expect to receive additional return for assuming unsystematic risk.
79-e	**Describe** the capital asset pricing model, **diagram** the security market line (SML), and **define** beta.
79-f	**Calculate** and **interpret** using the SML, the expected return on a security and **evaluate** whether the security is undervalued, overvalued, or properly valued.
79-g	**Explain** how the systematic risk of an asset is estimated using the characteristic line.

Introduction

This Reading Assignment focuses on the Capital Asset Pricing Model (CAPM). This is a model for pricing risky assets and links the required return to the systematic risk of the asset. Candidates should know the assumptions made by capital market theory, and understand the concepts of a risk-free asset and market portfolio representing a portfolio of risky assets. They should also be prepared to calculate required rates of return using CAPM which can be compared to expected rates of return to decide whether an asset is over or undervalued.

LOS 79-a

List the assumptions of the capital market theory.

Capital Market Theory builds on the foundation of Markowitz's work on optimal portfolios. The assumptions made are the previous assumptions in Reading 78, plus additional ones:

- All investors want to invest in points on Markowitz's efficient frontier and the specific portfolio will depend on the individual investor's utility function.
- Investors can borrow or lend at the risk-free rate. However using a higher borrowing rate does not significantly change the results.
- All investors have the same return expectations, in terms of the same probability distributions for expected future returns.
- All investors have the same time horizon, e.g. one year.
- All investments are infinitely divisible, e.g. there is no minimum unit size for a holding in an asset.
- There is no inflation or change in interest rates, or any inflation is fully anticipated.
- There are no taxes or transaction costs.
- Capital markets are in equilibrium. Initially all investments are correctly priced in line with their levels of risk.

Although some of the assumptions look unrealistic, relaxing many of the assumptions does not have a major impact on the model. If theories and models based on these assumptions can help explain asset pricing and rates of return then it is useful, despite the assumptions being stringent.

LOS 79-b

Explain what happens to the expected return, the standard deviation of returns, and possible risk-return combinations when a risk-free asset is combined with a portfolio of risky assets.

LOS 79-c

Identify the market portfolio and **describe** the role of the market portfolio in the formation of the capital market line (CML).

We now look at the impact on the efficient frontier if an investor can purchase a **risk-free asset**. The risk-free asset has zero variance and the rate of return is the NRFR, often labeled the RFR, which is discussed in Reading 76. The correlation and covariance between the risk-free asset and any other asset will be 0.

A portfolio that combines the risk-free asset with a portfolio will have an expected return and risk given by:

Equation 79-1

$$E(R_{port}) = w_{RF}(RFR) + (1 - w_{RF})E(R_i)$$

where

w_{RF} = proportion of the portfolio invested in the risk-free asset

$E(R_i)$ = expected return from portfolio i

Using Equation 78-5

$$\sigma^2_{port} = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2r_{12}w_1w_2\sigma_1\sigma_2$$

We can label the risk-free asset as the first asset and the second asset as portfolio i. We know that σ_{RF} is zero and the correlation between the risk-free asset and any other asset is zero, therefore:

Equation 79-2

$$\sigma_{port} = (1 - w_{RF})\sigma_i$$

If we now look at the risky asset as a point on the efficient frontier and we pick the point, M, where the line from the risk-free asset to M is tangential to the efficient frontier, we have a set of points representing portfolios described by the equations below:

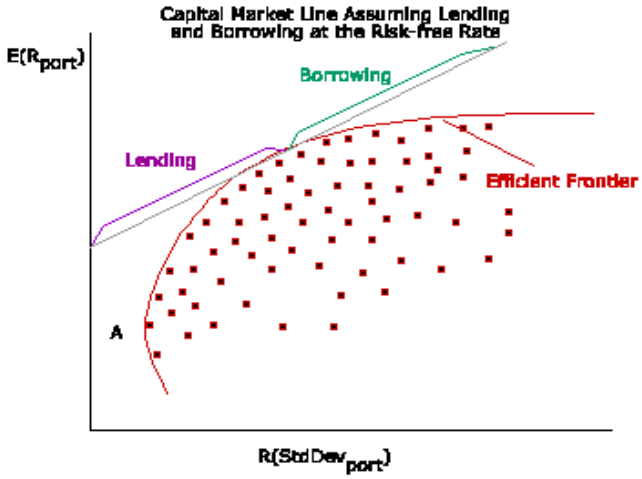
Equation 79-3

$$E(R_{port}) = w_{RF}(RFR) + (1 - w_{RF})E(R_M)$$

Equation 79-4

$$\sigma_{port} = (1 - w_{RF})\sigma_M$$

A new set of optimal portfolios will lie on this line. The line is called the **capital market line** (CML) and the point, M, where the tangent touches the curve is the **market portfolio**. All portfolios on this line will be a combination of the risk-free asset (or borrowing the risk-free asset) and the market portfolio. Theoretically the market portfolio must consist of a completely diversified portfolio which includes all risky assets.



