Financial Forecasting, Risk, and Valuation: Accounting for the Future

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Abstract
Valuation involves forecasting payoffs and discounting expected payoffs for risk. Forecasting is often seen as the province of the statistician, risk determination the province of asset pricing. This paper elaborates on the idea that financial forecasting, risk determination, and valuation are a matter of accounting. Accounting not only provides information to forecast payoffs but also specifies the payoffs to be forecasted. Further, accounting determines the transition from the present to the future and thus implicitly the evolutionary parameters that a statistician might estimate for forecasting. Accounting also bears on risk determination in the way it handles uncertainty. Accordingly, accounting is involved in both the numerator and the denominator of a valuation model. Indeed, a valuation model is a model of accounting for the future, and the effectiveness of a valuation model rides on the accounting principles employed.

This paper elaborates on one idea: financial forecasting, risk determination, and valuation are a matter of accounting. Forecasting is often seen as the province of the statitician. The paper makes the point that forecasting and accounting are so much linked that one can say that forecasting is really a matter of accounting for the future. Risk analysis (for valuation) has been the province of "asset pricing" in finance. The paper argues that accounting also bears on risk determination, introducing the idea that asset pricing also involves accounting for the future. Accordingly, accounting is very much the focus in valuation. Indeed, the paper opens up the possibility that all aspects of valuation can be carried out within an accounting framework.

Forecasting and risk determination are very much at the heart of practical valuation. Asset value is determined by future, uncertain payoffs, so valuation requires forecasting under uncertainty, with both the forecast and the uncertainty priced. For a one period payoff (for example), the valuation task is expressed as $P_t = E(X_{t+1})/(1+r)$ where X_{t+1} is consumption at the end of the next period, typically expressed as cash that can purchase

consumption, and *r* is the discount for the risk that consumption may be other than expected (plus the interest rate for the price of delayed consumption). Forecasting bears of the determination of the expected payoff in the numerator, while asset pricing bears on the determination of the discount in the denominator. Both can be viewed as a matter of accounting.

Forecasting and Accounting
A purely statistical approach to forecasting sees the object of the forecast as a drawing from a conditional distribution, with the expected value given by transitional parameters applied to current observables, and the risk (error) in the forecast given by distribution of unpredictable realizations around this expectation. These features are referred to as a generating "process" (an ARIMA process, for example). The statistical exercise simply estimates the parameters of the process from behavior in the data. But observables are often generated by nature, with the process governed by laws of nature, albeit often not deterministically. So those laws are utilized in the forecasting, such that tomorrow's weather is forecasted based on the principles of meteorology, albeit with error.

   Accounting is also a "process", but not one generated by nature. Rather accounting is man-made, a matter of design choice. The design consists of a number of structural relations (accounting equations) that articulate the balance sheet, income statement, and cash flow statement, and a set of accounting principles – so-called recognition and measurement principles – that prescribe the numbers that go into those statements. The process has three features that link accounting to forecasting and valuation:

1. Accounting links to cash flows (and thus consumption and valuation) through the basic structural relation that ties the balance sheet and income statement to the cash flow statement:

   Cash flow from an asset = Earnings – Change in the balance sheet value of asset.

   With equity valuation in mind, this "clean-surplus equation" is most often stated for equity, but applies to any asset, including debt (for debt valuation) and the firm, debt plus equity (for enterprise valuation).

2. Accounting principles (that determine earnings and balance-sheet book values) operate to allocate earnings between periods. Periodic earnings and cash flows differ according to timing rules prescribed for earnings and book values, but total earnings from an asset always equals total cash flows (because the change in book value is zero over the life of the asset).

3. Components of financial statements tie to earnings and book values according to fixed, structural relations such that financial statement numbers aggregate to earnings and book values in a deterministic way.

   Accounting Feature 1 implies that, rather than forecasting cash flows for valuation, one can equivalently forecast earnings and book values. Forecasting can be seen as a matter of accounting for the future, with that accounting defined by how earnings and book

values are measured. Forecasting cash flows implicitly involves pure cash accounting. Accrual accounting modifies the forecast to target a particular measurement of earnings and book values. The first order in forecasting is to specify the accounting, the issue of how one accounts for the future.

The implied research question, then, is what accounting best facilitates forecasting and the valuation. Cash accounting and accrual accounting can been compared on their utility for forecasting and valuation, and so can different forms of accrual accounting, IFRS and U.S. GAAP accounting for example. Accounting is a matter of design for utilitarian purposes – in this case, valuation – so the accounting researcher (and ultimately the accounting standard setter) asks: What accounting best serves forecasting and valuation? Historical cost accounting? Fair value accounting? A new design? In their conceptual framework documents, the FASB and IASB firmly embrace the idea that accounting serves to forecast future cash flows. But the issue is more subtle: accounting numbers are not just the predictor but also the target of the prediction, albeit with the purpose of forecasting future cash flows.

Accounting Feature 2 informs that the specification of accounting for the future also specifies the accounting for the present; accounting allocates to periods and, to the point, allocates between the present and the future. Accordingly, accounting principles determine the transition from the present to the future, so forecasting of future accounting numbers from current, observed numbers is also a matter of accounting. Statistical forecasting specifies that evolution with parameters from a process estimated from the data or dictated by nature. Accounting specifies the evolution from the process dictated by the accounting principles employed. Accounting is self-referential, with future numbers specified as the target for forecasting determined in part by the accounting for the current numbers. That self-reference directs the forecasting.

