A COMPARISON OF DIVIDEND, CASH FLOW, AND EARNINGS APPROACHES TO EQUITY VALUATION

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ABSTRACT

Standard formulas for valuing equities require prediction of payoffs "to infinity" for going concerns but a practical analysis requires that they be predicted over finite horizons. This truncation inevitably involves (often troublesome) "terminal value" calculations. This paper contrasts dividend discount techniques, discounted cash flow analysis, and techniques based on accrual earnings when applied to a finite-horizon valuation. Valuations based on average ex post payoffs over various horizons, with and without terminal value calculations, are compared with (ex ante) market prices to give an indication of the error introduced by each technique in truncating the horizon. Comparisons of these errors show that accrual earnings techniques dominate free cash flow and dividend discounting approaches. Further, the relevant accounting features of each technique are identified and the source of the accounting that makes it less than ideal for finite horizon analysis (and for which it requires a correction) are discovered. Conditions where a given technique requires particularly long forecasting horizons are identified and the performance of the alternative techniques under those conditions is examined.

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The calculation of equity value is typically characterized as a projection of future payoffs and a transformation of those payoffs into a present value (price). A good deal of research on pricing models has focused on the specification of risk for the reduction of the payoffs to present value but little attention has been given to the specification of payoffs. It is noncontroversial that equity price is based on future dividends to shareholders but it is well-recognized that dividend discounting techniques have practical problems. A popular alternative--discounted cash flow analysis--targets future "free cash flows" instead. Analysts also discuss equity values in terms of forecasted earnings and the classical "residual income" formula directs how to calculate price from forecasted earnings and book values. It is surprising that, given the many prescriptions in valuation books and their common use in practice, there is little empirical evaluation of these alternatives.[1]

This paper conducts an empirical examination of valuation techniques with a focus on a practical issue. Dividend, cash flow and earnings approaches are equivalent when the respective payoffs are predicted "to infinity," but practical analysis requires prediction over finite horizons. The problems this presents for going concerns are well known. In the dividend discount approach, forecasted dividends over the immediate future are often not related to value so the forecast period has to be long or an (often questionable) terminal value calculation made at some shorter horizon. Alternative techniques forecast "more fundamental" attributes within the firm instead of distributions from the firm. However this substitution solves the practical problem only if it brings the future forward in time relative to predicted dividends, and these techniques frequently require terminal value corrections also. In discounted cash flow (DCF) analysis the terminal value often has considerable weight in the calculation but its determination is sometimes ad hoc or requires assumptions regarding free cash flows beyond the horizon. Techniques based on forecasted earnings make the claim (implicitly) that accrual adjustments to cash flows bring the future forward relative to cash flow analysis, but this claim has not been substantiated in a valuation context.

The paper assesses how the various techniques perform in finite horizon analysis. What techniques work best for projections over one, two, five, eight year horizons and under what circumstances? A particular focus is the question of whether the projection of accounting earnings facilitates finite horizon analysis better than DCF analysis. Analysts typically forecast earnings but, for valuation purposes, should these be transformed to free cash flows? In classroom exercises students are instructed to adjust forecasted earnings for the accruals to "get back to the cash flows." This is rationalized by ideas that cash flows are "real" and the accounting introduces distortions, but is the exercise warranted?

The valuation techniques are evaluated by comparing actual traded prices with intrinsic values calculated, as prescribed by the techniques, from subsequent payoff realizations. Ideally one would calculate intrinsic values from unbiased ex ante payoffs but, as forecasts are not observable for all payoffs, intrinsic values are calculated from average ex post payoffs.[2] Firm realizations are averaged in portfolios and portfolio values are then pooled over time to average out the unpredictable component of ex post realizations. Intrinsic values calculated from these realizations are compared with actual prices to yield ex post valuation errors and, if average realizations represent ex ante expectations, estimates of ex ante errors on which the techniques are compared. Both mean errors and the variation of errors are considered as performance metrics. This comparison is made under the assumption that, on average, actual market prices with which calculated intrinsic values are compared are efficient at the portfolio level with respect to information that projects the payoffs.

Valuation techniques are characterized as pro forma accounting methods with different rules for recognizing payoffs, and their relevant features are identified within a framework that expresses them as special cases of a generic accounting model. This framework refers to the reconciliation of the infinite horizon cash flow and accrual accounting models in Feltham and Ohlson (1995) and the finite-horizon synthesis in Penman (1996). It establishes conditions where each technique provides a valuation without error, with and without terminal values, and identifies when (seemingly different) calculations yield the same valuation. In particular, it demonstrates that DCF techniques with "operating income" specified in the terminal value are identical to models that specify accrual earnings as the payoff. Hence the comparison of DCF techniques with accrual accounting residual income techniques amounts to comparing different calculations of the terminal value in DCF analysis. This brings the focus to the critical practical problem, the determination of terminal values.

This framework dictates the construction of the empirical tests. Conditions where a particular technique is ideal (for a finite-horizon analysis) are identified and the error metrics for the techniques are calculated over departures from this ideal. Thus the aspect of the technique's accounting that produces error is identified. Then error metrics for alternative techniques are calculated over the same conditions to assess improvement (or otherwise) that can be identified with the different accounting. In this way we develop an appreciation of how alternative accounting works for valuation purposes.

The analysis quickly dismisses dividend discounting techniques as inappropriate for finite horizons. It shows that techniques based on GAAP earnings dominate those based on cash flows. It demonstrates explicitly that the accrual accounting involved in earnings techniques provides a correction to the discounted cash flow valuation. This involves the accounting for anticipated investment and the recognition of non-cash value changes. It also compares discounted residual earnings approaches and capitalized earnings approaches under a variety of conditions. Finally, it identifies conditions where earnings approaches, while dominating discounted cash flow techniques, do not perform particularly well over five to eight year horizons. These are associated with high price-to-earnings and extreme price-to-book firms.

Section I describes the accounting involved in various valuation approaches. Section II outlines valuation over finite-horizons, identifies conditions where the techniques yield valuations without error, and demonstrates some equivalences between techniques. Section III outlines the research design and the data sources, and Section IV presents the results.

I. EQUITY VALUATION TECHNIQUES

A. The Dividend Discount Approach

The theory of finance describes equity valuation in terms of expected future dividends. Formally,

$$P_t = \sum_{\tau=1} \rho^{-\tau} E(\tilde{d}_{t+\tau}) \qquad \text{(DDM)} \qquad (1)$$

where P_t is the price of equity at time t, $d_{t+\tau}$ is net dividends paid at $t+\tau$, ρ is one plus the discount rate (equity cost of capital), indicated as a constant, and E is an expectation conditional on information at time t. Firm subscripts are understood.[3] This dividend discount model (DDM) targets the actual distributions to shareholders but, despite this appeal, its application in practice (over finite horizons) is viewed as problematic. The formula requires the prediction of dividends to infinity or to a liquidating dividend but the Miller and Modigliani (1961) dividend irrelevance proposition states that price is unrelated to the timing of expected payout prior to or after any finite horizon. So, for going concerns, targeted dividends to a finite horizon are uninformative about price unless policy ties the dividend to value-generating attributes. This calls for the targeting of something "more fundamental" than dividends.

B. Generic Accounting Approaches

In recognition of this so-called dividend conundrum, alternative valuation approaches target attributes within the firm which are conjectured to capture value creating activities rather than the value-irrelevant payout activities. The identification and tracking of additions to value is an accounting system. An accounting system that periodically recognizes additions to value that are distinguished from distributions of value is expressed as:

$$B_{t+\tau} = B_{t+\tau-1} + X_{t+\tau} - d_{t+\tau}, \qquad \text{(CSR)} \qquad (2)$$

for all τ. In this "clean surplus relation," $B_{t+\tau}$ is the measured stock of value ("book value") at $t+\tau$, $X_{t+\tau}$ is the measured flow of added value ("earnings") from $t+\tau-1$ to $t+\tau$ (calculated independently of dividends), and the dividends are negative for equity contributions. It is well-recognized (in Preinreich (1938), Edwards and Bell (1961) and Peasnell (1982), for example) that, solving for $d_{t+\tau}$ in the CSR equation and substituting into (1),

$$P_t^T \equiv B_t + \sum_{\tau=1} \rho^{-\tau} E_t\left[\tilde{X}_{t+\tau} - (\rho - 1)\tilde{B}_{t+\tau-1}\right] \qquad (3)$$

approaches P_t in (1) at $T \to \infty$, given a convergence condition similar to that for the dividend discount formula. The expression over which the expectation is taken compares future flows to those projected by applying the discount rate to beginning-of-period stocks. This equation holds for all clean-surplus accounting principles and alternative valuation techniques are distinguished by the identification of B and X and the rules for their measurement. In this respect, a valuation technique and a (pro forma) accounting system (for equity valuation) are the same thing.

C. Accounting for Financial Activities and Discounted Cash Flow Analysis

A common approach substitutes "free cash flows" for dividends as the target of analysis (for example, in Rappaport (1986), Copeland, Koller, and Murrin (1990), Hackel and Livnat (1992) and Cornell (1993)). The standard derivation begins with the cash conservation equation (CCE):

$$C_{t+\tau} - I_{t+\tau} \equiv d_{t+\tau} - F_{t+\tau}, \quad \text{all } \tau, \qquad \text{(CCE)} \qquad (4)$$

where C is cash flow from operations, F is cash flow from non-equity financing activities, I is cash investment, and d is dividends net of equity contributions (as before). Let FA_t denote the present value of future cash flows with respect to financing activities (net financial assets). Then, solving CCE for $d_{t+\tau}$ and substituting into (1),

$$P_t = \sum_{\tau=1} \rho_w^{-\tau} E(\tilde{C}_{t+\tau} - \tilde{I}_{t+\tau}) + FA_t, \qquad (5)$$

where $C_{t+\tau} - I_{t+\tau}$ is called "free cash flow" and FA_t is usually indicated as negative (net debt) to reflect net borrowing rather than lending. The discount rate, ρ_w, is the weighted-average (unlevered) cost of capital, recognizing (as in Modigliani and Miller (1958)) that the operation's cost of capital is independent of financing.

Feltham and Ohlson (1995) demonstrate that this expression can also be derived from the stocks and flows equation (CSR). Thus (5) is a special case of (3) with a particular accounting. This accounting identifies $B_{t+\tau} \equiv FA_{t+\tau}$ and $X_{t+\tau} \equiv C_{t+\tau} - I_{t+\tau} + i_{t+\tau}$, all τ, where $i_{t+\tau}$ is cash interest on financial assets which, with principal flows, is part of $F_{t+\tau}$ and which is negative for net debt. Thus the clean surplus equation, $FA_{t+\tau} = FA_{t+\tau-1} + C_{t+\tau} - I_{t+\tau} + i_{t+\tau} - d_{t+\tau}$, describes an accounting system that tracks financial assets (or debt). Free cash flows are invested in financial assets (or reduce debt) and dividends are paid out of financial assets. This merely places the CCE flow equation on a stocks and flows basis as the net addition to financial assets (net of interest) is equal to $F_{t+\tau}$, by CCE. The calculation in (3) becomes

$$P_t^T = FA_t + \sum_{\tau=1} \rho^{-\tau} E\left[(C - I + i)_{t+\tau} - (\rho - 1) FA_{t+\tau-1}\right] \qquad (6)$$

Replacing $i_{t+\tau}$ with $i^*_{t+\tau}$ such that

$$\sum_{\tau=1} \rho^{-\tau} E\left(i_{t+\tau}\right) = \sum_{\tau=1} \rho^{-\tau} (\rho - 1) E\left(FA_{t+\tau-1}\right) \qquad (7)$$

then

$$P_t^T = FA_t + \sum_{\tau=1} \rho_w^{-\tau} E\left(C_{t+\tau} - I_{t+\tau}\right) \qquad \text{(DCFM)} \qquad (8)$$

approaches P_t in (5) and (1) as $T \rightarrow \infty$. Condition (7) requires that interest be accounted for on accrual basis independent of the cash coupon (the "effective interest" method) and correspondingly $FA_{t+\tau}$ is, in expectation, at present value (market value) for all $\tau \geq 0$. We refer to (8) as the discounted cash flow model, DCFM.