Example 79-1 The Capital Market Line

A portfolio invests 30% in the risk-free asset which earns a return of 5%. The remainder is invested in a market portfolio which has an expected return of 12%, the market portfolio has a standard deviation of returns of 15%.

The expected return of the portfolio is, using Equation 79-3

$$E(R_{port}) = w_{RF}(RFR) + (1 - w_{RF})E(R_M) = (0.30 \times 5\%) + (0.70 \times 12\%) = 9.9\%$$

The standard deviation is, using Equation 79-4

$$\sigma_{port} = (1 - w_{RF})\sigma_M = 0.70 \times 15\% = 10.5\%$$

Another portfolio is more aggressive and has borrowed 30% of the original portfolio value at the risk-free rate.

The expected return for this portfolio is

$$E(R_{port}) = w_{RF}(RFR) + (1 - w_{RF})E(R_M) = (-0.30 \times 5\%) + (1.3 \times 12\%) = 14.1\%$$

The standard deviation is

$$\sigma_{port} = (1 - w_{RF})\sigma_M = 1.30 \times 15\% = 19.5\%$$

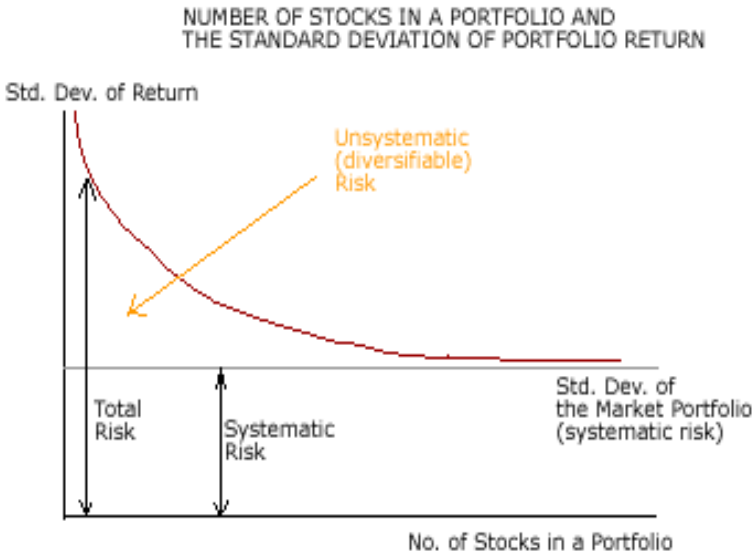
We can see that leveraging the portfolio by borrowing has increased the expected return and correspondingly increased the risk.

LOS 79-d

Define systematic and unsystematic risk and **explain** why an investor should not expect to receive additional return for assuming unsystematic risk.

Systematic and unsystematic risk

Next we consider diversification within a market and how many securities are needed to completely diversify a portfolio. Investing in only a relatively small number of stocks has a dramatic effect on reducing variance. Investment in 12 to 18 randomly selected stocks is sufficient to achieve 90% of the maximum benefits of diversification. Eventually, by adding stocks, variability will be reduced to that of the market. So, for example, if you are investing in U.S. equities, you cannot reduce variance below that of the US equity market itself. The market risk that you cannot diversify away is called **systematic risk**.



Variance = Systematic Variance + Unsystematic Variance

where

Systematic risk is market risk and cannot be diversified away.

Unsystematic risk is specific risk which can be eliminated by diversification.

Investors should not expect a higher return for taking on unsystematic risk because this can be diversified away by other holdings in the portfolio. Therefore an investor should expect a return which is dependent on the market risk of an asset or portfolio, which is the covariance of the asset with the market portfolio.

LOS 79-e

Describe the capital asset pricing model, **diagram** the security market line (SML), and **define** beta.

The Capital Asset Pricing Model (CAPM)

CAPM is concerned with measuring risk as systematic risk since it is assumed that unsystematic risk can be diversified away.

Beta is the measure of a security's volatility in terms of market risk; it is a standardized measure of risk since it compares the covariance of a stock to the variance of the market. For a stock x and market M it is given by:

Equation 79-5

$$\beta_x = \frac{\text{cov}(x, M)}{\text{var } M}$$

where

cov (x,M)	=	covariance between the stock's return and the market return
var M	=	variance of the market portfolio

The beta of the market is 1. If an asset has higher systematic risk than the market itself, the beta will be greater than 1, if lower than the market it will be less than 1. The beta of the risk-free asset, which has covariance of zero with the market, is 0.

