Combining Earnings and Book Value in Equity Valuation

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Abstract

It is common to apply multipliers to earnings and book value to calculate approximate equity values. However, applying a price-earnings multiple or a price-to-book multiple typically produces two valuations and the analyst is left with the question of how to combine these into one valuation. This paper calculates weights that do this. It shows that these weights differ over the difference between earnings and book value and systematically so over time: when earnings are small compared to book value the weights are different from when earnings are large relative to book value, and they vary in a non-linear way over the difference between the two. The weights have the interpretation of combining forecasts of future earnings based on earnings and book value separately into one composite forecast that uses both pieces of information together. So the paper calculates a second set of weights to ascertain how the two numbers are combined to forecast one-year-ahead earnings and three-years-ahead earnings. The calculated weights are applied out of sample to ascertain their predictive ability against other benchmarks.

Combining Earnings and Book Value in Equity Valuation

When valuing stocks investors often apply a multiple to earnings or the book value of equity. Rules of thumb develop which maintain that firms (in a particular industry, say) should sell at a number of times earnings or a number of times book value. The advantage of using these multipliers lies in their simplicity. They use only one number but that number is a "bottom line" number in the income statement or balance sheet and so is an aggregation of a considerable amount of information. However, simple as they are, the valuations they yield are usually approximations. They are regarded as benchmarks, as a starting point, and one then analyses other information to assess whether a particular firm might sell at a price different from the benchmark. Typically the multiples are applied to earnings and book value separately. Thus a benchmark is stated as price = $m_1 \cdot$ book value, where m_1 is the benchmark price-to-book (P/B) ratio, or as price = $m_2 \cdot$ earnings, where m_2 is the benchmark price/earnings (P/E) ratio. This paper investigates approximate benchmark valuations that combine earnings and book value together. It estimates weights such that a benchmark price = $w_1 \cdot$ book value + $w_2 \cdot$ earnings, and examines the robustness of these weights over time.

The weights, w_1 and w_2 are multiples applied to earnings and book value but in such a way as to accommodate what the two numbers imply jointly. Considering the two numbers together makes sense. Book value is the balance sheet measure of net assets that generate earnings and earnings is the income statement measure of returns from these assets. So they probably have information in common but both may also have information the other does not have. If book value were measured at market value, one would put all the weight on book value and none on earnings. If earnings were sufficient to value firms, one would apply a capitalization rate to the earnings and ignore book value. These ideal earnings and book values are not typical under GAAP accounting but one probably does not simply add the two valuations based on each separately. This would involve some double counting. So, how does one weight them? Typically, the multiples are determined one at a time: a price based on a multiple of earnings and a price based on a multiple of book value are calculated. This usually yields two different prices and one is faced with the problem of combining the two into one price that the attributes jointly imply.[1] The paper investigates how this might be done.

In the tradition of developing benchmark multipliers, the valuation produced by the weights is a minimalist valuation that ignores other information besides earnings and book values. It amounts to a minimalist financial statement analysis. It asks what can be extracted from the summary numbers of the income statement and balance sheet, considered together, without analyzing the line items that sum to them. However, given just the earnings and book value of a firm, there is one further piece of information that can be utilized and that is the difference between them. In ratio form this earnings-to-book is the accounting rate of return on equity. The paper shows that weights vary in a nonlinear way over the amount of earnings relative to book value, and systematically so over time. Accordingly one can improve the minimalist valuation by changing the weights according to the spread between earnings and book value. In particular, when earnings are particularly high or low relative to book value in the cross section more weight is given to book value and less to earnings. As the weights vary for different amounts of earnings relative to book value they are nonstationary for a given firm, depending each year on the earnings it reports relative to book value. So the results suggest the following approach to getting a composite benchmark multiplier for a particular firm: each year calculate the difference between the earnings realized for that year and the book value and apply weights to the earnings and book value that are appropriate for that difference.

The paper shows that estimated weights are robust over time and can be used to predict prices when applied out of sample. So the results are of some practical use. But the paper also gives meaning to the weights and explains why they might vary over the difference between earnings and book value. It takes a forecasting perspective similar to that in Ohlson (1995) and Feltham and Ohlson (1995). Price is viewed as based on expected future earnings so current earnings and book value inform about price because they forecast future earnings. A high P/E ratio (say) means that expected future earnings are high relative to those forecasted at the level of current earnings and a high P/B ratio means that expected future earnings are high relative to those indicated by the book value. Accordingly, the weights that combine earnings and book value into a composite valuation are also weights that combine forecasts of future earnings based on each separately into a composite forecast. The weights indicate how much emphasis one puts on current earnings as indicative of future earnings and how much one emphasizes the current book value. But the analysis differs from the Ohlson and Feltham and Ohlson models in that weights are shown to be changing over time, as periodic earnings and book values change, rather than being fixed firm parameters that are applied irrespective of the level of earnings relative to book value.

This interpretation contrasts to that in previous papers. Burgstahler and Dichev (1997) hypothesize that earnings is weighted as an indicator of the value of current operations while book value is given weight as an indicator of the ability of the firm to adapt into alternative businesses. In a similar vein, Barth, Beaver and Landsman (1996) see book value as warranting a higher multiple (and earnings a lower multiple) as the probability of liquidation increases because, they conjecture, book value indicates exit value as opposed to value in use. In his discussion of this paper David Burgstahler ably compares the approach here with that in Burgstahler and Dichev.

Just as the weights yield a benchmark a valuation, so they yield a benchmark forecast. Accounting research has had a long tradition of specifying benchmark earnings forecasts which have been used to evaluate other forecasts such as those by analysts. Most of the benchmark forecasts that have been developed in the “time series of earnings” literature are based on past earnings alone. The standard benchmark is the "random walk" or martingale model which predicts that future earnings will be the same as current earnings. However, the amount invested in the net assets that produce future earnings also indicates an ability to earn and the weights estimated here indicate how weight is shifted from an earnings-based forecast to one that utilizes the book value, and how this varies over the difference between earnings and book value. The resulting composite forecast is an alternative benchmark forecast but one that reflects the structure of the accounting. Earnings are calculated jointly with book values (they articulate) and future earnings are related to current book values, as well as current earnings, by the intertemporal properties of accounting. With this perspective the weights calculated to combine earnings and book value into a benchmark price are supplemented in the paper with weights that combine earnings and book value into a benchmark earnings forecast. These weights, like the price weights, are nonlinear in earnings-to-book value:

when earnings are low relative to book value (in the extreme, losses), or high relative to book value, more weight is given to the book value as a predictor of future earnings, and more to the earnings forecast when the ratio is less extreme.

The paper also shows that the weights that combine earnings and book value into price give an indication of the P/E and P/B ratios, the multiples applied to each separately. Indeed, the analysis yields revised benchmarks for these multipliers. A standard P/E benchmark is given by the capitalization rate but consideration of book value revises this and the difference between the revised benchmark P/E ratio and the standard one is determined by the weight applied to earnings in the composite valuation. Similarly, benchmark P/B ratios that differ from a standard of P/B = 1 are calculated and these are determined using the weight applied to book value. As Penman (1996a) lays out, the P/E ratio reflects expected future earnings relative to those forecasted from current earnings (that is, expected growth in earnings) and the weight applied to earnings "weights up" the earnings to reflect this. Similarly, the P/B ratio reflects expected future earnings relative to those forecasted from book value (expected growth in book value through earnings) and the weight applied to book value adjusts book value to inform about this.