Accounting Feature 3 says that earnings and book value are constructed from other aspects of the financial statements in a deterministic way. There are two implications for forecasting. First, forecasts of earnings and book values (and thus cash flows) can be constructed from more elementary elements; the structure lays out the building blocks of a forecast. So, as an example, a forecast of earnings is satisfied by a forecast of revenues and expenses (and their components), and a forecast of book value by a forecast of assets and liabilities (and their components). Second, structural relations discipline forecasting, and the forecaster cannot wander beyond the bounds imposed by these relations. For example, a forecast of earnings is constrained by accounting relations that require that earnings must not only equal revenues minus expenses but also equal the change in book value (for a given dividend), and the change in book value must equal the change in assets minus the change in liabilities. Forecasts outside these bounds are inadmissible.

Formalization

These ideas can be expressed more formally.

Accounting Feature 1. The standard derivation of the residual earnings valuation formula from the dividend discount formula formalizes feature 1. Given a constant discount rate, *r*, the value of an asset now (at time t) is

$$P_t = \sum_{\tau=1}^{\infty} \frac{d_{t+\tau}}{(1+r)^{\tau}} \tag{1}$$

where $d_{t+\tau}$ is the expected dividend (cash flow) from the asset in period, $t + \tau$. (Here and throughout the paper, variables time-subscripted with $\tau > 0$ are expected values.) This model is also, of course, a statement of the no-arbitrage price if r is the required return for risk borne.[1] Substituting the clean-surplus relation, $d_{t+\tau} = Earnings_{t+\tau} - (B_{t+\tau} - B_{t+\tau-1})$ into equation (1) for all $\tau > 0$,

$$P_t = B_t + \sum_{\tau=1}^{\infty} \frac{Earnings_{t+\tau} - rB_{t+\tau-1}}{(1+r)^{\tau}} \qquad (2)$$

$Earnings_{t+\tau}$ is earnings on the asset for period $t+\tau$ and $B_{t+\tau-1}$ is the book value of the asset on the balance sheet at the end of the prior period, both specified by a particular set of accounting principles. $Earnings_{t+\tau} - rB_{t+\tau-1}$ is referred to as residual earnings for year $t+\tau$. The model is usually applied to equities but applies to any asset (such as a bond), though for terminal assets (such as a bond) the summation runs only to maturity.[2]

   With no accounting restriction other than the clean-surplus relation, the model holds for all accounting methods. Accordingly, application of the model requires further specification of the accounting, and that accounting is an open issue. For example, one might specify a ("mark-to-market") accounting whereby

$$P_t = B_t$$

(as with a liquid, mark-to-market investment fund where investors trade in and out of the fund at book value, "net asset value"). This accounting forces an expectation of future residual earnings of zero, so the forecasting task is removed: valuation is satisfied by the accounting for the present. Alternative accounting involves $P_t \neq B_t$ but, for a given P_t, means that expected residual earnings is non-zero for some $t + \tau$. One sees that the accounting determines what is to be forecasted; forecasting is a matter of accounting for the future. The dividend discount model is just a special case where the balance sheet is empty, it reports no book value (except cash). Its unlevered equivalent, the discounted cash flow formula, is just the residual earnings formula stated for an accounting where earnings from operations equals free cash flow and book value equals net debt.[3]

   These observations pose the research question: What is the appropriate accounting for forecasting and valuation? The issue does not arise for infinite-horizon forecasting, for equation (2) is then equivalent to equation (1) for all accounting for earnings and book value; one is indifferent to the accounting. However, practical forecasting must be done over finite horizons, so the question amounts to one of relative forecasting error for a

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[1] The model holds as a statement of no-arbitrage only with a constant discount rate. We use this "textbook version" for familiarity, aware of the simplification involved. Rubinstein (1976) and Breeden and Litzenberger (1978) present dividend discount models with varying discounts, where the discount for risk appears in the numerator so that a risk-neutral expectation is then discounted with a time-varying risk-free rate. Feltham and Ohlson (1999) and Ang and Liu (2001) lay out residual earnings valuation models with stochastic discounts rates. The commentary here can be adapted to the more general model except that reference to risk premiums would refer to a discount for (time-subscripted) covariances in the numerator rather than additions to the risk-free rate.

[2] The residual earnings model has been around a long time. See, for example, Preinreich (1936, 1938). The model has been resurrected in recent times by Peasnell (1982), Brief and Lawson (1992), and Ohlson (1995). In Preinreich (1941), Preinreich recognizes the model in a student's prize essay by J. H. Bourne, *Accountant*, London, September 22, 1888, pp. 605-606 (as referenced by him).

[3] Lücke (1955) is the first to show this, I am told.

given forecasting horizon.[4] As with all forecasting, that question might be addressed in terms of assessed error distributions and the standard statistical metrics for evaluating those distributions. But now the accounting also enters in.