The expected return from a security is linked to its beta by the equation

Equation 79-6

$$E(R_i) = R_f + \beta_i (R_M - R_f)$$

where

R_f	=	RFR, the risk-free rate
$R_M - R_f$	=	market return less the risk-free rate, which is the **market risk premium**
β_i	=	beta of asset i

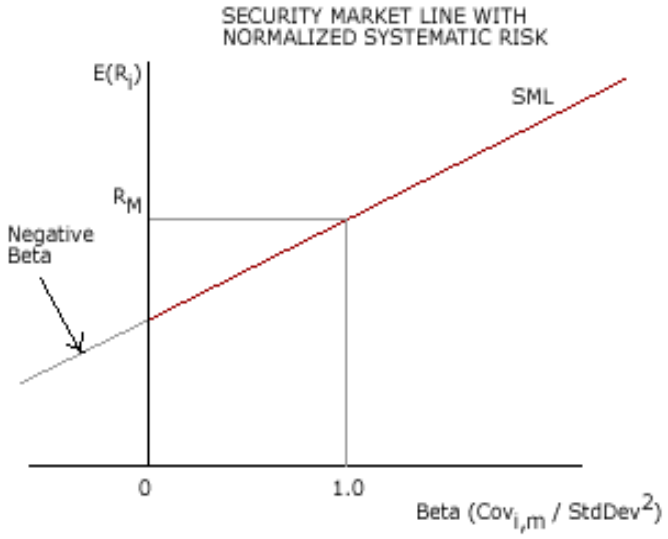
This is called the **Capital Asset Pricing Model**.

Example 79-2 Capital Asset Pricing Model

The return on the market portfolio is expected to be 15% and the risk-free rate 6%. If a stock has a beta of 1.5 then the expected return from the stock (or the required rate of return) is

$$R_x = R_f + \beta(R_M - R_f) = 6\% + 1.5(15\% - 6\%) = 19.5\%$$

The Security Market Line (SML) relates the expected return on stock to the risk-free rate (R_f), the market premium and the beta of the stock.



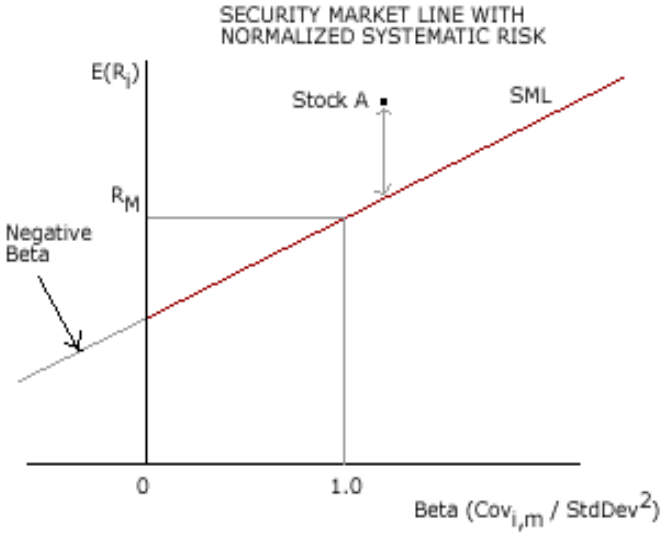
LOS 79-f

Calculate and **interpret** using the SML, the expected return on a security and **evaluate** whether the security is undervalued, overvalued, or properly valued..

All stocks should be in equilibrium and lie on the SML, but short term they may be incorrectly priced and lie above or below the line; this provides an opportunity to identify mispriced stocks.

Example 79-3 Security Market Line

An analyst estimates that the return from the same stock (Stock A) in Example 79-2 is 20% (including capital gain and dividend). Plotting the stock against the SML we can see that the estimated return is higher then the required return, so it is above the SML. Assuming that the analyst is correct then the stock is undervalued.



LOS 79-g

Explain how the systematic risk of an asset is estimated using the characteristic line.

Beta

Beta can be estimated using regression analysis to plot the **characteristic line**. This is the line of best fit through a scatter plot of points with the Y-axis being the return from the security and the X-axis the return from the market. For asset i,

Equation 79-7

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + \varepsilon$$

where

$R_{i,t}$ = rate of return for asset i during period t

$R_{M,t}$ = rate of return for the market portfolio during period t

α_i = intercept of the regression

β_i = beta of asset i

ε_i = random error term

There is no single correct time period to use for the regression; there is a trade off between a long time period being used to have a large number of observations, and a short time period which is more relevant to the current beta.