The analysis covers all NYSE and AMEX firms on the COMPUSTAT files with per-share earnings, book values and prices for 1968-74 and all NYSE, AMEX and NASDAQ firms on the files with these data for 1975-93. Firms on the research files (non-survivors) are included. For 1968-74, the number of firms per year range from 2,022 to 2,680 and for 1975-93, 4,015 to 6,198. Prices on COMPUSTAT are at fiscal-year end but similar results were obtained with prices obtained from CRSP files three months after fiscal year end.[2]

Normal Benchmarks for P/E and P/B Multipliers

The valuation task we consider is to estimate prices from earnings and book value without considering any other information. We view prices as based on forecasted earnings and so develop the price estimates in a way that reflects forecasting from earnings and book value to future earnings. We build from cases established by Ohlson (1995) where earnings or book value are sufficient for all information about future earnings, and thus for price. We follow the derivations in Penman (1996a), based on Ohlson's reformulation of the traditional "residual income" formula that expresses price in terms of forecasted summed cum-dividend earnings. We assume that equity price is given by the infinite-horizon dividend discount formula. Let $E_t(\tilde{X}_{t+\tau})$ denote expected clean-surplus ("comprehensive") earnings for a firm for period t+τ conditional upon all information at t and ρ_t its cost of equity capital plus one established at time t. Then (with firm subscripts omitted),

$$V_t^T \equiv \left(\rho_t^T\right)^{-1} E_t\left(\sum_{\tau=1}^{T} \tilde{X}^c_{t+\tau}\right) \tag{1}$$

approaches P_t^*, the price given by the infinite-horizon dividend discount formula, as $T \rightarrow \infty$.[3]

$$E_t\left(\sum_{\tau=1}^{T} \tilde{X}^c_{t+\tau}\right) \equiv E_t\left(\sum_{\tau=1}^{T} \tilde{X}_{t+\tau} + \sum_{\tau=1}^{T} \left(\rho_t^{T-\tau}\right) \tilde{d}_{t+\tau}\right)$$

for brevity, where the superscript "c" indicates the summed earnings are cum dividend, that is, they include earnings from expected dividends, d_{t+t}, paid and reinvested at each t+τ.

Given only earnings information and the cost of capital, future earnings are assumed to be forecasted by applying the cost of capital to earnings, and price is thus determined from current earnings alone if:

$$E_t\left(\sum_{\tau=1}^{T} \tilde{X}^{cd}_{t+\tau}\right) = \sum_{\tau=1}^{T} \rho_t^{\tau} X_t \tag{2}$$

in the limit as $T \rightarrow \infty$ or for an appropriate finite horizon, t+T.[4] Here, $E_t\left(\sum_{\tau=1}^{T} \tilde{X}^{cd}_{t+\tau}\right) \equiv E_t\left(\sum_{\tau=1}^{T} \tilde{X}_{t+\tau} + \sum_{\tau=0}^{T} \left(\rho_t^{T-\tau} - 1\right) \tilde{d}_{t+\tau}\right)$ includes the earnings from reinvesting the current dividend, d_t. Equation (2) says that, if earnings is the only information one has, then one forecasts future earnings as current earnings growing at the cost of capital. This recognizes that the reinvestment of dividends yields growth in earnings and, without other information, one can only conclude that earnings will grow at the cost of capital. Thus one forecasts next period's earnings as $E_t\left(\tilde{X}_{t+1}\right) = \rho X_t - (\rho - 1) d_t$ and cum-dividend as $E_t\left(\tilde{X}^{cd}_{t+1}\right) = \rho X_t$; similarly one forecasts earnings two periods ahead, cum-dividend, as $E\left(\tilde{X}^{cd}_{t+2}\right) = \rho^2 X_t$, and so on. By substituting (2) into (1), the cum-dividend price,

$$P_t^* + d_t = \frac{\rho_t}{\rho_t - 1} X_t . \tag{3}$$

This identifies a benchmark, "normal" (cum-dividend) P/E multiplier as $\frac{\rho_t}{\rho_t - 1}$. The dividend on the left-hand side sets the price cum-dividend just like the earnings forecast.[5] Similarly, given only the book value, future earnings are assumed to be forecasted by applying the cost of capital to the book value, B_t, and price is determined from book value alone if

$$E_t \left(\sum_{\tau=1}^{T} \tilde{X}^{c}_{t+\tau} \right) = \left(\rho_t^T \right) B_t \tag{4}$$

in the limit as $T \rightarrow \infty$ or for an appropriate horizon. This expression forecasts that book values will earn at the cost of capital, that is, the return on current equity will equal the cost of capital over the long run. By substituting (4) into (1),

$$P_t^* = B_t \tag{5}$$

and a benchmark, "normal" P/B ratio is one.

These expressions give benchmark valuations and benchmark multipliers for the cases where earnings or book values are sufficient for valuation. They also introduce the forecasting perspective. Both benchmark valuations correspond to a benchmark forecast that uses current earnings or book value to forecast future earnings on which prices are based. We now turn to using earnings and book values together for both valuation and for forecasting.

Weighting Earnings and Book Values

Typically GAAP accounting does not produce book values that equal the market value of equity, nor does it measure earnings that typically yield normal P/E ratios. However, a combination of the two may provide an indication of price that is better than the benchmarks in (3) or (5). Accordingly, for each firm in each year we calculate weights $[(1-w_t), w_t]$ that the market implicitly applies to per-share book value and earnings such that the traded price per share,

$$P_t = (1 - w_t)\ B_t + w_t\ [\varphi_t X_t - d_t] \qquad (6)$$

where $\varphi_t \equiv \rho_t / (\rho_t - 1)$ is the normal multiplier that capitalizes the earnings flow into a stock, like book value. (Firm subscripts are again understood). That is, the weights combine the two normal valuations into the price without error. For notational convenience, the term in the square parenthesis will be indicated by $\varphi_t X_t$ with the dividend adjustment implied.[6] Equation (6) characterizes the market as "buying earnings" and "buying assets" and the weights indicate the allocation of a dollar to each. Under the zero error condition the weights reflect other information that is relevant for price and this will vary over firms; but, by averaging over firms we discover if there are robust central tendencies.

The weights might be estimated without constraints and any number of schemes for aggregating earnings and book value might be considered. However the weights are specified to add to unity to yield a valuation that is a simple weighted average. This has the feature that when w = 1, price is given by capitalizing earnings and when w = 0, price is given by book value. Thus the benchmark valuations in (3) and (5) are special cases when all the weight is placed on one number or the other and other cases involve shifting weight from one to the other. It also has the dividend displacement feature. Under GAAP dividends reduce book values, dollar-for-dollar, but do not affect earnings. If dividends also reduce share price dollar-for-dollar, as maintained by the Miller and Modigliani dividend displacement property, weights that sum to unity appropriately project the effect of dividends on price (see Ohlson 1995).

Weights estimated using actual market prices, P_t, combine earnings and book values into intrinsic prices, P_t^*, only if market prices are "efficient." By (1) intrinsic prices are based on forecasted earnings. Substituting (1) for the left-hand side of (6),

$$E_t\left(\sum_{\tau=1}^{T} \tilde{X}_{t+\tau}^{c}\right) = (1 - w_t)\left(\rho_t^T\right) B_t + w_t \varphi_t \left(\rho_t^T - 1\right) X_t \qquad (7)$$

(for an appropriate T), where the dividend adjustment to capitalized earnings is again implied.

But $\varphi_t \equiv \dfrac{\rho_t}{(\rho_t - 1)} = \sum_{\tau=1}^{T} \rho_t^\tau / \left(\rho_t^T\right) \text{ all } T$, so

$$E_t\left(\sum_{\tau=1}^{T} \tilde{X}_{t+\tau}^{c}\right) = (1 - w_t)\left[\left(\rho_t^T\right) B_t\right] + w_t \left[\sum_{\tau=1}^{T} \rho_t^\tau X_t\right]. \qquad (8)$$

The terms in square parentheses are the benchmark earnings forecasts from current earnings and book value in (2) and (4), and the weights indicate how these are combined to yield one forecast that utilizes both. We estimate these weights also. For very long horizons ($T \to \infty$), these weights are the same as those in (6), given market efficiency (such that $P_t = P_t^*$).

This is in the spirit of Ohlson (1995) but differs substantially. The Ohlson model combines earnings, book value and other information additively into price but for practical purposes the model is underidentified. This paper calculates weights on earnings and book value such that other information is incorporated in the weights and (6) and (7) are determined with zero error. Then, by averaging over firms' weights that reflect differential other information, it seeks to discover robust central tendencies that promote simplified valuations based on earnings and book value alone. Further, weights are calculated over different combinations of earnings and book value whereas the Ohlson model identifies them as firm-specific parameters to be applied to all joint realizations of earnings and book value. Accordingly, the P/E and the determination of P/B can vary over earnings-to-book rather than being described in terms of fixed parameters.