This is an accounting system that tracks financial activities. The book value of equity is the value of the bonds and the technique for the valuation of bonds is appropriated for the valuation of equity. Correspondingly, the targeted flow reflects financing flows. For a firm with no financial assets or debt (an "all equity" firm, for example), free cash flow, $C_{t+\tau} - I_{t+\tau} \equiv d_{t+\tau}$, by CCE, and hence the target is the same as in the dividend discount formula with the same problems induced by dividend irrelevance. The clean-surplus system that is nominated to distinguish value added activities from dividend activities degenerates to tracking dividends. For a firm with debt financing, $C_{t+\tau} - I_{t+\tau} \equiv d_{t+\tau} - F_{t+\tau}$, but the adjustment to dividends for financing flows introduces a zero net present value attribute which is irrelevant to value (Modigliani and Miller (1958)). Value is deemed to be created by operational activities but this technique targets financing stocks and flows rather than operating stocks and flows. As $C_{t+\tau}$ applies to operations, it is the negative treatment of investment in the free cash flow measure of value added that produces this.

D. Accounting for Financial and Operating Activities and Earnings Approaches to Valuation

Feltham and Ohlson (1995) characterize clean-surplus accounting systems that incorporate operating activities. Identify $B_{t+\tau} \equiv FA_{t+\tau} + OA_{t+\tau}$. $OA_{t+\tau}$ is a measure of operating assets (net of operating liabilities) which are accounted for as $OA_{t+\tau} = OA_{t+\tau-1} + I_{t+\tau} + oa_{t+\tau}$ where $oa_{t+\tau}$ is measured operating accruals. By CSR, $X_{t+\tau} = \Delta(FA_{t+\tau} + OA_{t+\tau}) + d_{t+\tau}$ (where Δ indicates changes) and thus, as $\Delta FA_{t+\tau} = C_{t+\tau} - I_{t+\tau} + i^*_{t+\tau} - d_{t+\tau}$, as before, $X_{t+\tau} = C_{t+\tau} + i^*_{t+\tau} + oa_{t+\tau}$, where $C_{t+\tau} + oa_{t+\tau} \equiv OI_{t+\tau}$ is commonly referred to as operating income. Financial assets are booked at present value, as before, and thus interest is accrued into $i^*_{t+\tau}$. Investments are booked as part of operating assets rather than part of the value added flow and, in addition, other non-cash flow values (like receivables) are recognized as value added in the accruals. Current U.S. GAAP bears a strong resemblance to this accounting. Accordingly, from (3),

$$\tau=1 \quad \ldots \; - (\rho-1)\left(\tilde{F}A_{t+\tau-1} + \tilde{O}A_{t+\tau-1}\right)\Big] \qquad \text{(RIM)} \quad (9)$$

and, given the financial accrual condition in (7),

$$P_t^T = FA_t + OA_t + \sum_{\tau=1} \rho_w^{-\tau} E\left[\tilde{O}I_{t+\tau} - (\rho-1)\tilde{O}A_{t+\tau-1}\right] \qquad (10)$$

The target in (9) is referred to as (accrual accounting) "residual income" and we refer to (9) as the residual income model (RIM).

Equation (10) reflects that financing is at zero net present value and therefore drops out. The target, operating income less a charge against operating assets, has been popularized as "Economic Value Added" by Stewart (1991). The Coca Cola Co. refers to it as "economic profit."

E. Accounting Approaches Involving Capitalization

Ohlson (1995) shows that by iterating out flows from sequential book values in (3) (with no further assumptions),

$$V_t^T \equiv (\rho^T - 1)^{-1} E\left[\sum_{\tau=1} \tilde{X}_{t+\tau} + \sum_{\tau=1} (\rho^{T-\tau} - 1)\tilde{d}_{t+\tau}\right] \qquad \text{(CM)} \qquad (11)$$

approaches P_t in (1) and (3) as $T \rightarrow \infty$. This involves adjusting expected earnings within the firm for earnings from reinvesting the dividends paid out and capitalizing the aggregated cum-dividend flow at the cost of capital. It can be shown that $V_t^T = B_t + (\rho^T - 1)^{-1} \sum_{\tau=1} \rho^{T-\tau} E\left(\tilde{X}_{t+\tau} - (\rho - 1)\tilde{B}_{t+\tau-1}\right)$ so, for all T, V_t^T is current book value plus the capitalized terminal value of the expected residual income in (3) rather than its present value. Like (3) it holds for all clean-surplus specifications of X and B and the free cash flow and accrual accounting specifications are special cases. Easton, Harris and Ohlson (1992) show that the cum-dividend earnings (within the square parentheses), measured according to GAAP, are highly correlated with stock returns over five to ten year periods.

II. VALUATION OVER FINITE HORIZONS

Clearly all specifications of X and B and both the discounting and capitalization approaches produce the same valuation when attributes are projected "to infinity," and this equals the valuation for the infinite-horizon dividend discount formula. The practical issue is what specifications are appropriate for finite horizon forecasting and under what conditions.

By iterating out dividends from successive X and B (by CSR), the generic calculation in (3) can be stated as

$$P_t^T = \sum_{\tau=1} \rho^{-\tau} E\left(\tilde{d}_{t+\tau}\right) + \rho^{-T} E\left(\tilde{B}_{t+T}\right) \qquad (12)$$

that is, the present value of forecasted dividends to t+T plus the present value of the expected t+T stock. As, for DCF analysis, $B_{t+T} \equiv FA_{t+T}$ and for RIM, $B_{t+T} \equiv FA_{t+T} + OA_{t+T}$, the two valuations differ for a given horizon, t+T, by the present value of expected t+T operating assets, and are the same only when operating assets are projected to be liquidated (into financial assets).

Further, the DDM in (1) for a finite t+T is expressed as

$$P_t = \sum_{\tau=1} \rho^{-\tau} E\left(\tilde{d}_{t+\tau}\right) + \rho^{-T} E\left(\tilde{P}_{t+T}\right) \qquad (13)$$

by the no-arbitrage condition. Thus, for any specification of X and B, valuation is made without error ($P_t^T = P_t$) if $E\left(\tilde{P}_{t+T} - \tilde{B}_{t+T}\right) = 0$ (by comparing (12) and (13)), and the error of P_t^T is $\rho^{-T} E\left(\tilde{P}_{t+T} - \tilde{B}_{t+T}\right)$.

Accordingly, the DCF analysis will yield the correct valuation only if operating assets are to be liquidated into financial assets (measured at market value), and RIM will yield the correct valuation if expected t+T operating assets are at market value. For the CM approach in (11), valuation without error ($V_t^T = P_t$) occurs if $E\left(\tilde{P}_{t+T} - \tilde{B}_{t+T}\right) - \left(P_t - B_t\right) = 0$, that is when there is no expected change in the calculated premium to the horizon, and the error is given by the present value of the expected change in premium (Ohlson (1995)). The zero error conditions for both P_t^T and V_t^T have the feature that the accounting brings the future forward in time such that forecasting to the horizon is sufficient for forecasting "to infinity." For P_t^T the forecasted book value at t+T is sufficient for subsequent flows (and for expected price at t+T) and for V_t^T aggregated (cum-dividend) flows to t+T are sufficient for projecting subsequent flows at the cost of capital.

These zero error conditions are restrictive. DCF analysis cannot be used for firms with continuing operations and Ou and Penman (1995) show that neither condition is representative in the cross section with GAAP accounting over any "reasonable" horizon. "Terminal value" corrections are typically required, as recognized in practice.

Penman (1996) provides a general model of finite-horizon valuation which includes P_t^T and V_t^T as special cases. If, for a horizon t+T, $E(\ _{t+T+NS} - \ _{t+T+NS}) = K_S E(\ _{t+T} - \ _{t+T})$ for all N>0 and a given S>0, then

$$+\rho^{-T}\left[(\rho^S - K_s)^{-1} E\left(\sum_{\tau=1}^{S}\tilde{X}_{t+T+\tau} + \sum_{\tau=1}^{S}\left(\rho^{S-\tau} - 1\right)\tilde{d}_{t+T+\tau} - (K_s - 1)\tilde{B}_{t+T}\right) - E\left(\tilde{B}_{t+T}\right)\right] \quad (14)$$

provides the valuation, P_t, without error, and this valuation can be restated as

$$+\rho^{-T}\left[(\rho^{S}-K_s)^{-1}\,E\left(\sum_{\tau=1}^{S}\tilde{X}_{t+T+\tau}+\sum_{\tau=1}^{S}\left(\rho^{S-\tau}-1\right)\tilde{d}_{t+T+\tau}-(\rho^{s}-1)\,\tilde{B}_{t+T}\right)\right] \qquad (14a)$$

The expected changes in premiums that K_s projects are differences in cum-dividend flows relative to cum-dividend changes in value, by CSR, and thus (the constant) K_s captures projected errors in measuring value added, consistently applied. This constant measurement error is manifest in forecasted S-period expected residual income growing subsequent to t+T at the rate K_s-1, and accordingly can be inferred.

The standard terminal value calculation based on perpetual growth of some attribute is of course consistent with this. It sets S = 1 and capitalizes at the rate $\rho - K_1$ where K_1 is the one period growth rate. The formulation here gives this an accounting measurement error interpretation, generalizes it as an S-period calculation, and points out that it is the forecasted growth in residual earnings rather than earnings that indicates K_s, the measurement error on which the terminal value is based. P_t^{T*} combines P_t^T and V_t^T into a general valuation formula and $P_t^T = P_t$ is a special case when the last term in (14) is zero and $V_t^T = P_t$ (another special case) when $K_s = 1$ and T = 0.

This formulation yields the generalized terminal value for the DDM. As the last term in (14) gives the error, $E\left(\tilde{P}_{t+T}-\tilde{B}_{t+T}\right)$, then $E_{(t+T)}$ in (13) is supplied:

$$+ \rho^{-T}\left[(\rho^{S}-K_s)\, E\left(\sum_{\tau=1} \tilde{X}_{t+T+\tau} + \sum_{\tau=1}(\rho^{S-\tau}-1)\, d_{t+T+\tau} - (K_s-1)\tilde{B}_{t+T}\right)\right] \tag{15}$$

$$= P_t^{T*}$$

(Penman (1996)). This provides an umbrella over all other calculations: the specification of X and B and the calculation of price according to (14) reduces to the question of the appropriate specification of the terminal value for the dividend discount model. The specification of attributes to be forecasted to the horizon is not important. All valuations can be expressed in terms of a cum-dividend terminal value for the DDM and it is this calculation that is the determining one.

This umbrella identifies calculations that look different but are in fact the same. To be less cumbersome, set $S = K_s = 1$ and so (15) becomes

$$P_t = \sum_{\tau=1} \rho^{-\tau} E(d_{t+\tau}) + \rho^{-T}\left[(\rho-1)^{-1} E(\tilde{X}_{t+T+1})\right] \tag{15a}$$

(which equals P_t^{T*} in (14)). With the DCF specification, this is stated as

$$= \sum_{\tau=1}^{T} \rho^{-\tau} E(\tilde{d}_{t+\tau}) + \rho^{-T}\left[(\rho_w-1)^{-1} E(\tilde{C}-\tilde{I})_{t+T+1} + E(\tilde{F}A_{t+T})\right], \tag{15b}$$

and for the accrual accounting specification,

$$= \sum_{\tau=1}^{T} \rho^{-\tau} E\left(\tilde{d}_{t+\tau}\right) + \rho^{-T}\left[\left(\rho_w - 1\right)^{-1} E\left(\tilde{OI}_{t+T+1}\right) + \left(\tilde{FA}_{t+T}\right)\right] \quad (15c)$$

and so for $S > 1$ and $K_s > 1$. Thus, given the premium (error) condition under which (14) yields the price for the accrual accounting model, the DCF valuation will also yield the same price for the same horizon (only) if $E\left(\tilde{C} - \tilde{I}\right)_{t+T+1} = E\left(\tilde{OI}_{t+T+1}\right)$, and vice versa. Further, Penman (1996) shows that the practice of specifying capitalized operating income as the terminal value calculation in DCF analysis such that,

$$P_t = FA_t + \sum_{\tau=1} \rho_w^{-\tau} E\left(\tilde{C} - \tilde{I}\right)_{t+\tau} + \rho_w^{-1}\left[\left(\rho_w - 1\right)^{-1} E\left(\tilde{OI}_{t+T+1}\right)\right] \quad (15d)$$

is equivalent to (15c), the accrual accounting calculation. In effect, this is not cash flow analysis at all, but rather accrual accounting, and contrasts to the pure DCF analysis in (15b) which, stated in the form of (14a) for $K_s = S = 1$ (as is usual), is

$$+ \rho^{-T}\left[\left(\rho - 1\right)^{-1} E\left(C - I + i\right)_{t+T+1} - E\left(\tilde{FA}_t\right)\right] \quad (16)$$

$$= FA_t + \sum_{\tau+1}^{T} \rho_w^{-\tau} E\left(\tilde{C} - \tilde{I}\right)_{t+\tau} + \rho^{-T}\left[\left(\rho_w - 1\right)^{-1} E\left(\tilde{C} - \tilde{I}\right)_{t+T+1}\right],$$

with the accommodation for $S > 1$ and $K_s > 1$. As $C_{t+T+1} - I_{t+T+1} \equiv d_{t+T+1} - F_{t+T+1}$, this amounts to capitalizing financing flows that are forecasted to be a constant in perpetuity. Accordingly we examine accrual accounting against the pure DCF analysis with the understanding that this can be stated as a comparison of the terminal value calculation for DCF analysis in (15d) with that in (16).[4]

III. DATA AND RESEARCH DESIGN

The empirical analysis compares valuations based on the DDM, DCFM, RIM and CM over various horizons, with and without the terminal value calculations in (14). Valuations at time t are calculated from subsequent realizations of the X and B specified by the alternative models up to various t+T+1 and these are then compared with actual traded price at t.

