Accounting-Based Valuation Methods, Determinants of Market-to-Book Ratios, and Implications for Financial Statements Analysis

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1. Introduction

This paper seeks to accomplish three things. First, drawing on work by Edwards and Bell [1961] and Ohlson [1991], it explains how equity valuation can be implemented completely in terms of accounting numbers (earnings and book value). This approach differs from techniques currently practiced in that (1) unlike discounted cash flow (DCF) models, it requires no direct reference to future cash flows, and (2) unlike commonly practiced accounting-based valuation techniques (e.g., those based on price/earnings multiples), it requires no explicit or implicit assumptions about the linkage between earnings and cash flows, beyond an assumption that the accounting system is based on clean surplus (i.e., earnings include all gains and losses that affect owners' equity). The ability to define firm value directly in terms of accounting numbers, without reliance on restrictive assumptions, has implications for pedagogy, practice, and further research.

Second, the paper applies the Edwards-Bell-Ohlson valuation approach to study empirically the determinants of price-to-book ratios, and by inference, market prices. The variation in price/book ratios should be explained by future rates of profitability, the related growth in book value, and discount rates. Surprisingly, however, there is at best a weak linkage between price-to-book ratios and subsequent reported rates of profitability, once one controls for current profitability. This finding raises questions about what *does* explain the remaining variation in price-to-book ratios, and whether that variation is "rational." We find that some of the variation is attributable to subsequent growth, and some is explained by subsequent gains and losses experienced as firms cease to exist (because, for example, they become takeover targets). However, most of the variation in price-to-book ratios (holding current profitability constant) remains to be explained—either by large differences in discount rates, or mispricing, or a combination of both. While this study does not attempt to discriminate among these possibilities, it does discuss features of the evidence that point in one direction or another. Thus, such evidence has relevance to the current debate on asset pricing, and whether the "market-to-book effect" reflects an unidentified

risk factor or mispricing (Fama and French [1992a, 1992b, 1992c], Kothari, Shanken, and Sloan [1993], Lakonishok, Shleifer, and Vishny [1992]).

Third, the paper discusses implications for research on financial statements analysis. One implication of the philosophy and evidence presented here is that the traditional reliance of capital markets research on stock prices to divine "value-relevant" factors is not only unnecessary,[1] but limited in its ability to address at least one of the key issues in financial statements analysis: improving on current profitability as a predictor of future profitability. A second implication, based not only on the perspective adopted here but also evidence in prior studies, is that we may be approaching the limit of what can be learned about fundamental analysis from large-sample studies and traditional techniques. There is, however, some consolation. The difficulty of identifying programmable approaches to financial statements analysis that improve on the ability of current earnings and book value to predict future profitability—along with the inability of presumably "information-laden" stock prices to aid in that task—is in one sense a testimony to the "quality" of the accrual accounting process. Moreover, since earnings and book value alone can explain approximately two-thirds of the variation in stock prices, and since some portion of the remainder could reflect mispricing, the most basic products of the accrual system in the U.S. offer the analyst an excellent starting point in the valuation task.

2. Implementing the Edwards-Bell-Ohlson (EBO) approach to valuation

Copeland, Koller, and Murrin [1990] describe the two major competing valuation approaches and label them as the "accounting approach" (i.e., valuation based on application of various multiples of accounting numbers), and the "discounted cash flow" (DCF) approach.[2] Proponents of DCF methods underscore the importance of *not* basing valuation directly on accounting numbers, for a variety of reasons (e.g., see Copeland, et al [1990, Chapter 1] and Rappaport [1986, Chapter 2]). Chief among these is that accounting

[1] Penman [1992] deserves the credit arguing this case earlier and in much more detail.
[2] See DeAngelo [1990] for evidence on the widespread use of these two approaches.

numbers fail to reflect the timing of cash inflows and the investments necessary to generate them, and that accounting numbers are subject to manipulation and influenced by method choices that should not affect firm value. The philosophy underlying these concerns is that firm value is equal to discounted expectations of future cash flows, and that there is no generally acceptable way to map either current accounting numbers or future expectations of such into firm value, without first converting the accounting numbers into cash flows. Indeed, even some applications of the "accounting approach" reveal this philosophy. The commonly used formulae for determining "appropriate" PE multiples are made possible only by assuming free cash flows are proportional to earnings; such formulae are ultimately just restrictive versions of the DCF formula.

Given that accounting systems are designed at least in part to convert cash flow data into numbers more useful for valuation, it is ironic that experts suggest valuation can be properly conducted only by "undoing" the accounting process and converting the accounting numbers back into cash flows. It turns out, however, that the irony is more apparent than real. Although it has yet to be well recognized (if at all) in the investment community, firm value can be defined directly as a function of current and forecasted accounting numbers, and without explicit reference to cash flows, relying on nothing beyond (1) the same assumptions underlying the DCF approach and (2) the assumption of "clean surplus" accounting (i.e., earnings include all gains and losses that affect owners' equity). Moreover, it is sufficient that the clean surplus accounting be applied in *forecasting* future earnings and future changes in book value; the existence of "dirty surplus" in the current book value does not invalidate the valuation approach.

The expression that defines the value of the firm directly in terms of current and forecasted accounting numbers is provided by Ohlson [1991], Feltham and Ohlson [1992], and Brief and Lawson [1992], who rediscovered essentially the same ideas appearing in Preinreich [1938], Edwards and Bell [1961, Chapter 2, Appendix B], and Peasnell [1982]. Hereafter, the definition is labeled the Edwards-Bell-Ohlson (EBO) valuation formula (with

apologies to Preinreich, Peasnell, Feltham, and others). Below, we describe valuation based on DCF methods, explain how the EBO formula can be implemented in practice, and contrast the two approaches.

2.1 DCF methods: Firm value as a function of future cash flows

It is well accepted that the value of the firm to equity holders at the end of period t (labeled here as P_t) can be expressed as the discounted present value of future dividends:

$$P_t = \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[d_{t+\tau}] \qquad (1)$$

where d_t = dividends paid (net of capital contributions) at time t;

r = the cost of equity capital.

While some valuation experts explicitly use the dividend discount model to estimate firm value, a more common approach is to discount the cash flows generated by the firm.[3] Using the notation of Feltham and Ohlson [1992], this discounted cash flow (DCF) approach can be described as shown below. (Throughout the analysis, it is assumed that all amounts are defined in after-tax terms.)

$$P_t = fa_t + \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[c_{t+\tau}] \qquad (2)$$

where fa_t = market value of (net) financial assets;

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[3] The two approaches are equivalent under the assumption that free cash flows generated by the firm but not yet distributed to owners are invested in zero net present value projects.

c_t = cash from operations, net of investment

$= ox_t - \Delta oa_t$ = operating earnings
- change in operating assets,
net of operating liabilities

= operating earnings + depreciation - investment in net operating working capital and capital expenditures;

r = the weighted average cost of capital, if debt is included as a component of fa_t and thus the cash flows ($c_{t+\tau}$) being discounted are those available *before* distribution to either debt or equity holders; or

r = the cost of equity capital, if debt is treated as an operating liability, and debt service is considered an operating cash flow that affects ($c_{t+\tau}$).

Here, the price of the firm is written as the sum of the market value of the (net) financial assets, plus the discounted present value of future "free cash flows" (i.e., cash flows from operations, net of investment). Feltham and Ohlson [1992] describe net financial assets as marketable securities minus debt. In general, however, net financial assets can include any claims that (in expectation) are zero net present value projects, and are susceptible to valuation through reference to current market prices.

Since a manager or analyst can produce explicit forecasts of cash flows only for some finite horizon (say, year T), the value of cash flows generated beyond that point (sometimes labeled the "terminal value") is typically implemented by making some simplifying assumptions. Rappaport [1986] suggests that, in most industries, competition will ultimately drive the rate of return on new investment to the cost of capital, and that growth beyond that point creates no value. Under that assumption, growth beyond year T is irrelevant and can be ignored. Beyond year T, changes in net working capital are assumed equal to zero and capital expenditures are assumed equal to depreciation (Δoa_t=0); this implies that free cash flows ($c_{t+\tau}$) before debt service can be treated as if they are constant and equal to operating earnings (i.e., $ox_{t+\tau}$, or earnings before (tax-adjusted) interest). These assumptions lead to the following valuation formula:

$$P_t = fa_t + \sum_{\tau=1}^{T} \left((1+r)^{-\tau} E_t[c_{t+\tau}] \right) + \left(\frac{1}{(1+r)^T} \right) E_t\left(\frac{c_T}{r} \right)$$

$$= fa_t + \sum_{\tau=1}^{T} \left((1+r)^{-\tau} E_t[c_{t+\tau}] \right) + \left(\frac{1}{(1+r)^T} \right) E_t\left(\frac{ox_T}{r} \right) \qquad (3.1)$$

where r = the weighted average cost of capital (since cash flows are measured here before the effects of debt service).

If one is unwilling to assume that competition will render growth beyond year T irrelevant to firm value, then a more general formulation can be used.[4]

2.2 *The EBO valuation formula: Firm value as a function of current and future accounting numbers*

Following Ohlson [1991], we define abnormal earnings (x_t^a) as the amount by which earnings (x_t) differ from the required return (r) on beginning net book value (b_{t-1}):

$$x_t^a = x_t - r\, b_{t-1} \qquad (4)$$

Also following Ohlson [1991], we assume "clean surplus accounting"; that is, in moving forward from time t-1, all changes in net book value other than dividends (net of capital contributions) are recorded in earnings:

$$b_t = b_{t-1} + x_t - d_t \qquad (5)$$

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[4] If a constant fraction (k) of operating earnings are retained each year beyond T ($\Delta oa_{T+m} = k(ox_{T+m})$ for m=1,2,3...) to finance annual growth in free cash flow at rate g (thus implying that the rate of return on new investment is equal to g/k), then (3.1) can be generalized as follows:

$$P_t = fa_t + \sum_{\tau=1}^{T} \left((1+r)^{-\tau} E_t[c_{t+\tau}] \right) + \left(\frac{1}{(1+r)^T} \right) E_t\left(\frac{ox_T(1-k)}{r-g} \right)$$

When the implied rate of return on reinvestment (that is, g/k) is equal to r, this formula collapses to (3.1).