Terminology

Appraisal – for real estate, the process of estimating the current market value of a property.
Comparative sales approach – the value of a real estate is , at the most, the cost of the land and constructing the building at current prices.
Income approach – the value of real estate is the present value of it future income.
Market capitalization rate – divide a property's net operating income by the appropriate market capitalization rate to arrive at an estimate for its current market value. It reflects the rate of return required by investors in such a property.
Positive leverage – the return from a real estate investment is higher than the cost of debt, an investor will achieve a higher rate of return if he/she uses leverage to purchase the property.
Real Estate Investment Trust (REIT) – a closed-end investment company that invests in real estate and mortgages on real estate.
Real Estate Limited Partnership (RELP) – a real estate syndicate that invests in different types of real estate.
Seed financing – venture capital provided for product development and market research, the product is still at the 'idea' stage.
Start-up financing – venture capital provided for early stage product development and initial marketing.
First-stage financing – venture capital provided for initial commercial manufacture and sales.
Mezzanine (or bridge) financing – venture capital provided for a company that expects to go public in the near future.
Turnarounds – capital provided to restructure a company that has problems.
Leveraged buyouts (LBOs) – capital to fund a management group (a management buyout) or other investors who wish to purchase a business or company.
Investment company – a company that sell its own shares and uses the proceeds to buy stocks, bonds or other financial instruments.
Closed-end investment company – an investment company that issues a fixed number of shares, the shares are then traded in the secondary market.
Open-end investment company – a company that offers new shares to investors and redeems shares continuously.
Mutual fund – an open-end investment company.
No-load fund – shares are sold at net asset value, with no sales charge added.
Load fund – a fund that makes an initial sales charge, so the offering price is the net asset value plus a load.

Appendix A:

Exhibits

Exhibit 1: Accounting Statements

Exhibit 2: Puts and Calls

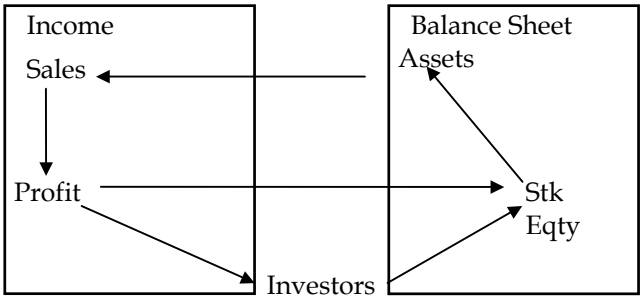
Exhibit 3: PE Breakdown

Exhibit 4: Ratios

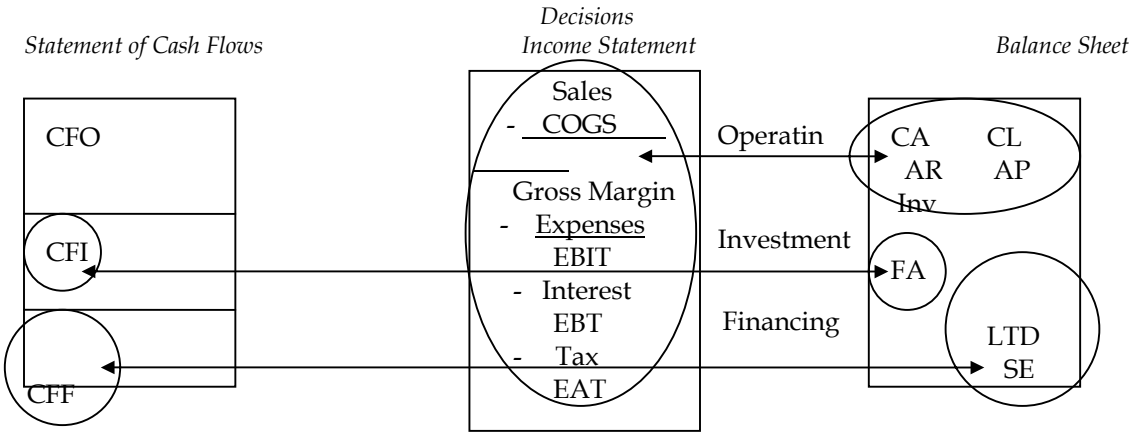
Exhibit 1: Accounting Statements

Income Stmt: Particular moment in the life of an asset

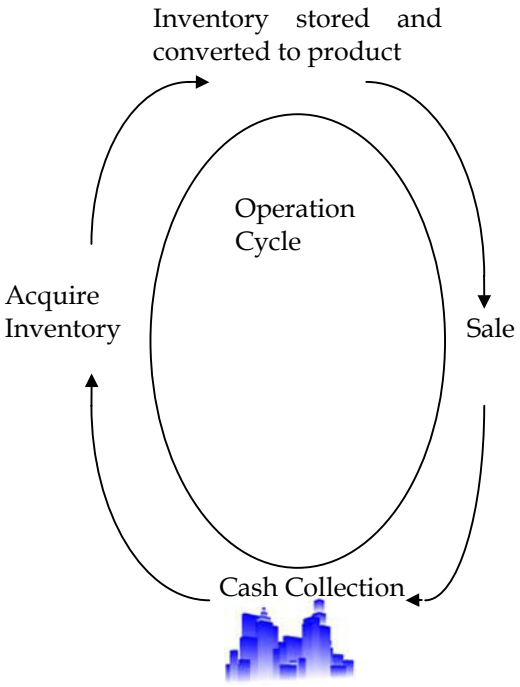
Convert assets into profit to return to Inv or Stkhldrs Equity



Assets come into Balance Sheet in SE to get to Assets



CEOs look at things from viewpoint of Cash Flow ... to pay bills, liquidity



A growing company never has enough cash collection to grow the inventory.