For a finite forecasting horizon, T, the dividend discount model (1), is stated (consistent with no-arbitrage) as

$$P_t = \sum_{\tau=1}^{T} \frac{d_{t+\tau}}{(1+r)^\tau} + \frac{P_{t+T}}{(1+r)^T} \qquad (1a)$$

By substituting earnings and changes in book value for dividends, it follows that (for all accounting for earnings and book value),

$$P_t = B_t + \sum_{\tau=1}^{T} \frac{Earnings_{t+\tau} - rB_{t+\tau-1}}{(1+r)^\tau} + \frac{P_{t+T} - B_{t+T}}{(1+r)^T} \qquad (2a)$$

The last term is the amount of value omitted from the balance sheet at $t+T$ under the specified accounting; that is, $P_{t+T} - B_{t+T}$ is the error in the balance sheet in capturing value at the forecast horizon. (It is referred to as the "continuing value" or "terminal value" in text books.) Accordingly, a given accounting can be evaluated by the amount of valuation error it produces (in expectation) in the balance sheet for a given forecast horizon. For a particular accounting where $P_t \neq B_t$ but the accounting is expected to add earnings to book value in the future such that $P_{t+T} = B_{t+T}$, the accounting yields zero error for the specified T (and correspondingly, residual earnings after T are expected to be zero). The case of $P_t = B_t$ is a special case, of course, where there is no error at time, t.[5] The claimed dominance of accrual-accounting valuation over discounted cash flow analysis (cash accounting) for equity valuation in based on the observation that $P_{t+T} - B_{t+T}$ is typically greater under discounted cash flow analysis: book value under discounted cash flow valuation records only net debt and, as net debt is typically positive (yielding negative book value of equity), $P_{t+T} - B_{t+T}$ is greater than P_{t+T}.

However, in evaluating ex ante error for a particular accounting specification, one must recognize that accounting reports an income statement as well as a balance sheet. Under the no-arbitrage condition, successive prices (cum-dividend) are reconciled such that

$$P_{t+T} = \frac{P_{t+T+1} + d_{t+T+1} - P_{t+T}}{r} \qquad (3)$$

Substituting the accounting relation, $d_{t+T+1} = Earnings_{t+T-1} - (B_{t+T+1} - B_{t+T})$,

$$P_{t+T} = \frac{Earnings_{t+T+1} + P_{t+T+1} - B_{t+T+1} - (P_{t+T} - B_{t+T})}{r} \qquad (4)$$

This substitution recognizes that the stock return in the numerator of equation (3) is always equal to earnings plus the change in the premium over book value in the balance sheet for the earnings period. If the expected change in premium—the error in the

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[4] For terminal investments, cash accounting typically suffices (as it does in bond valuation). Indeed, it is the practical problem of finite horizon forecasting for going-concern (infinite-horizon) assets that accrual accounting potentially plays a role. This point is at the crux of the discussion in Penman and Sougiannis (1998), Lundholm and O'Keefe (2001a), Penman (2001) and Lundholm and O'Keefe (2001b) on valuation errors from alternative models. See also Francis, Olsson, and Oswald (2000) and Corteau, Kao, and Richardson (2001).
[5] One might also add that an accounting system dominates when $P_{t+T} = B_{t+T}$ is satisfied for a smaller T.

balance sheet—is zero, then the expected return equals expected earnings. Thus, just as price equals capitalized expected return, so price is given by capitalized expected earnings:

$$P_{t+T} = \frac{Earnings_{t+T+1}}{r}$$

Accordingly, even though accounting principles produce error in the balance sheet, this is not important if balance sheet errors cancel: P_{t+T} is recovered by capitalizing earnings, and a valuation can be implemented by applying the finite-horizon dividend discount model in (1a) with P_{t+T}, so determined, as a terminal value.

   The idea that error in the balance sheet is unimportant to earnings measurement when that error is a constant was once (in textbooks of old) called the canceling error principle.[6] Earnings are just the change in book value (adjusted for net dividends), by the clean-surplus equation, so the effect on earnings from error in the ending balance sheet is canceled by error in the opening balance sheet. The principle is demonstrated in instruction to first-year accounting students: R&D expense and earnings are the same whether one capitalizes and amortizes R&D expenditures or expenses them immediately provided there is no growth in R&D expenditures. In a valuation context it implies that one is indifferent between two accounting systems that have very different errors in the balance sheet (R&D capitalization versus expensing, for example) if those errors cancel. Even though discounted cash flow analysis has much value missing from the balance sheet (such that typically $P_{t+T} - B_{t+T} > P_{t+T}$), it survives without error if one expects the premium of price over net debt to be constant.

   Penman (1997) adds an accounting feature, g, that produces a constant error in expected earnings, in addition to error in the balance sheet, such that $P_{t+T+1} - B_{t+T+1} = g\,(P_{t+T} - B_{t+T})$. This is accounting that depresses earnings (as well as book values). (Feltham and Ohlson (1995) show that conservative accounting induces this feature as well as balance sheet error.) Correspondingly, residual earnings are expected to grow at the rate, g, and this growth rate, induced by the accounting, can be incorporated in the valuation with a capitalization at $r - g$ rather than r:

$$P_{t+T} = B_{t+T} + \frac{Earnings_{t+T+1} - rB_{t+T}}{r - g}$$

Accordingly, valuation can tolerate not only error in the balance sheet but also error in the income statement. But note that the growth rate is a property of the accounting for earnings and book values; adding a growth rate to the denominator is a result of accounting with both error in the balance sheet and error in the income statement that results in expected growth in premiums over book value.