Estimation of Weights for Prices

Given earnings and book value (and no other information), there is only one additional piece of information that can be utilized to combine the two, and that is how much they differ. If $\varphi X_t = B_t = B_t$, there is no differential information and either is the best one can do. Indeed in this case w is indeterminate. However, when they differ by varying amounts, does the market weight them differently? Table 1 reports representative market weights for firms grouped in the cross section in each year on $\varphi_t X_t / (\varphi_t X_t + B_t)$. The second column of the table defines the groups. Group 1 is all loss firms. From (6) the value of w_t that yields the market price for each firm i in year t is (with firm subscripts attached)

$$w_{it} = (P_{it} - B_{it}) / (\varphi_t X_{it} - B_{it}) \tag{9}$$

and median and mean w_{it} for firms in each group were calculated. Weights based on pooling the n firms in each group were also calculated each year such that

$$w_t \text{ (pooled)} = \sum_{i=1}^{n} \left(P_{it} - B_{it}\right) / \sum_{i=1}^{n} \left(\varphi_t X_{it} - B_{it}\right) \tag{10}$$

to yield mean zero pricing errors for the group. These weights were not calculated for group 7 or for all firms pooled because of the indeterminacy when $\varphi_t X_t$ is close to B_t.[7] In addition, weights that minimize the mean absolute value of

$$P_{it} - B_{it} - w_t\,(\varphi_{it} X_{it} - B_{it})$$

for each group were calculated. These are referred to as MAE weights (weights that minimize mean absolute error). In all calculations, the equity cost of capital, $\rho_t - 1$, was estimated as the three-year T-bill rate (per annum) in year t plus the historical equity risk premium of 6%.

Weights for individual firms will differ from overall weights calculated for each group of course and, as David Burgstahler points out in his discussion, some weights for individual firms are large. Weights for individual firms reflect other information and the weights for groups, when applied to individual firms, reflect the approximation that arises from considering just earnings and book value. The issue is one of central tendency and of whether representative weights are robust over time.

The calculations were done for each year of the sample period, 1968-93. The weights in Table 1 are means over years. So, for the full period, the reported weight is the mean of 26 calculations. The number of firms is the average number in each group per year. The first MAD (mean absolute deviation) refers to the deviation of median weights in each year from the mean over all years and the second MAD is the mean over years of firms' weights from the median weight for the year. Mean weights are also reported for two subperiods, 1968-80 and 1981-93. The weights do vary over groups with the superscripts a and b indicating the absolute values of “t-statistics” on the means[8] relative to zero and one, respectively, were greater than 2.0. For all firms pooled together in the last row, the mean (over all years) of median w_i is .42. The median earnings per dollar of book value for these firms is .113 on average and a typical payout is 20% of earnings. So, applying the weights as in (6), this says that, for the typical firm with a typical cost of capital of 10%, price = [.58 x $1.00] + [.42 x (11 x $0.113 - $0.023 x .95)] = $1.09. The market imputes 51.3 cents for each dollar of earnings per dollar of book value, and adds 58 cents for the book value, to yield a price of $1.09 for each dollar of book value, a P/B ratio of 1.09 and a cum-dividend P/E of 9.85.[9] For a given group, weights vary somewhat over the two subperiods reported (the w(pooled) weights are very similar to the median weights). However, the weight pattern over groups is similar in the two subperiods and vary systematically from those for all firms as the grouping variable changes. For loss firms in group 1, the negative earnings are discounted (at the median) in favor of a weight greater than one for book values. For other groups below group 7 (capitalized earnings less than book value), earnings are weighted low relative to book value but, for groups above 7 (capitalized earnings greater than book value), earnings gets a high weight. These weights are greater than one indicating a multiplier effect on capitalized earnings. However, for the top groups, the weight on earnings declines from a peak for group 8, indicating the market applies less of a multiplier to high earnings relative to book value. In sum, the results do not indicate a simple relationship of decreasing weight on capitalized earnings as it increases relative to book value, but one of increasing weights with a reduction in the extremes.[10]

The median weights, the weights from pooling, and the MAE weights are similar (and so in both subperiods). Mean weights are not reported in Table 1. The pattern for mean weights over groups is similar but the means are lower than the medians for groups below 7 and higher for groups above 7, demonstrative of a skewness in the direction of the differences in central tendency. Some weights are very large and the mean (and calculated standard errors) are of course sensitive to them. The emphasis on median and MAE weights serves to discount the effects of extremes on means and squared derivations from means.

The reported pattern over groups was the same in all years except 1973-79 which are precisely the years when market prices were below the benchmark (normal) P/E and P/B on average.[11] The differences in results for the two subperiods reported is due largely to these years. The (otherwise) consistency indicates a systematic phenomenon. The year-to-year consistency is striking and this will become apparent in the out-of-sample prediction tests. This robustness accompanied by a large reduction in the absolute deviation of the weights from their medians within groups relative to that for all firms together, and a declining variation (MAD) of median weights over years for groups away from group 7.

These weights have particular interpretations. From (6),

$$P_t - B_t = w_t\left[\varphi_t X_t - B_t\right], \tag{11}$$

so the weight is the projection from the implicit premium calculated by accountants, $\varphi_t X_t - B_t$, to the actual premium over book value at which a stock trades, and the differential weights over groups indicate the variation in multipliers of the accounting premium for different levels of the accounting premium. The weight is similar to an "earnings response coefficient" except that it relates price (levels) to earnings (levels) rather than "unexpected" prices and earnings, and both are considered relative to book value. The results indicate that the market imputes a smaller discount than the accounting discount for groups below 7 (where $\varphi_t X_t < B_t$) and a larger premium than the accounting premium for groups above 7 (where $\varphi_t X_t > B_t$), but less so than for the extreme high groups, on average. As premiums and discounts over book value are determined by expected future earnings relative to current book value (by the residual income formula), the weights indicate how (the market perceives) future earnings relative to current book value will be different from current earnings relative to book value. This determines the P/E ratio [Ohlson (1995) and Penman 1996a] so the weights also project the P/E ratio. From (6),

$$P_t - \varphi_t X_t = (1 - w_t)(B_t - \varphi_t X_t), \tag{12}$$

that is, the weights indicate the adjustment to the accounting premium to establish the actual P/E relative to normal (and w=1 implies a normal P/E).

Accordingly, Table 2 reports the (mean over years) of B/P and E/P ratios implied by the median weights for each group.[12] Implied prices per dollar of book value, $\hat{P}_t$, are calculated for each group in each year t, as

$$\hat{P}_t = (1 - w_t) + w_t \left(\rho_t / (\rho_t - 1) \cdot \text{median } X_t / B_t\right)$$

(13)

where w_t is the median w_i for the group in the relevant year and the median earnings-to-book value is adjusted for the median payout for the group in the relevant year. The implied B_t/P_t and E_t/P_t ratios are $\frac{1}{\hat{P}_t}$ and $\text{median } (X_t / B_t) / (\hat{P}_t + d_t)$, respectively (with d_t based on median payout per dollar of book value). The table also reports the mean (over years) of median actual B/P and E/P for each group. The table indicates that the spread between $\varphi_t X_t$ and B_t distinguishes B/P and E/P ratios. For groups 6-10, both implied and actual E/P ratios are close to what one expects for a normal E/P given the historical return to equity of about 10%-12%, but differ in the extremes in a direction consistent with (12). Similar patterns are evident in the two subperiods.

The negative median weight for group 6 looks out of pattern.[13] These firms have accounting discounts ($\varphi_t X_t < B_t$) but these are relatively small. By (11), negative weights indicate that these firms tend to sell at a premium rather than a discount. Whereas firms in groups below 6 and above 7 tend to sell at a premium consistent in sign with the accounting premium, this is not so for this group. So the weight is in fact consistent with those for the higher groups where the actual premium is considerably larger than the accounting premium, but it happens that in group 6 the accounting premium is a discount.

The partitioning variable in these tables compares earnings and book values and thus is isomorphic to book rate of return (ROE), and this is reported in Table 2. The within-group Spearman correlation between ROE and the weights indicate that, with the exception of group 1 (and 7), the grouping has identified fairly homogeneous groups. So the results can be interpreted as weights, B/P and E/P implied by different levels of ROE. The positive relationship between ROE and the weights is consistent with the well-documented positive relationship between ROE and P/B [in Penman (1991), Bernard (1994) and Fama and French (1995)] but the variation in weights from the peak in group 8 indicates that the projection from ROE to P/B is not monotonic, and accordingly

P/E ratios differ over groups.[14] One might speculate that ROE is related to risk so that the results reflect a different multiplier, φ, over groups. Penman (1991) shows that empirically there is little relationship between ROE and CAPM beta; if anything, it's negative.