CEO is always looking for something which will grow cash.

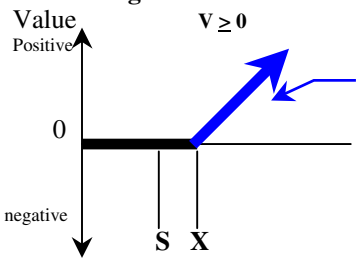
Newspaper cycles daily,
Boeing could take years

Notes:

Exhibit 2: Puts and Calls

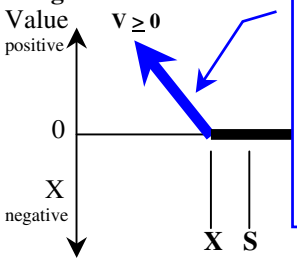
Interpret the diagrams that depict the expiration-day values of the long call, short call, long put and short put strategies; (X = strike price, S = Stock price, C = cost of Call, P = cost of Put)

Long Call



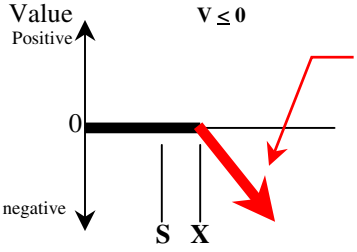
Value of the long call will be the **amount over strike** the stock is trading. **Long call will never have a value less than zero.**

Long Put



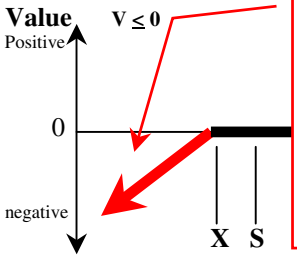
Value of the long put will be the **amount less than the strike** that the stock is trading. **Long put will never have a value less than zero.**

Short Call



Value of the short call will be the **amount over the strike** the stock is trading. **Short call will never have a value greater than zero.**

Short Put

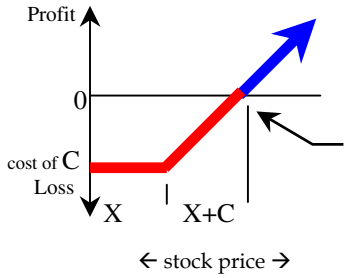


Value of the short put will be the **amount less than the strike** the stock is trading. **Short put will never have a value greater than zero.**

Interpret the **profit/loss** diagrams for the long call, short call, long put, and short put strategies;

Long Call

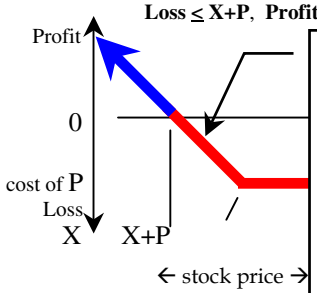
Loss ≤ C, Profit > X+C



Profit of the long call is the amount over the strike + cost of the call (X+C). Loss on the call is the amount the stock is under the call + strike, not to exceed the cost of the call.

Long Put

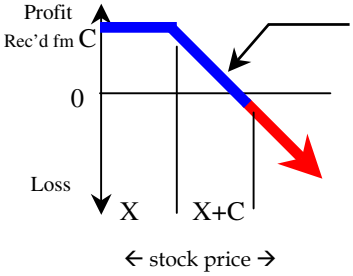
Loss ≤ X+P, Profit < X



Profit the long put is the amount under the strike and cost of the put. Loss on the put is the amount the stock is over the strike, not to exceed the cost of the put.

Short Call

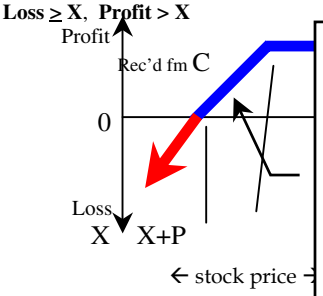
Loss ≥ X+C, Profit < X+C



Profit of the short call is the amount under the strike + cost of the call (X+C), not to exceed the proceeds received from the call. Loss on the call is the amount the stock is over the call + strike.