This design relies on assumptions required to infer ex-ante values from ex-post data. We assume that (a) average realizations are equal to their ex-ante rational expectations, and (b) observable market prices to which calculated intrinsic values are compared are efficient. Accordingly, the analysis is on portfolios of stocks observed over time with the aim of averaging out unexpected realizations and any market inefficiencies over firms and over time.

We first evaluate the valuation methods over all conditions and then under various circumstances where the accounting may affect the horizon over which analysis is done. The analysis over all conditions is implemented by random assignment of firms to portfolios. The conditional tests assign firms to portfolios on the basis of conditioning circumstances.

For the unconditional tests, firms are randomly assigned to 20 portfolios at the end of each year of the sample period, t = 1973-1990. Arithmetic average portfolio values of the respective accounting realizations are then calculated for each subsequent ten years (t+T, T=1,2, ,10) and ex post intrinsic values of common equity are calculated at the end of year t from these mean realizations according to the prescription of the relevant formula for each horizon, t+T. The respective techniques are evaluated on (ex post) errors of these values relative to observed price at the end of year t. Mean errors and the variation in errors are then calculated over all 18 years.[5]

The data used in this study are taken from the COMPUSTAT Annual and Research files which cover NYSE, AMEX, and NASDAQ firms. The combined files include non-surviving firms to the year of their termination. The files cover the period 1973 to 1992. Financial firms (industry codes 6000-6499) are not included in the analysis. The number of firms available for each year (with prices, dividends, and accounting data for that year) range from 3544 in 1973 to 5642 in 1987, with an average of 4192 per year. As there are no data after 1992, the number of years in the calculations declines as the horizon increases. For ten-year horizons (T=10), there are 10 years (1973-82) and for T=1, there are 18 years (1973-90).

The exercise raises a number of issues about the accounting for the attributes and these are addressed in Appendix A. The cost of capital determination is elusive and we applied a number of calculations. For the equity cost of capital we used, alternatively:

the risk free rate (the 3-year T-Bill rate p.a.) for the relevant year plus an equity risk premium of 6% p.a. for all firms (approximately the historical equity premium reported in Ibbotson and Sinquefield (1983) at the beginning of the sample period); the cost of capital given by the CAPM using the same risk free rate and risk premium with betas estimated for each firm; and the cost of capital for the firm's industry based on the Fama and French (1994) three factor (beta, size and book-to-price) model.[6] These all were updated each year. Finally, we used a 10% rate for all firms in all years. We report results with CAPM estimates (and the notation, ρ, will imply this) but little difference in results was observed with the calculations, and it will become apparent that reasonable risk adjustment cannot explain the results. For discounting or capitalizing operational flows, an unlevered cost of capital was calculated using standard techniques.[7]

The study is concerned with ex ante going-concern valuation but firms terminate ex post. Appendix B describes how the calculations deal with this to accommodate questions of survivorship.

IV. EMPIRICAL ASSESSMENT OF VALUATION TECHNIQUES

A. Unconditional Analysis

The unconditional analysis evaluates the techniques at the average over all conditions. Twenty replications are provided by random assignment of firms to 20 equal-size portfolios in each year without replacement. The mean number of firms in portfolios (over all years) was 210, and the mean (over the 20 portfolios) of the (arithmetic) mean portfolio per-share market prices (over years) was $14.29, with a range over the 20 portfolios of $13.79 to $14.65. The corresponding mean of the market value of equity was $212.41M (with a range of $192.53M to $230.16M), of carrying value of debt plus preferred stock to the market value of common equity, .90 (with a range of .817 to 1.078), and of estimated beta, 1.13 (with a range of 1.12 to 1.14). The mean ex ante CAPM required return on equity was 12.8% (with a range of 12.7% to 12.9%). Thus the randomization produced portfolios with similar average characteristics with little variation, including risk attributes.

Panel A of Table 1 presents means of portfolio ex post cum-dividend prices, dividends, free cash flows and GAAP cum-dividend earnings (available for common), for selected t+T, all in units of portfolio price at t. Standard deviations of the means over portfolios are given in parentheses to give an indication of the similarity of results over the twenty replications. Cum-dividend prices in the first row are calculated as $P^c_{t+T} = P_{t+T} + \sum_{\tau=1} \rho^{T-\tau} d_{t+\tau}$ and thus, with the deflation, the reported values are one plus the stock return. The dividends in the table include cash from stock repurchases. Cum-dividend earnings are calculated as $X_{t+T} + (\rho - 1)\sum_{\tau=1} \rho^{T-\tau-1} d_{t+\tau}$ which, when aggregated from t to t+T, gives the target in CM (11). With the deflation, these give, for each t+T, the cum-dividend earnings yield per dollar of price at t. All numbers include liquidating amounts for non-survivors (as described in Appendix B).

It is clear that, on average, ex post cum-dividend prices increased more than at the calculated average ex ante rate of 12.8% per year indicated at the bottom of the panel. This could indicate a misspecification of this rate but also reflects the bull market of the sample period. In other words, the data period is not long enough to average out deviations of realizations from expectations. Accordingly, systematic errors that cannot be diversified away by the averaging will be observed for any valid valuation technique. For the conditional analysis, valuation errors will be evaluated relative to each other so this is only a concern if portfolios reflect different sensitivities to the systematic departure from expectation.

The t+1 figures for dividends, free cash flows, and earnings indicate that the average annual yield of these payoffs was less than the 12.8% rate during the period, but each increased at the average over t+T at a rate greater than 12.8%, consistent with the growth in cum-dividend prices. However, the increase was less than that of the ex post prices, consistent with the standard observation that "prices lead" payoffs. The yields of ex post dividends and free cash flows were less than that of GAAP earnings. As free cash flows are returns to debt, preferred and common equity (whereas earnings are "available to common") it appears that GAAP earnings are closer to the expectation of payoff in the time t price (by which these realizations are initialized) than dividends or free cash flows.

Panel B of Table 1 demonstrates this more explicitly. It gives mean valuation errors for various valuation techniques for selected horizons. These valuation errors are per unit of price at t, calculated as

$$\text{Error}^{\iota}(\cdot) = |P_{pt} - P^{\iota}_{pt}(\cdot)| / P_{pt} \qquad (17)$$

where $P^{T}_{pt}(\,)$ is the portfolio intrinsic value at t calculated from ex post realizations to horizon t+T, and P_{pt} is the observed portfolio price at that date. Portfolio intrinsic values were calculated alternatively from means of individual firm's values and by applying the technique to portfolio realizations at each t+T. The former permits an examination of firm deviations from means but the mean is sensitive to outliers. The results here and elsewhere are based on the latter approach and are similar to the former.

The first line in Panel B calculates valuation errors by specifying $P^{T}_{pt}(\,) = \rho^{-T}(P^{C}_{pt+T})$. These are errors to forecasting horizon cum-dividend price at $\rho^{T}P_{pt}$, that is, by applying the cost of capital to actual price at t. They are thus the market's forecasting errors, and we refer to them as price model forecasts. The negative errors reflect on-average market inefficiencies at t, misspecification of ρ, or systematic (undiversifiable) ex post deviations from expectation in the period. Accordingly, they are presented as benchmark errors that arise for any of these reasons and which one would expect to observe for a perfect valuation technique. They serve to rescale the calculated errors for the various techniques. They may reflect market inefficiencies (at the portfolio level) at t+T also and these are not anticipated by the valuation techniques.

Rows two through five of the panel give valuation errors for the dividend discount model (DDM), the discounted cash flow model (DCFM), the residual income model using GAAP earnings and book values (RIM), and the capitalized GAAP cum-dividend earnings model (CM). These are calculated according to equations (1), (8), (9), and (11), respectively, with the target projected to the relevant t+T without a terminal value. The DCF calculation follows the conventional one of specifying FA_t as negative and equal to debt plus preferred equity (measured at their carrying values).[8] Free cash flow is after income taxes so the tax benefit of debt is included. Errors for the DCFM and RIM with terminal values are given lower in the panel. These are calculated according to (14a) with S = 1 and K_1, the annual "growth rate," set to 1.0 and 1.04 for the DCF model (for going concerns) and 1.00 and 1.02 for the RIM model, as indicated.[9] Finally, the results for a dividend discount model calculated with a terminal value as

$$P_t = \sum_{\tau=1} \rho^{-\tau} E\left(d_{t+\tau}\right) + \rho^{-1}\left[(\rho - K_1)^{-1} E(d_{t+T+1})\right] \qquad \text{(DDMA)} \quad (18)$$

are also reported (with K_1 = 1.00 and K_1 = 1.04).

The errors for the dividend discount models are large and positive for short horizons but decline over t+T towards the benchmark errors as more dividends (including liquidating dividends) are "pulled in" to the calculation.[10] The errors for the DCF calculation are also positive and large over all horizons, indeed greater than 150% of actual price. These errors reflect the missing accounting for operations. With the terminal value calculations, the errors are still large for all t+T, though declining with higher values of K_1. (When K_1 was set to 1.06 the mean error for t+8 was -0.076.) In contrast, the errors based on GAAP accounting in RIM and CM are lower for all horizons and much closer to the benchmark errors, reflecting the accounting for operating assets. Interpreted differently, a DCF calculation with capitalized GAAP operating income as a terminal value performs better than one based on capitalized free cash flow (calculation (15d) versus (16)).

The performance rankings are similar with the different calculations of the cost of capital. Mean absolute deviation of portfolio errors from these means were also calculated and the rankings over techniques were similar to that for means. In no case did earnings methods yield lower bias with higher variation in errors.

B. Conditional Analysis

The results in Table 1 pertain to the market portfolio and the reported errors are systematic errors. Valuation also involves distinguishing firms from the market and we now examine how errors differ over firms (for varying horizons) when the alternative techniques are applied. The analysis proceeds as before except that firms are assigned to 20 portfolios each year from a ranking on a conditioning variable that captures the accounting of the various techniques.

The use of the accounting models is justified by the difficulty of applying the DDM over finite horizons. This difficulty is acute when a firm has no or low payout. So, first, we assigned firms to portfolios based on payout to price at time t. Detailed results are available upon request. Predictably, the DDM and DDMA valuations varied over payout and this is demonstrative of the problem: variations in payout (over finite horizons) that produce different calculations are irrelevant to ex ante values. Errors for short horizons were typically large. Those for the DCF techniques were also large for all horizons, though declining in payout. In contrast the RIM and CM methods produced considerably lower errors over all levels of payout.

The main focus, however, is on the horizons that the alternative accounting techniques typically require. That is determined by their accounting and so we group firms on features of the accounting. We identify conditions where a particular technique performs poorly or well and how competing techniques perform under the same conditions. The accounting is defined by measurement rules for the stocks and flows so our analysis examines valuations for groups with different measures of the stocks and flows.