Book values are reputed to be lower than market values because of "conservative" carrying values of balance sheet assets and omission of others. Accordingly P_t is greater than B_t on average (and the projection from book value to price is on average biased). To incorporate this, weights in the following equation were estimated:

$$P_t = (1-w_{1t})B_t + w_{1t}\varphi_t X_t + w_{2t}B_t \qquad (14)$$

where w_{1t} (interpreted as in (11)) is the projection from the accounting premium to a bias-corrected premium.[15] Estimating w_{1t} requires a knowledge of the book value bias in w_{2t}. Here this is estimated as the median premium per dollar of book value in the cross section for the relevant year, that is, median P_t/B_t - 1.0. This aims to capture how much the accounting is biased for the typical firm but ideally w_{2t} should be assessed by firm with knowledge of its accounting principles (for R&D expenditures, for example). Of course, this estimate of w_{2t} is an accounting bias only if $P_t = P_t^*$ so this adjustment can also be interpreted as accommodating typical mispricing in the market.

The mean annual Spearman correlations between w_{1t} and the w_t weights in (6) over all firms[16] is .67. Table 3 summarizes the central tendency of the w_1 weights, now with four subperiods. Mean weights are also given to give a feel for the effect of large weights referred to previously. The pattern of weights is similar to that in Table 1. The MAD of the median weights over years is considerably less than that in Table 1, indicating more stability with the adjustment.

The weights are quite consistent over the four subperiods for which the means of annual median B/P (on which the w_{2t} adjustment is based) were .72, 1.18, .68 and .58. With the adjustment for the different pricing of book values in the 1970s, the weights during that period are similar to those in other periods (which was not so for the w_t weights). The same reduction in the weights in the extremes is evident and now the weight for group 6 is positive and indeed large. Results are similar for median, w (pooled) and MAE weights (not reported), but the mean weights reflect some large weights. Implied E/P and B/P ratios (not reported) are very similar to those in Table 2.

Estimation of Weights for Earnings Forecasts

Table 4 summarizes results from estimating weights applied to the benchmark forecasts of future earnings in (8). The second forecast in (8) is the forecast from current earnings alone, the "random walk" or martingale model (so-called in the literature) with an accommodation for retention.[17] The weight modifies this forecast to accommodate that from the book value. Rearranging (8),

$$E_t\left(\sum_{\tau=1}^{T} \tilde{X}^{c}_{t+\tau}\right) - \left(\rho^{T}-1\right) B_t = w_t \left(\sum_{\tau=1}^{T} \rho^{\tau} X_t - \left(\rho^{T}-1\right) B_t\right) \quad (15)$$

so, if one is used to thinking in terms of forecasting residual income, the weight indicates how one projects from the two forecasts to future residual income over a given horizon (on the left-hand side). As both sides compare (future and current) earnings to current book values projected at (ρ^T-1), the weight can alternatively be interpreted as indicating the "persistence" in earnings (to adopt a much-used term). If w=1, earnings are persistent, earnings "follow a random walk," (and the P/E is normal). The grouping variable can be expressed as

$$\left(\varphi_t X_t + B_t\right)/\varphi_t X_t = 1 + \left(\rho_t^T - 1\right) B_t / \sum_{\tau=1}^{T} \rho_t^{\tau} X_t, \qquad (16)$$

that is, as a difference between the forecasts from earnings and book values in (2) and (4), and the weights over groups are differences in the weight put on the alternative forecasts over this spread.

As in the previous tables, Table 4 presents the mean of calculations for each year. Two sets of median and MAE weights are reported, one in Panel A for T=3 (a three-year forecast horizon) and one in Panel B for T=1 (a one-year horizon).[18] For the three-year horizon the calculations cover 23 years, 1968-90 and for the one-year horizon, 25 years, 1968-92. The table also reports the ratio of ex post realized earnings to the horizon over the earnings forecasted from current earnings alone, and this is referred to as the earnings ratio. The results may be subject to survivorship bias as firms had to continue to the horizon to have future earnings. A comparison of the number of firms with those in Table 1 gives the number of non-survivors. These are larger for T=3 and more so for the loss firms in group 1 and in the upper extreme (where groups 11 and 12 in Table 1 have been combined into one group because of relatively few observations in group 12).

Over all firms, the median weights for T=3 are .76 on forecasts from earnings and .24 on those from book value, and their MAD over years and the superscripts indicate these are reliably different from zero or one. The corresponding numbers for T=1 are .89 and .11. This suggests the typical "random walk" forecast based on earnings alone can be improved by considering book value, but more so for a longer horizon. There is variation in the weights over groups but this is not large relative to the reported MAD, and results for median and MAE weights are similar. There is more variation in the weights for T=3 than T=1, and more in the second sub-period than the first. The form of the non-linearity is similar to that for the price weights: weights are lower in the extremes from a peaking in groups 5 and 6. The pattern for median earnings ratios (higher and lower in the extremes) is similar.[19]

The patterns here reflect the same phenomena as the results in Freeman, Ohlson and Penman (1982) (where non-central ROE predict one-year-ahead earnings better than a "random walk") but here explicit weights are given to combine the information in earnings and book value. A weight different from unity modifies the standard benchmark in the "time series of earnings" literature, the "random walk." Other benchmarks have been developed in that literature that weight lagged earnings as well as current earnings (usually employing ARIMA techniques). These suggest earnings have different implications for earnings one year ahead, two years ahead, and so on. This is reflected here in the multiyear forecast and indeed the difference in weights for T=1 and T=3 (.89 and .76 for all firms) indicates earnings of different lags are weighted differently (now in combination with book value).

These weight patterns and the sizes of weights for given group differ from those in Table 1 and the Spearman correlations between the two sets of weights (reported in Table 4) are not high. Given market efficiency (such that the prices on which Table 1 weights are based reflect long-run expected earnings), the difference is explained by information in prices about long-run earnings that is not realized (into earnings) within three years.[20] Under this interpretation the different weights in Table 1 indicate the market sees different earnings for $T > 3$. Further, the higher weight on book value for the price weights indicates that book value is given more weight in predicting long-run earnings. It suggests that current earnings may be a good indicator of earnings in the near future (reflecting positive serial correlation in earnings) but over the long term earnings revert towards those implied by book value. Indeed this slow mean reversion of earnings-to-book value (ROE) has been documented in previous research. Under this interpretation, the non-linear weights indicate that the mean reversion is faster in the extremes.

However, the differences are also consistent with market inefficiency, that is, with the market mispricing the implications of earnings and book values for three-year ahead earnings.[21] These alternative explanations could be investigated by taking positions in stocks based on differences in the two sets of weights. This would amount to a one-step screen that would replace the two-step screening based on multiples in (for example) Lakonishok, Shleifer and Vishny (1994).

Prediction tests

These results document that, as a matter of central tendency, capitalized earnings and book value are weighted in a way that is consistent over time and systematically differs over the difference between them. The combination of the two is of interest from an accounting theory viewpoint but the usefulness of the analysis depends on the success in applying the weights to determine price and to forecast earnings out of sample. That depends on the consistency of the accounting and the stability in the way that other information combines with earnings and book values over time. This section reports some prediction tests. The weighted combination is designed as a benchmark forecast so predictions are not compared against forecasts that presumably use a lot more information (analysts forecasts, for example) but against other contenders for minimalist benchmarks against which analysts forecasts (say) can be judged. In addition predictions using the estimated weights are compared against those which involve other schemes for combining earnings and book value.