Ohlson [1991] shows that, given the dividend discount formula (1), the clean surplus relation (5), and convergence conditions, the value of shareholders equity (P_t) can be written as a function of net book value and discounted expectations of future abnormal earnings[5]:

$$P_t = b_t + \sum_{\tau=1}^{\infty} \left((1+r)^{-\tau} E_t[x^a_{t+\tau}] \right) \qquad (6)$$

Equation (6) can easily be rewritten in terms of price-to-book ratios and rates of return on equity (ROE):

$$\frac{P_t}{b_t} = 1 + \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t\left[(ROE_{t+\tau} - r) \frac{b_{t+\tau-1}}{b_t} \right] \qquad (7)$$

where $ROE_t = \frac{x_t}{b_{t-1}}$.

To generate an estimate of firm value, equation (7) indicates that one must forecast future ROEs and the related growth in future book values. Firms that are expected to generate ROEs in excess of the required return r will trade at prices above book value, and vice versa. The impact of abnormally high or low future ROEs is compounded by the preceding growth in book value, captured by $\frac{b_{t+\tau-1}}{b_t}$. Since the growth in book value is a function of dividend policy, (7) may present the appearance that dividend policy is relevant to valuation, but that is not the case; (7) permits, but does not require, Miller-Modigliani dividend irrelevancy.[6]

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[5] Note that equation (6), like the DCF formula (2) is silent with respect to how the expectations are generated. Thus, such expectations could differ across individuals, including managers and investors, thus leading them to different estimates of the value of the firm.

[6] The role of dividends is most easily seen by writing price as a function of book value and future abnormal earnings, as in (6)—keeping in mind the definition of abnormal earnings in (4). If future dividends are increased, while holding investment policies constant, that has two offsetting effects on future abnormal earnings. First, since the dividends must be financed through borrowing, earnings will be reduced by the amount of the additional interest expense. Second, since future book value will be lower, the benchmark for evaluating abnormal earnings will be reduced by the amount of the dividend times the cost of capital. If

It may seem surprising that, in (6) and (7), firm value is expressed solely in terms of accounting numbers, without any assumptions other than "clean surplus" accounting. Indeed, the accounting literature is replete with explanations for why accounting numbers such as ROE *cannot* be translated into reliable estimates of firm value. Note that there is no assumption here about accounting earnings offering a good representation of "economic earnings," that the earnings are good predictors of cash flows, or even that the earnings and book value are free of manipulation.

The ability to write value in terms of accounting numbers without making any assumptions about the "quality" of the accounting numbers results from the self-discipline of clean surplus accounting. Assume that earnings for period t is manipulated upwards or is otherwise "artificially high." Then, unless the accounting *per se* influences one's view of the underlying economic fundamentals, the forecasts underlying the valuation are affected as follows. First, any upward manipulation of earnings must ultimately reverse in the form of lower future earnings. Second, the upward manipulation increases book value at time t, thus establishing a higher benchmark for assessing *abnormal* earnings until the reversal occurs. The combination of these effects reduces the discounted value of future abnormal earnings, producing a price-to-book ratio that is lower by an amount that offsets the higher current book value, leaving the price unaffected. Alternatively, if book value is "artificially low," perhaps because it excludes some economic asset such as R&D, then that distortion is reflected in higher future ROEs, producing a higher multiple to be applied to the low book value. Again, the estimated value is unaffected. In general, the EBO valuation formula delivers the same estimate of firm value, regardless of how aggressive or conservative is the firm's accounting, except to the extent that accounting policy choices themselves are perceived to reveal information about the firm's prospects.

Miller-Modigliani dividend irrelevancy holds, then these two effects offset perfectly, abnormal earnings is unaffected, and the future dividend has no impact on today's price. The valuation formula does not require this, however. For example, if at the margin, the firm can reduce its weighted average cost of capital by increasing dividends through more debt financing, future abnormal earnings and current price would be enhanced.

The ability to use the EBO valuation formula even in the face of "low quality" accounting does *not* imply that an analyst would be indifferent to a firm's accounting policies. First, accounting choices can impact the information set on which an analyst's expectations must be conditioned. Second, from a purely practical perspective, the EBO formula is most conveniently applied in situations where the accounting is "unbiased" in a sense defined by Feltham and Ohlson [1992]. Indeed, as will be discussed later, the advantages of "high quality" accounting and the rationale for analysts' adjustments to "normalize" earnings are more explicit in the context of valuation based on the EBO formula than in DCF-based valuation.

In order to implement valuation based on the EBO formula, there are several practical questions that must be answered.

What is the appropriate discount rate to be applied to future abnormal earnings?

One question that arises in implementing valuation based on (6) or (7) is whether it is appropriate to discount accounting numbers with the same required rates used to discount expected cash flows. The answer is yes.[7] Note that one special case of a clean surplus accounting system occurs where book value equals net financial assets ($b_t = fa_t$), and earnings equals cash flows net of investment ($x_t = c_t$). For this case, the value of the firm is given by the DCF formula (2), where cash flows are discounted by r. Movement to any other clean surplus accounting system produces the same estimate of value, so long as the same discount rate r is used (and assuming the information underlying expectations is held constant).

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[7] Although Ohlson [1991] develops (6) within a certainty setting where the required return (r) is the riskless rate, he also indicates the approach can easily be generalized to an uncertainty setting, where the appropriate required rate of return (r) is the cost of equity capital as implied by asset pricing theory. Thus, it is precisely the same required return that appears in (1), and is the same as that used in the DCF formula (2) if the cash flows being discounted are defined as net of interest and debt service.

How can value beyond a finite forecast horizon T be estimated?

The DCF method described by (3.1) assumes that, beyond year T, any growth is irrelevant because competition drives the rate of return on incremental investment to the cost of capital. Implicitly, (3.1) also assumes that the ROE on existing investment (including that resulting from cash outlays needed to replace existing capacity) is constant through time. Combining a constant ROE with the no growth assumption, we arrive at the following analogue to DCF method (3.1).[8]

$$\frac{P_t}{b_t} = 1 + \sum_{\tau=1}^{T} (1+r)^{-\tau} E_t\left[(ROE_{t+\tau} - r)\,\frac{b_{t+\tau-1}}{b_t}\right] + (1+r)^{-T} E_t\left[\frac{(ROE_T - r)}{r}\right]\left[\frac{b_{T-1}}{b_t}\right] \quad (8.1)$$

By explicitly identifying the constant ROE assumption that was implicit in the DCF formulae (3.1), equation (8.1) highlights a disadvantage of that commonly used DCF approach. Evidence in Penman [1991] demonstrates that ROE is mean reverting and therefore unlikely to remain constant through time unless the mean reversion is complete by year T. One might defend the DCF formula (3.1) (and thus (8.1)) by noting that an assumed constant ROE on an assumed stable investment base generates the same expected constant earnings stream that *could* arise from a more realistic scenario with a declining ROE and a growing investment base (or for a firm with ROE below r, a rising ROE and a shrinking investment base). However, that "more realistic" scenario generates the same value as (3.1) only for a specific rate of decay in ROE;[9] moreover, since long-horizon earnings are much less persistent than a random walk (Lipe and Kormendi [forthcoming]) even the assumption of constant expected earnings is not realistic in typical cases.

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[8] If we relax the no-growth assumption, allowing for growth in book value beyond year T at rate g, while maintaining a constant ROE (even on incremental investment), equation (8.1) would be altered simply by replacing (r) in the denominator of the terminal value with (r-g).

[9] Specifically, it assumes a first-order autoregressive decay in ROE with a parameter [1/(1+g)], where g is growth in the book value that would be reported under unbiased accounting as defined below.

A less restrictive terminal value calculation would recognize the possibility of mean reversion in ROE. Of course, this also requires specification of the mean to which ROE reverts. One might expect (as Copeland, et al [1990] suggest) that if competitive forces drive the rate of return on new investment to the cost of capital, ROE would also asymptote to the cost of capital. That is true so long as the firm uses what Feltham and Ohlson define as "unbiased accounting," under which firm value $P_{t+\tau}$ and book value $b_{t+\tau}$ are expected to converge as τ approaches infinity. On the other hand, if the accounting is "conservative," book value $b_{t+\tau}$ is expected to remain below firm value $P_{t+\tau}$, and even in a competitive equilibrium, $ROE_{t+\tau}$ will asymptote at some level above r. (In the words of Feltham and Ohlson [1992], the conservative accounting makes the firm "look more profitable.") If we denote this asymptote in $ROE_{t+\tau}$ as $\bar{r}$, and assume that beyond year T, the deviation $(ROE_{t+\tau} - \bar{r})$ follows a first-order autoregressive process with parameter p, we can then transform (7) into the following valuation formula[10]:

$$\frac{P_t}{b_t} = 1 + \sum_{\tau=1}^{T} (1+r)^{-\tau} E_t\left[(ROE_{t+\tau} - r)\frac{b_{t+\tau-1}}{b_t}\right] + (1+r)^{-T} E_t\left[\frac{(ROE_T-\bar{r})p}{(1+r-p)} + \frac{\bar{r}-r}{r}\right]\left[\frac{b_{T-1}}{b_t}\right] \qquad (8.2)$$

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[10] In the less restrictive case where growth beyond year T is potentially value-relevant, we can generalize (8.2) to allow for growth in book value beyond year T at rate g:

$$\frac{P_t}{b_t} = 1 + \sum_{\tau=1}^{T} (1+r)^{-\tau} E_t\left[(ROE_{t+\tau} - r)\frac{b_{t+\tau-1}}{b_t}\right] + (1+r)^{-T} E_t\left[\frac{(ROE_T-\bar{r})p}{(1+r-p(1+g))} + \frac{(\bar{r}-r)}{(r-g)}\right]\left[\frac{b_{T-1}}{b_t}\right]$$

Note, however, that this approach would typically not be realistic. The growth in book value would arise from reinvestment of cash, or from additional cash infusions. As discussed above, competitive forces make it unrealistic to forecast that, several years hence, one would expect to be able to invest cash in projects that will earn supernormal rates of return. Thus, growth in book value beyond the forecast horizon is unlikely to be relevant to valuation.

The key point here—both for practical implementation of the EBO valuation approach and the empirical work to follow in this study—is that whether (8.1) or (8.2) is used, realistic application requires that the forecasted long-run equilibrium level of ROE (denoted $\bar{r}$ in (8.2)) reflect the degree of the firm's accounting conservatism. In other words, to remain consistent with the no-growth assumption beyond year T, the forecasted level of ROE should reflect the fact that once a growing firm reaches a no-growth stage, ROEs will tend to rise for firms that use conservative accounting—and may thus be higher than ROEs during the forecast horizon. We will return to this issue in the following sectio and the subsequent empirical work.