B.1 Conditioning on the Current Stock Accounting

We first group firms on the current stock variables (B_t) of the respective techniques. A special case of the generic accounting model in (3) (and of the finite horizon model in (14)) arises when the accounting system accounts for B_t such that $P_t = B_t$ (and the other terms in (3) and (14) are zero). Here the horizon is T=0, all the future is brought forward into the current book value, and current book value is sufficient for all expected future payoffs (by applying the cost of capital to the book value). Clearly this "market value accounting" is an ideal case for practical valuation analysis. To the extent this is not satisfied, there is missing value in the current stock and one has to project the future to discover this value, and thus T>0. The ratio of the time-t stock to price captures the missing value, so we rank firms on this ratio for DCF accounting and GAAP accounting and examine the implied horizons (to capture the missing value) over deviations from the ideal.

Table 2 gives mean errors of the various techniques for 20 portfolios formed from ranking firms on FA_t/P_t. FA_t is the DCF stock and is again measured as (minus) the carrying value of debt plus preferred stock (PS). Only results for horizons t+1, t+5 and t+8 are reported; those for intervening horizons are approximated by rough interpolation. The layout of the table is a template for subsequent tables. Panels of valuation errors for six models are given as indicated. Results with alternative calculations of terminal values are available upon request. The table also reports the mean of the ranking variable,

$(Debt_t + PS_t)/P_t$ for each portfolio, the GAAP B/P ratio at t and free cash flow to equity, FCF^e_t/P_t where $FCF^e_t \equiv C_t - I_t + i^*_t$ (with i^* negative and equal to the after-tax interest on debt plus preferred dividends), and the GAAP E/P ratio at t. These are ranking variables in subsequent tables and this table displays their relationship to the ranking variable here.

The errors from predicting cum-dividend price by applying ρ^T to current price (the price model in the first panel) are negative and reflect the systematic unexpected value appreciations documented earlier. Differences in relative performance is indicated across portfolios with very high leverage firms performing better than average, demonstrating the effect of (favorable) leverage in good times. These errors provide the benchmarks for each portfolio.

The ranking variable compares the stock variable in the DCF calculation to price. Clearly, price cannot be equal to debt plus preferred stock, but, as price equals the value of operating assets minus the value of debt plus preferred stock, the ranking ratio captures the value of the omitted operating assets in the DCF stock. Over all levels of this condition the DCFM errors are positive and large for all horizons and are positively related to the level of omitted operating assets to price. They are also negatively related to the benchmark errors. The payoff in free cash flow is too low to justify the price at t. The low FCF after debt service is of course due to high investment relative to cash from operations, and this is extreme in the case of the high debt firms. The "terminal value correction" with $K_1 = 1.04$ reduces these errors but they are still large and the relationship to omitted operating assets remains.[11] The results for portfolio 1 are similar to those for dividend discounting (not reported) as these are pure equity firms where free cash flow equals dividends. The valuation for portfolios 2 to 20 implicitly involves adjusting forecasted dividends for forecasted financing, by CCE, but the ex post errors are larger with this adjustment.

As the zero-horizon ideal of $P_t = B_t$ is not possible with DCF accounting, one has to forecast future free cash flows but the results indicate that this calculation does not bring the future forward within horizons less than nine years. GAAP book values include a measure of operating assets. Correspondingly, the errors of the RIM calculation are much closer to the benchmarks. They are in the order of the benchmarks but still higher, indicating value payoffs are not entirely captured by the accounting. The terminal value calculation (RIM(TV:1.0)) reduces the errors for the lower portfolio numbers, but increases them for the higher ones (as explained with the next table). The CM errors also are lower than DCFM but are typically higher in the extremes. Mean square and mean absolute deviation of errors are calculated for each portfolio (overtime) and these are also considerably larger for the DCF calculation than the GAAP ones.

While the GAAP calculations are an improvement over DCFM in Table 2, their errors relative to the benchmarks are not perfect. In Table 3, firms are ranked on GAAP B/P (the GAAP stock to price) and this gives a spread relative to the ideal of $P_t = B_t$. This ideal is identified with portfolio 13 in the table. The negative correlation between B/P and the price model errors describes the positive correlation between B/P and subsequent beta-adjusted returns documented in Fama and French (1992), among others. This could indicate superior ex post performance for high B/P firms or higher risk, but also may reflect the often-claimed market inefficiency in pricing book values; we just take them as benchmark errors that reflect any of these phenomena.[12]

The valuation errors for RIM are positively related to the deviation of B/P from unity in portfolio 13. However, those for high B/P are close to their benchmark errors for t+5 and t+8. It is the low B/P firms for which the errors are relatively high and, as the ex ante error for RIM is given by E($_{t+T}$ - $_{t+T}$), these are firms for which the B/P is persistently low up to t+8. The RIM (TV:1.0) calculation in part supplies the missing value for the low B/P firms (and of course more so with a growth rate), but its errors for high B/P are actually higher than those for RIM. These are portfolios which on average had negative residual income and capitalizing a negative amount in the terminal value calculation reduces the valuation. This is of course a legitimate calculation as firms can have negative residual income (return on equity less than the cost of capital) perpetually and accordingly trade persistently at a discount to book value.[13] However, the results indicate that the horizons for the firms are too short and that the negative residual incomes expected at t will ultimately be higher.[14]

The errors for CM are also ordered on the benchmarks except they are higher for both low and extremely high B/P firms. The error of this model is explained by changes in premiums and it is indeed the extreme B/P that are associated with the biggest changes in premiums (Ou and

Penman (1995)). The errors for DCFM without a terminal value are very large (and positive) and we don't report them in this or subsequent tables. It is clear from the DCFM (TV:1.04) results reported that DCF analysis, even with a growth rate of .04 for the horizon correction, produces no remedy under these conditions. This is expected given the positive correlation between (Debt + PS)/P and B/P, because the table also indicates that FCF tends to be negative for low B/P firms.

The results for portfolio 13 (where book value approximates price) provide a particular point of reference. Here one expects cum-dividend price and book value to grow at the cost of capital and accordingly firms to earn cum-dividend earnings at the cost of capital (zero residual income). Thus portfolio 13's RIM valuation errors, just like those for the price model, represent systematic unexpected errors due to ex post rather than ex ante phenomena. Accordingly its RIM errors provide an alternative benchmark that reflects the unexpected ex post errors due to unexpected value appreciation. The errors for t+5 and t+8 are higher than those for the price model and this is consistent with the phenomenon that "price leads earnings": unanticipated value changes are incorporated into price before being recognized in earnings and book value. Errors for other portfolios reflect the phenomenon and thus should be scaled for it.

B.2 Conditioning on the Current Flow Accounting

Rather than the current stock being sufficient for valuation, the current flow, X_t, might be sufficient such that all expected future flows are projected by applying the cost of capital to the current flow. Adding d_t to both sides of (11) and substituting $\sum_{\tau=1} \rho^{\tau} X_t$ for the expected cum-dividend earnings in that expression (to give the projection from current earnings), (11) reduces to

$$P_t + d_t = \frac{\cdot}{(\rho-1)} X_t, \tag{19}$$

that is, cum-dividend price is the capitalized current flow and the $(P_t + d_t)/X_t$ ratio is determined solely by the cost of capital. Under this ideal all the future is pulled into the current flow calculation and the horizon is zero.[15]

In Table 4 firms are ranked on FCF^e/P and in Table 5 on the GAAP E/P at t, both with cum-dividend prices in the denominator. The ranking maximizes the dispersion from the ideal (for $X_t \equiv FCF_t$ to equity and X_t = GAAP earnings to common at t in the two tables). Portfolios 15 and 16 in Table 4 have FCF^e/P closest to the ideal in (19) ($(\rho-1)/\rho$ = .128/1.128 = .113) given the sample's average cost of capital of 12.8%. The errors for DCFM (TV:1.04) are indeed relatively small for these portfolios but increase over portfolios as FCF^e/P deviates from this value, and in a direction opposite to those for the price benchmark errors. They are particularly high for negative FCF firms where the problem of using DCF analysis is acute. The errors for RIM, with and without the terminal value, are much lower but, as with those for CM, they are higher for portfolios where the reported B/P are low.

In the results based on GAAP E/P rankings in Table 5, the CM(GAAP) model provides a benchmark reference. Portfolios 14 and 15 have mean E/P closest to .113 and thus represent the ideal in (19). By the same logic that P/B = 1 provided a benchmark in Table 3, the CM errors for these portfolios provide a benchmark that reflects ex post errors adjusted for errors expected given the systematic unpredictable value appreciation. Indeed the errors for portfolios 14 and 15 for CM are quite similar to those for RIM in benchmark portfolio 13 in Table 3. The CM errors increase from this benchmark as the spread from the ideal increases, and in a direction consistent with the price model errors.[16] However, they are higher for low E/P portfolios. This is so for the RIM calculations with and without terminal values. The DCFM errors are again large.

B.3 Conditioning on Accruals

The difference between free cash flows and GAAP earnings is the GAAP accruals for operating activities. Referring to Section I.D., GAAP earnings, $X_t = C_t + i_t^* + oa_t$ (where oa_t are operating accruals). As equity $FCF_t = C_t - I_t + i_t^*$, the difference between the two flow measures is $I_t + oa_t$. The FCF calculation treats investment as an immediate diminution of value by signing it negative. This is commonly claimed as the reason DCF analysis requires long horizons: as investment enters negatively into the calculation, a long horizon is required to capture the subsequent cash (in flows) from the investment. This is apparent in Table 4. For extreme FCF portfolios, where investment or disinvestment is large relative to cash flow from operations, the DCF valuation errors are particularly high. Accrual accounting (in general) treats investment as an operating asset that does not immediately affect earnings[17] and, in addition, brings other future cash flows forward in time through operating accruals (oa) like receivables and pension liabilities. The results above indicate that this accounting reduces the error in DCF valuation. However, accruals are by fiat and may themselves introduce error.

Table 6 ranks firms on GAAP E/P minus FCF^e/P. This difference is equal to (I + oa)/P which is also the change in operating assets to price. The greater the absolute difference between FCF and GAAP earnings, the worse the DCF calculations perform. In contrast the calculations made from GAAP attributes produce errors considerably closer to the benchmarks. Significantly, the accrual accounting produces the largest correction to DCF analysis when free cash flows are extreme and when the difference between earnings and free cash flows is the highest. The treatment of investment and additional accruals in GAAP accounting serve to correct the FCF calculation to facilitate finite horizon analysis. The results suggest that rather than adjusting earnings forecasts to get back to cash flows, one is better served (for valuation purposes) to preserve the accrual accounting.

B.4 Conditioning on GAAP B/P and E/P

The evidence indicates that GAAP accounting facilitates practical (finite horizon) valuation better than DCF calculations. However, the results also indicate conditions where GAAP models do not perform well relative to benchmarks. These are cases of high and (particularly) low B/P (Table 3) and low E/P (Table 5). These conditions are associated with the central portfolios in Table 6 where again the RIM errors are the highest. Given that these findings are not due to market inefficiencies, misspecification of discount rates or GAAP violations of clean surplus accounting, then the zero error conditions for (3), (11) and (14) are not satisfied in these circumstances for the horizons investigated.

The results for B/P and E/P involve conditions where the accounting produces extremes relative to the ideals. The results for high B/P were explained by ex post negative residual income. As the other conditions involve low book values and earnings to price, one suspects that conservatism in the accounting might be affecting the calculations. Conservative accounting that writes down book values is reputably present in the prescription and practice of GAAP accounting. Median B/P ratios are less than unity in the sample, reinforcing this impression. The low B/P are cases where the conservatism is likely to be extreme, and indeed the expensing of R&D expenditures under SFAS No. 2, for example, is associated with low B/P. However, conservative accounting for book values of assets is not sufficient to violate the horizon conditions in (14) from RIM (TV:1.0) as conservatism, consistently applied, will in this case produce the constant premiums on which the calculation is predicated. The no-change-in-premium-condition implies expected cum-dividend earnings equal to expected cum-dividend price change (return) at the horizon, that is, the conservatism does not affect earnings relative to price. Standard textbook accounting describes this: rapid amortization does not affect earnings if there is no change in the asset base because depreciation expense is the same whether one expenses an investment immediately or capitalizes and amortizes it. However, if amortizable assets are expected to be changing at the horizon, expected earnings will be affected by conservative accounting (downwards for growing assets), and the constant premium condition for $K_1 = 1.0$ will not be satisfied. This has a formal representation in Feltham and Ohlson (1995).