Table 5 gives error metrics from predicting prices using the calculated weights. For each firm and in each year, 1969-93, a forecasted price, $\hat{P}_{it}$, was calculated following (6) using the median weight for the firm's $\varphi X/(\varphi X+B)$ group calculated in the preceding year. This forecast is referred to as F1a. A forecasted price was also calculated using the weights for the group that minimize MAE in the previous year. This is referred to as F1b. Pricing errors relative to actual price, P_{it}, were calculated as $(\hat{P}_{it} - P_{it})/P_{it}$. For benchmarking, errors were also calculated for the following forecasts:

$$\hat{P}_{it} = \varphi_t X_{it} \qquad \text{(F2)}$$

$$\hat{P}_{it} = B_{it} \qquad \text{(F3)}$$

$$\hat{P}_{it} = B_{it} + \varphi_t X_{it} \qquad \text{(F4)}$$

$$\hat{P}_{it} = B_{it} + w^e \varphi_t X_{it} \qquad \text{(F5)}$$

$$\hat{P}_{it} = w^b B_{it} + \varphi_t X_{it} \qquad \text{(F6)}$$

$$\hat{P}_{it} = (1-w) B_{it} + w \varphi_t X_{it}$$

where, alternatively,

$$w \equiv \text{median } w_i \text{ for all firms pooled} \qquad \text{(F7)}$$

$w \equiv$ firms' own weight in previous year (F8)

$w \equiv$ median w_i for forecasting 3-year's earnings (F9)

$$\hat{P}_{it} = \rho_i \; P_{it-1} - d_{it} \qquad \text{(F10)}$$

Weights in these forecasts were those estimated in the previous year except for F9 where they were those estimated three years prior. Results based on the w(pooled) calculation and adjusted weights in (14) are similar to those for F1a and so are not reported.

F2 (setting w=1) and F3 (setting w=0) are forecasts based on earnings and book values alone. F4 simply adds the two valuations and serves as a benchmark to test for redundancy and the need to combine them. F5 and F6 combine the two but without convexifying: in F5 book value is a starting point and an additive weight is applied to the earnings (without taking away from book value) and in F6 capitalized earnings is a starting point and the weight determines the amount of book value to be added (without taking away from earnings). The weights, w^e and w^b, used in these forecasts were the medians for all firms in the preceding year. The mean of w^e over all years was .215 and that for w^b was .677. F7 convexifies but the weight is the median weight for all firms in the previous year. As a benchmark it serves to test whether distinguishing weights by the spread between $\varphi_t X_t$ and B_t improves forecasts over one representative weight from the cross section. F8 utilizes the weight estimated according to (6) for the particular firm in the preceding year. Thus, relative to F1a and F1b, its error indicates the merit of convexifying but on the basis of firm-specific weights rather than representative weights for a given $\varphi_t X_t$ - B_t spread in the cross section. F9 applies the weight for the firm's group for forecasting three years of earnings (as in Table 4) to the forecast of price. Its errors are relatively large and are omitted from the table. F10 is a particularly demanding benchmark. This forecasts the end-of-year price as that expected from price at the beginning of the fiscal year, ex-dividend. Its error is (minus) the unexpected stock return (given the cost of capital calculation) which is the updating of price through the arrival of information over the year. So, the F10 errors relative to those for F1a and F1b compare this updating with that from the updating through the end of year weighted earnings and book value.

Table 5 reports selected error measures for groups based on the spread between $\underline{\varphi_t X_t}$ and B_t. Group 7 is not included because of the indeterminancy problem and groups 11 and 12 (in Table 1) are combined into group 11. The results for "All" groups also excludes group 7 firms, and also those in group 1. The large errors for F4 indeed point to the need to combine earnings and book values. Median errors for forecasts from earnings or book values alone, F2 and F3, are relatively small for central groups (6 and 8) but increase as the spread increases in groups away from these groups. In contrast the median errors for F1a remain small over the spread. The median absolute errors give a similar picture, and this dominance in absolute error remains up to the .9 percentile for most groups (for which only the results for "All" firms are reported).[22] MAE estimation accommodates variation from the median and, while median errors for F1b are not as small as those for F1a, its absolute errors are smaller at the .5, .75 and .90 percentiles than those for F1a, F2 and F3. Overall, the results indicate improvement in calculating a combined P/E and P/B ratio from ones based on normal multipliers of each.

On the error metrics in Table 5 the F1a and F1b forecasts perform better for most groups than those based on additive weights, F5 and F6. Median and median absolute errors are smaller by applying the group weights in F1a and F1b than applying the same weights for all firms in F7, and the absolute errors at the higher percentiles are smaller for F1b than F7. The forecast based on the firm's own weight in the previous year, F8, performs relatively well on median and median absolute error criteria.[23] This indicates some consistency at the firm level in the way that other information combines with earnings and book values. However, F8 fares less well in the extremes and its absolute errors are more right skewed. At the .75 and .9 percentiles, its absolute errors are substantially greater than those for F1a or F1b, and those for F7.

The median errors for the forecast from prior price, F10, are rank ordered over groups indicating that realizations of spreads between earnings and book value are related to returns; that is, they update prices. The median errors of F1a and F8 are lower than those for F10 (in absolute value) but on absolute error criteria, F10 performs better than F1a, F1b or F8. This indicates that some new information over the year which determines the returns (that F10 measures) is captured in part by the weighting of new earnings and book value with the historical weights, but these central tendency weights do not capture a lot of the new information (as expected). Accordingly if a forecast were to beat the benchmark, it would have to discover this information and the future earnings it implies.

The bottom of Table 5 reports the results of a matched pair analysis. In each year the difference between absolute error for the Fla prediction and each of the other predictions was calculated for each firm, and similarly so for the Flb prediction. The difference was then deflated by actual price. The table reports the mean (over years) of the median absolute error differences for each year and a t-statistic that compares that mean with a standard error calculated from the time series of median differences. Results are given only for all firms pooled. A negative sign in the table indicates that the Fla or Flb prediction typically had lower absolute errors for the same firm. The signs are negative for all comparisons except that using the firm's own weight, F8, (which is not significantly different from zero) and the price forecast, F10. The error differences are in units of actual price so, for example, the Fla prediction typically was 11.8% closer to the actual price than the F2 prediction.

Table 6 summarizes errors from forecasting earnings using the weights in Table 4. The forecast target is

$$\text{TARGET} \equiv \sum_{\tau=1}^{3} X^{c}_{t+\tau} / \left[\left(\rho_t^3\right) B_t\right]. \tag{17}$$

This is actual ex post earnings over three years relative to that forecasted from book value (and is the left-hand side of (15) in ratio form).[24] All forecasts are deflated by current book value so errors are in units of current book value. The EF1a and EF1b forecasts employ the median w_i and MAE weights for the relevant group, respectively, and thus the forecast is (with the appropriate weight),

$$\text{TARGET} = (1 - w) + w\varphi_t X_t / B_t \tag{EF1}$$

Benchmark forecasts are:

$$\text{TARGET} = \varphi_t X_t / B_t = \sum_{\tau=1}^{3} \rho^{\tau} X_t / \left[\left(\rho_t^3 - 1\right) B_t\right] \tag{EF2}$$

$$\text{TARGET} = 1.0 \tag{EF3}$$

$$\text{TARGET} = (1 - w) + w\varphi_t X_t \,/\, B_t$$

where, alternatively,

$w \equiv$ median w_i for all firms (EF4)

$w \equiv$ firm's own weight three years before (EF5)

$w \equiv$ median weight for forecasting price (EF6)

$\text{TARGET} = P_t/B_t$ (EF7)

EF2 and EF3 are the forecasts for $\varphi_t X_t$ and B_t alone $\left(EF2 = \left[(\rho_t^3) B_t\right] / \left[(\rho_t^3) B_t)\right]\right.$, that is, with w=1 and w=0, respectively. The justification for EF4 - EF6 should be clear from the discussion of Table 5. The target is the (ex post) intrinsic P/B ratio (Penman 1996a) and so F7 simply forecasts the intrinsic P/B as equal to the actual, traded P/B.

Only the results for the three-year horizon are presented as those for a one-year horizon were similar. Also results for EF1 forecasts using mean and w(pooled) weights were similar. Weights used were those estimated three years prior to the forecast year to enforce the out-of-sample condition. After Table 5 the table is readily interpreted without much commentary. Only the results for all firms pooled are given for the .75 and .9 percentile of absolute errors. At the median the EF1 forecasts outperform EF2 and EF3 and more so for groups away from the central ones (and more so for the higher groups). These forecasts also outperform all other forecasts for most groups, including those based on the same weight for all firms and those based on firm's own weights. The absolute errors for EF1a and EF1b are better than those for EF2 and EF4 only at the .9 decile. On the matched pairs analysis at the bottom of the table (carried out the same as before) the forecasts based on combined earnings and book values typically have lower absolute errors for a given firm against all forecasts, but the improvement over EF2 is only marginal. This is an important exception because this is the benchmark forecast based on earnings alone.[25] The comparisons here are hampered by the out-of-sample requirement that weights used in the combination forecast be three years old but, in summary, Table 6 indicates that combined forecasts from earnings and book value beat the benchmarks on bias criteria but reduce the scale of errors only in the extremes.

