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Accounting based valuation models: what have we learned?

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Abstract

The present survey article formed the basis of a presentation by G. Richardson to the 8 July 2003 plenary session of the Accounting and Finance Association of Australia and New Zealand Conference in Brisbane, Australia. The present article reconciles the historical and forecasting branches in the published accounting literature. Prior survey articles have primarily focused either on the historical branch or the forecasting branch. While these approaches have yielded useful insights, they do not attempt to synthesize the link between the two branches of the published literature. An obvious link between the two branches is that the Ohlson model begins with the Residual Income Model as an initial assumption. We believe that there are other links that need further emphasis. In the process, we also review the empirical issues and the evidence within these two branches. We know of no paper to date that has surveyed the empirical evidence on both the historical and forecasting branches of the published literature. In particular, we draw inferences on the following question: on balance, what have we learned from nearly a decade of research on accounting based valuation models and its applications?

Key words: Accounting based valuation; Residual income; Linear information dynamics, Conservatism; Accounting based measures of expected returns

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1. Introduction

The role of accounting numbers in valuation has been of fundamental interest to analysts, investors and researchers alike. Much of the empirical research in

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accounting based valuation has revolved around analysing historical and forecasted accounting numbers. The Ohlson (1995) and Feltham and Ohlson (1995, 1996) models spawned considerable interest in the role of historical accounting numbers in valuation. Empirical applications of these models include studies examining the value relevance of historic accounting numbers in both the levels (e.g., Collins *et al*., 1997) and the changes (e.g., Easton and Harris, 1991). The Ohlson (1995) and Feltham-Ohlson (1995, 1996) models also revived an interest in the Edwards-Bell-Ohlson residual income model (RIM) which found applications in valuation based on forecasted accounting numbers (Penman and Sougiannis, 1998), fundamental analysis (Frankel and Lee, 1998) and cost of capital studies (Gebhardt, Lee and Swaminathan, 2001).

The fact that both the historical and forecasting branches of the published literature have evolved from the residual income model leads us to believe that a link exists between the historical and forecasting branches of the published empirical accounting literature. The present survey article reconciles the historical and forecasting branches in the published accounting literature. Prior survey articles have primarily focused either on the historical branch or the forecasting branch. Lo and Lys (2000) analyse the Ohlson (1995) model and its empirical implications, and therefore focus on the historical branch. Bernard (1995) focuses on the forecasting branch, in particular the RIM and its inherent advantages over the dividend discounting approach to valuation. Lee (1999) argues that the essential task of valuation is forecasting. Therefore, historical accounting numbers in a fundamental analysis exercise are not sufficient statistics for the stream of expected payoffs. While these approaches have yielded useful insights, they do not attempt to synthesize the link between the two branches of the published literature. An obvious link between the two branches is that the Ohlson (1995) model begins with RIM as an initial assumption. We believe that there are other links that need further emphasis. For example, empirical tests of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models point to the conclusion that analyst forecasts capture future expected abnormal earnings (i.e., goodwill) far better than do historical accounting numbers combined with linear information dynamics. As a second example, tests for accounting conservatism in the historical branch based on Ohlson (1995) and Feltham-Ohlson (1995, 1996) models have been disappointing, yet the Ohlson (1995) and Feltham and Ohlson (1995, 1996) theory gives us sharp insights in the forecast branch regarding the joint implications of conservative accounting and growth for continuing value expressions given finite forecasting horizons. As yet another example, in an attempt to resolve the omitted variables conundrum facing historical type models, several empirical studies employ analyst forecasts to proxy for other information. In the limit, historical type Ohlson (1995) and Feltham and Ohlson (1995, 1996) empirical studies, with enough supplementing by forecasts, become pure forecast type RIM models.

In the process, we also review the empirical issues and the evidence within these two branches. We know of no paper to date that has surveyed the empirical

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evidence on both the historical and forecasting branches of the published literature. In particular, we draw inferences on the following question: on balance, what have we learned from nearly a decade of research on accounting based valuation models and its applications? Moreover, what direction should future research take given the relatively weak evidence in some areas (e.g., conservatism) and the relatively stronger evidence in others (the superiority of the forward price/earnings (P/E) model in a variety of applications)? It is important to ask these questions at this stage so that researchers can explore directions for future research.

The remainder of the present paper is organized as follows. Sections 2, 3 and 4 deal with the historical branch. The topics addressed under this branch will include empirical tests of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models; evidence on conservative accounting; and incorporating other information into empirical tests of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models. Sections 5, 6 and 7 deal with the forecasting branch. The topics addressed under this branch are the ‘horserace’ literature examining and comparing the valuation performance of the residual income valuation model and its counterparts, the dividend discount model (DDM) and the free cash flow valuation model; accounting based measures of expected returns and finally, accounting based multiplier models. The article will wrap up with a summary assessment of what we have learned from accounting based valuation models in general. A common thread through all the sections is the heavy intellectual debt of both branches to the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models.

2. Empirical tests of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models

The empirical evidence in support of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models is mixed. Dechow *et al.* (1999) compute intrinsic value estimates based on current accounting data (book value, abnormal earnings) and other information as proxied by one-period ahead forecasted abnormal earnings. To obtain intrinsic values, estimates of the persistence of abnormal earnings and the persistence of other information are obtained from past data using a pooled time series cross-sectional approach. The measure of intrinsic value derived in this fashion does not explain stock price better than a simple forward P/E model. Dechow *et al.* interpret their results to imply that the market puts too much weight on forecasted earnings and not enough on book value. As they point out, a simple forward P/E model is appropriate if the persistence of abnormal earnings (ω in Ohlson (1995)) is one and the persistence of other information (γ in Ohlson (1995)) is zero. In Appendix I, we summarize all the key Ohlson (1995) and Feltham-Ohlson (1995, 1996) models referred to in the present paper. The market appears to overlook the mean reversion of current abnormal earnings. Dechow *et al.* show that a simple forward P/E model best captures how investors set current price. This does not imply that a simple

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forward P/E model is the best measure of intrinsic value. Dechow *et al.* relax the assumption of market efficiency and show that price deviates from intrinsic value in the short run but returns to the fundamentals in the long run. These fundamentals are better captured by Ohlson (1995) estimates than they are by a simple forward P/E model. Therefore, the results of Dechow *et al.* point to the usefulness, rather than the irrelevance, of Ohlson (1995) intrinsic value estimates. For a similar point, see Frankel and Lee (1998).

Myers (1999) computes intrinsic values based on current accounting data and estimates of linear information dynamic (LID) parameters for the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models.[1] The LID parameters are estimated firm-by-firm based on the past time series of annual data. Myers observes that the measures of intrinsic values based on the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models do not explain stock price better than the book value of owner's equity. One potential explanation offered by Myers is that the past time series of data is not sufficiently stationary for many firms in order to produce reliable estimates of LID parameters. Nevertheless, the results of Myers and Dechow *et al.* (1999) call into question the comparative advantage of Ohlson (1995) and Feltham-Ohlson (1995, 1996) based estimates of intrinsic values, relative to simpler models such as book value or a forward P/E model.[2]

Several authors point out that accounting researchers should not take the LID as given and argue that better results might be obtained if the researcher relaxes the rather restrictive assumptions underlying the LID of the Ohlson (1995) and Feltham-Ohlson (1995, 1996). Bar-Yosef *et al.* (1996) use a Garman and Ohlson (1980) structure and show that a multi-lagged structure for the information dynamics outperforms a single lag structure in terms of the ability to forecast future dividends. They do not explore the pricing relation implied by the modified LID. Morel (1999) extends the Bar-Yosef *et al.* (1996) analysis to the pricing relation implied by a multi-lagged LID structure in a Garman-Ohlson (1980) setting. She concludes that two lags are optimal for book value, dividends and earnings, which is inconsistent with the single lag structure of Ohlson (1995) and Feltham-Ohlson (1995, 1996) models. Callen and Morel (2001) modify the Ohlson (1995) LID to incorporate an AR (2) structure for the time

[1] Linear information dynamics (LID) are linear stochastic processes exhibiting the temporal evolution and interdependence of accounting and nonaccounting information variables. The LID provide forecasts of future expected abnormal earnings given the current realizations of accounting variables and other information.

[2] Choi *et al.* (2003) argue that the disappointing performance of intrinsic values based on Ohlson (1995) and Feltham and Ohlson (1995, 1996) models is as a result in part to the way Dechow *et al.* (1999) and Myers (1999) calculate intrinsic values. Dechow *et al.* (1999) do not formally correct for conservatism effects, while Myers (1999) omits other information in all but one of his estimated models. Attempts by Choi *et al.* (2003) to take conservatism effects into account remove bias but do not improve accuracy of Ohlson (1995) intrinsic values.