Short Put

Loss ≥ X, Profit > X



Profit the short put is the amount more than the strike of the put, not to exceed the proceeds received from the put. Loss on the put is the amount the stock is less than the strike.

Notes:

Exhibit 3: PE Breakdown

Note: 3 Stage ROE Profit Margin * Total Asset Turnover * Financial Leverage

$$\frac{NI}{Sales} * \frac{Sales}{Total\ Assets} * \frac{Total\ Assets}{Equity}$$

Editor's Review:

Income Statement	
Sales	
- COGS	
Gross Margin	
- Expenses	(mgmt hides it's perks if EAT is OK)
EBIT	
- Interest	Bank happy
EBT	What mgmt earns for shareholders
- Taxes	Gov't happy
EAT	Stockholders happy

EAT = EBT - EBT(t)
EAT = EBT(1-t)

Expected EPS = Expected Sales/share * Expected Net profit Margin

We know last year's P & P/E
Can calc next year's earnings
then Proportion via P/E to get $P_{proj\ EOY}$

Income Stmt: Next year's projected
[(S) (EBDIT) - D - I] (1-t)
pending ratio Depr Inter tax
sales per shr Exp adj

$P_{proj\ EOY} = (E_{Proj\ EOY})(P/E)$

Earnings, DDM & ROE Calc

$P = Div / Earn$
$E \quad k - g$

Dividend pay-out
k - g

(Retention) (ROE)

k = Real Rate + Interest Prem + Risk Prem
Nominal rate should really multiply

Tax * Interest * Oper'g * Asset * Financial
Reten Burden Profit Turnover Leverage
Rate Margin

$k = R_f + \beta(R_m - R_f)$ β is # units of risk in the stock

Stockholders want and pay for k, k determines the P

$\frac{NI}{EBT} * \frac{EBT}{EBIT} * \frac{EBIT}{Sls} * \frac{Sls}{Assets} * \frac{Assets}{Equity}$

$P_0 = \frac{D_1}{k - g}$

WACC = $(w_e k_e) + (w_d k_d)$

Oper Profit Margin * Total Asset Turnover * -Interest Expense Rate * Financial Leverage ***Multiplier*** * Tax Retention ***Rate***

$P_0 = \frac{D_1}{k - g}$

$\left[\frac{EBIT}{Sls} * \frac{Sls}{Assets} - \frac{Int}{Assets}\right] * \frac{Assets}{Equity} * (1 - T)$

Note: tax ret (1-t)

$Return_{Estimated} = \frac{Cash\ Div + Price_{End} - Price_{Now}}{Price_{Now}}$

Bad side

Good side of

$P_0 = \frac{D_1}{k - g}$ restate: $k = \frac{D}{P} + g = k = R_f + \beta(R_m - R_f)$ also $k = (1+RR)(1+IP)(1+RP)$
real infl risk
should be in equilibrium

Exhibit 4: Ratios

calculate the financial ratios in each major category of analysis and discuss the uses of those ratios;
Common Size Statements: B/S in percent of Total Assets, I/S in percent of Sales
Quickly compare two different size firms, same firm trends over time, structure of firm's financial statements
Internal Liquidity (Solvency): ability of firm to meet future short term obligations, compare near term obligations with current assets or cash flows

Current Ratio: $\frac{\text{Current Assets}}{\text{Current Liabilities}}$ Working Capital = CA - CL

Quick ratio $\frac{\text{Cash + mkt sec + AR}}{\text{CL}}$ not include. inventory

Acid Test $\frac{\text{CA - Inv}}{\text{CL}}$ a.k.a. Quick Ratio

Cash ratio $\frac{\text{Cash + mkt sec}}{\text{CL}}$ even more conservative

Receivables Turnover $\frac{\text{Net Annual Sales}}{\text{Avg Receivables}}$ Avg collection: $\frac{365}{\text{Annual Turnover}}$

Days Receivable $\frac{365}{\text{Avg Receivables}}$ Avg # of days to get paid

Working Cap / Sales $\frac{\text{CA - CL}}{\text{Net Sales}}$ higher % indicates more liquidity

Payables Turnover $\frac{\text{COGS}}{\text{@ AP}}$ @ payable period: $\frac{365}{\text{Annual Turnover}}$ (do they pay their bills)

Operating Performance: How well management is operating the business

Operating Efficiency Ratios: How management uses its assets and capital

Activity ratios: sales per something

Inventory Turnover $\frac{\text{COGS}}{\text{@ Inventory}}$ @ Inventory period $\frac{365}{\text{Inventory Turnover}}$

Total Asset Turnover $\frac{\text{Net Sales}}{\text{@ Tot Net Assets}}$ high or low relative to industry? low: tie up too much assets