The difference in the ability of the earnings-book value combination to predict prices (in Table 5) versus earnings (in Table 6) can be attributed to book value being a more important indicator of long-run earnings (after three years ahead) than for earnings in the immediate future: near-term earnings are typically similar to current earnings but as the forecast horizon increases, earnings tend to revert towards a level implied by the current book value. The poor performance of the price weights in predicting earnings (EF6) reinforces this interpretation. Of course the difference in results may also be due to price inefficiencies.

Conclusion

This paper calculates weights that combine capitalized earnings and book values into equity price, and weights that combine forecasts of future earnings from past earnings and book values. As a matter of central tendency, these weights differ over the spread between capitalized earnings and book values and are robust over time. Accordingly, predictions of price using the calculated weights out of sample reduce the typical error of predictions from earnings and book value alone. Further, the weights provide metrics for calculating benchmark price-to-book ratio and the price/earnings ratios.

Not only does the analysis yield revised benchmark P/B and P/E ratios but it also calculates price as a multiple of combined earnings and book value. It is thus useful for a rough determination of price (in the typical analysis that applies multiples to fundamental attributes) without conducting a full pro forma analysis that utilizes other information besides earnings and book value. Multiple analysis is typically done within sets of "comparable firms" and here comparable firms are identified as groups based on the spread between capitalized earnings and book value and by the firm itself with its own historical weights. As such it is coarsely done and one can readily think of refinements. Industry comparison groups are common and one can replicate the analysis within industries and determine weights for a given firm by reference to spread groups in the same industry. Significantly, Alford (1992) finds that matching firms on industry <u>and</u> ROE produces the lowest errors amongst a set of methods for determining the P/E ratio. As weights reflect accounting principles one might also partition on differences in accounting principles as well as differences in operations. The analysis might also accommodate differences in the cost of capital, although the cost of capital is elusive. With respect to the weights that produce earnings forecasts, the analysis might be used for a rough forecast determination and as a benchmark against which an analyst's forecast (which presumably incorporates other information) can be evaluated. However, in out-of-sample prediction tests, forecasts using weighted earnings and book values corrected for biases in forecasts based on earnings alone but did not typically reduce absolute errors.

The synthesis of pro forma analysis over finite horizons [in Penman (1996b)] reduces the valuation problem to forecasting weighted earnings and book values at the horizon along with dividends to the horizon. The benchmark here simply weights current earnings and book value as a minimalist procedure and one might progress from here by estimating typical weights for forecast horizons of one, two, three, ... years, by spread group (and industry). The weights on current earnings and book values here are, of course, average weights and one might also investigate, as a matter of financial statement analysis, how the financial statement line items that aggregate to the two summary numbers explain the variation in firms' weights from the average.

Footnotes

1. The issue arises in the Tax Court where valuations based on weighting of book value and capitalized earnings (and dividends) are entertained. See LeClair (1990). Beatty, Riffe and Thompson (1996) examine tax court valuations based on multiples of earnings and book values together. Cheng and McNamara (1997) examine valuations based on arithmetic averages of P/E and P/B valuations.
2. These prices were adjusted for stock splits, stock dividends and cash dividends over the three months. They reflect annual earnings and book values that are announced after fiscal-year end (and within the three months for most firms) but also information about the following year's earnings arriving after fiscal-year end. Using year-end prices assumes final earnings and book values are known approximately by the market at year end.
3. As a simplification, the cost of capital is assumed to be an expected constant over all $t+\tau$.
4. Penman (1996b) lays out various calculations where truncated forecast horizons give the same valuation as infinite horizons.
5. Henceforth the notation, P/E, will imply the ratio is cum-dividend.
6. The adjustment by the full amount of the annual dividend assumes that the dividend is paid out at the end of the year. To accommodate dividends paid out over the year, the adjustment is $d_t(1 - (\rho - 1)/2)$. This approximation assumes that dividends are paid half way through the year. The dividend in (6) is net of capital contributions but the calculations are on a per-share basis and these contributions (and share repurchases) are assumed to be

accommodated in the weighted-average per-share earnings calculation.

7. Also firms (in group 7) with $\varphi_t X_t$ and B_t differing by less than 0.03 per share were excluded from mean and median calculations.

8. There "t-statistics" are means relative to their estimated standard error estimated from the time series of means. However, as prices and earnings relative to book value are likely to be serially correlated over time, these are not based on independent observations.

9. The 10% cost of capital implies $\varphi = 11$ and the .95 is the dividend adjustment described in footnote 6.

10. Freeman (1994) also estimates non-linear coefficients in regressions of price on earnings and book value.

11. The mean of median E/P ratios from 1973-79 was .134 (compared to the average T-Bill rate of .067) and was less than the T-Bill rate in all other years. The average median B/P ratio over these years was 1.22 and less than 1.0 in all other years. The median weight pattern from 1973-79 was the reverse of that for all other years (with earnings for the lower groups getting higher weights than those for the higher groups).

12. The reciprocal of P/B and P/E are calculated to minimize affects of large median values on the mean over years and, in the case of P/E, to provide continuity through zero.

13. The weights for group 6 are negative in every year except 1973-79. In each of those years, the median weight for group 6 was the largest (positive) weight of any group.

14. Penman (1996a) finds that P/E ratios vary over ROE only in the extremes and Table 2

indicates that P/E are typically quite similar for ROE between 8.5% and 36.0%. (Note, however, that the P/E in Penman (1996a) are based on earnings before extraordinary items).

15. Feltham and Ohlson (1995a) model biased accounting along these lines.

16. The within-group correlations are almost perfect because of the standardization on $\varphi_t X_t - B_t$.

17. Retention is usually accommodated with a drift term.

18. Weights following the w(pooled) calculation were similar and, in this case, so were the mean weights.

19. The high earnings ratio for group 2 is affected by small denominators.

20. The horizon issue includes the question of capitalizing summed forecasted earnings (as done here) or discounting them. See Ou and Penman (1996).

21. Evidence in Bernard (1994) and Sinha (1996) indicates that the market may not always appreciate the information in earnings relative to book value.

22. Some absolute errors are greater than 1.0 at the .9 decile and may be affected by the truncation at 1.0 for some negative forecast errors: for $\hat{P}_t < P_t$, the deflated absolute errors can't be greater than 1.0 when $\hat{P}_t$ must be positive, but are unbounded for $\hat{P}_t > P_t$. $\hat{P}_t$ is always positive for F2, except for group 1, and its errors are typically negative. $\hat{P}_t$ is almost always positive for F2 and its errors are typically negative for groups below 6. For this reason, mean absolute errors are not reported but are available on request.

23. Firms that fell in group 7 in the prior year were not included in the F8 calculations.

24. This is the same as the "T1" forecast target in Ou and Penman (1996).

25. Matched absolute errors were also investigated for the extremes but (with the exception of Group 1, of course), the improvement of median absolute errors over EF2 was not statistically significant.

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Table 1

Weights (w) that the Market Places on Capitalized Earnings and Book Values;
for Different Spreads Between Capitalized Earnings (φX) and Book Value (B)