If low earnings relative to price at t and low book value relative to price at t are indicative of low values of the two accounting numbers to price at the horizon,[18] then one expects these effects to be identified by current B/P and E/P, as indicated. As the effect is induced by the accounting in both measures, the conditioning circumstance involves joint values of the two ratios. Accordingly, Table 7 displays mean valuation errors for various joint values of B/P and E/P. In each year firms are ranked on B/P and those with $.95 \le B/P < 1.05$ assigned to portfolio 12. Then firms with $B/P < .95$ are ranked on E/P and assigned to portfolios 1-11 from this ranking, and those with $B/P \ge 1.05$ are also ranked on E/P and assigned to portfolios 13-20. Portfolio 12 has a mean B/P of .996, close to unity by construction. However it also has a mean E/P of .108 (and a similar book return on equity by implication), closest to the assumed cost of capital. Thus this portfolio describes results for both a normal book value and a (close to) normal P/E ratio in (19) and the errors for the RIM and CM calculations (highlighted in the table) are again the benchmark errors given the systematic ex post price errors. For low B/P (portfolios 1-11), the errors for RIM and CM are increasing in decreasing E/P: the mispricing of these models is identified with both low B/P and low E/P. The GAAP models do not perform well in conditions that are associated with conservatism in the accounting for book values and its spillover to earnings when assets are growing.

This deficiency is also apparent for RIM (TV:1.0) where capitalized terminal residual income is too low for these conditions. The K_1 captures the measurement error in earnings induced by the accounting and expected growth in residual income at the horizon is determined by it. Accordingly, the specification of $K_1 > 1.0$ provides an accommodation. Table 7 reports results for RIM (TV:1.04) and its errors for low B/P and E/P portfolios are considerably lower than those of RIM (TV:1.0) for the longer horizons. However, even with this adjustment, the errors are higher than the benchmarks. If one considers a perpetual growth in residual income higher than 4% to be unreasonable, then longer forecasting horizons are required for these firms. In any case, it is clear that DCFM (TV:1.04) provides no remedy in these conditions.

V. CONCLUSION

The paper documents that equity valuation methods based on forecasting GAAP (accrual) earnings and book values have practical advantages over dividend discounting and discounted cash flow analysis. GAAP accounting has the feature of bringing the future forward in time in accruals and, by an accounting for operating assets, excluding investment expenditures as a charge against cash flow from operations in the accounting for the payoff. This facilitates valuing firms from forecasts of payoffs over relatively short horizons.

The analysis of valuation errors of the relevant techniques over different conditions provides a practical guide to when a particular technique will work well (or otherwise). The analysis is couched within a framework that reveals the accounting at work in the contrasting techniques, so errors can be identified with the missing accounting in a particular technique. Thus the results indicate that GAAP accounting supplies some of the missing accounting (for operations) in DCF analysis, but they also indicate conditions (associated with high P/E and high P/B firms) when the GAAP accounting is unsatisfactory. GAAP accounting is of course only one form of accrual accounting and one might investigate other rules that provide a remedy. Indeed the analysis suggests a utilitarian criterion for normative accounting principles: they should facilitate finite-horizon valuation.

In this respect the analysis that compares pure cash flow accounting with GAAP accrual accounting is quite narrow and further research might compare alternative accrual accounting systems. This might promote better techniques and better accounting. Also, the paper takes a macro view by looking at average results in the cross section. One might continue the analysis in micro settings (for industries or firms) and, as the accounting for operations is an important feature, these might be identified by characteristics of firms' operations.

DCF techniques are the most common in practice and in teaching in business schools. The typical valuation book "backs out" accruals from financial statements to get to the cash flows. In Copeland, Koller and Murrin (1990), for example, "cash is king" and the accounting is suspect. The results here modify that view. However, the paper shows that DCF techniques that involve (accrual) operating income in the terminal value calculation are equivalent to residual income accrual accounting techniques. In effect, this terminal value calculation corrects the errors from forecasting free cash flow to the horizon to get back the accruals. One questions the efficiency of going through this exercise (of taking out accruals and then adding them back in) when forecasting the accrual numbers produces the same result, and indeed whether this can really be called a DCF technique.

Appendix A

Calculation of Target Attributes

This appendix provides details of calculations in the implementation of the alternative valuation approaches.

Dividends

Dividends are defined as common dividends per share ex date (COMPUSTAT item 26) adjusted for stock splits and stock dividends over time. For the dividend discount model, per-share cash distributions from stock repurchases were added to these dividends at each $t+\tau$ to capture all cash payments to shareholders. Since information about stock repurchases is not available in our data bases we followed Ackert and Smith (1993) and Shoven (1986) to discover them. We searched the CRSP monthly returns file for information on shares outstanding and each decrease in shares outstanding (adjusted for stock splits and reverse splits) was treated as a stock repurchase. The amount of cash distributed was determined by multiplying the decrease in shares by the price at the end of the month preceding the decrease. This amount was divided by the number of shares outstanding before the decrease to arrive at a per-share cash distribution.

For the period 1973 to 1992 we detected 7,659 share decreases (6,117 for NYSE and AMEX firms and 1,542 for NASDAQ firms). This number seems plausible for our sample period given that Comment and Jarrell (1991) report 1,303 stock repurchases for the 4-year period 1985-1988.

The mean per-share distribution was \$0.99 with a standard deviation of 3.82 over the 20-year sample period.

Free Cash Flows

Two free cash flow calculations were made. Results are similar for the two calculations, but those reported are based on the second.

a) Calculations Based on GAAP Free Cash Flow

Accounting regulation for the reporting of cash flow information first appeared in 1971 when APB Opinion No. 19 mandated the preparation of the "Statement of Changes in Financial Position." Under this regulation firms reported a working capital statement (COMPUSTAT format code = 1.000), a cash by source and use of funds statement (COMPUSTAT format code = 2.000), or a cash statement by activity (COMPUSTAT format code = 3). In 1987 the FASB issued Standard No. 95, "Statement of Cash Flows" mandating the reporting of cash receipts, cash payments, and net change in cash resulting from operating, investing, and financing activities during a period (COMPUSTAT format code = 7.000).

For firms with format code = 7.000 in a given year, cash from operations ($C_{t+\tau}$) was calculated as

$$C_{t+\tau} = \text{Operating Activities-Net Cash Flow (item 308)} + \text{Interest Paid-Net (item 315)}.$$

When Interest Paid-Net was not available, then Interest Expense (item 15), if available, was substituted for Interest Paid-Net.

Cash Investment ($I_{t+\tau}$) was calculated as

$$I_{t+\tau} = \text{Investing Activities-Net Cash Flow (item 311)}$$

+ Capitalized Interest (item 147).

Investments in financial assets are included in investing activities under GAAP. We did not exclude them as, for the DCF calculation, we identified only debt and preferred stock as financial items.

For format codes 1, 2 and 3,

$C_{t+\tau} - I_{t+\tau}$ = the change in Cash and Cash Equivalents (item 274)
- Sale of Common and Preferred Stock (item 108)
- Long-Term Debt-Issuance (item 111)
+ Long-Term Debt-Reduction (item 114)
- Change in Current Debt (301)
+ Purchase of Common and Preferred Stock (item 115)
+ Cash Dividends (item 127)
+ Interest Expense (item 15)
+ Capitalized Interest (item 147).

When data were not available for this calculation,

$C_{t+\tau}$ = Funds from Operations (item 110)
+ Interest Expense (item 15)
- Working Capital Changes-Other (item 236).

$I_{t+\tau}$ was calculated by one of the following:

$I^{1}_{t+\tau}$ = Increase in Investments (item 113)
+ Capital Expenditures (item 128)
+ Acquisitions (item 129)
- Sale of Investments (item 109)
- Capitalized Interest (item 147).

or

$I^{2}_{t+\tau}$ = Change in Property, Plant and Equipment-Total (Net) (change in item 8)
+ Depreciation and Amortization (item 14)
+ Change in Investments and Advances-Other (change in item 32)
+ Change in Intangibles (item 33)
- Capitalized Interest (item 147).

When a format code was not available,

$C_{t+\tau}$ = Income Before Extraordinary Items (item 18)
+ Extraordinary Items and Discontinued Operations (item 48)
+ Depreciation and Amortization (item 14)
+ Interest Expense (item 15)
+ Change in Deferred Taxes (item 74)
- Change in Working Capital (item 179)

The change in working capital was modified for the change in Debt in Current Liabilities (item 34) when available. Cash Investment was calculated by $I^2_{t+\tau}$ above.

In all calculations, items not available were set to zero.

b) Calculation Based on Articulation of Balance Sheet and Income Statement

The above calculations are complicated and fraught with difficulties due to nonavailability of some line items. From Section I.D, $\Delta OA_{t+\tau} = I_{t+\tau} + oa_{t+\tau}$ and $oa_{t+\tau} = OI_{t+\tau} - C_{t+\tau}$. Thus $C_{t+\tau} - I_{t+\tau} = OI_{t+\tau} - \Delta OA_{t+\tau}$ and free cash flow is calculated by identifying operating income in the income statement and net operating assets in consecutive balance sheets (Feltham and Ohlson (1995)). Thus we calculated

$C_{t+\tau} - I_{t+\tau}$ = Income Before Extraordinary Items (item 18)
+ Interest Expense (item 15)
- Change in Total Assets (change in item 6)
+ Change in Total Liabilities (change in item 181)
- Change in Total Long-Term Debt (change in item 9)
- Change in Debt in Current Liabilities (change in item 34)

The exclusion of extraordinary items excludes gains and losses on debt repurchases (financing activities) but also may exclude some operating activities. This is a problem only if these are not mean zero in portfolios. By this calculation (as in the first), financial assets (FA_t) are identified as (minus) the sum of debt and preferred stock at time t measured at their carrying values, as designed. The book value of debt is the book value of long-term debt (COMPUSTAT item 9) plus the debt in current liabilities (COMPUSTAT item 34). For preferred stock COMPUSTAT item 130 is used.

These calculations of free cash flow are after tax but include tax benefits of interest on debt. Accordingly the "value of the tax shield" is included in the present value calculation rather than being calculated separately (as in the "compressed adjusted present value technique" employed by Kaplan and Ruback (1995)).

The calculation of free cash flow and financial assets is on a total dollar basis and the total dollar intrinsic price at t was placed on a per-share basis by dividing by shares outstanding at t (item 25).

GAAP Accounting

GAAP earnings and book value were calculated on a per-share basis. Earnings at time $t+\tau$ were identified as primary earnings per share (COMPUSTAT item 53), adjusted for stock splits and stock dividends over time. Book value per share is influenced by share issues so its value at each $t+\tau$ (for determining residual income) was calculated as book value per share at t plus accumulated earnings net of cash dividends per share from t to $t+\tau$ (split-adjusted). In calculating the payoff for the CM in (11), $d_{t+\tau}$ is specified as common dividends per share ex date, adjusted for stock splits and stock dividends over time. That is, $d_{t+\tau}$ does not include cash distributions from stock repurchases as these are reflected in the per-share calculation of earnings per share.

Appendix B

The Treatment of Terminations

Firms may delist for various reasons including mergers, liquidations, acquisitions, insufficient reporting, etc. and the analysis incorporates corrections for ex post terminations in each of the valuation models. The information needed for such corrections is obtained from the CRSP monthly returns files and the COMPUSTAT files.

The CRSP files provide delisting codes indicating the reason for delisting. We detected 3,355 delistings for our sample in the period 1973-1992 (1,792 delistings for NYSE and AMEX firms and 1,563 for NASDAQ firms). Out of this total, 1,851 delistings were due to mergers, 261 due to acquisitions, 124 due to liquidations and the remaining 1,119 due to other reasons. In addition, the CRSP files provide per-share amounts for any cash or non-cash distributions at the time of termination. We detected 1,736 cash and 1,013 non-cash terminal distributions for our sample (some firms had both cash and non-cash distributions). The mean terminal distribution was $19.85 per-share with a standard deviation of $20.62. A total of 402 NYSE and AMEX firms and 797 NASDAQ firms did not have any cash or non-cash terminal distributions. In this case the terminal (non-cash) distribution was assumed to be equal to the last price of the delisting firm in the CRSP files. The mean terminal price for these firms was $3.55 with a standard deviation of $8.50.

The corrections for terminations incorporated in each valuation model are given below.

Dividend Discount Model (DDM)

In this model the dividend in the termination year was measured as the sum of dividends per share, cash distribution per share from stock repurchases and cash and/or non-cash terminal distribution per share, all adjusted for stock splits and stock dividends. Tracking subsequent dividends on non-cash distributions is difficult so the assumption is that securities received are liquidated.