2.3 *Contrast of DCF and EBO valuation procedures*

At one level, the difference between DCF methods and the EBO accounting-based valuation method is trivial: one is simply a mathematical transformation of the other, and each should produce the same estimate of value if grounded on the same underlying information. On another level, however, the difference appears more substantive: the mathematical transformation at issue is essentially the accrual accounting process, and accrual accounting is intended (in part) to convert cash flow data into something more useful for estimating firm value. The EBO approach recognizes that there is nothing wrong with using forecasted values of these accrual accounting numbers directly to estimate value. This approach stands in contrast to spirit of the academic and professional literature on valuation, where the accrual accounting numbers are used only indirectly, as a basis for forecasting (in some unspecified way) future cash flows. The differences in perspective of the EBO and DCF approaches are discussed in more detail below.

(1) Linkage of value to "value drivers"

The so-called "value drivers" on which a DCF estimate is based are nearly always accounting numbers. Both Copeland, et al [1990] and Rappaport [1986] refer to "return

on investment" and its detailed components (e.g., sales, profit margins, and capital investment) as value drivers. In fact, the approach recommended by Copeland involves checking the reasonableness of the cash flow forecasts by producing corresponding earnings and balance sheet data, and then assessing whether the implied rates of return on investment are consistent with the firm's market position and the level of competition it faces.

If cash flow forecasts are ultimately to be anchored in a series of forecasted accounting rates of return or related statistics, then a valuation approach more direct than the DCF method is the EBO approach. The EBO valuation method is framed immediately in terms of fundamental value drivers—earnings and the related investment base—that managers and analysts forecast and monitor regularly. Thus, they may represent a convenient tool for thinking about and teaching valuation. Moreover, by requiring a focus on rates of return on investment, the EBO valuation approach may help avoid unrealistic assumptions about such rates that can arise implicitly using DCF methods (as discussed above in the context of equation (3.1)).[11] It also readily employs knowledge about the systematic time series behavior of ROE and its determinants, something that has been largely ignored (or even viewed with disdain) in most professional literature about DCF valuation.

(2) Estimation of terminal value

When DCF approaches are applied, a large fraction of total firm value is typically represented in the terminal value. (DeAngelo [1990] indicates this is one reason why DCF models may lack credibility.) Copeland, et al [1990] apply DCF methods in companies in four industries and show that, even after allowing for a rather lengthy (eight-year) forecast horizon, terminal values are large, ranging from 56 to 125 percent of total value.

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[11] Copeland, et al [1990, p. 216] describe one approach to terminal value calculation using DCFs that implicitly assumes that ROEs rise to infinity! Yet, I have spoken to analysts who have employed that approach in practice. (The approach assumes that the terminal value is equal to operating earnings forecasted for year T, divided by (r-g).)

When the EBO accounting-based valuation methods are employed, terminal values tend to be much smaller. At a technical level, the reason is that DCF terminal values include the present value of *all* expected cash flows beyond the forecast horizon, whereas EBO terminal values include only the present value of *abnormal* earnings beyond that point. From a more substantive perspective, the reason is that in the presence of competitive forces, the accrual accounting process reflects some (and possibly all) of the expected long-horizon cash flows in near- and intermediate-term earnings and book value, and the EBO formula links value to this accrual process directly. The DCF approach, on the other hand, "unravels" all of the accruals, spreads the resulting cash flows over longer horizons, and then reconstructs its own "accruals" in the form of discounted expectations of future cash flows. The essential difference between the two approaches, then, is that the EBO valuation formula recognizes that the accrual process may already have performed a portion of the valuation task, whereas the DCF approach ultimately moves back to the primitive cash flows underlying the accruals.

Terminal value estimation is most straightforward under the EBO approach when the accounting is unbiased. In that case, ROEs differ from the cost of capital only due to the presence of economic rents, as opposed to accounting choices. If (as would often be the case) economic rents are expected to dissipate within a forecast horizon of reasonable length, then there are no abnormal ROEs beyond that horizon, and the terminal value is zero. This is illustrated in Table 1, where economic rents are dissipated within a four-year forecast horizon, and the year 5 terminal value is nil. In contrast, under the DCF approach, the year 5 terminal value represents 70 percent of the total value.

If the firm uses conservative accounting, then ROEs remain above the cost of capital forever, and the EBO terminal value is larger. This is illustrated in Table 1 by assuming that 40 percent of economic assets are in the form of R&D that is expensed immediately. In that case, the terminal value equal to 28 percent of the total value.

That prices can be expressed largely in terms of book value and earnings forecasts over a horizon of intermediate length is convenient not just in practice or in teaching, but also for research purposes. A subsequent section of the paper relies on that notion to explain prices in terms of profitability and book value growth over the following decade. An analogous approach based on a DCF model would require cash flow data over a much longer horizon, as well as a large estimated terminal value, to explain price (for example, see Easton [1985]). Alternatively, restrictive assumptions would be necessary to link future cash flows to nearer-term earnings (for example, see French and Poterba [1991] or Malkiel [1992]).

Of course, the EBO approach does not skirt the assumptions underlying DCF terminal value; it simply embeds some of them in an accrual process that produces a forecasted book value for the end of the forecast horizon. If the assumption that economic rents will dissipate within that forecast horizon is reasonable, and the accounting is unbiased, this book value will provide an accurate estimate of the DCF terminal value. Alternatively, if the accounting is biased, but book value is adjusted by a multiple (based on forecasted ROE at the end of the forecast horizon) that compensates for this bias, one can still produce an accurate estimate. Thus, the EBO approach frames the valuation task by focusing on the question, "Once economic rents dissipate and (therefore) ROEs stabilize (ignoring the impact of growth on ROE), what will be the book value of the firm?"[12] The answer, of course, will depend on the firm's earnings path to that point, its earnings retention rate, and any expected capital infusions. The practical usefulness of the EBO approach, relative to DCF methods, depends in part on whether framing the question in this way imposes some discipline on the estimation process that would otherwise be missing.

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[12] In the presense of biased accounting, ROEs vary through time even in a fully competitive equilibrium, as a function of growth. However, in such an equilibrium, growth offers no enhancement to the present value of the firm, and can thus be ignored for valuation purposes.

(3) Perspective on accounting conservatism

Except when accounting choices reveal, obscure, or otherwise alter one's view of the firm's underlying economic prospects, value estimates from the EBO formula should not be affected by the degree of conservatism in the firm's accounting policies. However, as hinted above, unbiased accounting in the context of the EBO valuation formula offers the advantage of permitting valuation based on the shortest possible forecast horizon—that is, based on the smallest set of accounting numbers.[13]

Unbiased accounting also permits forecasts of ROE over the forecast horizon that can be based entirely on a view of how quickly economic rents will evolve and dissipate. In contrast, with biased accounting, one must additionally consider the interaction between ROE and growth that arises within the forecast horizon, as well as the shift in ROE that will occur simply as a result of movement from a growth to an assumed no-growth stage beyond the forecast horizon. Such considerations can be sufficiently complex that the process would be more conveniently framed in terms of primitive cash flows.

In sense suggested above, the accounting-based EBO valuation methods provide a motive for "normalizing" accounting book values and earnings, much as analysts do; with "better" accounting, value can be summarized with forecasts over shorter horizons, with less concern about the interaction between profitability and growth that arises under biased accounting. In contrast, the role of accounting method differences is less transparent when DCF methods are used, since in the end, the accounting methods are "unraveled" anyway.[14]

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[13] Recall that, with unbiased accounting, ROE is expected to revert to the cost of capital as soon as economic rents are expected to dissipate. Beyond that point, abnormal earnings must be zero and further forecasts are irrelevant. In contrast, with biased accounting, ROE is expected never to revert to the cost of capital, and valuation becomes an infinite horizon problem. The less bias in the accounting, the smaller the long-run deviation of ROE from the cost of capital, and the smaller is the terminal value, relative to total value.

[14] At a minimum,this introduces some clumsiness in teaching, when moving from discussions of the importance of adjusting reported accounting numbers, to valuation.

(4) Treatment of cash flows from investing and financing activities

Under the DCF approach, one explicitly forecasts cash flows for investment in net working capital, capital expenditures, and (if cash flows to equity holders are being discounted) for debt service. None of these same flows need be considered *explicitly* under the EBO valuation approach. The reason is that the EBO approach, like the accounting system on which it relies, views value creation as something that occurs only through operating activities, not through investment and financing activities.[15] If, as suggested by the Modigliani-Miller theorems, it is operating activities that are the key to value creation, then the accounting-based valuation formula offers the advantage of focusing attention on those and only those activities.[16]

2.4 *Contrast of the EBO formula with other accounting-based valuation methods*

In addition to the EBO valuation formula, there exist a variety of other methods that estimate firm value based on accounting numbers, without direct reference to future cash flows. However, all of these are distinct from the EBO approach in an essential way. One set of such methods used in practice—those based on application of PE multiples, price/book multiples, unlevered price-to-sales multiples, etc., for presumably "comparable" firms—are *ad hoc;* they do not explicitly identify the determinants of the multiples or the linkage between the denominator and the numerator.

A possible exception is application of PE multiples that are driven by the widely-known formulae based on the expected earnings retention rate (k), growth rate (g) , and the cost of capital (r) (Miller and Modigliani [1961]). For example, given an expected return on investment of r* that exceeds the cost of capital over a forecast horizon T, one formula is written as

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[15] This is not a restrictive view, since any value created or destroyed through investment or financing activities generates an earnings impact that is still considered in the EBO valuation.

[16] See Ohlson [1991] for a discussion of the relation between clean-surplus accounting and the Miller-Modigliani theorems.

$$\frac{P_t}{E_t} = \frac{1 + T(g\text{-}kr)}{r} \quad \text{where } g = kr^* \ .$$

Such formulae may appear on the surface to be similar to the EBO formula. However, the above formula is based on the assumption (sometimes justified because earnings are presumed to be "normalized") that free cash flows are proportional to earnings, and also imposes restrictive assumptions on the path that cash flow growth can assume. In the end, this and all related approaches (e.g., Fama and Miller [1972]) are just versions or special cases of the DCF model, based on restrictive assumptions that the EBO formula does not require.[17]

3. Application: fundamental determinants of market-to-book ratios

We now examine empirically the factors that determine variation in price-to-book ratios. One motive for the analysis is to enhance our understanding of the relative importance of the factors that must be forecast in order to explain fundamental values. A second motive is to begin an investigation that could ultimately shed light on the "market-to-book" anomaly that has been the recent focus of attention in finance (e.g., Fama and French [1992a, 1992b, 1992c], Lakonishok, Shleifer, and Vishny [1992], Kothari, Shanken, and Sloan [1993]). It has long been documented that stock returns vary inversely with prior price-to-book ratios in ways that cannot be explained by existing capital asset pricing models. At issue is whether the ability of price/book ratios to predict stock returns is best characterized as a market inefficiency or a risk factor.