   Empirical work in Penman and Sougiannis (1998) and Francis, Olsson, and Oswald (2000), compares valuation errors of accrual-based valuation models and cash flow models against observed prices, and broadly affirms that accrual models (based on U.S. GAAP) produce lower valuation error relative to observed prices for a variety of forecast horizons. Consistent with the above, they show, however, that the error with accrual accounting is higher when the premium over book value is higher and when changes (growth) in the premium are expected.

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[6] Easton, Harris, and Ohlson (1992) first invoked the idea in a valuation setting. Ohlson (2005) elaborates.

However, little accounting theory has been advanced for evaluating different (accrual) accounting methods for forecasting and valuation. The field is wide open. But it is an important one. Indeed it is at the heart of accounting design and forecasting for valuation. With an eye on the error criterion, one might suggest that the best accounting would be fair value accounting that sets $P_t = B_t$: a perfect balance sheet with $T = 0$ that the removes the need for forecasting. Essentially, accountants do all the forecasting for the investor and analysts disappear. The movement amongst standard setters for fair value accounting and an asset-liability approach (rather than an income statement approach) seems to be inspired by the idea of developing a better balance sheet. So are the prescriptions of those who argue that more "intangible" assets should be recorded on the balance sheet. However, while this accounting may appear to reduce balance sheet error, the question is ultimately that of average ex post valuation error using both income statements and balance sheets. Indeed fluffy asset values from Level-3 fair value guesstimates may produce large errors in term of investment outcomes, for imprecise estimates in the balance sheet are compounded in the income statement.[7] The idea that "better" balance sheet accounting produces a better accounting for valuation is misdirected: It ignores the canceling error notion. Historical cost accounting leaves value off the balance sheet, but focuses on earnings which, we have seen, has an important role reducing the error from an accounting system.[8] So there is no problem with omitted intangible assets, for example, if earnings from the assets are flowing through the income statement. For the case where $P_t \neq B_t$,

$$ P_t = B_t + \frac{Earnings_{t+1} - rB_t}{r} = \frac{Earnings_{t+1}}{r} $$

if $P_{t+1} - B_{t+1} = P_t - B_t$. If conservative accounting is applied such as to depress earnings, $P_{t+1} - B_{t+1} = g(P_t - B_t)$ and residual earnings are expected to growth at the rate, g. The valuation is accordingly modified to accommodate this accounting

$$ P_t = B_t + \frac{Earnings_{t+1} - rB_t}{r - g} \qquad (5) $$

The Coca-Cola Company has an important brand asset missing from the balance sheet (giving it a price-to-book ratio of about 5), but is easy to value from its earnings on that brand with this simple formula.[9]

These points aside, clearly much research needs to be done. The main point here is that forecasting must entertain accounting but the evaluation of appropriate accounting (for valuation) must also entertain its use in forecasting. Accordingly, accounting prescriptions might move away from pure accounting concepts (such as "measurement attributes" and definitions of assets and liabilities that absorb much of the current FASB and IASB deliberation documents) to the utilitarian focus on forecasting. Vague accounting concepts such as "reliability" might then take on some bite with a focus on average ex post valuation error. Standard metrics for efficient forecasting might be

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[7] This follows because earnings are affected by error in both the opening and closing balance sheet.
[8] Ohlson and Zhang (1998) compare income-statement and balance-sheet accounting. CEASA's White Paper No. 2 compares fair value accounting and historical cost accounting for valuation. See Nissim and Penman (2007). Penman (2009) applies these ideas in evaluating the accounting for intangible assets.
[9] See Penman (2010, p. 500) for an example.

exploited for the task. Fair value accounting and historical cost accounting might be evaluated with the question: How does the accounting help or frustrate the practical task of forecasting and valuation?

Accounting Feature 2. It is clear from valuation model (2) that the division of value between current book value and expected future earnings is also a matter of accounting: The difference between price and book value is just the amount of value that the accounting has not yet booked to book value, and that amount will differ for different accounting specifications. Accordingly, it is the accounting for the present that determines the transition from book values and past earnings and dividends to future earnings.

As a statistical model, forecasting might be represented as applying transitional parameters to current and past accounting numbers. For example, with a linear specification,

$$Earn_{t+1} = \beta_1 Earn_t + \beta_2 B_t + \beta_3 d_t + \varepsilon_{t+1} \tag{6}$$

(with ε_{t+1} mean zero). The parameters are often estimated from the data. Early research (that conditioned earnings forecasts on past earnings alone) took that approach. Lintner and Glauber (1967) Ball and Watts (1972) estimated a martingale, with drift, for the earnings process and subsequent papers applied Box-Jenkins techniques, popular at the time, to earnings time series. But the process is generated by the accounting and this process should direct the forecasting. This is easily seen in the case where mark-to-market accounting for book value yields $P_t = B_t$. In this case, $\beta_1 = 0$, $\beta_2 = r$, and $\beta_3 = 0$, by construction of the accounting that yields a forecast of residual earnings for $t+1$ equal to zero. A martingale process in earnings (that sets $\beta_1 = 1+r$, $\beta_2 = 0$, and $\beta_3 = -r$, thus accommodating a drift term for retention) implies a valuation model where book value is irrelevant: $P_t = \dfrac{(1+r)Earnings_t}{r} - d_t$, that is, the cum-dividend trailing P/E ratio = $(1+r)/r$. (It should be easy to see that this forecasting applies in the case of constant balance-sheet errors earlier.) More generally, the parameters in forecasting equation (6) embed accounting principles, along with the required return. This point is made vividly in Ohlson (1995) which specifies linear dynamics dictated by the accounting, such that the earnings forecast is a weighted average of the book value forecast and the "martingale" earnings forecast above, with the weights determined by the accounting for earnings and book value. Accordingly, in the general case, the β coefficients in equation (6) involve both the required return and accounting process features.