Discounted Cash Flow Model (DCFM)

For terminating firms, intrinsic values were calculated as the present value of dividends (including terminal dividends) as this equals the present value of cash flows.

Earnings Models (RIM and CM)

To estimate earnings in the terminal year we followed Bernard (1994) and estimated terminal gains or losses as the difference between the last market value on CRSP and the last book value on COMPUSTAT. The mean per share terminal gain for the 3,355 delistings in our sample was $6.46 with a standard deviation of 16.68. Earnings $X_{it+\tau}$ in the termination year was calculated as the sum of reported earnings per share and the terminal gain or loss per share.

FOOTNOTES

An exception is Kaplan and Ruback (1995).

This contrasts with Kaplan and Ruback (1995) and Abarbanell and Bernard (1995) where pri are compared to values calculated from forecasts of cash flows or earnings. That approach limited by the availability of dividend and cash flow forecasts and of earnings forecasts f longer horizons. Further, it assumes that the analyst forecasts identified are unbiased. this point see Frankel and Lee (1995).

Rubinstein (1976) derives the model under no-arbitrage conditions. In that derivation t discount for risk is in the numerator which is then discounted to present value at the ris free rate. The common textbook form is stated here as this is usually how the model is ap in practice.

DCF analysis is sometimes applied with adjustments (distinguishing "discretionary" capit investments, for example). These amount to additional accounting of which GAAP accrual accounting for operational activities is one form, and the aim here is to compare this accounting with the strict cash accounting case.

Firms with different fiscal year ends in the same calendar year were assigned to portfol together and portfolio prices were based on firm prices of fiscal year end.

The Fama and French estimates are based on risk premiums estimated on data after our portfolio formation dates. For CAPM rates, we also used an 8% equity premium which was the historical rate at the end of the sample period. (This of course produced lower errors as define them.)

Precisely, those used in Kaplan and Ruback (1995) with unlevered betas calculated from estimated equity betas and debt and preferred stock betas assumed to be 0.25. The income t rate was set at the prevailing top federal corporate rate in the relevant year plus 4% for and other taxes.

Financial assets are not netted out as one has difficulty distinguishing them from opera cash in cash and cash equivalents. Accordingly interest income (but not expense) is includ free cash flows.

The analysis was also repeated with growth rates of 1.02 and 1.06, with similar results. rate of 1.04 or 1.06 applied to RIM, though reducing errors towards the benchmark might be considered excessive: they imply a relatively rapid perpetual growth in book return on equ

For companies that terminated, the liquidating dividend was calculated as the price at liquidation (see Appendix B). To the extent that distributions in liquidation were stock r than cash, calculated values for the DDM are overstated.

The occasional large negative value in this panel arises from capitalizing relatively hi free cash flow in the terminal value calculation with the small capitalization rate that K_1 = 1.04 can produce.

The results in Table 3 were similar when the cost of capital was based on the Fama and F

(1994) risk model which includes B/P as a risk factor.

Ou and Penman (1995) document persistent discounts. In the DCF terminal value calculati we capitalized only positive free cash flows as a perpetual negative free cash flow is not realistic.

The ex post negative residual earnings could also be due to our specification of the cos capital on which the residual earnings calculation is based. The negative amounts were particularly associated with periods of high interest rates.

This is what Fischer Black had in mind when he advocated calculating earnings as a suffi number (with a multiplier) for value. See Black (1980).

Note, however, that the price model errors might reflect the so-called "P/E effect" pric inefficiency.

An exception is the accounting for investment in research & development under SFAS No. 2

Beaver and Morse (1978) document that differences in P/E ratios from the median persist time and Ou and Penman (1992) provide similar documentation for premiums.

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Table 1

Mean Portfolio Values of Realized Valuation Attributes (Panel A) and Ex post Valuation Errors for Valuation Techniques (Panel B), for Selected Horizons (Standard Deviation of Portfolio Means in Parentheses) 1973-1990

	Horizon (t+T)					
	t+1	t+2	t+4	t+6	t+8	t+10
Panel A: Future Attributes						
Cum-div. price	1.155	1.371	1.934	2.769	3.814	5.298
	(.006)	(.018)	(.048)	(.081)	(.112)	(.228)
Dividends	.088	.100	.140	.181	.235	.285
	(.007)	(.008)	(.013)	(.018)	(.036)	(.053)
Free cash flows	.076	.108	.104	.147	.206	.233
	(.030)	(.038)	(.051)	(.059)	(.109)	(.105)
Cum-div. GAAP earnings	.100	.115	.174	.236	.308	.422
	(.005)	(.006)	(.010)	(.013)	(.026)	(.037)
$(1.128)^T$	1.128	1.272	1.619	2.060	2.621	3.335

Table 1 (continued)

	Horizon (t+T)					
	t+1	t+2	t+4	t+6	t+8	t+10
Panel B: Valuation Errors						
Price model	-.031	-.085	-.177	-.294	-.381	-.538
	(.006)	(.014)	(.027)	(.035)	(.046)	(.073)
DDM	.923	.845	.663	.478	.283	.069
	(.006)	(.008)	(.016)	(.021)	(.036)	(.045)
DCFM	1.937	1.868	1.762	1.670	1.552	1.450
	(.057)	(.058)	(.066)	(.078)	(.086)	(.099)
RIM	.175	.176	.103	.038	-.028	-.120
	(.013)	(.013)	(.019)	(.021)	(.027)	(.039)
CM	.199	.189	.074	.022	-.031	-.113
	(.035)	(.034)	(.033)	(.029)	(.035)	(.047)
DCFM (TV: 1.0)	1.254	1.188	1.112	.946	.782	.827
	(.184)	(.155)	(.142)	(.251)	(.222)	(.353)
DCFM (TV: 1.04)	.918	.853	.765	.558	.378	.506
	(.269)	(.224)	(.199)	(.424)	(.342)	(.560)
RIM (TV: 1.0)	.206	.192	.083	.037	.008	-.164
	(.045)	(.039)	(.061)	(.073)	(.073)	(.092)
RIM (TV: 1.02)	.058	.049	-.061	-.099	-.117	-.307
	(.054)	(.046)	(.073)	(.086)	(.087)	(.108)
DDMA (TV: 1.0)	.574	.504	.314	.132	-.061	-.295
	(.029)	(.039)	(.042)	(.053)	(.050)	(.055)
DDMA (TV: 1.04)	.424	.356	.167	-.010	-.203	-.452
	(.043)	(.059)	(.058)	(.070)	(.064)	(.073)

NOTES:

Means are mean over years of means for 20 portfolios to which firms were randomly assigned in each year, 1973-90. Standard deviations are means of yearly standard deviations of portfolio values.

Valuation error is actual portfolio price at t minus model price, deflated by actual price at t. Price model valuation errors are calculated by setting model price equal to the present value of actual ex-post cum-dividend price at each horizon, t+T.

DDM refers to the dividend discount model in equation (1) of the text, DCFM to the discounted cash flow model in equation (8), RIM to the residual income model in equation (9) with GAAP earnings and book values, and CM to the capitalized GAAP earnings model in equation (11). TV indicates a terminal value was calculated for going concerns according to (14a) with the assumed subsequent growth rate in the terminal payoff indicated within the parentheses. DDMA is the dividend discount model with a terminal value calculated according to equation (18).

All calculations include terminal distributions to equity holders for nonsurviving firms.

Table 2

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on Debt Plus Preferred Stock to Price

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean (Debt+PS)/P	Mean GAAP B/P	Price Model			DCFM			DCFM (TV: 1.04)		
1	.000	.640	-0.024	-0.235	-0.388	0.990	0.947	0.877	0.810	0.891	0.532
2	.007	.550	-0.002	-0.025	-0.090	1.005	0.909	0.789	0.714	0.351	0.272
3	.034	.471	-0.002	-0.044	-0.116	1.060	1.009	0.920	0.927	0.575	0.463
4	.072	.546	-0.013	-0.127	-0.205	1.107	1.037	0.956	0.763	0.541	0.718
5	.116	.570	-0.034	-0.163	-0.259	1.197	1.128	1.005	1.018	0.421	0.041
6	.165	.615	-0.034	-0.173	-0.302	1.278	1.167	1.055	0.767	0.450	0.217
7	.221	.669	-0.030	-0.170	-0.331	1.356	1.293	1.140	1.148	0.532	0.498
8	.286	.734	-0.030	-0.183	-0.358	1.470	1.338	1.205	0.915	0.131	0.177
9	.359	.772	-0.034	-0.244	-0.385	1.545	1.409	1.205	0.768	0.570	-0.163
10	.443	.816	-0.044	-0.283	-0.404	1.713	1.530	1.331	1.095	0.694	0.444
11	.538	.896	-0.037	-0.268	-0.399	1.735	1.557	1.281	1.036	0.596	0.085
12	.654	.941	-0.046	-0.294	-0.493	1.957	1.809	1.682	1.205	0.874	0.399
13	.791	.985	-0.036	-0.351	-0.447	2.449	2.227	1.841	1.085	-0.766	-1.711
14	.964	1.047	-0.047	-0.311	-0.511	2.426	2.047	1.922	0.192	1.367	0.639
15	1.176	1.082	-0.043	-0.235	-0.313	2.586	2.313	2.251	1.455	0.967	0.974
16	1.442	1.115	-0.032	-0.265	-0.485	3.036	2.703	2.758	1.000	1.551	1.577
17	1.789	1.162	-0.040	-0.349	-0.497	3.413	3.147	3.219	1.388	1.717	1.412
18	2.302	1.270	-0.042	-0.414	-0.678	4.002	3.622	3.676	1.058	1.787	1.490
19	3.344	1.409	-0.052	-0.604	-1.060	5.380	4.448	4.214	0.110	0.531	2.521
20	10.962	1.432	-0.080	-0.861	-1.336	9.204	7.761	8.307	-3.251	3.542	6.497

Table 2 (continued)

Portfolio	Portfolio Attributes at t		Horizon t+1	Horizon t+5	Horizon t+8	Horizon t+1	Horizon t+5	Horizon t+8	Horizon t+1	Horizon t+5	Horizon t+8
	Mean FCF^e/P	Mean GAAP E/P	RIM			RIM (TV: 1.0)			CM		
1	.096	.075	0.322	0.178	-0.026	0.289	0.009	-0.208	-0.101	0.000	-0.181
2	.037	.071	0.415	0.343	0.272	0.311	0.223	0.150	0.181	0.245	0.210
3	.002	.070	0.515	0.375	0.263	0.353	0.169	0.170	0.286	0.234	0.191
4	.002	.078	0.438	0.292	0.147	0.233	0.134	0.131	0.241	0.154	0.067
5	.008	.082	0.416	0.273	0.162	0.222	0.158	-0.053	0.259	0.156	0.095
6	-.002	.085	0.356	0.219	0.090	0.196	0.049	0.007	0.164	0.098	0.014
7	.008	.090	0.301	0.169	0.023	0.149	0.058	0.029	0.149	0.064	-0.044
8	-.002	.096	0.232	0.114	0.025	0.176	0.116	0.031	0.132	0.050	0.008
9	-.004	.096	0.182	0.042	-0.054	0.089	0.046	-0.046	0.018	-0.025	-0.059
10	.001	.096	0.128	0.002	-0.090	0.110	-0.058	-0.035	0.069	-0.033	-0.071
11	-.006	.103	0.066	-0.072	-0.173	0.000	-0.108	-0.127	0.041	-0.101	-0.139
12	-.003	.099	0.016	-0.074	-0.193	0.103	0.032	0.032	0.071	-0.049	-0.159
13	.011	.097	-0.018	-0.116	-0.181	0.117	-0.069	0.041	0.091	-0.096	-0.112
14	.016	.095	-0.070	-0.141	-0.249	0.080	-0.038	-0.027	0.144	-0.062	-0.171
15	-.012	.096	-0.100	-0.148	-0.184	0.152	0.006	0.039	0.144	-0.033	-0.039
16	.021	.087	-0.119	-0.143	-0.206	0.237	0.008	-0.098	0.262	0.003	-0.083
17	-.032	.085	-0.166	-0.178	-0.276	0.269	-0.129	-0.085	0.183	-0.029	-0.184
18	-.012	.068	-0.247	-0.250	-0.330	0.303	-0.010	-0.038	0.388	-0.029	-0.204
19	.042	.014	-0.356	-0.302	-0.433	0.535	-0.089	-0.037	0.785	0.102	-0.255
20	.539	-.281	-0.248	-0.330	-0.393	1.132	-0.049	0.322	2.330	0.202	-0.098

Notes:

PS is the carrying value of preferred stock and FCF^e is free cash flow to common equity. The GAAP E/P ratio is calculated as $X_t/(P_t+d_t)$ where X_t is GAAP earnings available for common in the portfolio formation year, t. P_t is the common stock price at the end of year t and d_t is the annual dividend for year t. GAAP B/P is reported book value of common equity to price at t. See notes to Table 1 for descriptions of valuation techniques and the calculation of the means.