The EBO valuation formula provides a new vehicle for tackling the debate. The formula offers a framework for describing the relation between price/book ratios and accounting fundamentals. Assuming that *ex post* observations of those fundamentals,

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[17] Although Fama and Miller produce valuation models that involve discounting earnings, the modeling relies on the assumption that earnings and cash flows from operations are the same. Thus, Fama and Miller sometimes refer to their earnings concept as "cash earnings" or "net operating cash flow".

when averaged over large samples, are good proxies for their expected values, the formulae permit an assessment of whether observed price/book ratios are "too variable."

The evidence presented here is based on the sample of all firm-years (1) with non-missing earnings data on the 1992 Compustat PST active and research files; (2) appearing in the 1992 CRSP files; and (3) with SIC codes between 1000 and 5999. (Thus, financial firms are excluded). The number of firms varies from 1640 in 1991 to 2306 in 1974, with a median of 1912. In any given analysis, some firms are unavailable due to lack of data on book value or market value. Since both active and research files are used, survivor bias is mitigated; however, the specific type of survivor bias that Kothari, Shanken and Sloan [1993] suggest might explain the market-to-book effect remains an issue.[18]

The first step: Linking price/book, current ROEs, and future ROEs

Predicting future ROEs based on current ROEs

As is evident in equation (7), price/book ratios in an efficient market should depend on expected future ROEs, the related growth in book value, and the required rate of return. We begin our analysis with a focus on future ROEs. Penman [1991] has already established that future ROEs are related to current ROEs, and therefore that price/book ratios are also related to current ROEs. Thus, we will re-establish those linkages in a more complete and more recent sample, and then consider what factors beyond current ROEs explain price/book ratios.

Table 2 Panel A shows the relation between current ROEs, current price/book ratios, and future ROEs. To construct the table, we partition the sample firms into deciles (within each year) on the basis of current ROE, and then examine the path of ROE within each decile over the next 15 years. When assigning a firm-year to an ROE decile, we exclude firms with a negative book value in the denominator of ROE (or price-to-book).

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[18] Kothari, Shanken, and Sloan note that when firms are newly added to the Compustat files, historical data is added at the same time. If Compustat selects firms for inclusion on some basis that would induce a correlation between their historical market-to-book ratios and subsequent returns, it could contribute to or even explain the market-to-book effect.

However, once a firm is assigned to a given decile in this "base year," it is retained for purposes of calculating ROEs for subsequent years, even if its book value turns negative. This is accomplished by "pooling" all remaining firms in the decile, calculating the *sum* of earnings and book value for the pool, and then dividing to obtain an ROE. Thus, the ROEs reported represent rates of return on portfolios that in the base year contained equal amounts of book value of each firm, but which contain differing amounts in subsequent years, depending on the growth patterns of the various firms.[19]

Table 2 Panel A confirms prior findings of mean reversion in ROEs (e.g., Freeman, Ohlson, and Penman [1982]; Penman [1991]; Fama and French [1992c]). Yet the mean reversion is not immediate, and thus current ROE predicts variation in future ROEs even over intervals as long as three to five years. The mean reversion is stronger for high ROE firms, consistent with competitive forces driving out abnormally high profitability while dislocation costs "trap" some firms with abnormally low profits. Eleven to 15 years after the partitioning date, there is little variation among the top seven deciles.

The reversion of ROEs to a common level for such a broad cross-section of firms is interesting, because it would not be expected if ROEs reflected persistent variation in either risk or accounting conservatism. Either such variation is unimportant or unstable or both.

Since current ROEs are good predictors of future ROEs, and future ROEs are among the determinants of current price/book ratios, one would expect a relation between current ROEs and current price/book ratios. Table 2 Panel A (as well as prior research by Penman [1991], Ou and Penman [1992], and others) confirms this result. The price/book ratios increase monotonically across all but the first ROE decile.

A large number of the firms underlying Table 2 Panel A are acquired, liquidated, or go bankrupt, and do not survive for the full 15 year horizon. Any gain or loss that arises at the cessation of a firm's existence is relevant for pricing, but is not included in the reported

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[19] A disadvantage of this approach is that, in years well beyond the base year, some firms will have experienced much more growth in book value than others, and thus will exert much more influence on the final result. This problem can be particularly severe when the initial book value is positive but "small." To mitigate this problem, firms with price-to-book ratios greater than ten in the base year are excluded.

earnings figure on which the ROEs are based. In that sense, Panel A suffers from a survivorship bias that would tend to make price-to-book ratios look more variable (relative to subsequent ROEs) than they should. In Panel B, ROEs beyond the base year are augmented with the effects of any such gains or losses. The gains/losses are estimated by subtracting the final book value from the latest stock market value available on CRSP at least one month after (but no more than one year after) the firms' last full fiscal year.[20] The intention is to rely on a market value that already reflects the expected price impact of whatever event led to the dropping of the firm from the active Compustat file.

Table 2 Panel B shows a higher average level of ROE—reflecting gains on the many takeover targets in the sample. However, the dispersion in ROE across the deciles beyond the base year changes little. This suggests that current ROE is not a good predictor of gains/losses resulting from cessation of the firm.

Predicting future ROEs with price/book ratios: some surprising evidence

Equation (7) suggests that, if prices are set in an efficient market, then price/book ratios should predict future (abnormal) ROEs. Moreover, since prices could potentially reflect much information about future ROEs that current ROEs do not embed, one might expect the partitioning on price/book ratios to generate substantially more predictive power than the one based on current ROEs. Table 3 tests this proposition by partitioning the sample on the basis of current price/book ratios, and then examining current and future ROEs. In Panel A, ROEs based on reported earnings are shown; Panel B reports ROEs that include gains/losses at cessation of the firm.

Surprisingly, Table 3 Panel A shows that almost regardless of the forecast horizon, price/book ratios are *less* accurate than current ROEs as predictors of future ROEs. Note that the range in future ROEs across the extreme price/book partitions is smaller than that

[20] If no CRSP price was available within this range—as occurred in about 10 percent of the cases where the firm was delisted before or very soon after its final fiscal year—the final market value per Compustat was substituted.

across the extreme current ROE partitions in Table 2 Panel A for every horizon through year 8, and is nearly the same thereafter. Movement to Panel B places the predictive ability of price/book ratios in only a slightly better light. The range in future ROEs across the extreme price/book deciles is larger than that across the ROE deciles for horizons beyond year 5—but if we examine the range across extreme *quintiles*, price-to-book ratios lose most or all of their predictive advantage.

The result in Table 3 is puzzling, since it is hard to understand how prices could contain *less* information than current ROEs. Equation (7) helps illustrate that there can only be two explanations (aside from market inefficiency) for the relative lack of explanatory power in price/book ratios. One is that the partition on price/book ratios is a relatively noisy predictor of future ROEs, because it reflects not only expectations of future ROEs, but also expectations of future growth in book value. Given that future growth in book value is so closely linked to future ROEs, this explanation seems somewhat strained, but is nevertheless possible. The other possibility is that price/book ratios are noisy indicators of future ROEs because they are influenced by variation in required rates of return.

The incremental power of price-to-book ratios to predict ROEs

We could take some solace in a finding that, even though price/book ratios are inferior to current ROE as predictors of future ROEs, they at least offer *some* incremental predictive power. Indeed, Penman [1991] shows that, for a given level of current ROE, future ROEs vary positively with a dichotomous partition on current price/book. However, that result is driven largely by the firms in the highest decile of current ROEs, and is rather weak for other cases.[21]

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[21] A feature of the Penman approach that was appropriate for his purposes, but which makes it difficult to apply his evidence to our purpose, is that he reports only median ROEs within deciles. It is not clear what should be the precise relation between price-to-book ratios and median subsequent ROEs within price-to-book deciles.

Table 4 extends an analysis similar to that Penman [1991]to the present sample. In Table 4, firms are partitioned into quintiles on the basis of current ROE, and are partitioned independently into three groups based on current price/book ratios: low (lowest three deciles), medium, and high (highest three deciles). Panel A of Table 4 is most similar to Penman; in that panel, the ROEs exclude gains/losses on cessation of the firm. Unlike the Penman [1991] analysis, Panel B includes such gains/losses.

As expected, those firms in Panel A with the highest price/book ratios tend to have higher subsequent ROEs for a given level of current ROE—at least for years +1 and +2. This confirms that price/book ratios capture *some* information about future ROEs that is not reflected in current ROEs.

The surprising feature of Table 4 Panel A lies in the weakness of the result. The average price-to-book ratio for those in the high category is 2.65—nearly 4 times the average in the low category (.67). Simple inspection of equation (7) suggests that such a difference should be associated with substantial differences in expected future ROEs, future growth in book value, or required rates of return. However, substantial differences are *not* apparent in the subsequent ROEs. The high price/book firms generate subsequent ROEs that never exceed those of the low price/book firms by more than 2 percent; the average difference over the entire forecast horizon is almost nil (0.02 percent). Contrast these differences with the substantial range across the extreme partitions based on current ROE: 15, 16, and 33 percent in year t+1 (for the low medium, and high price-to-book groups, respectively), 10, 12, and 24 percent in year t+2, and so on. Current ROE has predictive power beyond price-to-book ratios, but the reverse is not true.

Price-to-book ratios fare much better in Table 4 Panel B, where gains/losses at the time of firm termination are included in the ROEs. On average across the forecast horizons, the subsequent ROEs are 5 percent higher for the high price-to-book group than the low one (16.4 percent versus 11.4 percent). However, with discount rates in any plausible range, a 5 percent differential in future ROE is not sufficient to explain a four-fold

differential in price-to-book ratios. Moreover, one could question how meaningful it would be to "explain" the variation in stock prices with gains and losses that themselves are functions of stock prices. Such an explanation would still leave unanswered the question of whether variation in price-to-book ratios could be linked to profitability in the product markets, as opposed to the capital markets.