Spread Group	$\varphi X/(\varphi X+B)$	All Years, 1968 – 93						1968 - 80		1981 - 93	
		No. of Firms	Median w_i	MAD of Median w_i Over Years	MAD from Median w_i Within Years	w (pooled)	MAE wt.	Median w_i	MAE wt.	Median w_i	MAE wt.
1	$\varphi X \leq 0.0$	1007	-.08[b]	.15	.78	-.03[b]	.05[ab]	-.01[b]	.09[ab]	-.14[ab]	.01[b]
2	.00 - .15	150	.17[ab]	.29	.80	.16[ab]	.34[ab]	.33[ab]	.52[ab]	.02[b]	.17[ab]
3	.15 - .25	171	.16[b]	.36	1.04	.20[ab]	.40[ab]	.36[ab]	.61[ab]	-.04[b]	.20[ab]
4	.25 - .35	287	.18[b]	.44	1.30	.13[b]	.37[ab]	.49[ab]	.71[ab]	-.13[b]	.02[b]
5	.35 - .425	388	.03[b]	.70	1.86	-14[b]	.21[ab]	.51[a]	.73[a]	-.45[ab]	-.30[b]
6	.425 - .475	412	-.71[b]	1.53	3.72	-.80[ab]	.08[b]	.30	.76[a]	-1.72[ab]	-.74[ab]
7	.475 - .525	525	1.54[a]	.75	*	*	1.33[a]	1.94[a]	1.56[a]	1.13[a]	1.10[a]
8	.525 - .575	512	3.13[ab]	1.74	3.99	3.22[ab]	2.33[ab]	2.07[a]	1.65[a]	4.19[ab]	3.01[ab]
9	.575 - .65	504	2.10[ab]	.95	2.33	2.18[ab]	1.52[ab]	1.77[a]	1.43[a]	2.65[ab]	1.61[ab]
10	.65 - .75	287	1.74[ab]	.71	1.69	1.71[ab]	1.27[a]	1.74[ab]	1.37[a]	1.75[ab]	1.17[a]
11	.75 - .85	77	1.16[a]	.72	1.37	1.06[a]	.57[ab]	1.33[a]	.57[ab]	1.00[a]	.57[ab]
12	>.85	31	.52[ab]	.19	1.36	.37[ab]	.17[ab]	.47[ab]	.31[ab]	.58[ab]	.04[ab]
All	All	4356	.42[ab]	.36	5.19	*	.25[ab]	.76[a]	.42[ab]	.076[ab]	.08[ab]

Notes: All figures are means over the years indicated. The superscripts a and b indicate that absolute value of means relative to zero and one, respectively, were greater than 2 times their standard error estimated from the time series of means.
MAD is mean absolute deviation.
MAE wt. is the weight that minimizes the mean absolute error in predicting price.
* indicates value is very large due to cases of $\varphi X/(\varphi X+B)$ close to 50%.

Table 2

Median Return on Equity (ROE), Book/Price (B/P) and Earnings/Price (E/P)
for Spreads Between Capitalized Earnings and Book Value; 1968-93

Spread Group	Median ROE	Spearman Corr. (w_i, ROE_i)	B/P		E/P	
			Implied	Median Actual	Implied	Median Actual
1	-.139	.41	.97	1.02	-.129	-.154
2	.012	-.02	1.40	1.42	.016	.016
3	.033	-.01	1.30	1.32	.044	.043
4	.057	-.02	1.26	1.27	.071	.070
5	.085	-.06	1.10	1.12	.093	.090
6	.110	-.12	.97	.98	.105	.101
7	.137	.24	.90	.84	.121	.103
8	.172	.08	.58	.67	.096	.099
9	.230	.05	.42	.51	.093	.097
10	.363	.00	.28	.37	.101	.102
11	.753	-.03	.22	.33	.171	.151
12	1.746	.12	.20	.22	.259	.242
All	.113	.37	.98	.82	.109	.076

Notes: Groups are determined by the spread between ¢X and B as in Table 1.

ROE is book rate of return on equity; w_i is weight for firm i calculated as in Table 1.

The Spearman correlation for all firms (.37) excludes firms in group 7.

All figures are means over the 26 years.

Table 3

Weights (w_1) that the Market Places on Capitalized Earnings (φX) and Book Value (B), Adjusted for the Median Difference Between Price and Book Value; for Different Spreads Between φX and B

Spread Group	All Years, 1968 - 93				Median w_{1i}			
	Median w_{1i}	MAD of Median w_{1i} Over Years	w_1 (pooled)	Mean w_{1i}	1968-73	1974-80	1981-87	1988-93
1	.03[b]	.07	.13[ab]	-.32[ab]	.07[b]	.06[b]	-.02[6]	.02[b]
2	.61[ab]	.11	.60[ab]	.22[ab]	.64[ab]	.44[ab]	.60[ab]	.80[ab]
3	.70[ab]	.14	.74[ab]	.19[ab]	.75[ab]	.48[ab]	.70[ab]	.89[a]
4	.90[a]	.22	.85[ab]	.25[ab]	1.07[a]	.61[ab]	.88[ab]	1.10[a]
5	1.15[a]	.35	1.00[a]	.28[ab]	1.36[a]	.74[ab]	1.15[a]	1.40[ab]
6	1.61[ab]	.72	1.49[ab]	.09[b]	1.81[a]	1.01[a]	1.51[ab]	2.24[ab]
7	1.33[a]	.58	*	2.65[a]	1.42[a]	1.17[a]	1.45[a]	1.29[a]
8	1.21[a]	1.05	1.34[a]	2.60[ab]	1.43[a]	.90[a]	2.09[a]	.34[b]
9	1.47[ab]	.59	1.46[ab]	2.33[ab]	2.03[ab]	.93[a]	1.77[ab]	1.19[a]
10	1.40[ab]	.51	1.39[ab]	2.02[ab]	2.37[ab]	.87[a]	1.22[ab]	1.27[ab]
11	1.02[a]	.62	.92[a]	1.62[ab]	2.15[ab]	.50[ab]	.59[ab]	.98[a]
12	.47[ab]	.18	.33[ab]	1.49[a]	.53[ab]	.35[ab]	.44[ab]	.57[ab]
All	.59[ab]	.25	*	.98[a]	1.10[a]	.54[ab]	.40[ab]	.37[ab]

Notes: Weights, w_1, are calculated for each firm according to equation (14) in the text. See notes to Table 1.

Table 4

Estimated Weights (w) Applied to Capitalized Earnings ($\underline{\varphi X}$) and Book Values (B)

to Forecast Subsequent Cum-Dividend Earnings, and Related Indicators; for Different Spreads Between $\underline{\varphi X}$ and B

Spread Group	All Years					1968-80	1981-	All Years
	No. of Firms	Median Earnings Ratio	Median w_i	MAD of Median w_i Over Years	MAE wt.	Median w_I	Median w_i	Spearman Corr. (price wt., earn. wt.)
Panel A: Three-Year Horizon; 1968-90								
1	491	*	.43[ab]	.13	.33[ab]	.35[ab]	.52[ab]	.23
2	112	2.19	.86[ab]	.19	.82[ab]	.72[ab]	1.05[ab]	.09
3	134	1.13	.94[a]	.18	.94[a]	.82[ab]	1.10[ab]	.11
4	236	.97	1.00[a]	.22	.95[a]	.85[ab]	1.20[ab]	.13
5	333	.91	1.14[ab]	.33	1.05[a]	.91[a]	1.45[ab]	.11
6	363	.89	1.41[ab]	.53	1.33[ab]	1.06[a]	1.87[ab]	.10
7	466	.87	.80[ab]	.32	1.01[a]	.90[ab]	.67[ab]	-
8	446	.85	.21[b]	.56	.25[b]	.61[ab]	-.32[ab]	.19
9	418	.84	.58[ab]	.31	.56[ab]	.77[ab]	.33[ab]	.26
10	213	.79	.63[ab]	.25	.54[ab]	.80[ab]	.41[ab]	.36
11	60	.63	.46[ab]	.25	.23[ab]	.65[ab]	.32[ab]	.39
All	3275	.81	.76[ab]	.10	.63[ab]	.76[ab]	.79	-.03

Spread Group	All Years					1968-80	1981-	All Years
	No. of Firms	Median Earnings Ratio	Median w_i	MAD of Median w_i Over Years	MAE wt.	Median w_i	Median w_i	Spearman Corr. (price wt., earn. wt.)
Panel B: One-Year Horizon; 1968-92								
1	852	*	.61[ab]	.13	.45[ab]	.50[ab]	.71[ab]	.08
2	141	1.90	.89[ab]	.11	.87[ab]	.78[ab]	1.00[a]	.10
3	162	1.07	.96[a]	.12	.95[a]	.87[ab]	1.04[ab]	.07
4	273	1.01	.97[a]	.12	.95[a]	.88[ab]	1.07[ab]	.14
5	372	.97	1.01[ab]	.18	.97[a]	.90[a]	1.14[ab]	.12
6	399	.96	1.08[ab]	.29	1.05[ab]	.94[a]	1.23[ab]	.11
7	507	.95	.91[ab]	.24	.89[ab]	.99[ab]	.83[a]	-
8	488	.95	.78[ab]	.29	.76[ab]	.97[a]	.58[ab]	.19
9	468	.94	.87[ab]	.17	.82[ab]	.96[a]	.75[ab]	.23
10	258	.91	.84[ab]	.16	.76[ab]	.96[a]	.72[ab]	.33
11	93	.70	.61[ab]	.23	.33[ab]	.78[ab]	.43[ab]	.38
All	4016	.91	.89[ab]	.06	.75[ab]	.90[ab]	.87[ab]	.03

Notes: Groups are identical to those in Tables 1 and 2.
Numbers are means over years.
* indicates negative denominators.
Earnings ratios are cum-dividend earnings to the horizon divided by the earnings projected by current earnings at the cost of capital: $\sum_{\tau=1}^{T} \tilde{X}_{t+\tau}^{cd} / \sum_{\tau=1}^{T} \rho^{\tau} X_t$.