Table 3

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on GAAP Book/Price Ratios

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean GAAP B/P	Mean (Debt+PS)/P	Price Model			DCFM (TV: 1.04)			RIM		
1	-.033	.818	0.091	0.002	-0.098	1.231	1.272	1.372	1.149	0.789	0.597
2	.240	.279	0.038	-0.008	-0.059	1.077	0.753	0.663	0.770	0.588	0.490
3	.315	.293	-0.011	-0.080	-0.090	1.197	0.598	0.700	0.657	0.465	0.318
4	.392	.361	-0.015	-0.125	-0.192	1.191	0.910	0.631	0.569	0.374	0.221
5	.459	.471	-0.025	-0.146	-0.218	1.199	0.900	0.373	0.497	0.321	0.169
6	.527	.540	-0.016	-0.150	-0.257	1.274	0.805	0.731	0.424	0.255	0.110
7	.594	.634	-0.013	-0.164	-0.282	1.040	0.848	0.531	0.353	0.180	0.073
8	.672	.780	-0.037	-0.211	-0.431	1.339	0.715	-0.544	0.284	0.111	-0.037
9	.734	.772	-0.018	-0.151	-0.242	1.181	0.552	0.203	0.212	0.068	-0.050
10	.807	.906	-0.028	-0.200	-0.336	1.095	-0.024	0.934	0.146	0.010	-0.125
11	.873	.945	-0.046	-0.221	-0.391	1.307	0.674	1.152	0.073	-0.040	-0.161
12	.946	1.027	-0.036	-0.270	-0.503	0.488	0.839	0.574	-0.004	-0.121	-0.244
13	1.021	1.341	-0.056	-0.326	-0.588	0.815	1.171	0.012	-0.084	-0.198	-0.316
14	1.114	1.475	-0.070	-0.375	-0.605	0.653	0.687	0.368	-0.171	-0.242	-0.327
15	1.229	1.731	-0.075	-0.438	-0.677	0.162	0.891	-0.146	-0.270	-0.318	-0.402
16	1.338	1.839	-0.069	-0.374	-0.648	0.281	0.612	1.865	-0.375	-0.353	-0.416
17	1.530	2.241	-0.067	-0.488	-0.701	-0.584	0.765	-0.101	-0.526	-0.453	-0.502
18	1.744	2.973	-0.086	-0.459	-0.716	-0.898	0.539	1.439	-0.720	-0.550	-0.570
19	2.150	2.925	-0.111	-0.518	-0.803	-0.545	-0.153	1.755	-1.035	-0.698	-0.686
20	3.302	4.290	-0.143	-0.933	-1.282	-2.108	1.189	-3.167	-1.910	-1.073	-0.817

Table 3 (continued)

Portfolio			Horizon			Horizon		
Portfolio	Attributes at t		t+1	t+5	t+8	t+1	t+5	t+8
	Mean FCF^e/P	Mean GAAP E/P	RIM (TV: 1.00)			CM		
1	.485	-.083	0.500	0.457	0.403	0.665	0.415	0.343
2	-.026	.035	0.498	0.397	0.279	0.492	0.393	0.382
3	-.045	.055	0.362	0.232	0.307	0.285	0.245	0.186
4	-.052	.065	0.266	0.150	0.083	0.203	0.163	0.108
5	-.056	.071	0.245	0.130	0.096	0.182	0.142	0.065
6	-.062	.081	0.223	0.054	0.017	0.130	0.105	0.018
7	-.021	.088	0.153	0.038	0.077	0.103	0.034	0.018
8	-.045	.094	0.094	-0.061	-0.070	0.076	-0.031	-0.121
9	-.040	.096	0.058	-0.038	-0.039	0.030	-0.025	-0.078
10	-.030	.099	0.068	-0.030	-0.196	0.036	-0.057	-0.139
11	-.036	.107	0.041	-0.066	-0.172	0.007	-0.078	-0.168
12	-.020	.107	0.019	-0.095	-0.205	-0.013	-0.147	-0.224
13	-.024	.112	-0.053	-0.201	-0.244	-0.009	-0.218	-0.304
14	-.012	.113	0.048	-0.040	-0.137	-0.005	-0.187	-0.267
15	.009	.113	0.000	-0.102	-0.139	0.044	-0.213	-0.308
16	.062	.103	0.131	-0.032	-0.183	0.201	-0.106	-0.217
17	.028	.102	0.265	-0.136	-0.177	0.276	-0.119	-0.241
18	.079	.090	0.324	0.021	-0.160	0.532	-0.020	-0.175
19	.099	.061	0.671	-0.030	0.074	0.853	0.127	-0.115
20	.428	-.014	1.573	0.173	0.372	2.475	0.617	0.269

Notes:

See notes to Tables 1 and 2.

Table 4

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on Free Cash Flow (to Equity) to Price

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean FCF^e/P	Mean GAAP E/P	Price Model			DCFM (TV: 1.04)			RIM		
1	-1.851	-.001	-0.016	-0.507	-0.932	0.948	1.978	4.220	-0.049	-0.007	-0.123
2	-.505	.068	-0.026	-0.337	-0.479	1.479	2.123	2.358	0.069	0.051	-0.038
3	-.311	.077	-0.009	-0.220	-0.306	2.364	1.603	1.222	0.132	0.120	0.001
4	-.216	.084	-0.016	-0.118	-0.180	2.500	1.449	1.419	0.184	0.162	0.078
5	-.153	.083	-0.022	-0.143	-0.202	2.105	1.134	1.225	0.242	0.193	0.123
6	-.107	.078	-0.007	-0.128	-0.256	1.814	1.122	1.040	0.289	0.200	0.125
7	-.071	.079	-0.030	-0.157	-0.203	1.654	1.292	0.021	0.322	0.204	0.114
8	-.042	.080	-0.035	-0.139	-0.289	1.300	0.991	0.861	0.327	0.220	0.115
9	-.019	.077	-0.039	-0.085	-0.163	1.087	0.913	0.606	0.346	0.251	0.173
10	-.000	.079	-0.028	-0.089	-0.167	1.081	0.611	0.540	0.384	0.277	0.170
11	.015	.078	-0.034	-0.142	-0.278	1.028	-0.174	0.773	0.360	0.251	0.122
12	.030	.085	-0.056	-0.161	-0.252	0.625	0.592	0.281	0.298	0.171	0.070
13	.047	.089	-0.067	-0.192	-0.345	0.719	0.382	0.371	0.220	0.096	0.002
14	.067	.095	-0.066	-0.231	-0.383	0.773	-0.079	0.060	0.157	0.010	-0.112
15	.094	.100	-0.082	-0.271	-0.417	0.760	-0.207	-0.312	0.053	-0.081	-0.180
16	.128	.104	-0.098	-0.346	-0.580	0.598	0.016	0.141	-0.021	-0.162	-0.270
17	.181	.105	-0.089	-0.422	-0.675	0.087	0.406	-0.060	-0.130	-0.250	-0.358
18	.271	.096	-0.132	-0.481	-0.746	-0.023	-0.419	0.864	-0.181	-0.265	-0.357
19	.484	.065	-0.137	-0.549	-0.807	0.121	0.304	0.967	-0.303	-0.356	-0.431
20	2.697	-.178	-0.109	-0.751	-1.188	-0.596	2.243	3.890	-0.231	-0.320	-0.462

Table 4 (continued)

Portfolio	Portfolio Attributes at t		Horizon			Horizon		
	Mean (Debt+PS)/P	Mean GAAP B/P	RIM (TV: 1.0) t+1	t+5	t+8	CM t+1	t+5	t+8
1	4.164	1.147	0.782	0.073	0.343	1.187	0.311	-0.001
2	2.824	.979	0.488	0.109	0.213	0.581	0.167	0.033
3	2.005	.908	0.426	0.221	0.214	0.444	0.234	0.061
4	1.540	.845	0.444	0.208	0.164	0.394	0.235	0.131
5	1.265	.760	0.269	0.268	0.279	0.280	0.197	0.153
6	1.111	.716	0.346	0.188	0.107	0.324	0.170	0.127
7	.928	.672	0.282	0.155	0.168	0.260	0.122	0.097
8	.869	.668	0.221	0.196	0.058	0.274	0.162	0.093
9	.867	.653	0.266	0.278	0.115	0.291	0.208	0.171
10	.642	.614	0.285	0.251	0.090	0.266	0.208	0.130
11	.505	.626	0.270	0.183	0.060	0.223	0.160	0.061
12	.486	.667	0.156	0.125	-0.081	0.175	0.099	0.047
13	.439	.720	0.116	0.119	-0.056	0.037	0.034	0.002
14	.505	.791	0.066	-0.062	-0.013	0.089	-0.045	-0.103
15	.564	.880	0.023	-0.091	-0.266	-0.021	-0.098	-0.137
16	.683	.945	-0.011	-0.112	-0.185	-0.050	-0.185	-0.226
17	.952	1.063	-0.015	-0.109	-0.160	0.008	-0.190	-0.254
18	1.227	1.125	0.024	-0.148	-0.146	0.060	-0.161	-0.228
19	1.649	1.289	0.188	-0.226	-0.189	0.358	-0.137	-0.227
20	3.203	1.259	0.509	-0.069	0.053	0.982	-0.061	-0.335

Notes:

See notes to Tables 1 and 2.

Table 5

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on GAAP E/P Ratios

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean GAAP E/P	Mean FCF^e/P	Price Model			DCFM (TV: 1.04)			RIM		
1	-1.256	1.051	0.050	-1.163	-1.382	-4.165	3.430	3.080	0.491	0.126	0.018
2	-.223	.047	0.030	-0.383	-0.534	-0.602	0.846	1.332	0.063	0.133	0.059
3	-.055	-.041	0.062	-0.179	-0.152	0.407	1.620	2.193	0.233	0.298	0.223
4	.003	-.040	0.066	0.067	0.009	1.082	0.948	1.154	0.415	0.429	0.360
5	.027	-.035	0.048	0.057	-0.001	0.341	0.812	0.959	0.426	0.409	0.350
6	.042	-.056	0.046	-0.051	-0.108	0.881	1.192	0.621	0.369	0.353	0.271
7	.055	-.040	0.044	-0.061	-0.084	1.185	0.944	0.706	0.386	0.317	0.214
8	.062	-.056	0.037	-0.057	-0.146	1.439	1.584	0.314	0.361	0.286	0.194
9	.072	-.043	0.022	-0.078	-0.148	1.631	0.974	0.731	0.337	0.220	0.107
10	.079	-.040	-0.010	-0.113	-0.252	1.362	0.665	0.834	0.290	0.165	0.031
11	.087	-.029	-0.019	-0.166	-0.284	1.184	1.079	0.816	0.252	0.092	-0.040
12	.094	-.030	-0.035	-0.200	-0.381	1.104	0.920	0.981	0.197	0.052	-0.103
13	.102	-.022	-0.042	-0.266	-0.390	0.928	0.567	0.149	0.140	-0.028	-0.187
14	.111	-.019	-0.056	-0.277	-0.478	1.102	0.599	0.043	0.072	-0.069	-0.201
15	.119	-.001	-0.076	-0.350	-0.570	0.571	0.276	-0.143	0.005	-0.142	-0.296
16	.130	-.015	-0.108	-0.417	-0.668	1.120	-0.158	-0.121	-0.080	-0.239	-0.377
17	.144	-.004	-0.103	-0.441	-0.676	0.426	0.523	-0.263	-0.133	-0.268	-0.395
18	.162	-.019	-0.128	-0.527	-0.821	0.867	-0.281	0.313	-0.256	-0.362	-0.477
19	.195	-.035	-0.148	-0.523	-0.896	0.862	0.157	-0.579	-0.348	-0.429	-0.553
20	.358	.148	-0.177	-0.653	-1.091	0.928	-0.058	0.941	-0.532	-0.608	-0.711