Fixed Asset Turnover $\frac{\text{Net Sales}}{\text{@ Net Fixed Assets}}$ utilization of fixed assets hi: old depr equipment

Equity Turnover $\frac{\text{Net Sales}}{\text{Average Equity}}$ excludes CL & LT Debt

Receivables Turnover $\frac{\text{Net Annual Sales}}{\text{Avg Receivables}}$ Avg collection period: $\frac{365}{\text{Annual Turnover}}$

Operating Profitability: rate of profit on sales, % return on capital
(How good is mgmt turning profits into sales)
Note: Run down Income Statement and ratio to Sales (GP, EBIT, EBT, EAT)

EBIT: Mgmt earns

Tax: Government earns

Interest: Banker's earn

EBT: Stockholder's earn

Gross Profit Margin $\frac{\text{Gross Profit}}{\text{Net Sales}}$ (GP = Sls - COGS) relative cost price position in industry?

Operating Profit Margin $\frac{\text{Operating Profit}}{\text{Net Sales}}$ (EBIT) variability is business risk indicator

Net Profit Margin $\frac{\text{Net Income}}{\text{Net Sales}}$ NI = EAT

EBT Margin $\frac{\text{EBT}}{\text{Net Sales}}$ before tax profit margin

Common Size Income Statement
lists all expense and income items as a % of sales
(Inc Stmt: / Sls) (Bal: / Sls or Tot Assets)

Return on Total Capital $\frac{\text{Net Income + Interest Expense}}{\text{Average Total Capital}}$ Debt, Pref. Stock, C Stock return on all capital employed

Return on Total Equity $\frac{\text{Net Income}}{\text{@ Total Equity}}$ ROE

Return on Owners Equity $\frac{\text{Net Income – Preferred Dividend}}{\text{@ Common Equity}}$

Return on Equity (ROE): DuPont System duPont formulation
ROE = NI / Equity or EAT/Equity

3 Step ROE = $\frac{NI}{Equity}$ = Net Profit Margin * Asset Turnover * Financial Leverage a.k.a.Equity Multiplier

$\frac{NI}{Sls} * \frac{Sls}{Assets} * \frac{Assets}{Equity}$ Note: $\frac{(Sls)(Assets)}{(Sls)(Assets)}$

4 Step ROE = $\frac{NI}{Equity}$ = Tax Reten * Interest Burden * Oper'g Profit * Asset Turnover * Financial Leverage

$\frac{NI}{EBT} * \frac{EBT}{EBIT} * \frac{EBIT}{Sls} * \frac{Sls}{Assets} * \frac{Assets}{Equity}$

5 Step Equation = { Oper Profit Margin * Total Asset Turnover - Interest Expense Rate * Financial Leverage Multiplier * Tax Retention Rate }

{ $\frac{EBIT}{Sls} * \frac{Sls}{Assets} - \frac{Int}{Assets} * \frac{Assets}{Equity} * (1 - T)$ }

Financial Risk: Uncertainty of returns to equity holders due to a firm's use of fixed obligation debt securities

Debt / Equity remember firm value is Db + Eq
Db=1, Eq=2, firm value = 3, D/E = ½
(not D/E=1/3, easy mistake in a hurry)

LTD / LT Cap LTD = Long Term Debt LT Cap = Long Term Capital

Total Debt / Total Capital

Interest Coverage $\frac{EBIT}{\text{Interest Expense}}$ $\frac{NI + Tax + Int\ Exp}{Int\ Exp}$

(**Note: Look for this on the exam**

Cash Flow / LTD

Cash Flow / Total Debt

Growth Analysis

Retention rate (remember: growth = retention rate * ROE)	earnings retained / total earnings
ROE	see above, profitability
Total Asset Turnover	see above, operational performance
Total Assets / Equity	note component of ROE
Net Profit Margin	see above, profitability
Sustainable growth rate	g = retention * ROE

retention rate = 1 – (Oper Inc after taxes)

Risk Analysis: uncertainty of income flows for the total firm and for sources of capital

Business Risk: Uncertainty of income caused by a firm's industry
Variability of sales due to products, customers, production methods

Business Risk Coefficient of variation of operating income CV = σ/mean

$\frac{\text{Standard Deviation of Operating Earnings (OE)}}{\text{Mean Operating Earnings}}$ need 5<Thru> 10 yrs to compute coef of variation

Sales Volatility Coefficient of Variation of Sales CV = σ/mean

$\frac{\text{sd of sales}}{\text{mean sales}}$ prime determinant of earnings variability

Operating Leverage $\%\Delta OE / \%\Delta Sls$ or $\Sigma \mid [\%\Delta OE] / [\%\Delta Sls] \mid / N$ employment of fixed production costs direction of change not important, but relative size of the change is relevant