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series of abnormal earnings. However, the intrinsic values so derived do not explain price better than the Ohlson (1995) intrinsic values based on an AR (1) specification for abnormal earnings. The strength of all three of these studies is that the authors modify the LID and then calculate (or show how to calculate) the new pricing relations that are obtained. Myers (1999) stresses the need to modify the pricing relation when the LID are modified and shows how to do so when order backlog is incorporated as other information in a Feltham and Ohlson (1995) setting. A limitation of the approach that seeks to modify the LID is that sufficient stationary time series data is, for many firms, unavailable to use in order to yield reliable estimates of the optimal lag structure. Myers (1999) uses an exogenous Fama and French (1997) methodology to estimate the cost of capital. However, cost of capital is endogenously determined in Ohlson (1995) (see Ohlson, 1990 p. 653). Morel (2003) recognizes this and endogenously estimates the parameters of the LID, both linearly and non-linearly. She obtains LID parameter estimates and valuation relation coefficients that are inconsistent with Ohlson (1995) theory.

Biddle *et al*. (2001) modify the LID of Ohlson (1995) to permit the possibility that current abnormal earnings determine next period capital investment, a possibility precluded by the LID of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models. This modification introduces a non-linear relation between current abnormal earnings and expected future abnormal earnings, which is inconsistent with the linear relationships assumed in Ohlson (1995). Biddle *et al*. do not derive the resulting modified pricing relation. They test the insights of the modified LID for predicting future abnormal earnings and get results consistent with a non-linear relationship between current and expected future abnormal earnings.

None of the LID modifications discussed above result in intrinsic value estimates that explain stock price much better than intrinsic values based on the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models. Given the mixed empirical evidence from tests of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models, we must ask: what has been the contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models?

We take the position that the primary contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models has been to provide a rigorous specification for empirical researchers who explore the association between current accounting observables and stock prices or returns, in the spirit of Ball and Brown (1968) (Ball–Brown hereafter). Support for this view exists in Dechow *et al*. (1999), who claim that the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models provide a unifying framework for assessing the models typically used in empirical studies. Many association study specifications used prior to Ohlson's work lacked theoretical support, and Dechow *et al*. (1999) point out that some of these specifications represent special cases of the Ohlson (1995) model. For example, the simple price on book value regression specification in the levels (Barth, 1991) invokes the assumption, in the context of Ohlson (1995), that $\omega = 0$ and

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other information v is ignored. This model is shown by Dechow *et al.* to be modestly dominated by a specification that relates the level of prices to book value, abnormal earnings and other information. As a second example involving earnings and return association studies, a simple specification that relates abnormal stock returns to unexpected earnings lacks formal theoretical support and poses the dilemma of measuring unexpected earnings. Based on the Ohlson (1995) model, Easton and Harris (1991) derive an expression that relates return to the level and changes of earnings. Easton and Pae (2003) modify the Easton and Harris specification based on the LID of Feltham and Ohlson (1996). They obtain a specification whereby return is linear in the level and changes of earnings, lagged dividends, changes in current capital investment and lagged changes in operating assets. The addition of the change in cash investments and change in lagged operating assets increases their model adjusted R^2 from 10.2 per cent to 11.5 per cent – a modest but detectable improvement. More importantly, Easton and Pae (2003) are able to get a predicted positive valuation coefficient on the change in cash investments, consistent with on average, positive net present value (NPV) investments. The Easton and Harris specification (based either on Ohlson (1995) or Feltham and Ohlson (1996) provides association study researchers with a theoretically supported specification that does not require measuring the unexpected component of current earnings. This breakthrough is important to Ball-Brown researchers and would not have been possible without the formal models of Ohlson (1995) and Feltham and Ohlson (1995, 1996).

The objective of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models is to obtain a parsimonious relation between current accounting realizations and stock price, based on simple but elegant LID that relate current accounting realizations to the present value of expected future dividends (PVED). It is a tautology that one can outperform a parsimonious relation when analyst forecasted abnormal earnings are added to the model containing only accounting realizations. For many firms, the future is not like the past and analysts forecast future abnormal earnings better than LID do. Therefore if the task at hand is the best possible estimate of intrinsic value, we concur with (Myers, 1999) assessment that the LID examined do not capture aspects of the market valuation process very well, which leaves much room for fundamental analysis. This does not, in our view, diminish the contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models to Ball-Brown researchers.

Since the main contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models has been to derive a parsimonious but theoretically supported pricing relation between accounting realizations and stock price (or returns), the onus lies with those who seek to modify the LID to get more complex pricing relations to demonstrate the benefit of that additional complexity, given the research question. More particularly, the onus on those who would seek to modify the LID is to show that inferences in some area of application (i.e., Ball-Brown information content studies) would significantly change given the modified LID.

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3. Evidence on conservative accounting

In general, it is possible to characterize conservative accounting to fall into three distinct categories. The first two types, characterized by ex-ante conservative accounting, consist of the selection of accounting policies and methods that are conservative, given the expected future cash flows generated by the project, at the time the accounting policies are chosen. An example of this is the immediate expensing of R&D expenditures. Given that the R&D expenditure is at least zero expected NPV, the choice to expense the entire R&D expenditure is a conservative accounting choice.[3] A second type of ex-ante conservative accounting is that managers do not book the present value of expected profits at the time positive expected NPV projects are undertaken. This form of *ex-ante* conservatism is a well-known feature of the historic cost model and is not controversial. A third form of conservative accounting is *ex post* in nature, or what we refer to as delayed recognition conservatism. Here, subsequent to the choice of the initial accounting policy, unexpected news relating to the expected future cash flows generated by projects is booked in the financial statements if the news is negative (e.g. asset impairment), but is not booked if the news is positive (e.g. improved business environment).

It is well known that Generally Accepted Accounting Principles (GAAP) accounting incorporates the asymmetric features of delayed recognition conservatism (e.g. Statement of Financial Accounting Standard No. 142), whereby assets are written down, but are not generally written up. The empirical question posed in the Ohlson (1995) and Feltham and Ohlson (1995, 1996) literature is whether the first type of *ex ante* conservatism holds, on average. Some of the published literature on positive accounting theory (Watts and Zimmerman 1978) attempts to explore this issue in a general sense by asking the question: what are the determinants of managers' accounting policy choices? In the context of the Ohlson (1995) and Feltham and Ohlson (1995, 1996) literature, the relevant question to be addressed is: do managers, on average, choose accounting policies that are *ex ante* conservative? We explore the empirical evidence to date on this issue.

We first begin with Feltham and Ohlson (1996), which illustrates both the nature and source of conservative accounting and their use in valuation. Feltham and Ohlson (1996) explicitly and implicitly identify all the three forms of conservative accounting noted above. The first type of *ex ante* conservative accounting is characterized by the parameter choice $(1 - \delta)$ in Proposition 2 of their model (see Appendix I). This is the declining balance depreciation rate chosen at the time the cash flow investment is incurred and is based on expected

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[3] The motive for accounting policy selection is exogenous to the Ohlson and Feltham-Ohlson models. These models abstract away from the frictions because of asymmetric information.

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future cash flows. This depreciation rate is non-stochastic and is a constant multiple of operating assets. Therefere, δ is adhered to consistently from period t to $t + 1$. The depreciation policy is referred to in Feltham and Ohlson (1996) as *ex-ante* conservative if the depreciation parameter $(1 - \delta)$ is greater than $(1 - \gamma)$, where γ is the persistence of cash flows from the project and $(1 - \gamma)$ measures economic depreciation. In the R&D example noted above $(1 - \delta) = 1$ or $\delta = 0$.

The second form of *ex ante* conservative accounting is explicitly discussed in Feltham and Ohlson (1996) in their Proposition 6. They clearly point out that GAAP is not characterized by mark-to-market accounting for operating assets, at the date of project commencement, and therefore stock price will exceed book value (i.e. goodwill will exist) for this reason alone if the projects undertaken are positive NPV in expectation. In addition, as Feltham and Ohlson (1996) point out, no accounting system seeks to record the present value of profits from future projects not yet undertaken. This is a second source of positive goodwill, if the investment opportunity set is characterized by positive NPV investment opportunities.