In summary, the evidence indicates that surprisingly, price-to-book ratios are not only dominated by current ROEs as predictors of subsequent reported profitability in product markets, but that price-to-book ratios convey almost no incremental predictive power for that purpose. Price-to-book ratios *do* reflect incremental information about future gains/losses from takeovers, liquidations, and bankruptcies. However, even after taking this into consideration, most of the variation in price-to-book ratios has yet to be traced into the subsequent economic fundamentals.

In pursuit of an explanation:

price/book ratios as predictors of growth in book value

If large variation in price-to-book ratios cannot be explained as a function of sufficiently large differences in subsequent ROEs, what *could* explain the variation? Equation (7) indicates that, assuming the high price/book firms' expected ROEs exceed the required rate of return, then a higher expected rate of growth in book value could explain the higher price/book ratios.

Table 5 uses the same partitions developed in Table 4, but instead of tracking subsequent ROEs, the table tracks subsequent growth in book value. Specifically, the table displays percentage increase in book value—or in the notation of equation (7), $\left[\frac{b_{t+\tau-1}}{b_t} - 1\right]$.

As one might expect, there is a substantial growth in book value for all of the portfolios over the fifteen-year horizon. The amounts range from 171 percent to 920 percent. More interestingly, however, the growth rates are higher for the high price/book

portfolios, almost regardless of which forecast horizon or ROE decile is compared. By the tenth year, the high price-to-book firms' book value has increased 394 percent, compared to only 190 percent for the low group. The direction of the difference is consistent with expectations, and if the magnitude is large enough, it could explain the puzzle posed above. That is, even similar levels of abnormal ROEs for high price/book firms, when applied to a more quickly growing base of book value, could potentially justify substantially higher price/book ratios.

Applying the accounting-based valuation formula:

Are price/book ratios more variable than justified?

We now turn to whether the differences in profitability and growth across the price/book partitions are large enough to justify the magnitude of the variation in price/book ratios. To address this question, we turn again to equation (7) and its derivatives. Using the information about future ROEs and future growth in book value, we ask what price/book multiple the market would have assigned, if its expectations of ROEs and book values were equal to the ultimate realizations. We begin with estimates based on a common discount rate. We then ask how much variation must be introduced into the discount rates to justify the observed variation in actual price/book ratios. Finally, we discuss the plausibility that such variation is rational.

Our estimates are based on ROEs that include gains/losses from liquidation, sale, or merger of a firm. Thus, we are to some extent failing to trace market prices all the way to profitability in the product markets; under the alternative where such gains/losses are excluded, the variation in price-to-book ratios would be more difficult to explain.

We continue to assume that in the base year, each partition includes a portfolio of firms with equal amounts of book value; that "buy-and-hold" portfolio is held though subsequent years so that the relative amount of each firm's book value changes in accordance with the firm's growth pattern. When firms cease to exist, it is assumed that

any proceeds are invested in zero net present value projects, thus reducing the remaining base of book value that is subject to earning abnormal profits. When data for surviving firms fail to extend beyond a given forecast horizon because that horizon would carry beyond 1991, it is assumed that subsequent ROEs, growth in book value, and price-to-book ratios are expected to be the same as that realized by firms that remain at longer horizons (some of which cease to exist prior to year 15).

In estimating price-to-book ratios based on realized ROEs and growth, we must adopt some assumption for handling terminal values, since we do not have an infinite series of [illegible] estimations. If accounting were unbiased, one could reasonably assume a

[redacted]

terminal value, on the premise that in the base year, one would not typically expect any

[redacted]

whether accounting conservatism varies across high and low price/book firms in a way

that could potentially explain the results based on the first method.

price over book. This method generates higher estimated price/book ratios than the first

Our success in explaining the observed price/book ratios is still limited, however, because the estimated price/book ratios are not as variable as the actuals. The estimated ratios are on average "too high" for the firms whose actual price/book ratios are low (specifically, 1.00 versus .67), and "too low" for the high group (1.76 versus 2.65). Put differently, the range in the estimated ratios (1.00 to 1.76) is only about one-third as large as the range in the actual ratios (.67 to 2.65). When the terminal values are based on the final price/book ratio, the discount rate necessary to match the estimated and actual ratio for the medium group rises substantially, to 16 percent, but the estimated ratio for the low group is still "too high" (.91 versus .67) and the estimated ratio for the high group is still "too low" (2.09 versus 2.65).

The results indicate that, even after accounting for variation in future ROEs—including gains/losses on cessation of the firm—and future growth in book value, there still remains substantial unexplained variation in the observed price/book ratios. Absent some research design bias, we are left now with only the following explanations: a large portion of the variation in price/book ratios must largely be explained by variation in required rates of return, or to mispricing, or to some combination of both.

Variation in price/book ratios explainable by differences in required rates of return

In Table 6, we also impute the required rates of return necessary to produce estimated price/book ratios that are consistent with both the actual price/book ratios and the subsequently realized ROEs and growth in book value. It is assumed that discount rates are constant across the forecast horizon. If instead, discount rates are mean-reverting over time (for example, see Ball, Kothari, and Watts [1992]), then the variation in the initial discount rates required to explain the variation in price-to-book ratios would be larger.

Table 6 indicates that the remaining variation in actual price-to-book ratios could be explained if the required rate of return on low price/book firms was 16.5 percent, while the required rate for high price/book firms was only 10.5 percent. Comparable rates when

terminal values are based on ending price/book ratios are both higher, as expected: 19.5 percent and 13.5 percent. Note, however, the limits to what is revealed by the difference between the latter set of estimates; when terminal values are based on final prices, imputation of required rates is (by construction under clean surplus accounting) tantamount to computing the average annual returns for the related portfolios. Thus, these required rates simply reconfirm that raw returns are negatively related to price-to-book ratios, without supporting or refuting a grounding in the fundamentals. In contrast, there is no such mechanical linkage between the first set of imputed required rates and stock returns. The similar ranges of implied discount rates between low- and high-price/book firms for the two sets of estimates (6 percent) suggests that if there was ever any difference in mispricing across the price/book portfolios, it was eliminated over the 10 years.

The difficult question remaining at this stage of the analysis is whether the range of discount rates necessary to explain the variation in price-to-book ratios is justified on the based of differences in risk, or is a reflection of some mispricing. A differential risk premium of 6 percent may seem large for two such broad cross-sections of firms, but it is not implausible. Assuming an average risk-free rate of 7 percent for the period, required rates of 16.5 and 10.5 percent for the low and high price/book firms suggest the former group of firms are about two to three times more risky. (That is, the risk premium is two to three times higher for the low price/book group.) Discount rates of 19.5 and 13.5 percent imply the low price/book firms are about twice as risky. Whether the differences in implied discount rates can be explained by differences in risk will not be tested directly in this draft, and is impossible to resolve completely, given the present state of knowledge of asset pricing. There are, however, certain aspects of the evidence that are puzzling.

First, there are some subsets of firms for which the pricing is especially difficult to explain. Recall that current ROE dominates price-to-book ratios as a predictor of future profitability, which is consistent with the possibility that prices fail to respond fully to current ROE. If so, mispricing would be most likely to arise in partitions where current

ROE and price-to-book ratios are most inconsistent. Information about the pricing in the two key cells—high price/book with low ROE and low price/book with high ROE—appears in Table 6. In the first group, the firms are initially priced at 3.02 times book value, even though they show losses in the base year, and subsequently experience below-average profitability at all horizons except years 5 and 6 (where high ROEs are driven largely by a gain on dissolution of a single firm).[23] Even after considering the very high growth rates experienced by these firms, the initial price/book ratio can be justified only with a discount rate as low as 6.7 percent (10 percent when terminal values are based on ending price/book ratios). Assuming a risk-free rate of 7 percent, this leaves little or no room for a risk premium. In the other key partition, with low price/book ratios and high ROEs, the actual price-to-book ratio is below one (.72), even though future profitability is above average and future growth is among the highest of all partitions. However, that pricing could be explained by plausibly high levels of required rates: 16.5 percent when terminal values are linked to accounting numbers and 21.5 percent when terminal values are based on ending price/book ratios.

The second puzzling aspect of the evidence involves an internal inconsistency between the imputed rates required to match estimated and actual price-to-book ratios, and the subsequently realized accounting rates of return. Unless obscured by differences in accounting conservatism, there *should* be some relation between required rates of return and the accounting profitability of subsequent investment projects. The riskier the firm, the higher should be its hurdle rate for accepting investment projects, so as to produce the higher cash flows per unit of capital necessary to compensate owners for bearing the risk. Although required rates of return can change after projects are accepted, thus weakening the relation between those required rates and accounting profitability, one would expect *some* relation to remain over the long run.

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[23] Readers may be tempted to "blame" the high price/book ratio on a small denominator, but note that the very same denominator appears in the ROE and the growth calculation. .

The expected relation is certainly not evident in the data. The low price/book firms have average implied discount rates 6 percentage points higher than the high price/book firms, suggesting a higher equilibrium level of ROE. Of course, in the short run, the low price-book firms are expected to have *lower* ROEs—after all, that's one reason why they have lower price/book ratios. But as abnormal economic returns dissipate over time, one would expect the higher hurdle rates of this group to be accompanied by higher realized rates of return, while those of the high price/book firms evolve toward lower realized rates of return. A glance back to Table 4 indicates that this relation never surfaces at any horizon in the ROEs based on reported earnings, and beyond year 10, is also absent in the ROEs that include gains/losses on takeovers, etc. One possibility is that risk premia are mean reverting, and thus differential risk premia disappear such long horizons. If so, however, the initial difference in discount rates would have to be even greater to explain the observed variation in price/book ratios (about 13 percent, versus the 6 percent mentioned above, assuming an exponential decay with a half-life of 5 years), thus raising other puzzling issues. Another possibility is that differences in economic rents persist even over long horizons, and approximately offset the impact on ROEs of differences in risk premia.

One might be tempted to attribute the apparent inconsistency to the impact of accounting. That is, even if low price-to-book firms have high risk, high hurdle rates, and high rates of profitability when calculated under unbiased accounting, the firms could still produce reported ROEs over long horizons that are no higher because their accounting is less conservative (causing the denominator of the ROE to be higher). Indeed, a group selected on the basis of low price-to-book ratios would be expected to have a "less conservative denominator." This possibility, however, is inconsistent with evidence presented below on differences in accounting conservatism across price/book groups. It is also inconsistent with the evidence in Table 2 Panel A suggesting that differences in accounting conservatism across firms are too small to maintain a spread in ROEs across the top seven deciles of the ROE distribution for more than five years.