OL = % change in operating earnings / % change in sales , calc from #'s not %

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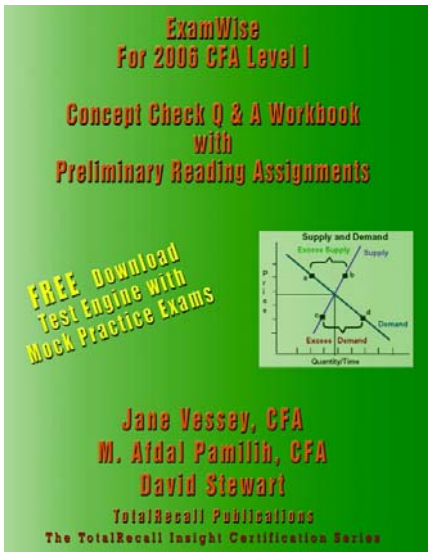

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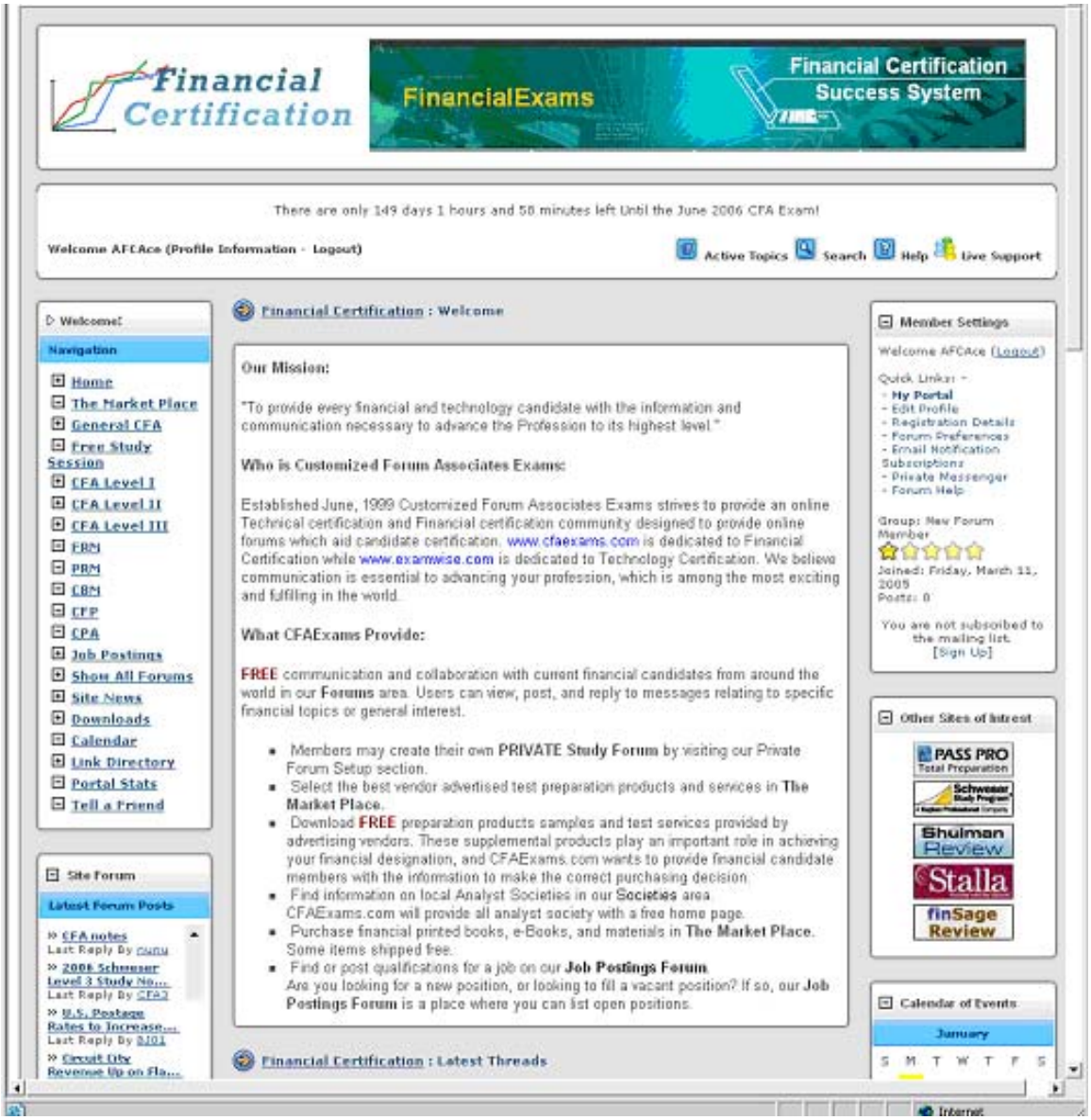

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