The third form of conservative accounting, delayed recognition conservatism, is implicitly recognized by something Feltham and Ohlson (1996) refer to as event contingent depreciation (see their Proposition 5 in Appendix I). In the linear information dynamic (LID) of Feltham and Ohlson (1996), even in the presence of event contingent depreciation, the declining balance depreciation schedule as reflected by the depreciation parameter δ_1 is adopted at the commencement of the project and is based on the *ex ante* present value schedule for project cash flows at commencement. Once selected, δ_1 is a given prior depreciation parameter going into period t and is not altered in the presence of other information in the current period, which Feltham and Ohlson (1996) refer to as v_{1t}. In their Proposition 5 setting (see Appendix I), other information (v_{1t}) reflects new information in period t that predicts cash flows in period $t + 1$ beyond knowledge of period t cash flows and their persistence, γ. This other information represents unexpected economic news at the time the initial depreciation policy, δ_1, is selected. Therefore, the decision to book this unexpected economic news is an event contingent accrual choice, one they refer to as δ_2 in their model. As examples of favourable (unfavourable) news, v_{1t} can be thought of as a one-time order (a windfall loss) that won't show up in earnings until the next period. If δ_2 is chosen so that there is immediate recognition of bad news (i.e. impairment accounting) but delayed recognition of good news, delayed recognition conservatism exists. Delayed recognition shows up in their Proposition 5 model (see Appendix I) as a further reconciling item between price and book value. This dichotomy, in the Feltham-Ohlson (1996) model, between *ex ante* conservatism and *ex post* delayed recognition conservatism has been overlooked by many existing Ohlson empirical researchers. What has resulted is a state of confusion regarding tests of *ex ante* conservatism, in the following sense: we would argue that researchers must consider all three types of conservatism when seeking to test for a particular type of conservatism.

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Beaver and Ryan (2000) is one of the few empirical papers in the published literature that attempts to distinguish between *ex ante* conservatism and *ex post* delayed recognition effects. In particular, they control for delayed recognition effects (which they refer to as lags) and find that there is a persistent bias in the market to book ratio. The persistent market to book bias can be thought of as an estimate of the first and second types of *ex ante* conservatism, after controlling for *ex post* effects.

Basu (1997) attempts to characterize conservatism by stating that bad economic news items are more quickly recognized in financial statements than good economic news. Therefore, his definition of conservatism is entirely *ex post* in nature and nowhere in his study or in subsequent studies using this method can we find a discussion of *ex ante* conservatism or the need to control for it. Basu observes that the earnings-return relation is stronger for negative returns than for positive returns, implying that earnings reflect bad news more quickly than good news. The slope coefficients in Basu's reverse regression of annual earnings on annual returns capture not only delayed recognition accounting, but also *ex ante* conservatism. This is because choosing an accounting policy that is *ex ante* conservative, given expected future cash flows, understates earnings, thereby giving Basu's result of a reduced earnings-return association for good news firms. For example, given that R&D expenditure is at least zero expected NPV, expensing the entire R&D expenditure reduces the current earnings without affecting returns (since the project is zero NPV), therefore giving a lower earnings-return relation for positive returns firms. If the R&D expenditure is positive expected NPV, expensing the R&D expenditure reduces current earnings, while returns increase (as price impounds the positive NPV project), thereby lowering the earnings-return relation even more. The point holds more generally for investments in internally generated intangible assets. To summarize, Basu's slope coefficient measure of conservatism captures all three forms of conservatism and therefore falls short of partialling out the *ex ante* effects of conservatism in order to isolate delayed recognition effects.

The published empirical auditing literature has used the Basu regression to permit inferences regarding changes over time in auditor enforced conservatism given changes in auditor liability exposure (e.g., Basu, 1997, p. 27). The above analysis suggests that such inferences are potentially confounded by the all other things being equal assumption. For example, if a period of relatively high legal liability is accompanied by a period of relatively high investments in R&D and other intangibles, tests for auditor enforced conservatism are confounded by immediately expensing such investments, which is GAAP driven and non-discretionary rather than being correlated with auditor vigilance or effort. More generally, one cannot inspect temporal patterns of Basu's slope coefficient (see his figure 3) and attribute patterns entirely to *ex post* conservatism.

Pae *et al*. (2003) propose that tests of effects resulting from changes in auditors' liability exposure, using the Basu regression, should control for the amount of price-to-book pressure prevailing across different liability exposure

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regimes. They argue that lower price-to-book multiples put more pressure on auditors to insist on write-downs. Since such multiples reflect all three types of conservatism, Basu's slope coefficients are open to multiple interpretations.

Several authors (e.g., Ahmed *et al*., 2000 and Myers, 1999) have obtained, on a firm-by-firm basis, estimates of conservatism implied by the LID of the Feltham-Ohlson (1995, 1996) models. These results have been mixed. Myers (1999) obtains an average negative coefficient on lagged operating assets when the LID of Feltham and Ohlson (1995, 1996) are employed and other information is assumed to be unobservable. He concludes that LID based estimates do not capture the effects of conservatism very well.

Several problems have confounded LID based estimates of conservatism. First, the Feltham-Ohlson (1995, 1996) models pertain to a single firm and a prediction about *ex ante* conservatism on average across firms is beyond the scope of the model. Some firms will practice aggressive accounting and others, conservative accounting, for reasons that Feltham and Ohlson (1995, 1996) theory cannot explain. There is no 'on average' prediction in these models. Therefore, observing that the mean LID conservatism coefficient is negative (Myers, 1999; Ahmed *et al*., 2000) is not inconsistent with Feltham-Ohlson theory. Secondly, LID based measures of *ex ante* conservatism are confounded if (for reasons argued above) they fail to partial out delayed recognition conservatism. As support for this claim, consider the impact of impairment write-downs. Suppose a given firm experiences an impairment write-down in period t. The larger the beginning-of-period overstatement of operating assets, the larger the write-down will be, hence the more negative the resulting abnormal earnings will be in the year of the write-down. For a sample of firms experiencing write-downs, a spurious negative coefficient will be observed by the researcher between current negative abnormal earnings and beginning-of-period operating assets. This will confound tests of a positive coefficient implied by accounting policy (i.e. $\delta < \gamma$) conservatism. Therefore, LID based tests of *ex ante* conservatism are confounded unless the effects of impairment write-downs are partialled out.

Ahmed *et al*. (2000) employ time series valuation relation tests of conservatism on a firm-by-firm basis. This avoids the constraint of a pooled cross-sectional estimate, since the underlying information dynamics likely differ from firm to firm. Second, their specification is inspired by of Feltham and Ohlson (1996) and they have separate tests of *ex ante* conservatism of the type, $\delta < \gamma$ (proxied by their coefficient on beginning-of-period operating assets) and positive NPV type conservatism (proxied by their coefficient on current period investment). Third, they control for other information by employing a perfect foresight measure of other information, namely, they include the next period's realized abnormal earnings in the model. In theory, this should control for *ex post* delayed recognition effects. With these empirical design improvements over the prior literature, Ahmed *et al*. (2000) show that: (i) the mean valuation relation coefficient on lagged book value is positive and significant; (ii) the

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mean valuation relation coefficient on current capital investment is positive and significant; and (iii) the mean valuation relation coefficient on their perfect foresight measure of other information, is positive and significant. This evidence is consistent with both types of *ex ante* conservatism, on average. While of Feltham and Ohlson (1995, 1996) theory does not make any average predictions, the results are consistent with intuition about the conservative nature of US GAAP.

As a practical matter, it may be impossible for the Ohlson (1995), and Feltham and Ohlson (1995, 1996) researchers to distinguish between the two types of *ex ante* conservatism ($\delta < \gamma$ and no immediate recognition of profits on positive expected NPV projects) referred to earlier. Consider the above evidence in Ahmed *et al*. (2000). A positive valuation relation coefficient on lagged book value can reflect either form of conservatism, since past positive expected NPV projects will contribute to the coefficient on lagged book value.

Where does this leave us? Tests for on average conservatism in the Ohlson (1995) and Feltham and Ohlson (1995, 1996) empirical literature have been confounded by the different types of conservative accounting and LID based measures have not been reliable. The Basu (1997) measure may be the most reliable measure of conservatism currently available to empirical researchers. As we have documented, even this measure reflects multiple forms of conservatism. This conclusion is somewhat disappointing, as the Basu measure does not invoke any formal theory, let alone that of Ohlson (1995) and Feltham and Ohlson (1995, 1996).

More positively, Zhang (2000) notes that the theory of Ohlson (1995) and Feltham and Ohlson (1995, 1996) has given us sharp insights about the joint implications of conservatism and growth for valuation. With conservative accounting and growth, both the Feltham-Ohlson (1995, 1996) models predict positive price-to-book premiums at the horizon. This must be considered, as well as the investment opportunity set at the horizon, when one seeks a continuing value expression at the horizon and uses the residual income model for valuation.