By depicting forecasting as a process that applies parameters dictated by the accounting, we make the point of linking forecasting to accounting. However, it is unlikely that accounting numbers are generated by a stationary process. For this reason, practical forecasting usually forecasts by modeling pro forma future financial statements with interperiod relations changing period-to-period as indicated by both an analysis of the business and an analysis of the (quality of) accounting. (This is not to exclude parametric approaches to forecasting, however.) Accounting Feature 3 talks to the issue of building earnings forecasts from the components of pro forma financial statements.

Accounting Feature 3. The point that the accounting structure should be incorporated in forecasting is straightforward. Earnings and book values build in the accounts from more

elementary numbers, and the forecaster understands that one cannot be worse off by expanding the information set (subject to the costs involved), particularly when the elements tie to features of the business. The breakdown of earnings and book value in the forecasting equation (6) into components recognizes that, to constrain the β coefficients to be the same for all components losses information: Different components of earnings have different "persistence."

While the point may be obvious, it was not always so. As mentioned, researchers once carried out earnings forecasting by estimating univariate time-series models for earnings. That research concluded that it is quite difficult to develop a statistical model that "beats" a simple martingale with drift. However, Freeman, Ohlson, and Penman (1982) showed that, with the addition of just one predictor – book value – one could readily do so. The issue is not one of statistics, nor solely of expanding the information set, but an issue of expanding the information set in a way that that is consistent with the structure of the accounting: Earnings and book value "articulate" as a matter of accounting and articulate to indicate future earnings and value. Exploiting this structure for both forecasting and valuation is the focus of modern financial statement analysis.[10]

Less appreciated is the point that accounting relations constrain a forecast and thus disciplines forecasting. In honoring the structure, a forecaster cannot go beyond an earnings number that is justified by articulated balance sheets and cash flow statements. A forecast of cash flow is disciplined by forecasted balances sheets and income statements. Forecasting can tend to speculation and disciplining speculation (in a "bubble" period, for example) must be seen as a desirable attribute. How often does statistical fitting produce forecasts outside of these bounds? Bound to parameter estimates (in sample) that are then applied out-of -ample, the answer is likely to be often.

Risk and Accounting

The observant reader will have noticed that, while the required return, r, appears in the valuation models, it has been swept under the rug in the discussion. When it comes to forecasting, the required return (discount rate) cannot be ignored, for the forecasting parameters in equation (6) embed not only the accounting but also the discount rate (as the special cases discussed there demonstrate). In short, one can not get very far in valuation without the specification of the discount rate, or more specifically, the risk premium required over the risk-free rate.

Practical valuation looks to asset pricing in finance to supply the risk premium. Risk in valuation is summarized by moments of the joint error distribution of forecasts, and asset pricing develops models that price these distributions. Asset pricing models are based on assumptions on the form of the distribution or utility functions (as with the Capital Asset Pricing Model), or assumptions of no arbitrage (an in no-arbitrage asset pricing models). Or models are developed simply from observed correlations between attributes and returns and between asset returns and conjectured common factor-mimicking portfolios. The Fama and French three-factor model that includes factors related to size and book-to-market (as well as the market return) appears to be the premier model of this type. All

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[10] Many of the papers that incorporate accounting line items in forecasting and valuation are referenced in Penman and Zhang (2006) (which itself explicitly exploits the accounting structure to forecast earnings and to price earnings).

models recognize the diversification property: Risks across assets are less than perfectly correlated so is reduced by diversification (without cost in a frictionless market); the investor is exposed only to common factors that cannot be diversified away, so covariances must be taken into account.

However, application of these models brings one to a screeching halt. Despite the important theoretical insights, asset pricing has been remarkably unsuccessful; after 50 years of endeavor, we have little faith in estimating the risk premium for a given asset.[11] From an accounting-based valuation perspective, the attribution of the risk premium to book-to-price (by Fama and French) is especially confusing given that valuation model (2) sees book-to-price as an outcome of a valuation rather than an input to determine the discount rate for that valuation.