See notes to Table 1 for other features of the table.
The Spearman correlation is between weights in Table 1 and those here. These were not calculated for Group 7.

Table 5

Summary of Errors of Alternative Price Forecasts, by Groups Based on Spread Between Capitalized Earnings and Book Value, 1969-93

Error Metric/ Group	Forecast									
	F1a	F1b	F2	F3	F4	F5	F6	F7	F8	F10
Median										
Group 1	.102	-.211	*	.054	1.339	-.207	*	-1.162	-.208	.575
2	.016	-.181	-.902	.404	.515	.426	-.263	-.274	.058	.343
3	.042	-.185	-.656	.356	.698	.408	-.047	-.160	.035	.283
4	.033	-.095	-.430	.299	.873	.394	.168	-.071	.041	.188
5	.019	-.065	-.261	.146	.890	.269	.277	-.059	.015	.120
6	.023	-.073	-.160	.016	.858	.156	.323	-.073	-.016	.080
8	.025	-.059	-.164	-.313	.522	-.177	.170	-.242	-.068	.006
9	.034	-.126	-.198	-.481	.319	-.354	.051	-.347	.023	-.040
10	.057	-.141	-.165	-.622	.214	-.501	.015	-.414	.011	-.104
11	.037	-.355	.223	-.671	.546	-.525	.364	-.281	-.014	-.159
All	.024	-.100	-.268	-.176	.620	-.048	.155	-.198	-.001	-.062

Error Metric/ Group	Forecast									
	F1a	F1b	F2	F3	F4	F5	F6	F7	F8	F10
Median Absolute										
Group 1	.716	.697	*	.733	1.457	1.005	*	1.236	1.138	.646
2	.473	.439	.900	.721	.790	.729	.613	.513	.612	.447
3	.428	.387	.668	.627	.845	.642	.522	.454	.502	.375
4	.391	.363	.500	.569	.916	.585	.482	.418	.424	.312
5	.336	.319	.397	.443	.947	.465	.455	.371	.334	.270
6	.308	.295	.358	.372	.899	.377	.445	.348	.302	.238
8	.328	.319	.379	.422	.637	.344	.376	.413	.302	.231
9	.388	.403	.444	.540	.556	.454	.398	.506	.324	.256
10	.476	.483	.510	.654	.575	.567	.476	.600	.375	.297
11	.540	.585	.710	.701	.863	.656	.711	.705	.597	.343
All	.366	.361	.461	.474	.754	.441	.432	.436	.337	.267

Error Metric/ Group	Forecast									
	F1a	F1b	F2	F3	F4	F5	F6	F7	F8	F10
.75 Percentile Absolute										
Group 1	1.227	1.060	*	1.155	3.357	1.649	4.054	2.181	3.235	1.222
2	.780	.691	.964	1.192	1.316	1.200	.852	.791	1.308	.770
3	.764	.637	.782	1.069	1.490	1.115	.839	.728	1.091	.676
4	.660	.595	.671	.959	1.589	1.021	.848	.689	.930	.564
5	.590	.553	.602	.751	1.512	.803	.808	.612	.697	.495
6	.543	.509	.567	.622	1.387	.642	.771	.574	.598	.437
8	.563	.536	.595	.596	1.065	.536	.663	.608	.548	.414
9	.678	.634	.676	.688	1.024	.630	.701	.692	.630	.450
10	.939	.783	.814	.786	1.175	.726	.883	.795	.809	.495
11	1.200	.810	1.517	.834	2.078	.831	1.749	1.069	1.317	.540
All	.644	.604	.710	.737	1.290	.719	1.290	.684	.703	.497

Error Metric/ Group	Forecast									
	F1a	F1b	F2	F3	F4	F5	F6	F7	F8	F10
.90 Percentile Absolute										
All	1.024	.936	.970	1.052	2.023	1.064	1.258	.938	1.409	.699
Matched Pairs: Median Absolute Error differences (All Firms)										
F1a:										
Mean	-----	-.003	-.118	-.072	-.631	-.064	-.043	-.047	.015	.077
t-statistic	-----	-.32	-5.17	-8.74	-41.72	-5.29	-5.41	-2.50	1.41	9.66
F1b:										
Mean	.003	-----	-.100	-.075	-.637	-.063	-.050	-.046	.006	.066
t-statistic	.32	-----	-5.02	-8.34	-48.39	-5.65	-2.78	-2.74	.64	5.51

Notes: F1-F10 indicate alternative forecasts of price given in the text.

F1a indicates forecast F1 using median weights for the group and F1b indicates F1 forecasts using weights that minimize mean absolute forecast errors.

Groups are defined as in Table 1. The "All" group excludes firms in groups 1 and 7.

* indicates a projection based on negative earnings typically yields negative prices.

Table 6

Summary of Errors of Alternative Forecasts of Three-Years' Capitalized Earnings
Deflated by Book Value, by Groups Based on Spread Between Capitalized Earnings and Book Value; 1971-90

Error Metric/Group	Forecast							
	EF1a	EF1b	EF2	EF3	EF4	EF5	EF6	EF7
Median								
Group 1	-.039	.186	-1.253	.957	-.800	-1.104	1.029	.973
2	.077	.099	-.074	.836	.129	.006	.590	.682
3	.028	.029	-.030	.710	.134	-.016	.498	.557
4	.021	.046	.006	.562	.130	.074	.386	.420
5	.020	.049	.057	.411	.132	.128	.309	.385
6	.022	.041	.088	.258	.126	.149	.282	.334
8	.031	.036	.186	-.028	.139	.117	.511	.591
9	.040	.037	.250	-.285	.128	.184	.720	.896
10	.073	-.048	.492	-.691	.228	.446	.988	1.198
11	.184	-.229	1.610	-1.051	1.009	.196	.850	1.542
All	.028	.033	.125	.175	.131	.139	.443	.536

Error Metric/Group	Forecast							
	EF1a	EF1b	EF2	EF3	EF4	EF5	EF6	EF7
Median Absolute								
Group 1	.841	.863	1.306	1.160	1.030	3.008	1.300	1.222
2	.483	.472	.479	.899	.473	1.036	.760	.830
3	.414	.399	.404	.765	.412	.817	.641	.694
4	.348	.356	.346	.614	.354	.609	.555	.596
5	.318	.320	.307	.475	.324	.451	.490	.562
6	.258	.256	.253	.338	.261	.308	.308	.521
8	.321	.319	.321	.313	.307	.357	.704	.777
9	.483	.490	.472	.552	.458	.605	.950	1.142
10	.809	.832	.838	.989	.793	1.341	1.332	1.557
11	1.574	1.616	2.100	1.509	1.775	3.434	1.850	2.502
All	.379	.383	.372	.521	.378	.513	.655	.745

Error Metric/Group	Forecast							
	EF1a	EF1b	EF2	EF3	EF4	EF5	EF6	EF7
.75 Percentile, Absolute								
All	.783	.789	.799	.965	.794	1.117	1.241	1.494
.90 Percentile, Absolute								
All	1.416	1.427	1.476	1.619	1.458	2.145	2.039	2.682
Matched Pairs: Median Absolute Error Differences (All Firms)								
EF1a:								
Mean	-----	-.002	-.012	-.140	-.140	-.095	-.365	-.301
t-statistic	-----	-.98	-1.10	-9.76	-9.76	-8.30	-4.86	-6.19
Ef1b:								
Mean	.002	-----	-.002	-.130	-.130	-.088	-.337	-.295
t-statistic	-.98	-----	-.24	-9.60	-9.60	-8.52	-4.702	-6.15

Notes: Groups are defined as in Tables 1 and 4. The "All" firms exclude those in groups 1 and 7.

EF1 - EF7 are alternative forecasts given in the text.