4. Incorporating other information

Ohlson (2001) discusses the empirical implications of ignoring other information, v_t in the basic Ohlson (1995) valuation relation:

$$P_t = b_t + \alpha_1 x_t^a + \alpha_2 v_t. \quad (1)$$

Given the linear information dynamics in Ohlson (1995), Table 1 illustrates that other information used by investors to forecast abnormal earnings can be recovered by 1-year ahead analyst forecasts of abnormal earnings:

$$v_t = E(x_{t+1}^a) - \omega x_t^a. \quad (2)$$

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Table 1
Implementing v in O, FO type models

Original theory	Suggested Proxies for v	Test of proxy for v	Unknown variables	Full Recovery[a]
O95	Ohlson (2001)	Dechow, Hutton and Sloan (1999)	v_t	$E(x^a_{t+1})$
FO95	Liu and Ohlson (2001)	Callen and Segal (2003)	v_{1t}, v_{2t}	$E(ox^a_{t+1})$ $E(oa_{t+1})$
FO96	Begley and Feltham (2002)	Begley and Feltham (2002)	v_{rt}, v_{it}	f_{t1}, f_{t2}

[a] Full recovery of other information means that the proxies for other information terms suffice to recover all information used by investors other than current accounting variables.

Substituting equation (2) into equation (1), Ohlson (2001) derives the following modified valuation relation, expressing price as a function of three observables:

$$P_t = b_t + (\alpha_1 - \alpha_2\omega)x^a_t + \alpha_2 E(x^a_{t+1}). \tag{3}$$

Ohlson explains how the coefficient $(\alpha_1 - \alpha_2\omega)$ is predicted to be negative if the product of the two persistence coefficients, $\omega\gamma$ is positive. The basic intuition is that x^a_t and its persistence are reflected in $E(x^a_{t+1})$ and therefore the negative coefficient in x^a_t avoids double counting. Equation (3) says that, given unbiased accounting, there is a parsimonious valuation relation that fully recovers other information and is based on data readily available to the researcher. The equation is important as it represents the first straddle between the historical and forecast branches of the Ohlson empirical literature.

Dechow *et al*. (1999) use this approach in their testing of the empirical implications of the Ohlson (1995) model. Liu and Ohlson (2000) show how a similar approach can be used when testing the empirical implications of Feltham and Ohlson (1995). Feltham and Ohlson (1995) derive the following valuation relation:

$$P_t = b_t + \alpha_1 ox^a_t + \alpha_2 oa_t + \beta_1 v_{1t} + \beta_2 v_{2t}. \tag{4}$$

The empiricist faces the same challenge in estimating this equation discussed above: the valuation relation is expressed in terms of unobservable (to the researcher) other information terms. In the above equation, v_{1t} is other information that predicts future abnormal earnings over and above that predicted by current abnormal earnings (ox^a_t) and its persistence (ω_{11}). Moreover, v_{2t} is other information that predicts growth in operating assets, over and above that predicted by current operating assets and its past growth (ω_{22}). The linear information dynamics assumed in Feltham and Ohlson (1995) imply the following:

$$v_{1t} = E(ox^a_{t+1}) - \omega_{11} ox^a_t - \omega_{12} oa_t \tag{5}$$

$$v_{2t} = E(oa_{t+1}) - \omega_{22} oa_t. \tag{6}$$

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As illustrated by Table 1, full recovery of the two other information terms is possible if the researcher has access to forecasts of abnormal operating earnings and the growth in operating assets for the next period. Liu and Ohlson (2000) show how a substitution of equations (5) and (6) into equation (4) produces a parsimonious valuation relation expressing price as a function of five observables:

$$P_t = b_t + k_1 ox_t^a + k_2 E(ox_{t+1}^a) + k_3 oa_t + k_4 E(oa_{t+1}). \tag{7}$$

With positive known persistence parameters (γ_1, ω_{11}), the predicted signs of k_1 and k_3 are negative. Liu and Ohlson (2000) explain why current abnormal earnings and current operating assets are not informationally redundant. Given knowledge of expected upcoming abnormal earnings, one still needs to know current abnormal earnings (ox_t^a) and current operating assets (oa_t) to fully recover the other information term, v_{1t}. Similarly, given knowledge of expected upcoming operating assets, one still needs to know current operating assets to fully recover the other information term, v_{2t}. These points are obvious from an inspection of equations (5) and (6) above. Callen and Segal (2003) use this approach in their tests of Feltham and Ohlson (1995).

Begley and Feltham (2002) extend the Ohlson (2001) and Liu and Ohlson (2000) analysis to Feltham and Ohlson (1996). As illustrated by our Table 1, they show that, under certain assumptions, one-period and two-period ahead analyst forecasts of abnormal earnings are sufficient to recover other information beyond that contained in the following current accounting variables: current capital expenditure, current abnormal earnings and lagged operating assets.

Begley and Feltham contain the sharpest discussion to date in the literature on a reconciliation of historical type empirical Ohlson (1995) and Feltham-Ohlson (1995) models that rely on linear information dynamics and the forecast type literature that rely on analyst forecasts of future abnormal earnings and a terminal value expression at the truncated horizon.

What follows are insights that build on the Begley and Feltham (2002) analysis. They are not intended to be a critique of their paper. The basic argument that Begley and Feltham (2002) make is that *k*-period analyst forecasts can be used to supplement a parsimonious valuation relation based on accounting numbers when the researcher seeks proxies for other information not impounded in these accounting numbers but used by investors to value firms. Alternatively, Begley and Feltham argue that accounting numbers can be used to supplement analyst forecasts when the horizon is too truncated to fully capture investor information about future abnormal earnings.

A crucial unanswered question in the Begley and Feltham setting is as follows: how many forecast periods are sufficient to fully recover other information not reflected in current accounting numbers but used by investors to value firms? In their empirical analysis, Begley and Feltham assume that one-period and two-period ahead forecasts of abnormal earnings (hereafter referred to f_{t1} as and f_{t2}) are sufficient to fully recover other information not reflected in current

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abnormal earnings, beginning-of-the-period net operating assets or current capital expenditure. But why should two forecast periods suffice to fully recover investor information about the investment opportunity set at the horizon? Begley and Feltham acknowledges this. In an unpublished appendix, Begley and Feltham modify their theoretical model and show that f_{t1}, f_{t2} and f_{t3} are sufficient to fully recover analyst information about the investment opportunity set, not recovered in f_{t1} and f_{t2}. The analyst is predicted at time t to have other information about investments to be undertaken 2 years hence. Since they assume a 1-year lag between investments and subsequent cash receipts generated by this investment, f_{t3} fully recovers this other information about future investments.

However, it may be necessary to extend the analyst forecast horizon beyond 3 years to fully recover investor information about future investments. In particular, f_{t4} may be needed or even $f_{t5}, \ldots, f_{t7}$. For example, the lag between investments and revenue may be 5 years, as in the case when clinical trials for a drug that a pharmaceutical company plans to introduce may not begin until 5 years. In this case, we will need a f_{t7} to fully recover investor information about this project, assuming it is undertaken 2 years hence.

This logically leads to the next unanswered question: how many forward forecasts of abnormal earnings are required to fully recover other information used by investors? Alternatively, how many forward forecasts are required before the forecast type residual income model stands alone and does not require supplementing by current accounting numbers? This is an unresolved issue empirically and an interesting topic for future research. In their empirical analysis, Begley and Feltham (2002) show that a simple model that estimates goodwill as the present value of one- and two-period ahead forecasted abnormal earnings explains 77 per cent of the variability in observed goodwill in their pooled regression model (see their table 6). When current accounting numbers are included as additional explanatory variables, the explanatory power of the model improves by a modest 3 per cent, to 80 per cent.

The evidence in Courteau *et al.* (2001) offers some insights regarding how much of the Value Line analyst information is impounded in her one-period, two-period and three–five period ahead forecasts of abnormal earnings. In their pooled panel regression of stock prices on intrinsic values (see their table 6), Courteau *et al.* show that a RIM model that derives intrinsic value from the current book value and the present value of one-, two-, three- and four-period ahead forecasts of abnormal earnings (a horizon of 4 years hence is used, and the number for horizon 3 is interpolated from those of horizons 2 and 4) explains 78 per cent of observed stock price; further, that R^2 climbs from 78 per cent to 93 per cent when Value Line's forecasted price minus book premium at the horizon four periods hence is added to the model. This suggests to us that the empirical researcher should exercise caution in assuming that in a Begley and Feltham (2002)-type empirical regression, analyst residual earnings for one- and two-periods ahead are sufficient to recover other information used by

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investors, but not impounded in the current accounting numbers employed in the Begley and Feltham model. The Courteau *et al*. results imply that analyst abnormal earnings forecasts to horizons four periods will not be sufficient to recover information about the continuing value at the horizon used by investors. Therefore, it is likely that the Begley and Feltham (2002) model will suffer from an omitted variables problem as a result of incomplete proxies for other information, even if the forecast horizon were extended to 4 years. Resolving this conjecture is an interesting topic for future research.