Indicators of accounting conservatism are presented for the low, medium, and high price-to-book groups in Table 7. We compare not only accounting methods, but also asset mix. Asset mix is potentially relevant, since accounting tends to be more conservative for inventory and plant than for cash and receivables. Finally, the level of R&D expenditures is compared across the two groups, since R&D accounting represents the extreme in conservatism.

Table 7 provides little support for the notion that differences in accounting conservatism cause important differences in ROEs across the three groups. The three groups have nearly equal amounts of assets invested in FIFO and LIFO inventory. The prevalence of accelerated depreciation is similar for high and low price/book firms. The mean LIFO reserve is about 50 percent larger for the low price/book group—but that difference goes the "wrong" way, in terms of explaining the issue raised above. Only the presence of higher R&D expenses for the high price/book firms is consistent with more accounting conservatism in that group—but the difference in mean levels of R&D expense (2 percent of equity) seems far too small to explain the phenomenon at issue here.

Accounting conservatism can take on many forms not captured in Table 7. For example, the creation of unrecorded assets through a market penetration strategy or human resource development program has the same effect as accounting conservatism. Firms with such unrecorded assets would tend to have high current price-to-book ratios and high subsequent rates of profitability (as calculated under traditional accounting systems), even if their risks and hurdle rates are low. This phenomenon, perhaps in combination with persistent impacts of monopoly rents on ROE, might obscure the expected equilibrium relation between ROE and discount rates across price-to-book partitions.

Even if biases in accounting could explain why we can't document the expected equilibrium relations between required and realized returns, we would still be left with some loose ends. Assuming that discount rates vary substantially and persistently across firms (as required to "justify" the variation in price-to-book ratios) and assuming that

unidentified sources of accounting conservatism also vary substantially and persistently across firms (as required to explain the obscuring of the relation between discount rates and realized returns in price/book portfolios), then differences in ROE *across ROE partitions* should be large and long-lasting. But we've already documented that when we restrict attention to ROE in the product markets, firms in the top 70 percent of the distribution revert to similar levels of ROE within five years. The various puzzles could be attributable to mispricing, to Compustat-induced selection bias of the kind described by Kothari, Shanken, and Sloan [1993], or some other unidentified factor.

Summary

A primary determinant of the variation in price-to-book ratios is variation in the current levels of profitability (ROE). This section has focused on the fundamental drivers of the remaining variation. The preliminary findings are as follows.

(1) Surprisingly, little or none of the variation in price-to-book ratios can be traced to subsequent variation in reported ROEs, beyond the variation already explained by current ROEs. Differences in future profitability in the product markets—beyond that implied by current differences—must either be small, unpredictable, ignored by stock prices, or obscured by other factors that affect stock prices.

(2) Perhaps one-third to two-thirds of the difference between high and low price-to-book ratios (holding current ROE constant) can be traced to a combination of future growth in book value and gains/losses on takeovers, mergers, liquidations, and bankruptcies.

(3) The remaining variation in price-to-book ratios must be attributable to either variation in required rates of return, research design bias, sampling error, mispricing, or some combination thereof. Plausible degrees of variation in

required rates would be sufficient to explain the variation in price-to-book ratios, but such an explanation raises other unresolved puzzles.

The above findings have implications for financial statements analysis and research thereon. It is to those and other implications that we now turn.

4. Implications for research in financial statements analysis

On the goals of research in financial statement analysis

The accounting-based valuation formula (7) clarifies what are the central tasks of financial statements analysis for purposes of valuation: prediction of abnormal ROEs, prediction of the related growth in book value, and estimation of the discount rate. As Penman [1992] underscores, this view differs from the perspective that permeates empirical capital markets research. The traditional perspective is that (1) the ultimate objective is to predict future cash flows; (2) testing the ability to predict future cash flows is difficult, because so much of firm value comes in the form of cash flows to arrive only over very long horizons, and (3) a feasible alternative is to assume market efficiency and attempt to explain the market's assessment of the present value of future cash flows (that is, stock price).

The ability to express firm value directly in terms of accounting numbers suggests that the prediction of ROEs and book value is just as "worthy" an objective as the prediction of future cash flows. Moreover, since (as discussed earlier) forecasts of ROE and book value over relatively short horizons may be nearly sufficient to describe firm value (especially when the accounting is unbiased), the "long horizon problem" that arises in predicting future cash flows is not likely to be nearly as severe.

Finally, there is no special need in our research to assume market efficiency or, for that matter, even to explain stock prices. The ability to predict abnormal ROEs and book value necessarily implies some ability to explain the value of the firm—regardless of

whether that value is equal to the stock price. Certainly, one might motivate a comparison of estimated values with prices either to test market efficiency, or (if efficiency is assumed) to see whether the predictions can be improved. But the more fundamental purpose of financial statements analysis is the prediction of ROEs and book values, not explaining stock prices. (Penman [1992] elaborates on this point.)

On the components of the task of financial statements analysis, and the role of stock-price-based tests

The three components of the financial statements analysis task—predicting future ROEs, predicting future growth in book value, and assessing risk—potentially involve different analyses (even though the components are clearly related, as suggested by Tables 4 and 5). For example, the impact of competitive advantage and barriers to entry on the *rate* of profitability (ROE) may or may not coincide with opportunities for growth in the *base* to which that rate will apply. If one accepts stock prices as good reflections of available information, the results in section 3 suggest that it is difficult to improve upon predictions of the *rate* of profitability in product markets, once current profitability is already considered. The incremental opportunities for explaining value appear to lie elsewhere, including the prediction of growth and assessing risk. The first of these two has thus far received scant direct attention in the literature.

In using stock prices as a tool for divining what financial statement data is "value-relevant," capital markets researchers have implicitly been engaged in a search for factors useful in some undefined combination of each of the three components of the financial statements analysis task. Ironically, the component of the task that is probably most often assumed to be the focus of such research—the prediction of future profitability—is apparently the component about which stock prices have the least to say. (That is, after controlling for current profitability, price/book ratios are poor predictors of future rates of profitability in the product markets.) Whether the reason is that the variation in price/book

ratios is driven by rational variation in discount rates and growth expectations, or by market inefficiency, the implication is the same for research on fundamental analysis: price/book ratios are rather noisy divining rods for discovering the keys to predicting how future rates of profitability will differ from the past. Moreover, if much of the variation in price/book ratios is unrelated to changes in profitability, the same is likely to be true of changes in stock prices—as the low explanatory power that permeates the capital markets literature attests.

On the limits of programmable approaches to predicting profitability

If prices are of limited use in predicting how profitability will change, then one is left to tackle the task more directly. The literature already contains some such approaches. Freeman, Ohlson, and Penman [1982], Ou and Penman [1989a,1989b], Ou [1990], and Penman [1991] all report some success in predicting changes in ROE or earnings. However, the success is largely driven by one feature of the data: the ability to predict changes in earnings, due to the mean reversion in ROE or related measures. The question now is what *beyond* current ROE would complement its ability to predict future ROE.

Ou and Penman [1992] take a logical step toward answering that question, by testing whether any of a long list of other financial statement numbers can enhance the power of prediction based on ROE alone. They experience little notable success. The evidence suggests, then, that it is difficult to push our predictive power much further by identifying some *general*, programmable model based on financial statement data. Ou and Penman [1992] leave open the question of whether a somewhat more contextual approach might be more fruitful. The empirical results in papers like Bernard and Noel [1991] suggest some improvements are possible, but they are far from dramatic in terms of explanatory power. The evidence in this paper indicates that the weakness of the results

may not be so much a reflection of weakness in research design as it is the inherent difficulty of the task involved.[24]

The good news: on the "quality" of book value and current ROE

While the difficulty of improving on the ability of current profitability to predict future profitability may seem disappointing in one sense, it is gratifying in another. After all, if there were a lot of information about changes in future profitability imbedded in the financial statements, one could in some cases question why such information isn't already reflected in the *current* profitability. For example, given that inventory buildups in certain contexts tend to translate into subsequent declines in profitability (see Bernard and Noel [1991]), one could question why such earnings impacts aren't reflected immediately. In a sense, then, the difficulty of using financial statement data to predict changes from the current level of profitability is a testimony to the quality of the current earnings calculation. It also suggests that research on profitability prediction might benefit by turning to data from *outside* the accounting system. (For example, Anderson, Fornell, and Lehmann [1992] use customer satisfaction as a predictor of ROE, and Lee [1993] incorporates information about corporate strategy in such predictions.)

Just as the difficulty of improving on current ROE as a predictor may actually be a testimony to the power of accrual accounting (at least as practiced in the U.S.), it may also suggest that book value and current earnings are good indicators of value. Having found that these accounting numbers are good predictors of future fundamentals, we close with a return to stock prices to see how well their level can be explained by book value and current ROE.

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[24] The view presented here is more pessimistic than that of Penman [1992], who points to evidence in Penman [1991] to indicate that the stock market is capable of improving on the ability of current ROE to predict future ROE, and therefore suggests it must be possible to discover the source of that ability. One reason for the contrasting views is differences in the construction of Table 4 Panel A and a similar table in Penman [1991], but the more important reason is simply differing interpretations of the strength of the relation between price-to-book ratios and future ROEs in those tables.

Table 8 reports the results of estimating the following regression (suggested by equation (6)) each year from 1982 through 1991, for the subset of firms analyzed previously that appear on the active Compustat file. (These results have yet to be updated for the full sample.)

$$P_{jt} = \alpha_t + \beta_t b_{jt} + \gamma_t \text{Rank}(ROE_{jt}) * b_{jt} + \varepsilon_{jt} \qquad (9)$$

The results show that book value per share and ROE explain about 66 percent of the cross-sectional variance in price per share (on average across the ten years). Even when ROE is excluded and only book value remains as a regressor, the explanatory power remains at 54 percent.

To gain some perspective on what it means that book value alone can explain 54 percent of the variance in price, we consider the explanatory power of a pure cash accounting system, where book value is simply equal to the cash balance. Book value from that primitive system would explain, for the typical year, 18 percent of the cross-sectional variance in price (see Table 8). Thus, the accrual accounting system produces a book value capable of enhancing our ability to explain the variance in price from 18 percent to 54 percent; adding the accrual earnings number (as reflected in ROE) takes us further, to 66 percent.