Might accounting provide some insight and remedy? There have been some attempts. Beaver, Kettler, and Scholes (1970) estimated "accounting betas" and Rosenberg (1975) estimated "fundamental betas" based on accounting risk measures that became the initial product for the BARRA firm. The Beaver, Kettler, and Scholes idea of an accounting beta is appealing. No-arbitrage asset pricing models see the risk in expected dividends in model (1) as coming from the covariance of dividends with a kernel in the economy (market-wide dividends in the CAPM, for example).[12] Applying the same idea to accounting-based valuation in (2), covariance of a firm's earnings with economy-wide earnings seemingly substitutes. Feltham and Ohlson (1999) make the substitution and Christensen and Feltham (2009) explore the idea further. In a recent promising paper, Nekrasov and Shroff (2009) show that cost-of-capital estimates based on estimated covariances between firm-specific return of equity and market-wide return on equity produce average valuations errors (relative to market price) that are smaller than those from cost-of-capital estimates supplied by the CAPM. Further, adding similar betas for earnings associated with market capitalization (size) and book-to-market produce smaller valuation errors than those from the Fama and French three-factor model. Research in finance is now estimating "cash-flow betas" based on accounting numbers—earnings and book rates-of-return actually, not cash flows (despite the name)—and is finding that the estimates clear up some puzzles presented by betas estimated from stock returns.[13]

Accounting Feature 3 facilitates this type of endeavor. First, earnings and return on equity can be broken down into their structural components (such as leverage, profit margins, and asset turnovers) to gain more insight into the determinants of the covariance; one evaluates both sales risk and margin risk in market downturns (for example), rather than the aggregate. Penman (2010, Chapter 18) supplies an (untested) framework for doing so. Second, the accounting structure supplies a solution to a very practical problem that came to the fore during the financial crisis of 2008. Financial engineering, the modeling of risk that came into disrepute during the crisis, typically understands risk from the history of prices and returns. But the state space is not necessarily revealed from the history, particularly the rare events with which extreme

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[11] A few years ago, I made a casual survey of textbooks and research papers for the size of the market risk premium they were estimating or suggesting that students use in application of the CAPM. The numbers ranged from 3 percent to 9.2 percent. This is a large range, with the error in any estimate multiplicatively magnified by errors in estimated betas applied to determine the required return. See also a survey of 150 textbooks by Pablo Fernandez at Hhttp://ssrn.com/abstract=1473225.

[12] The reference is to the numerator covariance in the no-arbitrage valuation models discussed in footnote 1.

[13] See, for example, Cohen, Polk, and Vuolteenaho (2009).

"tail risk" is associated. However, one can simulate outcomes by tracing their forecasted effect through to earnings outcomes via the structure of the accounting system. The forecast of a lattice of outcomes replaces the forecast of expected values earlier in this paper. A valuation model then reduces each alternative paths to a value and a return outcome, and a profile of return outcomes under all hypothesized conditions is developed, including a perfect-storm (tail) outcome that might not be in the history. Feasible scenarios must be specified, of course, so the modeling does not protect against outcomes unimagined. Penman (2010, Chapter 18) provides examples.

However, this point aside, an important element is missing in the examination of accounting betas: accounting itself. Earnings and its covariance with market-wide earnings depend on how the accounting for earnings is done. A covariance between mark-to-market earnings and economy-wide mark-to-market earnings may be different from that for historical cost accounting (or the "mixed accounting model" of GAAP and IFRS). Indeed, the accounting might act quite perversely. Conservative accounting, widely practiced, depresses income when a firm grows investments. This induces a negative covariance between a growing firm's earnings and market-wide earnings if investments are made when the broad economy is up. The income deferred by conservative accounting is realized when investment slows, increasing earnings (as shown empirically in Penman and Zhang (2002)), and this is likely to happen when the economy is down.

There are three cases where accounting betas (or "cash-flow betas") will work. First, if mark-to-market accounting were employed for all assets (such that $P_t = B_t$), then earnings equal returns, so the accounting beta equals the return beta. The accounting records shocks to value immediately, so is revealing of the risk to value. Second, the same applies for the (constant-balance-sheet-error) accounting where $P_t \neq B_t$, but $P_{t+\tau+1} - B_{t+\tau+1} = P_{t+\tau} - B_{t+\tau}$, all $\tau > 0$. Here, again, earnings equal returns, as the comparison of equations (3) and (4) indicate. Third, in the case of the Penman (1997) generalization of constant errors in both the balance sheet and the income statement where $P_{t+\tau+1} - B_{t+\tau+1} = g(P_{t+\tau} - B_{t+\tau})$, all $\tau > 0$ returns and earnings differ only by a constant (and a constant cannot affect covariances).

Presumably none of the three forms of accounting is practical for all assets in the economy. Historical cost accounting, as practiced, typically tends to smooth earnings (shocks) over time. Indeed, there is a tension in the structure of accounting between risk revelation and earnings forecasting. Mark-to-market accounting records shocks immediately, but earnings cannot forecast future earnings ($\beta_1 = 0$ in the forecasting equation (6)). Historical cost accounting, with its emphasis of the income statement, produces earnings that are indicative of future earnings ($\beta_1 \neq 0$). But to produce this predictability, historical cost accounting not only jeopardizes the risk-revealing property of mark-to-market accounting, but smoothes earnings overtime. Predictability is enhanced, but presumably the ability of earnings to report shocks to value is reduced.

Is there a feature of historical cost accounting that might be risk revealing? The answer is yes. What follows is conjectural, though it is backed up with some empirical evidence. A fourth accounting feature links accounting to risk:

Accounting Feature 4. Accounting defers earnings recognition under uncertainty.