The Begley and Feltham (2002) analysis is path-breaking in that it is the first published attempt at synthesis between forecast type and historical type accounting based valuation models. A philosophical question arises from considering their synthesis. It seems to us that the main aim of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models was to establish a parsimonious relation between stock price and observable accounting variables based on some assumed linear information dynamic. In an attempt to resolve the omitted variables conundrum facing historical type models, the above studies have added analyst forecasts to proxy for other information. In the limit, if we add analyst forecasts of abnormal earnings to forecast horizon T and add the forecasted price minus book premium as a continuing value expression at the horizon, we do not need the accounting variables or linear information dynamics at all. In other words, historical type Ohlson (1995) and Feltham-Ohlson (1995, 1996) empirical models, with enough supplementing by forecasts, become pure forecast type RIM models in the limit. This achievement comes at a cost: we no longer have a parsimonious relation that uses accounting variables to explain price.

The remaining sections of the present paper examine the contribution of studies in the forecast branch of accounting based valuation models. A recurring theme is that these studies owe their intellectual roots to the Ohlson (1995) and Feltham and Ohlson (1995, 1996) theories despite the fact that no linear information dynamics are employed in the forecast branch of the published literature.

5. The residual income valuation model versus other valuation approaches

There has been considerable controversy in the published literature surrounding the equivalence, for finite forecast horizons, of the discounted cash flow (DCF) model versus the Edwards-Bell-Ohlson RIM. For a flavour of this controversy, see the exchange between Penman (2001) and Lundholm and O'Keefe (2001a,b).

Though we run the risk of rekindling the controversy by revisiting the issues at debate, our view is that both sides were essentially right! We will now attempt to synthesize the various points of view.

Feltham and Ohlson (1995) show the equivalence, for infinite horizons, of the cash accounting model (DCF), which we represent as follows:

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$$V_t = \overline{FA}_t + \overline{OA}_t \tag{8}$$

$$= \overline{FA}_t + PV_t^{t+T}(FCF_t) + PV_{t+T+1}^{\infty} \tag{9}$$

where:

V_t = intrinsic value of owner's equity at date t;

$\overline{FA}_t$ = fair value of net financial assets at date t;

$\overline{OA}_t$ = fair value of net operating assets at date t;

$PV_t^{t+T}(FCF_t)$ = present value of expected operating free cash flows from the date t to a horizon T periods hence (discounted at the weighted average cost of capital), and

PV_{t+T+1}^{∞} = present value of expected operating free cash flows from horizon to infinity discounted at weighted average cost of capital (also known as the continuing value expression).

Feltham and Ohlson (1995) point out that, for the cash accounting model, book value equals current net financial assets. Suppose net financial assets are always marked to market, so that $FA_t = \overline{FA}_t$. Suppose further that one adopts the extreme view that intrinsic value equals book value as defined by this model:

$$V = FA_t. \tag{10}$$

As pointed out by Penman and Sougiannis (1998) the valuation error ($P - V$) that will result from (10) is as follows:

$$(P_t - V_t) = \overline{OA}_t. \tag{11}$$

Now, it is obvious that this will be a large positive valuation error, equal to the fair value of the net operating assets. The culprit, as pointed out by Penman and Sougiannis, is that the cash accounting model expenses the current net operating assets investment.

Suppose one adopts a more realistic view and at least forecasts the FCF fundamentals to horizon T, but assumes a continuing value of zero:

$$V_t = FA_t + PV_t^{t+T}(FCF_t). \tag{12}$$

Penman and Sougiannis point out that the valuation error that will result from equation (12) is as follows:

$$P_t - V_t = \overline{OA}_{t+T} = PV_{t+T+1}^{\infty}(FCF_t). \tag{13}$$

For most firms, this will be a smaller, though still positive valuation error equal to the value of net operating assets at the horizon. This means that, to paraphrase Penman and Sougiannis, a very long forecast horizon, T, is needed to recover the cash coming in from cash investments made before horizon T.

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Penman and Sougiannis claim that expensing net operating assets is a limitation of the *FCF* model, relative to accounting based valuation models such as RIM. Lundholm and O'Keefe (2001a,b) counter that, with a full set of pro-forma accrual financial statements out to horizon *T*, the analyst is in the same information position with either DCF or RIM: from the pro-forma financial statements, the expensed net operating assets at the horizon (at least at book) can be fully recovered. From that point on, the objective for analysis is the best possible estimate of future dividends beyond the horizon, and all three valuation models (DDM, RIM and DCF) should yield identical valuation estimates. Who is right? In our view, both are right. Penman and Sougiannis are correct in that the DCF model is not complete on its own, and requires accrual information in order to recover the missing piece: expensed operating assets. Lundholm and O'Keefe are correct in that, if one assumes full pro-forma financial statements are available, then the missing piece is recovered and the choice of models is then a matter of indifference.

Let us now consider RIM:

$$V_t = \overline{FA_t} + \overline{OA_t} = \overline{BV_t} \tag{14}$$

$$= BV_t + PV_t^{t+T}(RI_t) + PV_{t+T+1}^{\infty}(RI_t). \tag{15}$$

Suppose that one again adopts the extreme view that intrinsic value equals book value as defined by the RIM model:

$$V_t = BV_t. \tag{16}$$

The valuation error $(P - V)$, that will result from equation (16) is as follows:

$$P_t - V_t = PV_t^{\infty}(RI_t). \tag{17}$$

Now the missing piece is goodwill. For most firms, this is a less serious missing piece, relative to missing the entire net operating assets investment. One would expect a valuation error in equation (17) to be lower than equation (11). In general, the empirical evidence bears this out, since FA_t is negative for most firms. Again, suppose one adopts a more realistic view and forecasts the RIM fundamentals to horizon *T*, but again assumes a continuing value of zero:

$$V_t = BV_t + PV_t^{t+T}(RI_t). \tag{18}$$

The valuation error that will result from equation (18) is as follows:

$$P_t - V_t = PV_{t+T+1}^{\infty}(RI_t) \equiv \text{horizon goodwill}. \tag{19}$$

This time the missing piece is goodwill at the horizon. How serious is this missing piece? Courteau *et al.* (2001) shed light on this issue. For a sample of

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422 companies, they use Value Line's forecasted stock price at the horizon to yield ideal terminal value estimates, $P_{t+T} - FA_{t+T} \equiv \overline{OA}_{t+T}$, for the DCF model; and $P_{t+T} - BV_{t+T} \equiv$ horizon goodwill, for RIM. Using these ideal terminal values, they show in their table 1 that the DCF forecasted fundamentals to the horizon (equation (12)) explain only 4.5 per cent of market value, on average, leaving 95.5 per cent of value to be forecast in the continuing value expression; the corresponding RIM fundamentals to the horizon (Equation 18) explain 48 per cent of market value on average, leaving 52 per cent of value to be forecasted in the continuing value expression.

Without a doubt, accruals bring future cash flows forward, in a way that is economically meaningful to the analyst contemplating a choice between DCF and RIM. With DCF, 96 per cent of value is still left to be forecast at horizons 4 years hence. It is hard not to agree with Penman and Sougiannis (1998) that this is a limitation of the DCF model. Lundholm and O'Keefe (2001a,b) counter that, with internally consistent expressions, the same information set that allows the analyst to forecast horizon goodwill can enable the analyst to recover the necessary inputs to the DDM and DCF models, and the DCF, DDM and RIM models should yield identical valuations. They are correct, though once again, a full set of pro-forma financials is needed at the horizon for the DCF and DDM models. The analyst can still recover the inputs to valuation with a consistently estimated continuing value expression, but she has to be careful in estimating the DCF continuing value.

Where does this leave us? Is the terminal value conundrum more problematic for the DDM and DCF models, relative to RIM? If one has forecasted horizon stock price, then all three models collapse to PVED. However, forecasts of stock price are generally not available to capital market researchers, unless Value Line covers the stock. When faced with the need to choose between DCF and RIM combined with ad hoc terminal value expressions, which model should the analyst or researcher use? We would tend to agree with Lundholm and O'Keefe that, with internally consistent assumptions, the two models should perform about the same. Focusing on accuracy, measured as absolute pricing errors $(P - V)$ scaled by P, Courteau *et al.* (2001) show (see their table 4) that, with a 2 per cent assumed growth rate in post horizon fundamentals in each model, the median absolute pricing error is very close: 36.42 per cent of stock price versus 35.48 per cent, for RIM versus DCF, respectively. One of the contributions of Lundholm and O'Keefe is to show researchers how to avoid traps that lead to internally inconsistent assumptions that will give the false impression of a difference between the models. Courteau *et al.* avoid these inconsistencies, which is possibly why the results are so close.