Table 5 (continued)

Portfolio	Portfolio Attributes at t		Horizon t+1	t+5	t+8	Horizon t+1	t+5	t+8
	Mean (Debt+PS)/P	Mean GAAP B/P	RIM (TV: 1.0)			CM		
1	4.578	1.120	1.708	0.053	0.382	4.215	0.484	0.123
2	1.751	1.095	1.304	0.302	0.335	1.897	0.534	0.250
3	.922	.764	0.989	0.368	0.503	1.240	0.530	0.312
4	.619	.588	0.753	0.429	0.374	1.095	0.547	0.397
5	.739	.596	0.722	0.369	0.383	0.777	0.425	0.338
6	.772	.635	0.640	0.401	0.202	0.509	0.411	0.266
7	.681	.631	0.522	0.277	0.058	0.319	0.285	0.193
8	.904	.647	0.434	0.259	0.175	0.456	0.270	0.180
9	.831	.663	0.261	0.182	0.117	0.345	0.178	0.098
10	.661	.691	0.255	0.070	0.018	0.286	0.118	0.012
11	.605	.700	0.186	0.082	0.031	0.156	0.019	-0.047
12	.657	.732	0.066	-0.055	-0.169	0.082	-0.008	-0.120
13	.676	.783	0.065	-0.141	-0.118	0.052	-0.096	-0.195
14	.696	.848	0.009	-0.111	-0.146	-0.018	-0.114	-0.201
15	.893	.895	-0.060	-0.177	-0.354	-0.118	-0.197	-0.299
16	1.069	.957	-0.206	-0.243	-0.348	-0.241	-0.295	-0.363
17	1.197	1.022	-0.149	-0.274	-0.165	-0.209	-0.284	-0.359
18	1.425	1.128	-0.210	-0.179	-0.382	-0.381	-0.359	-0.440
19	1.781	1.211	-0.243	-0.422	-0.498	-0.495	-0.379	-0.483
20	2.580	1.438	-0.207	-0.434	-0.302	-0.584	-0.487	-0.577

Notes:

See notes to Tables 1 and 2.

Table 6

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on the Difference Between GAAP Earnings and Free Cash Flow to Price

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean (GAAP E-FCF^e)/P	Mean FCF^e/P	Price Model			DCFM (TV:1.04)			RIM		
1	-4.168	2.40881	-0.062	-0.926	-1.348	-3.282	3.755	5.453	0.057	-0.128	-0.289
2	-.568	0.42296	-0.069	-0.508	-0.764	0.233	0.375	2.079	-0.217	-0.229	-0.303
3	-.249	0.24194	-0.074	-0.396	-0.618	0.287	-0.013	0.668	-0.108	-0.133	-0.212
4	-.120	0.16030	-0.066	-0.350	-0.519	0.276	0.124	0.076	0.018	-0.055	-0.136
5	-.050	0.10691	-0.050	-0.186	-0.289	-0.232	0.221	0.365	0.167	0.078	0.011
6	-.009	0.07906	-0.045	-0.177	-0.286	0.839	0.449	-0.033	0.246	0.144	0.077
7	.018	0.06130	-0.034	-0.128	-0.250	0.864	0.173	0.424	0.311	0.198	0.125
8	.039	0.04779	-0.037	-0.130	-0.224	0.633	0.437	0.564	0.321	0.203	0.103
9	.058	0.03818	-0.038	-0.146	-0.234	0.751	0.101	0.396	0.302	0.169	0.079
10	.075	0.02719	-0.051	-0.177	-0.267	0.678	0.430	0.163	0.299	0.173	0.066
11	.093	0.01534	-0.063	-0.175	-0.285	1.069	-0.154	0.644	0.270	0.139	0.058
12	.114	0.00436	-0.061	-0.203	-0.332	1.110	1.050	0.505	0.227	0.117	0.025
13	.139	-0.01991	-0.058	-0.171	-0.265	1.054	0.883	0.737	0.194	0.066	-0.058
14	.169	-0.04539	-0.053	-0.231	-0.396	1.289	0.986	-0.348	0.176	0.082	-0.021
15	.206	-0.08267	-0.059	-0.208	-0.292	1.381	1.082	0.779	0.162	0.049	-0.056
16	.255	-0.12375	-0.058	-0.205	-0.345	1.835	1.452	0.979	0.122	0.033	-0.041
17	.321	-0.17973	-0.050	-0.262	-0.389	2.014	0.846	0.958	0.049	-0.014	-0.137
18	.421	-0.26757	-0.046	-0.247	-0.398	2.513	2.230	1.340	0.017	-0.018	-0.095
19	.617	-0.44429	-0.051	-0.406	-0.608	2.445	1.256	2.324	-0.040	-0.080	-0.199
20	2.028	-1.68530	-0.045	-0.531	-0.971	1.202	2.023	4.150	-0.156	-0.094	-0.196

Table 6 (continued)

Portfolio	Portfolio Attributes at t		Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8
Mean GAAP E/P	Mean GAAP B/P		RIM (TV: 1.0)			CM		
1	-.755	1.205	0.956	0.331	0.526	2.293	0.123	-0.266
2	-.080	1.318	0.523	0.072	-0.027	0.853	0.043	-0.079
3	.024	1.180	0.365	0.134	0.082	0.438	0.051	-0.074
4	.058	.982	0.299	0.167	0.120	0.314	0.016	-0.073
5	.067	.828	0.320	0.241	0.115	0.204	0.053	0.036
6	.077	.749	0.273	0.217	0.121	0.274	0.098	0.077
7	.080	.683	0.268	0.212	0.142	0.235	0.127	0.101
8	.083	.653	0.264	0.160	0.157	0.181	0.132	0.087
9	.086	.646	0.216	0.174	0.148	0.152	0.089	0.071
10	.091	.664	0.198	0.173	0.108	0.158	0.098	0.049
11	.096	.700	0.216	0.217	0.174	0.174	0.081	0.048
12	.099	.731	0.176	0.156	0.113	0.102	0.082	0.033
13	.102	.766	0.183	0.128	-0.029	0.084	0.012	-0.037
14	.102	.790	0.179	0.146	0.104	0.119	0.056	-0.015
15	.105	.812	0.220	0.095	0.130	0.145	0.006	-0.041
16	.108	.862	0.215	0.164	0.117	0.154	0.038	0.006
17	.112	.922	0.182	0.105	0.023	0.120	0.039	-0.075
18	.114	.984	0.290	0.119	0.187	0.212	0.065	-0.035
19	.125	1.039	0.309	0.078	0.094	0.269	0.022	-0.138
20	.127	1.183	0.600	0.221	0.324	0.745	0.208	-0.056

Notes:

See notes to Tables 1 and 2.

Table 7

Mean Ex post Valuation Errors of Valuation Techniques for Selected Horizons, for Portfolios Formed from a Ranking on B/P Ratios and E/P Ratios

Portfolio	Portfolio Attributes at t		Horizon			Horizon			Horizon		
			t+1	t+5	t+8	t+1	t+5	t+8	t+1	t+5	t+8
	Mean GAAP B/P	Mean GAAP E/P	Price Model			DCFM (TV: 1.04)			RIM		
1	.091	-.522	0.091	-0.471	-0.740	0.163	2.001	2.557	1.065	0.626	0.499
2	.319	-.012	0.087	0.059	0.019	1.103	1.235	1.576	0.704	0.651	0.557
3	.361	.028	0.072	0.148	0.107	1.166	1.123	1.014	0.649	0.561	0.489
4	.400	.045	0.061	0.083	0.052	1.385	1.049	0.839	0.602	0.528	0.471
5	.432	.057	0.024	-0.004	-0.068	1.553	1.104	0.548	0.556	0.442	0.332
6	.476	.069	0.004	-0.065	-0.152	1.268	1.139	0.734	0.498	0.364	0.241
7	.523	.081	-0.012	-0.101	-0.179	0.930	0.727	0.698	0.441	0.292	0.173
8	.584	.094	-0.029	-0.160	-0.249	0.923	0.630	0.465	0.382	0.227	0.115
9	.645	.107	-0.038	-0.270	-0.418	0.892	0.809	-0.011	0.304	0.144	0.020
10	.691	.126	-0.089	-0.404	-0.552	0.836	0.582	0.653	0.252	0.042	-0.137
11	.685	.192	-0.118	-0.462	-0.719	1.026	-0.176	0.670	0.233	0.004	-0.165
12	.996	.108	-0.037	-0.245	-0.342	0.776	-0.103	-0.324	0.022	-0.016	-0.083
13	2.215	-.581	-0.017	-0.670	-0.839	-4.410	1.376	1.725	-0.615	-0.163	-0.182
14	1.710	-.054	0.028	-0.277	-0.338	-0.309	1.728	1.244	-0.453	-0.175	-0.149
15	1.492	.056	0.002	-0.252	-0.289	-1.345	0.828	0.813	-0.360	-0.184	-0.200
16	1.449	.097	-0.018	-0.239	-0.425	0.674	0.901	0.916	-0.343	-0.229	-0.285
17	1.438	.125	-0.057	-0.387	-0.667	0.032	-0.319	0.289	-0.371	-0.310	-0.394
18	1.465	.149	-0.100	-0.481	-0.772	-0.052	-0.026	-0.181	-0.437	-0.424	-0.504
19	1.516	.183	-0.144	-0.528	-0.878	0.476	-0.521	-0.108	-0.534	-0.521	-0.559
20	1.833	.328	-0.187	-0.720	-1.091	-0.331	-0.791	-0.405	-0.814	-0.695	-0.766

Table 7 (continued)

Portfolio	Portfolio Attributes at t		Horizon t+1	Horizon t+5	Horizon t+8	Horizon t+1	Horizon t+5	Horizon t+8	Horizon t+1	Horizon t+5	Horizon t+8
	Mean (Debt+PS)/P	Mean FCF^e/P	RIM (TV: 1.0)			RIM (TV: 1.04)			CM		
1	1.846	.457	0.917	0.358	0.240	0.916	0.056	-0.079	1.644	0.332	0.247
2	.454	-.091	0.824	0.421	0.604	0.753	0.169	0.489	1.130	0.661	0.496
3	.455	-.081	0.661	0.504	0.451	0.519	0.330	0.284	0.706	0.507	0.438
4	.408	-.079	0.580	0.467	0.297	0.383	0.266	0.035	0.479	0.450	0.419
5	.481	-.058	0.386	0.262	0.267	0.099	-0.019	0.050	0.398	0.327	0.247
6	.445	-.052	0.306	0.209	0.072	-0.011	-0.084	-0.233	0.296	0.234	0.161
7	.425	-.043	0.188	0.135	0.205	-0.175	-0.170	-0.001	0.190	0.147	0.097
8	.513	-.033	0.129	0.034	0.037	-0.264	-0.315	-0.242	0.150	0.062	0.028
9	.662	-.029	0.068	-0.035	-0.066	-0.353	-0.410	-0.390	-0.041	-0.051	-0.101
10	.833	-.028	-0.096	-0.244	-0.065	-0.604	-0.711	-0.352	-0.173	-0.218	-0.300
11	1.099	.014	-0.266	-0.281	-0.177	-0.892	-0.805	-0.562	-0.442	-0.318	-0.370
12	1.399	.032	0.182	-0.021	-0.139	-0.192	-0.384	-0.486	0.153	-0.029	-0.104
13	3.708	.641	2.128	0.474	0.428	2.689	0.238	0.183	4.355	1.010	0.331
14	2.232	.061	1.161	0.376	0.129	1.257	0.162	-0.138	1.678	0.398	0.183
15	2.188	.029	0.590	0.080	-0.022	0.403	-0.247	-0.327	0.901	0.155	-0.018
16	1.839	-.017	0.487	0.031	-0.072	0.269	-0.290	-0.370	0.580	0.051	-0.150
17	1.833	.012	0.150	-0.131	-0.344	-0.238	-0.527	-0.772	0.226	-0.130	-0.311
18	1.762	.019	-0.092	-0.247	-0.364	-0.604	-0.679	-0.791	-0.056	-0.285	-0.419
19	2.340	-.016	-0.115	-0.177	-0.330	-0.642	-0.593	-0.775	-0.289	-0.373	-0.450
20	3.694	.160	-0.041	-0.665	-0.274	-0.556	-1.412	-0.734	-0.520	-0.394	-0.592

Notes:

See notes to Tables 1 and 2.