The accounting principles that allocate earnings to periods embed a risk assessment with the effect that, when earnings are uncertain, they are deferred to the future. In accounting parlance, earnings are "unrealized" until certain "realization" criteria -- typically a confirmed sale in the market -- are met. Those criteria have to do with the resolution of uncertainty. Typically, "receipt of cash must be reasonably certain" and cash (or assets close to cash, like receivables recognized at the same time as revenue) are low-beta assets. Deferred earnings produce growth, because interperiod allocation implies that more future earnings mean lower current earnings and thus higher future earnings relative to current earnings. Accordingly, accounting under uncertainty creates growth such that growth is an indication of risk.

Deferring income to the future rather than booking it to earnings and book value in the present is referred to as conservative accounting (and the name is warranted if the accounting is in response to risk). In applying the deferral principles, IFRS and (particularly) U.S. GAAP accounting are conservative.[14] Models of conservative accounting in Feltham and Ohlson (1995) and Zhang (2000) show how conservative accounting creates growth.[15] Ceteris paribus (holding real activity constant), conservative accounting reports lower current earnings and higher long-term earnings, but continued application of conservative accounting shifts earnings from the short-term to the long-term. The features are by construction of the accounting. Conservative accounting that we suggested upsets covariances between earnings and market-wide earnings as a measure of risk, now plays a positive role in risk revelation.

The idea of earnings deferral aligning with risk is merely suggestive; in a market where only systematic risk is priced, it would have to be that growth created by the accounting bears on outcomes correlated with common factors such as the market portfolio in CAPM pricing. But note that investors typically see growth as risky. "Growth" funds, for example, are deemed to yield higher expected returns than "income" funds and correspondingly are deemed to be higher risk. In valuation practice one usually regards the "terminal value" part of a valuation as relatively uncertain, based as it is on long-term growth prospects. Fundamental investors have always discounted growth, understanding that in most cases it can be competed away. Relative to their forecasts for the short-term, analysts' long-term growth estimates perform poorly against actual realizations, indicating they contain considerable uncertainty. And we know that leverage adds earnings growth but also adds risk.[16] The idea has currency in asset pricing in finance, though the growth referred to there is expected growth in dividends.[17]

Though the idea is conjectural, three papers support it.

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[14] For example, (risky) research and development and brand-building expenditures are expensed immediately rather than capitalized in book value and amortized against income in the future. Liabilities tend to be booked while (intangible) assets are omitted from the balance sheet. The practice of "recognizing losses early" while deferring gains (in the application of the lower-of-cost-or-market rule, for example) is a hallmark of conservative accounting. All create growth, ceteris paribus.

[15] The accounting effects are demonstrated with examples in Penman (2010, Chapter 16).

[16] For a demonstration, see Penman (2010, Chapter 13).

[17] See, for example, Menzly, Santos and Veronesi (2004) and Lettau and Ludvigson (2005). In the theory of finance, a low-risk asset is one that protects consumption during bad states of the world. Firms with value in anticipated growth are likely to he hit more in bad times rather than providing a safe haven.

First, Ohlson (2008) shows that one can, in principle, design an accounting where earnings growth is fully revealing of risk and the required risk premium. The model is an elucidation of the permanent income model where $\beta_1 = 1+r$, $\beta_2 = 0$, and $\beta_3 = -r$ in equation (6), but where the accounting defers earnings such that the growth rate in earnings is equal to the risk premium in r and, correspondingly, that growth rate indicates the covariance of unexpected earnings, ε_{t+1} in equation (6) with the economy-wide common return. The model predicts that price-to-book indicates expected returns (positively) rather than book-to-price as in the Fama and French correlations. With $r =$ risk-free rate + risk premium and $g =$ risk premium, growth and the risk premium cancel in valuation. So a valuation cannot admit cannot admit growth that adds to price for added growth just adds to the risk premium: in the capitalization by $r - g$ in a valuation model like model (6), the discount rate becomes the risk-free rate.

Second, Thomas and Zhang (2009) shows that the idea has significant appeal at the aggregate level. In the Fed Model for valuing equities, earnings yields on stocks are compared to that on long-term government bonds with the implicit assumption that growth incorporated in an earning/price ratio is offset by the risk premium for stocks over bonds (so the earnings yield equals the risk-free rate). Thomas and Zhang (2009) show empirically that that Fed Model works quite well for the stock market as a whole.

The third paper, Penman and Reggiani (2008) is an empirical paper that confronts the idea that book-to-price (B/P) indicates risk. The paper makes the point that B/P, with book value in the numerator, is in part an accounting phenomenon: given price, B/P is determined by how the accounting is done. Thus, if B/P is to indicate risk, it might be due how the accounting handles risk. The point of departure is again the case of $P_t = B_t$. A risk-free money market fund has the same B/P as a risky hedge fund because of mark-to-market accounting, so B/P in that case cannot differentiate risk (and that is due to the accounting employed). If B/P $\neq$ 1 is to indicate risk, it may be by construction of the accounting that departs from mark-to-market accounting. That accounting necessarily involves deferral of earnings, and deferral creates growth.