Finally, what is the loss in valuation accuracy when the analyst or researcher employs an ad hoc terminal value (i.e., perpetuities with some constant assumed growth rate that is applied to all firms in the sample)? Courteau *et al.* show, using Value Line horizon price forecasts, that the loss in valuation accuracy can be substantial. Relative to the above metrics, the median absolute pricing errors for the DCF and RIM models with ideal terminal values are 14.18 per cent

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versus 13.71 per cent of stock price, respectively, for DCF versus RIM. This suggests that comprehensive valuations culminating in a horizon price forecast outperform ad hoc terminal value approaches by a wide margin.

It is fair to say that yet another contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models has been to rekindle an interest in RIM. As Penman and Sougiannis (1998) point out, students in finance were taught for decades to undo accruals in order to derive the cash fundamentals needed for intrinsic valuation. At the very least, the above 'horserace' literature confirms, without a doubt, that one need not necessarily undo the accruals in order to estimate value. It is hard to see how we could have arrived at this juncture without the interest sparked in RIM by seminal pieces like Ohlson (1995) and Feltham and Ohlson (1995, 1996) Penman (1998) and Penman and Sougiannis (1998).

6. Accounting based measures of expected returns

Researchers in the forecast branch of the residual income model have used analyst forecasts of abnormal earnings to some horizon and an assumed continuing value expression to back into inferences about the market's cost of equity capital. This approach assumes market efficiency and that analyst forecasts reliably represent investor estimates of the future fundamentals. This is the reverse engineering branch of the published RIM literature.

If one had unbiased analyst estimates of expected dividends out to an infinite horizon, and Efficient Markets Hypothesis (EMH) holds, then the market's cost of capital is the expected rate of return, r, that equates stock price to this series. Long horizon dividend forecasts are seldom available. For RIM, and given a fixed forecast horizon, the reverse engineering approach requires a continuing value expression at the horizon. This will depend on growth estimates imposed on the data by the researcher.

To some cost of capital researchers, Value Line's horizon price forecasts seemed to hold promise:

$$IV_{VL} = (BV + ECDE + P_4 - BV_4)/(1 + r)^4 \tag{20}$$

where:

IV_{VL} = intrinsic value,

BV = current book value of shareholder's equity,

$ECDE$ = Value Line's expected cum-dividend earnings to the horizon four years hence,

$P_4 - BV_4$ = Value Line's expected price minus book premium at the horizon four years hence, and

r = required rate of return for a given stock.

The horizon price minus book premium seemed to provide the missing growth piece, leaving the researcher with the simple problem of solving for r,

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the only unknown left if one assumes EMH and reliable Value Line estimates. This approach or a variation thereof involving the dividend discount model is used by Botosan and Plumlee (2003) to derive an accounting based measure of cost of capital. As they recognize, the limitation of this approach is the optimism inherent in Value Line's horizon price forecasts. Such price forecasts reflect Value Line's promised rate of return, when combined with Value Line's forecasted dividends. This promised rate of return need not equal the cost of capital, if Value Line does not believe the market is efficient with respect to its' information. Courteau *et al.* (2003) show that Value Line's expected rate of return is only moderately correlated with capital assets pricing model estimates of the required rate of return.

To a greater or lesser extent, analyst optimism in the forecasted fundamentals represents an impediment to all accounting based measures of expected returns. Simply put, very few analysts behave as if the market is efficient with respect to his/her information. This problem plagues the reverse engineering branch of the published literature.

Some RIM researchers have used ad hoc continuing value expressions in conjunction with equation (20) above, therefore imposing researcher estimates of growth at the truncated horizon. Examples of this approach are Claus and Thomas (2001) and Gebhardt *et al.* (2001). The limitation of this approach, one that is well recognized by both studies, is that if the continuing value expressions are noisy as a result of inaccurate post horizon growth estimates, the cost of capital estimates will be noisy. Each of these studies adopts methodologies to address this issue.

A very innovative RIM based approach, which avoids the above growth conundrum, is that of Easton *et al.* (2002):

$$IV_{ETSS} = BV + 1/(R - G)\{ECDE - (R - 1)BV\} \tag{21}$$

where:
$R = (1 + r)^4$ is 1 plus the 4 year expected return on equity, and
$G = (1 + g)^4$ is 1 plus the expected rate of growth in 4 year abnormal earnings and all other variables are as defined above.

Easton *et al.* (2002) develop a regression methodology at the portfolio level to simultaneously solve for R and G, in order to yield an accounting based measure of r. The advantage is to avoid imposing the researcher's g assumptions on the data. Easton *et al.* (2002) obtain an estimated equity premium at the market portfolio level of 5.3 per cent, which is reasonable given historical estimates of the equity premium.

Ohlson and Juettner-Nauroth (2001) develop an abnormal earnings growth valuation model, which is an alternative to RIM. The model requires analyst forecasts of earnings per share (EPS) next period and the growth in EPS for periods beyond next period. With the assumption that there is no abnormal

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growth in EPS beyond period $t + 2$, Easton and Monahan (2002) develop the following simple price to forward earnings (PFE) model:

$$IV_{PFE} = (EPS_{t+1} + r \times DPS_{t+1} + EPS_{t+2})/((1 + r)^2 - 1) \quad (22)$$

where:

IV_{PFE} = current intrinsic value implied by the PFE model,
EPS_{t+1} = consensus Institutional Brokers' Estimation System (IBES) analyst forecasts of EPS 1 year hence,
EPS_{t+2} = consensus IBES analyst forecasts of EPS 2 years hence, and
DPS_{t+1} = expected dividend per share 1 year hence.

While Easton and Monahan (2002) acknowledge that such restrictive EPS growth assumptions beyond $t + 2$ are unlikely to hold, they validly point out that they are probably just as good as are more complex growth assumptions imposed on the data by the researcher. In the reverse engineering tradition, Easton and Monahan (2002) derive the accounting based measure of expected return, r, implied by today's stock price and the forecasted fundamentals required by equation (22). Using the return decomposition methodology of Campbell (1991) and Vuolteenaho (2002), Easton and Monahan (2002) explore the measurement error in a variety of accounting based measures of expected returns, including measures implied by PFE, Gebhardt *et al*. (2001) and Easton *et al*. (2002) discussed above. They conclude that all accounting based measures of expected returns contain considerable measurement error, but that the forward P/E model performs as well as the more complicated models. What is striking is the robustness of the forward P/E model, something we observed earlier in a previous section (recall the discussion of Dechow *et al*. (1999) in Section (1). We revisit the robustness of a simple forward P/E model in the next and final section, dealing with the published multiplier literature.

7. Accounting based multiplier models

Courteau *et al*. (2003) recognize the possibility that the Easton *et al*. (2002) model introduced in the previous section could be used as an out of sample multiplier model:

$$IV_{ETSS} = BV + 1/(R - G)\{ECDE - (R - 1)BV\} \quad (23)$$

where all terms are as defined in the previous section.

Excluding a hold-out firm in an industry, Courteau *et al*. (2003) use today's stock price and the fundamentals required by equation (24), forecast by Value Line, to solve for the industry multiplier, $1/(R - G)$ implied by a regression approach using all industry data. The resulting multiplier is used to price the fundamentals for the hold-out firm and the resulting pricing error is computed.

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A focus on pricing errors once again assumes EMH. The stock price of the hold-out firm is never used in the analysis so these hold-out firms can be thought of as pseudo private companies which the analyst seeks to value using a multiplier approach. Since the approach uses the analyst forecasts of *ECDE* to the horizon 4 years hence, for the hold-out firm, this approach is an alternative to the analyst forecasting the price minus book premium at the horizon for the hold-out firm in question. Alternatively, the analyst may have a forecasted horizon premium for the hold-out firm, but may want to check the resulting valuation for plausibility using an Easton *et al.* (2002) model or some other multiplier approach.

Courteau *et al.* (2003) compare the performance of an Easton *et al.* (2002) RIM based multiplier approach to one based on a simple forward P/E model, where earnings are simply added together to obtain the valuation attribute for estimation firms in the industry:

$$IV_{FPE} = \hat{\alpha}_i \cdot \sum_{t+1}^{4} EPS_t = \sum_{t+1}^{4} EPS_t \Bigg/ \left\{ E\left(\sum_{t+1}^{4} EPS_t \Big/ P_0 \right) \right\} \tag{24}$$

where
EPS_t = Value Line forecasted *EPS* for each of 4 years hence, and
P_0 = current stock price

Liu *et al.* (2002) demonstrate that the above forward P/E multiplier model outperforms a simple 1-year forward P/E multiplier model and more complex multiplier models based on RIM models. Intrigued by this finding, Courteau *et al.* (2003) explore whether the above forward P/E model outperforms the Easton *et al.* (2002) RIM multiplier model in terms of bias and accuracy focusing on hold-out pricing errors.