With no knowledge of corporate strategy, market position, production technology, or human resources, two accounting numbers—book value and ROE—can explain 66 percent of the variation in price. Viewed in combination with the evidence on how difficult it is to improve on these two numbers as predictors of future earnings, such evidence suggests that for most firms, the much-maligned accounting process produces a sound

5. Summary and concluding remarks

The Edwards-Bell-Ohlson valuation formula offers an alternative to valuation techniques that are used in practice and that underpin much research in accounting and finance. EBO defines firm value directly in terms of book value and earnings, which

account for an estimated one-third to two-thirds of the variation in price-to-book ratios

attributable to mispricing remains an unresolved issue.

Table 1
Relative importance of terminal value calculations:
DCF method vs. EBO method with/without unbiased accounting

	Year 1	Year 2	Year 3	Year 4	Year 5 and beyond
Projected accounting data and computed value of firm, with unbiased accounting:					
Sales	200.00	226.00	255.38	288.58	288.58
Op Exp	155.00	180.00	207.00	236.00	238.08
Depn & Amortization	20.00	22.60	25.54	28.86	28.86
Earnings	25.00	23.40	22.84	23.72	21.64
Dividends	12.00	8.71	6.24	23.72	21.64
Beg book value	100.00	113.00	127.69	144.29	144.29
ROE	0.25	0.21	0.18	0.16	0.15
Abn Earnings	10.00	6.45	3.69	2.08	0.00
PV of ab earn	8.70	4.88	2.43	1.19	
Terminal value				0.00	
Current book, plus cum PV of ab earn				117.19	

Projected accounting data and computed value of firm, with conservative accounting:					
Sales	200.00	226.00	255.38	288.58	288.58
Op Exp	155.00	180.00	207.00	236.00	238.08
Depn & Amortization	12.00	13.56	15.32	17.31	17.31
R&D Exp	13.20	14.92	16.86	11.54	11.54
Earnings	19.80	17.52	16.20	23.72	21.64
Dividends	12.00	8.71	6.24	23.72	21.64
Beg book value	60.00	67.80	76.61	86.57	86.57
ROE	0.33	0.26	0.21	0.27	0.25
Abn Earnings	10.80	7.35	4.71	10.74	8.66
PV of ab earn	9.39	5.56	3.10	6.14	
Terminal value				33.00	
Current book, plus cum PV of ab earn, including term value				117.19	

Projected cash flows and computed value of firm (independent of accounting method):					
Cash from op, before R&D expense	45.00	46.00	48.38	52.58	50.50
Cap Exp plus R&D	33.00	37.29	42.14	28.86	28.86
Free cash flow	12.00	8.71	6.24	23.72	21.64
PV of FCF	10.43	6.59	4.10	13.56	
Terminal value				82.50	
Cum PV of FCF, plus terminal value:				117.19	

See notes of explanation on following page.

Notes to Table 1:

1) Sales are forecast to rise at 13 percent annually. Growth beyond year 4 is ignored, because under the assumption that competition drives the rate of return on incremental investment to the cost of capital, growth beyond year 4 adds nothing to current firm value.

2) Operating expenses begin at 77.5 percent of sales, and rise to 82.5 percent of sales, consistent with competition driving the rate of return on investment to the cost of capital.

3) Book value includes only depreciable assets, and (in case of unbiased accounting), capitalized R&D. Each year's beginning balance of depreciable assets is 30 percent of sales for the year; each year's beginning balance of R&D (if capitalized) is 20 percent of sales. Capital expenditures are amounts necessary to maintain these relations. Depreciable assets (and R&D, when capitalized) are expensed at rate of 40 percent per year.

4) Dividend policy is to distribute all free cash flow.

5) Cost of capital is equal to 15 percent.

Table 2: Predicting future ROE with current ROE

Panel A: Path of subsequent ROE for partitions based on current ROE

Decile based on current ROE	Mean price/ book	ROE for current year (0) through year 15:											
		0	1	2	3	4	5	6	7	8	9	10	11-15
1	1.18	-0.21	-0.09	-0.06	-0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.03	0.05
2	0.93	0.02	0.02	0.03	0.05	0.04	0.04	0.06	0.07	0.05	0.04	0.04	0.04
3	1.02	0.07	0.05	0.07	0.08	0.08	0.08	0.08	0.07	0.09	0.09	0.08	0.07
4	1.07	0.10	0.09	0.09	0.10	0.10	0.11	0.10	0.11	0.11	0.10	0.11	0.09
5	1.19	0.12	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.11	0.11	0.10	0.09
6	1.30	0.14	0.13	0.13	0.12	0.12	0.11	0.12	0.12	0.12	0.11	0.11	0.11
7	1.46	0.16	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.11
8	1.70	0.18	0.16	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.11	0.10
9	2.15	0.22	0.18	0.16	0.15	0.14	0.14	0.13	0.13	0.12	0.10	0.09	0.11
10	2.92	0.34	0.24	0.18	0.15	0.15	0.13	0.12	0.11	0.09	0.08	0.07	0.11
Range	1.74	0.55	0.33	0.24	0.17	0.15	0.11	0.10	0.07	0.06	0.03	0.04	0.06

Panel B: Path of subsequent ROE—including gain/loss at cessation of firm—partitions based on current ROE

Decile based on current price/book	Mean price/ book	ROE for current year (0) through year 15:											
		0	1	2	3	4	5	6	7	8	9	10	11-15
1	1.18	-0.21	-0.04	0.02	0.07	0.09	0.09	0.10	0.16	0.09	0.09	0.06	0.13
2	0.93	0.02	0.03	0.05	0.08	0.08	0.08	0.16	0.11	0.11	0.07	0.10	0.09
3	1.02	0.07	0.06	0.10	0.12	0.12	0.13	0.12	0.10	0.12	0.11	0.15	0.14
4	1.07	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.12	0.14	0.15	0.17	0.14
5	1.19	0.12	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.13	0.14	0.18	0.14
6	1.30	0.14	0.15	0.16	0.15	0.15	0.14	0.15	0.15	0.17	0.17	0.15	0.15
7	1.46	0.16	0.18	0.17	0.17	0.17	0.16	0.18	0.17	0.16	0.18	0.15	0.14
8	1.70	0.18	0.21	0.18	0.17	0.18	0.17	0.18	0.20	0.18	0.15	0.33	0.21
9	2.15	0.22	0.23	0.21	0.21	0.17	0.20	0.17	0.18	0.27	0.25	0.14	0.16
10	2.92	0.34	0.30	0.24	0.24	0.24	0.21	0.19	0.19	0.16	0.14	0.12	0.19
Range	1.74	0.55	0.34	0.22	0.17	0.15	0.12	0.09	0.03	0.08	0.06	0.05	0.06

Table 3: Predicting future ROE with current price-to-book ratios

Panel A: Path of subsequent ROE for partitions based on current price-to-book ratios

Decile based on current ROE	Mean price/ book	ROE for current year (0) through year 15:											
		0	1	2	3	4	5	6	7	8	9	10	11-15
1	0.44	0.00	-0.01	0.02	0.05	0.06	0.07	0.07	0.07	0.07	0.06	0.04	0.07
2	0.64	0.05	0.04	0.07	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.07	0.06
3	0.79	0.08	0.08	0.08	0.09	0.10	0.10	0.10	0.10	0.08	0.10	0.11	0.08
4	0.91	0.10	0.09	0.10	0.11	0.11	0.11	0.11	0.10	0.11	0.10	0.11	0.09
5	1.05	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.09
6	1.21	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10
7	1.43	0.14	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.11	0.10	0.10	0.10
8	1.75	0.15	0.14	0.14	0.13	0.12	0.12	0.13	0.12	0.11	0.10	0.09	0.09
9	2.31	0.17	0.16	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.07	0.08
10	4.19	0.20	0.19	0.16	0.14	0.13	0.11	0.10	0.11	0.10	0.09	0.09	0.13
Range	3.75	0.20	0.19	0.14	0.09	0.07	0.04	0.03	0.04	0.03	0.03	0.05	0.07

Panel B: Path of subsequent ROE—including gain/loss at cessation of firm—for partitions based on price/book

Decile based on current price/book	Mean price/ book	ROE for current year (0) through year 15:											
		0	1	2	3	4	5	6	7	8	9	10	11-15
1	0.44	0.00	0.00	0.03	0.06	0.08	0.09	0.11	0.11	0.10	0.09	0.08	0.13
2	0.64	0.05	0.05	0.08	0.10	0.11	0.11	0.12	0.14	0.11	0.11	0.11	0.15
3	0.79	0.08	0.09	0.11	0.11	0.12	0.13	0.12	0.13	0.11	0.14	0.15	0.14
4	0.91	0.10	0.11	0.13	0.13	0.14	0.13	0.14	0.14	0.13	0.12	0.14	0.15
5	1.05	0.12	0.13	0.13	0.15	0.15	0.15	0.14	0.13	0.17	0.15	0.15	0.12
6	1.21	0.13	0.15	0.16	0.16	0.15	0.16	0.15	0.16	0.16	0.16	0.15	0.14
7	1.43	0.14	0.16	0.16	0.15	0.16	0.15	0.16	0.15	0.15	0.14	0.14	0.13
8	1.75	0.15	0.19	0.18	0.17	0.17	0.17	0.19	0.18	0.15	0.15	0.14	0.13
9	2.31	0.17	0.22	0.20	0.22	0.20	0.19	0.18	0.19	0.20	0.15	0.14	0.17
10	4.19	0.20	0.27	0.24	0.24	0.22	0.20	0.20	0.20	0.22	0.22	0.26	0.21
Range	3.75	0.20	0.27	0.20	0.18	0.14	0.11	0.10	0.09	0.12	0.13	0.18	0.08

Table 4
Predicting ROE: Incremental power of price/book ratios, beyond current ROE

Panel A: Path of ROE for partitions based on current ROE and current price-to-book ratio