The residual earnings valuation model again provides the starting point for relating B/P to growth and risk. Stating the model in its constant growth form,

$$P_t = B_t + \frac{Earnings_{t+1} - rB_t}{r - g} \tag{7}$$

where g represents expected residual earnings after date $t+1$ expressed as a growth rate applied to expected $t+1$ residual earnings. Here value is divided into three components, current book value, B_t, value added from forward earnings, $Earnings_{t+1}$, and value from "long-term growth", g. Setting $g = 0$,

$$P_t = B_t + \frac{Earnings_{t+1} - rB_t}{r} \tag{8}$$

But book value cancels here, such that

$$P_t = \frac{Earnings_{t+1}}{r} \tag{9}$$

Thus, with no expected long-term growth expected, price equals capitalized earnings, and the forward earnings yield indicates the required return: $Earnings_{t+1}/P_t = r$. So it is the forward E/P ratio that is the starting point assessing the required return, not the B/P of

asset pricing models. Indeed, as model (7) holds for all B/P, book-to-price cannot add further to the evaluation of r. Accordingly, if B/P is to add to the assessment of r, it must be because it indicates growth that is risky. It makes a lot of sense that earnings growth is risky: basic economics tells us that added earnings come with added risk; if earnings expected in the short-term, $Earnings_{t+}1$, are at risk, so must earnings expected to be added in the long run.

With this in mind, Penman and Reggiani (2008) invoke another accounting feature—a property of conservative accounting—that brings B/P into the picture:

Accounting Feature 5. Conservative accounting that produces earnings growth not only reduces book value relative to price but also depresses earnings relative to book value.

This is the property referred to earlier in introducing accounting that depresses both book value and earnings when there is growth. For a given price, growth results in higher book value relative to (depressed) earnings. Further, if the growth generated by the accounting reflects risk—such that growth does not add to price—growth yields a higher B/P relative to E/P. If so, varying combinations of E/P and B/P should indicate different risk and expected return.

Accordingly the paper asks whether B/P adds to average return for a given E/P. The table below summarizes the results from data using all U.S. listed stocks from 1963-2006.

		E/P Portfolio				.
		1	2	3	4	5
	1	4.3%	10.9%	14.2%	17.1%	19.7%
B/P	2	8.8	9.1	13.0	16.0	22.1
Port-	3	14.4	8.5	12.1	17.0	21.6
folio	4	15.5	13.4	14.7	18.0	24.3
	5	26.4	20.1	20.2	22.6	30.0

To prepare this table, firms were ranked on their earnings/price (E/P) ratios each year and grouped into the five portfolios indicated. Then, within each E/P portfolio, firms were grouped into five B/P portfolios. Returns are then observed over the following 12 months. The table reports the average annual returns for each portfolio from replicating these positions in each of the 44 years. Although significance tests have not been reported here, it is clear that E/P ranks returns (across rows) as equation (9) suggests. However, for a given E/P, the higher the B/P ratio (down columns), the higher the average return.

One can always attribute the result to market inefficiency, of course, but the "rational" accounting interpretation can also be put on the table. The result for E/P suggests that short-term earnings are at risk and the market prices them as such: more expected earnings (relative to price) mean higher risk, consistent with the risk-return tradeoff. This is not difficult to swallow. Investors surely see earnings at risk and casual evidence, let alone much research, suggests that when firms' actual earnings differ from expectation, stock prices are shocked. The results for B/P further suggest that additional long-term

earnings are also at risk, consistent with the notion that growth is risky but also consistent with the idea that accounting defers earnings to the future under uncertainty.[18]

The results also explain the Fama and French B/P effect in stock returns, and in a way that reconciles B/P as a risk attribute to accounting-based valuation. B/P is correlated with E/P—the average rank correlation is 0.31(and 0.48 for positive E/P)—so part of the B/P effect is due to short-term earnings risk. But B/P also indicates growth at risk. Note, however, that the growth is quite different from the growth typically attributed to B/P, where a low B/P (rather than a high B/P) is deemed to be "growth" (as opposed to "value").

Synthesis

The discussion has provided a synthesis of forecasting and accounting. Financial forecasting for valuation involves accounting for the future, for accounting both specifies what is to be forecasted and how the forecaster transitions from the present to the future. The point opens up a number of research questions, most importantly the issue of what is the appropriate accounting for the future.

The discussion on accounting, risk, and asset pricing is more conjectural. The reader is asked to consider that accounting for the future that involves earnings deferral has something to do with risk. (Accountants have no problem with the idea.) It opens the question as to whether asset pricing models might be developed from the idea that earnings and earnings growth are at risk. This is not an unreasonable suggestion, for investors "buy earnings", and typically see that earnings are at risk. The discussion here has added some provocative accounting reasons to adopt this perspective.

Moreover, the perspective is supported by empirical research, reported here, that provides an accounting rationale for the book-to-price effect in stock returns which has so mystified researchers in asset pricing. Asset pricing models have been developed based on the empirical regularity of the book-to-price effect but, without an explanation for the effect, these models are ad hoc. The discussion in the paper here raises the question of whether a pricing model can be developed from the notion that earnings and earnings growth are at risk, but in a way that is consistent with the theory of no-arbitrage asset pricing. If so, both aspects of valuation – forecasting and the discount for risk – will be seen as a matter of accounting for the future.

Bringing together the ideas the paper, one appreciates that forecasting is a matter of accounting and that accounting has the potential to be revealing about risk. All depends on the accounting principles. For a given set of accounting principles, how does the forecasting and risk revelation help or hinder valuation? How might an alternative accounting be designed to enhance valuation and risk determination?

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[18] The E/P and B/P stock screen has long been trolled by value-growth investors. The interpretation here suggests that this trading strategy comes with risk.

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