Courteau *et al.* (2003) observe that the best model in terms of hold-out pricing errors is obtained when Value Line's forecasted price minus book premium is used as the continuing value expression, representing the ideal missing piece to add on to current book value and forecasted abnormal earnings to the horizon. This is not a RIM model, since an equivalent valuation is obtained by Value Line's PVED and the present value of forecasted horizon price. Courteau *et al.* (2003) refer to these pricing errors as benchmark pricing errors representing the best that an analyst could do using a comprehensive valuation approach. Focusing on the explanatory power of intrinsic value for stock price, both scaled by current book value, Courteau *et al.* (2003) report an R^2 for the benchmark model of 91.8 per cent. The corresponding R^2 for the forward P/E multiplier model and Easton *et al.* (2002) multiplier model are 86.8 per cent and 83.9 per cent, respectively. Therefore, they conclude that a comprehensive valuation approach dominates multiplier models and the forward P/E multiplier model dominates the RIM based Easton *et al.* (2002) multiplier model. The robustness

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of a relatively simple forward P/E model has been reported in two other contexts in the present paper: in comparison to Ohlson model intrinsic value estimates (see Section 1), and in comparison to RIM based measures of expected returns (see Section 5). The dominance of forward P/E models over RIM models in a variety of applications is striking. Resolving why this is so represents an interesting topic for further research.

Of course, the noise caused by using multiplier approach increases with industry heterogeneity as the dilemma of finding industry comparables is compounded. This is well known in the published multiplier literature and implied by the results of Bhojraj and Lee (2002). Consistent with this, Courteau *et al.* (2003) also show that the relative accuracy edge of the Value Line benchmark model over any of the multiplier models is most apparent for small, fast growing target firms from highly heterogeneous industries.

8. Conclusions

The present paper has surveyed the historical and forecast branches of accounting based valuation models, focusing on the contribution of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models in both of these branches.

On balance, what have we learned? On the one hand, a case can be made that the contribution of research in these two branches has been profound. From the historical branch of the published literature, we have theoretical support for Ball-Brown empirical specifications that came at the late stages of 25 years of information content studies. Such specifications require a parsimonious relation between stock price or returns and accounting variables. Based on an elegant yet simple linear information dynamics, the Ohlson and Feltham-Ohlson models have provided parsimonious specifications. They have shown us how to handle relevant but omitted variables resulting from other information.

From the forecast branches of the published literature, the Ohlson and Feltham-Ohlson models sparked renewed interest in accounting based valuation models employing forecasted accounting variables as the target fundamentals. The 'horserace' literature confirms without a doubt that one need not necessarily undo the accruals in order to estimate intrinsic value. This insight has resulted in the complete rewrite of financial statement analysis texts. Such a breakthrough would not have been possible without the foundations laid by the Ohlson and Feltham-Ohlson models. An exciting yet currently unexplained puzzle is that a simple forward P/E model seems to represent value as well, if not better than more complicated accounting based valuation models. This empirical fact coincides with a renewed interest in the P/E model sparked by the abnormal earnings growth valuation model of Ohlson and Juettner-Nauroth (2001).

On the other hand, some empirical researchers have become disenchanted with the historical branch of the published literature, pointing to the apparent misspecification of the linear information dynamics of the Ohlson (1995) and Feltham-Ohlson (1995, 1996) models. Simple questions like whether US GAAP

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is on average characterized by conservatism have not been satisfactorily resolved using empirically based Feltham-Ohlson (1995, 1996) models. Further, attempts to modify the linear information dynamics have not improved the valuation relation performance of models in the historical branch. Finally, every attempt to date to resolve the other information conundrum by substituting observables for unobservables has led to the realization that omitted variables remain.

Ironically, some accounting academics view the historical branch of the published literature as synonymous with Ohlson, Feltham-Ohlson empirical research and deny that the forecast branch has anything to do with the Ohlson, Feltham-Ohlson models since there are no linear information dynamics invoked in the forecast branch. Therefore, the above disenchantment with the historical branch has led some to claim that they are disenchanted with Ohlson, Feltham-Ohlson empirical research in general. To us, this view is misguided. The Ohlson, Feltham-Ohlson models provide the intellectual foundation for the forecast branch of the published literature, and help us to understand the properties of accounting based valuation models with truncated horizons. This challenge of finding appropriate continuing value expressions will remain a very hot topic for accounting based valuation researchers for the foreseeable future.

With the exception of Dechow *et al.* (1999), all of the research surveyed in the present paper has invoked the efficient markets hypothesis as a maintained assumption. In all of the applications, the best model of intrinsic value is one that minimizes (price – intrinsic value) pricing errors, which implicitly assumes that the price is correct. In the forecast branch, another contribution of accounting based valuation models has been to yield measures of intrinsic value so that price/intrinsic value mispricing errors can be identified. The assumption is that stock price can stray from the fundamentals in the short term but must move towards these fundamentals in the long run. Promising applications include Frankel and Lee (1998) and Lee *et al.* (1999). This strand of the forecast branch has been of considerable interest to academics in finance. Once again, these papers owe their substantial debt to Ohlson (1995) and Feltham-Ohlson (1995, 1996) models.

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Appendix I
Summary of Ohlson (1995) and Feltham-Ohlson (1995, 1996) type models

Ohlson (1995)

Information dynamics:

$$x^a_{t+1} = \omega x^a_t - v_t + \varepsilon_{1t+1} \tag{25}$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2t+1} \tag{26}$$

where:

$x^a_t \equiv$ current abnormal earnings $= x_t - r(b_{t-1})$,
$x_t \equiv$ current earnings,
$b_t \equiv$ current book value of common equity,
$\omega \equiv$ persistence of current abnormal earnings,
$v_t \equiv$ other information impacting future abnormal earnings with persistence γ, and
$\varepsilon_{1t+1}, \varepsilon_{2t+1} \equiv$ zero expectation disturbance terms.

Valuation equation:

$$P_t = b_t + \alpha_1 x^a_t + \alpha_2 v_t \tag{27}$$

where:
$\alpha_1 = \omega/(R - \omega)$,
$\alpha_2 = R/(R - \omega)(R - \gamma)$,
$R = 1 + r$, and
r and P_t are the discount rate and current stock price, respectively.

Feltham-Ohlson (1995)

Information dynamics:

$$ox^a_{t+1} = \omega_{11} ox^a_t + \omega_{12} oa_t + v_{1t} + \varepsilon_{1t+1} \tag{28}$$

$$oa_{t+1} = \omega_{22} oa_t + v_{2t} + \varepsilon_{2t+1} \tag{29}$$

$$v_{1t+1} = \gamma_1 v_{1t} + \varepsilon_{3t+1} \tag{30}$$

$$v_{2t+1} = \gamma_2 v_{2t} + \varepsilon_{4t+1} \tag{31}$$

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where:
$ox_t^a \equiv$ current abnormal operating earnings = $ox_t - r(oa_{t-1})$,
$ox_t \equiv$ current operating earnings,
$\omega_{11} \equiv$ persistence of current abnormal earnings,
$\omega_{12} \equiv$ correction for accounting conservatism,
$oa_t \equiv$ current book value of operating assets,
$v_{1t} \equiv$ other information impacting future abnormal earnings with persistence γ_1,
$\omega_{22} \equiv$ growth in net operating assets, and
$v_{2t} \equiv$ other information impacting future net operating assets with persistence γ_2.

Valuation equation:

$$P_t = b_t + \alpha_1 ox_t^a + \alpha_2 oa_t + \beta_1 v_{1t} + \beta_2 v_{2t} \tag{32}$$

where
$\alpha_1 = \omega_{11}/(R - \omega_{11}) \geq 0$,
$\alpha_2 = \omega_{12}R/(R - \omega_{11})(R - \omega_{22}) \geq 0$
$\beta_1 = R/(R - \omega_{11})(R - \gamma_1) > 0$
$\beta_2 = \alpha_2/(R - \gamma_2) \geq 0$
and all other variables are as defined above.