Current P/B quantile	Current ROE quintile	Mean price/ book	ROE for current year (0) through year 15:											
			0	1	2	3	4	5	6	7	8	9	10	11-15
Low	1	0.54	-0.07	-0.02	0.00	0.03	0.05	0.05	0.06	0.07	0.05	0.04	0.03	0.06
	2	0.64	0.08	0.06	0.08	0.09	0.10	0.10	0.10	0.10	0.09	0.10	0.09	0.08
	3	0.72	0.13	0.10	0.10	0.10	0.10	0.11	0.11	0.10	0.10	0.10	0.10	0.08
	4	0.73	0.17	0.13	0.11	0.11	0.10	0.12	0.11	0.12	0.11	0.10	0.11	0.04
	5	0.72	0.26	0.13	0.10	0.10	0.10	0.11	0.10	0.09	0.10	0.07	0.09	0.11
Medium	1	1.16	-0.10	-0.02	0.02	0.05	0.05	0.04	0.05	0.05	0.05	0.07	0.06	0.03
	2	1.10	0.09	0.08	0.09	0.10	0.10	0.10	0.09	0.08	0.11	0.10	0.10	0.09
	3	1.12	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11
	4	1.20	0.17	0.15	0.14	0.13	0.13	0.13	0.14	0.13	0.12	0.12	0.12	0.10
	5	1.19	0.25	0.18	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.09	0.09	0.08
High	1	3.02	-0.18	-0.10	-0.05	-0.04	-0.05	-0.01	0.00	0.02	0.02	0.03	0.02	0.06
	2	2.52	0.08	0.07	0.08	0.07	0.06	0.07	0.08	0.10	0.10	0.08	0.10	0.04
	3	2.28	0.13	0.13	0.12	0.11	0.10	0.10	0.11	0.11	0.12	0.11	0.09	0.09
	4	2.33	0.17	0.17	0.16	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.11	0.10
	5	3.11	0.28	0.23	0.19	0.16	0.16	0.14	0.12	0.12	0.10	0.09	0.08	0.13
Low	Mean	0.67	0.11	0.08	0.08	0.09	0.09	0.10	0.10	0.09	0.09	0.08	0.08	0.07
Medium	Mean	1.15	0.11	0.10	0.10	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.08
High	Mean	2.65	0.10	0.10	0.10	0.09	0.08	0.09	0.09	0.10	0.10	0.09	0.08	0.08

Table 4 (continued)
Predicting ROE: Incremental power of price/book ratios, beyond current ROE

Panel B: Path of ROE—including gain/loss upon cessation of firm—
for partitions based on current ROE and current price-to-book ratio

Current P/B quantile	Current ROE quintile	Mean price/ book	ROE for current year (0) through year 15:											
			0	1	2	3	4	5	6	7	8	9	10	11-15
Low	1	0.54	-0.07	-0.01	0.01	0.05	0.07	0.08	0.09	0.12	0.09	0.08	0.07	0.16
	2	0.64	0.08	0.07	0.10	0.11	0.12	0.13	0.13	0.12	0.11	0.14	0.15	0.13
	3	0.72	0.13	0.11	0.13	0.11	0.12	0.13	0.13	0.12	0.13	0.12	0.11	0.16
	4	0.73	0.17	0.14	0.12	0.13	0.11	0.13	0.12	0.13	0.15	0.13	0.16	0.06
	5	0.72	0.26	0.14	0.14	0.11	0.10	0.11	0.10	0.24	0.12	0.09	0.12	0.17
Medium	1	1.16	-0.10	0.01	0.08	0.11	0.11	0.09	0.11	0.11	0.11	0.09	0.13	0.08
	2	1.10	0.09	0.10	0.11	0.13	0.14	0.13	0.13	0.10	0.16	0.13	0.14	0.14
	3	1.12	0.13	0.15	0.15	0.15	0.15	0.14	0.15	0.15	0.15	0.16	0.17	0.14
	4	1.20	0.17	0.18	0.16	0.16	0.17	0.16	0.17	0.17	0.15	0.16	0.14	0.14
	5	1.19	0.25	0.20	0.17	0.16	0.16	0.18	0.15	0.16	0.16	0.12	0.11	0.15
High	1	3.02	-0.18	0.02	0.05	0.10	0.09	0.10	0.27	0.19	0.11	0.06	0.07	0.10
	2	2.52	0.08	0.15	0.17	0.16	0.14	0.14	0.15	0.14	0.12	0.13	0.23	0.13
	3	2.28	0.13	0.18	0.16	0.17	0.17	0.17	0.17	0.18	0.16	0.16	0.20	0.12
	4	2.33	0.17	0.23	0.21	0.19	0.21	0.18	0.20	0.22	0.19	0.17	0.36	0.20
	5	3.11	0.28	0.29	0.24	0.25	0.23	0.22	0.19	0.19	0.23	0.21	0.13	0.20
Low	Mean	0.67	0.11	0.09	0.10	0.10	0.10	0.12	0.11	0.15	0.12	0.11	0.12	0.14
Medium	Mean	1.15	0.11	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.13	0.14	0.13
High	Mean	2.65	0.10	0.17	0.17	0.18	0.16	0.16	0.19	0.18	0.16	0.15	0.20	0.15

Predicting growth in book value: Incremental power of price/book ratios, beyond current ROE

Table 5

Current P/B quantile	Current ROE quintile	Mean price/ book	Growth in book value for current year (0) through year 15:											
			0	1	2	3	4	5	6	7	8	9	10	11-15
Low	1	0.54	0.00	0.19	0.02	0.01	0.05	0.15	0.40	0.61	0.83	0.77	1.04	1.71
	2	0.64	0.00	0.05	0.19	0.28	0.29	0.42	0.61	0.76	0.95	1.27	1.47	2.24
	3	0.72	0.00	0.13	0.20	0.31	0.40	0.54	0.70	0.82	0.99	1.19	1.32	2.12
	4	0.73	0.00	0.15	0.93	0.39	0.47	0.65	0.84	1.07	1.37	1.82	2.37	3.25
	5	0.72	0.00	0.22	0.36	0.56	0.71	0.95	1.19	1.55	1.94	2.56	3.29	6.15
Medium	1	1.16	0.00	0.19	0.12	0.28	0.29	0.48	0.64	0.81	1.11	1.39	1.79	3.43
	2	1.10	0.00	0.07	0.13	0.22	0.50	0.52	0.69	0.86	1.04	1.54	1.49	2.30
	3	1.12	0.00	0.10	0.20	0.32	0.46	0.61	0.75	0.93	1.18	1.39	1.62	2.49
	4	1.20	0.00	0.15	0.27	0.40	0.60	0.73	0.95	1.20	1.39	1.62	1.93	2.78
	5	1.19	0.00	0.26	0.49	0.68	0.89	1.12	1.47	1.68	1.98	2.36	3.39	4.09
High	1	3.02	0.00	0.01	0.18	0.43	0.76	1.09	1.46	2.10	3.12	4.11	5.61	9.20
	2	2.52	0.00	0.38	0.35	0.64	1.25	1.67	1.57	1.96	2.31	2.93	3.77	4.80
	3	2.28	0.00	0.16	0.36	0.53	0.73	1.19	1.25	1.57	1.94	2.35	2.74	4.04
	4	2.33	0.00	0.17	0.40	0.60	0.80	1.08	1.38	1.72	2.09	2.50	2.86	4.18
	5	3.11	0.00	0.33	0.72	1.14	1.52	1.93	2.47	2.88	3.46	4.14	4.73	7.56
Low	Mean	0.67	0.00	0.15	0.34	0.31	0.39	0.54	0.75	0.96	1.22	1.52	1.90	3.09
Medium	Mean	1.15	0.00	0.15	0.24	0.38	0.55	0.69	0.90	1.10	1.34	1.66	2.04	3.02
High	Mean	2.65	0.00	0.21	0.40	0.67	1.01	1.39	1.63	2.05	2.58	3.21	3.94	5.95

Table 6

Variation in price-to-book ratios explained by variation in subsequent ROEs and growth, and imputed discount rates necessary to complete the explanation

Base year price/book quantile	Base year ROE quintile	Base year ROE	Base year price/book	Average future ROE: without cessation gain/loss*	Average future ROE: with cessation gain/loss*	Terminal value based on ROE in yrs 11-15: Estimated price/book for r=.13	Terminal value based on ROE in yrs 11-15: Disc rate justifying actual PB:	Terminal value based on ending price-to-book ratio: Estimated price/book for r=.16	Terminal value based on ending price-to-book ratio: Disc rate justifying actual PB:	Terminal value based on ending price-to-book ratio: Ending price/book
Low	Average	.11	.67	.08	.12	1.00	.165	.91	.195	1.53
Medium	Average	.11	1.15	.10	.14	1.15	.130	1.15	.160	1.69
High	Average	.10	2.65	.09	.17	1.76	.105	2.09	.135	2.31
Low	Highest	.26	.72	.10	.14	1.39	.165	1.19	.195	1.70
High	Lowest	-.18	3.02	.01	.10	.73	.067	1.61	.100	2.22

*"Cessation gain/loss" is difference between market value and book value after firm is removed from Compustat file due to takeover, liquidation, bankruptcy, etc.

Table 7

Degree of Accounting Conservatism for Low, Medium, and High Price/Book Firms

	Low price/book firms		Medium price/book firms		High price/book firms	
	Median	Mean	Median	Mean	Median	Mean
Asset mix and leverage (all variables scaled by total assets):						
Cash & receivables	.24	.26	.25	.24	.29	.30
Inventory: FIFO & avg cost	.11	.17	.03	.14	.06	.14
Inventory: LIFO	.00	.07	.00	.07	.00	.07
Net plant: on accelerated depn	.00	.12	.00	.20	.00	.12
Net plant: on straight-line depn	.01	.11	.00	.12	.01	.14
Liabilities	.61	.58	.54	.56	.50	.51
Other indicators of accounting conservatism:						
LIFO reserve, scaled by equity	.12	.17	.10	.14	.07	.12
Annual R&D expense, scaled by equity	.00	.03	.00	.03	.00	.05

Table 8

Book Value and ROE as Explainers of Price

Summary of series of the following cross-sectional regressions for each year, 1982-1991:

$$P_{jt} = \alpha_t + \beta_t b_{jt} + \gamma_t \text{Rank}(ROE_{jt}) * b_{jt} + \varepsilon_{jt}$$

where P_{jt} = stock price per share for firm j, end of year t;

b_{jt} = book value per share for firm j, end of year t;

ROE_{jt} = return on equity for firm j, year t (expressed in terms of percentile of the ROE distribution for the year).

Mean values of coefficients (with mean t-statistics in parenthesis):			
α_t	β_t	γ_t	R-squared
Regression of price against book value, defined as cash balance per share:			
18.71	.46	—	.18
(31.48)	(17.56)		
Regression of price against book value of equity:			
6.38	1.13	—	.54
(11.13)	(41.24)		
Regression of price against book value of equity and scaled ranks of ROE:			
5.18	.40	.14	.66
(9.76)	(8.57)	(19.95)	

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