Feltham and Ohlson (1996)

Proposition 1

Information dynamics:

$$cr_{t+1} = \gamma cr_t + \kappa ci_t + \varepsilon_{1t+1} \tag{33}$$

$$ci_{t+1} = \omega ci_t + \varepsilon_{2t+1} \tag{34}$$

where
$cr_t \equiv$ current period cash receipts,
$\gamma \equiv$ persistence of current period cash receipts,
$ci_t \equiv$ current period cash investments,
$\kappa \equiv$ impact of current period cash investments on future cash receipts,
$\omega \equiv$ growth in cash investments
and all other variables are as defined above.

Valuation equation:

$$P_t = \Phi E_t(cr_{t+1}) + \beta E_t(ci_{t+1}) = \Phi(\gamma cr_t + \kappa ci_t) + \beta(\kappa ci_t) \tag{35}$$

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where
$E_t(.)$ ≡ expectations operator at time t,
$\Phi = (R - \gamma)^{-1}$,
$\Phi_\kappa = \kappa R^{-1} + \kappa\gamma R^{-2} + \kappa\gamma^2 R^{-3} + \ldots,$
$\beta = (\Phi_\kappa - 1)/(R - \omega)$,
and all other variables are as defined above.

Proposition 2

Information dynamics:

$$cr_{t+1} = \gamma cr_t + \kappa ci_t + \varepsilon_{1t+1} \tag{36}$$

$$ci_{t+1} = \omega ci_t + \varepsilon_{2t+1} \tag{37}$$

where all variables are as defined above.

Depreciation policy with clean surplus:

$$oa_{t+1} = oa_t + ci_{t+1} - dep_{t+1}, \tag{38}$$

$$ox_t \equiv cr_t - dep_t \tag{39}$$

$$dep_{t+1} = (1 - \delta)oa_t \tag{40}$$

where
dep_t ≡ current period depreciation expense,
δ ≡ depreciation policy parameter,
and all other variables are as defined above.

Valuation equation:

$$V_t = oa_t + \alpha_1 ox_t^a + \alpha_2 oa_{t-1} + \alpha_3 ci_t \tag{41}$$

where
$\alpha_1 = \Phi\gamma$,
$\alpha_2 = \Phi R(\gamma - \delta)$,
$\alpha_3 = (\Phi\kappa - 1)R/(R - \omega)$,
and all other variables are as defined above.

Proposition 5

Information dynamics:

$$cr_{t+1} = \gamma cr_t + \kappa ci_t + v_{1t} + \varepsilon_{1t+1} \tag{42}$$

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$$ci_{t+1} = \omega ci_t + v_{2t} + \varepsilon_{2t+1} \tag{43}$$

where all variables are as defined above.

Valuation equation:

$$V_t = oa_t + \alpha_1 ox_t^a + \alpha_2 oa_{t-1} + \alpha_3 ci_t + \beta_1 v_{1t} + \beta_2 v_{2t} + \beta_3 \varepsilon_{1t} \tag{44}$$

where
$\alpha_1 = \Phi\gamma$,
$\alpha_2 = \Phi R(\gamma - \delta_1)$,
$\alpha_3 = \beta R = (\Phi\kappa - 1)R/(R - \omega)$,
$\beta_1 = \Phi(1 - R\delta_2)$,
$\beta_2 = \beta = \Phi R(\gamma - \delta_1)$,
$\beta_3 = -\Phi R\delta_3$,
δ_1, δ_2, δ_3 are the depreciation policy parameters,
and all other variables are as defined above.

Ohlson (2001)

Information dynamics:

$$x_{t+1}^a = \omega x_t^a - v_t + \varepsilon_{1t+1} \tag{45}$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2t+1} \tag{46}$$

where all variables are as defined above.

Recovery of other information:

$$v_t = E(x_{t+1}^a) - \omega x_t^a \tag{47}$$

where all variables are as defined above.

Valuation equation:

$$P_t = b_t + (\alpha_1 - \alpha_2\omega)x_t^a + \alpha_2 x_{t+1}^a \tag{48}$$

where α_1 and α_2 and are the coefficients from the valuation equation in Ohlson (1995) and all other variables are as defined above.

Liu-Ohlson (2000)

Information dynamics:

$$x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} oa_t + v_{1t} + \varepsilon_{1t+1} \tag{49}$$

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$$oa_{t+1} = \omega_{22} oa_t + v_{2t} + \varepsilon_{2t+1} \tag{50}$$

$$v_{1t+1} = \gamma_1 v_{1t} + \varepsilon_{3t+1} \tag{51}$$

$$v_{2t+1} = \gamma_2 v_{2t} + \varepsilon_{4t+1} \tag{52}$$

where all variables are as defined above.

Recovery of other information:

$$v_{1t} \equiv E(ox^a_{t+1}) - \omega_{11} ox^a_t - \omega_{12} oa_t \tag{53}$$

$$v_{2t} \equiv E(oa_{t+1}) - \omega_{22} oa_t \tag{54}$$

where all variables are as defined above.

Valuation equation:

$$P_t = b_t + k_1 ox^a_t + k_2 E(ox^a_{t+1}) + k_3 oa_t + k_4 E(oa_{t+1}) \tag{55}$$

where
$k_1 = \alpha_1 - \beta_1\omega_{11}$
$k_2 = \beta_1$
$k_3 = \alpha_2 - \beta_1\omega_{12} - \beta_2\omega_{22}$
$k_4 = \beta_2$
and β_1 and β_2 are the coefficients from the valuation equation in Feltham and Ohlson (1995).

Begley and Feltham (2002)

Information dynamics:

$$cr_{t+1} = \gamma cr_t + \kappa ci_t + v_{rt} + \varepsilon_{1t+1} \tag{56}$$

$$ci_{t+1} = \omega ci_t + v_{it} + \varepsilon_{2t+1} \tag{57}$$

$$v_{rt+1} = \zeta_r v_{rt} + \varepsilon_{3t+1} \tag{58}$$

$$v_{it+1} = \zeta_i v_{it} + \varepsilon_{4t+1} \tag{59}$$

where
v_{rt} = other information impacting future cash v_{it} receipts with persistence ζ_r
v_{it} = other information impacting future cash investments with persistence ζ_i and all other variables are as defined above.

Depreciation and capitalization policy:

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$$oa_t = \delta oa_{t-1} + ci_t \tag{60}$$

$$oi_t = cr_t - (1-\delta)\, oa_{t-1} \tag{61}$$

where oi_t is the operating income and all other variables are as defined above.

Operating asset and operating income dynamics:

$$oa_{t+1} = \delta oa_t + \omega ci_t + v_{it} + \varepsilon_{2t+1} \tag{62}$$

$$oi_{t+1} = \gamma oi_t + [\kappa - (1-\delta)]\, ci_t - (\delta - \gamma)(1-\delta)\, oa_{t-1} + v_{rt} + \varepsilon_{1t+1} \tag{63}$$

where all variables are as defined above.

Valuation equation (before inferring other information):

$$GW_t = \lambda_{roi} roi_t + \lambda_{ci} ci_t + \lambda_{oa^-} oa_{t-1} + \lambda_{vr} v_{rt} + \lambda_{vi} v_{it} \tag{64}$$

where
$\lambda_{roi} = \Phi_\gamma \gamma$, $\Phi_\gamma = (R - \gamma)^{-1}$,
$\lambda_{ci} = R\Phi_\omega \eta$, $\Phi_\omega = (R - \omega)^{-1}$ and $\eta = \Phi_\gamma \kappa - 1$,
$\lambda_{oa^-} = R\Phi_\gamma(\lambda - \delta)$,
$\lambda_{vr} = R\Phi_\gamma \Phi_r$, $\Phi_r = (R - \zeta_r)^{-1}$,
$\lambda_{vi} = R\Phi_i \Phi_\omega \eta$, $\Phi_i = (R - \zeta_i)^{-1}$,
$roi_t \equiv$ current period residual operating income $= oi_t - r(oa_{t-1})$,
$GW \equiv$ current period goodwill $= P - b$, and all other variables are as defined above.

Recovery of other information:

$$v_{rt} = f_{t1} - (\theta^1_{roi} roi_t + \theta^1_{ci} ci_t + \theta^1_{oa^-} oa_{t-1}) \tag{65}$$

$$v_{rt} = [\, f_{t2} - (\theta^2_{roi}\, roi_t + \theta^1_{ci} ci_t + \theta^2_{oa^-} oa_{t-1} + \theta^2_{vr} v_{rt})]/\theta^2_{vi} \tag{66}$$

where
$\theta^1_{roi} = \gamma$,
$\theta^2_{roi} = \gamma^2$,
$\theta^1_{ci} = \kappa - (R - \delta)$,
$\theta^2_{ci} = \kappa(\gamma + \omega) - (R - \delta)(\delta + \omega)$,
$\theta^1_{oa^-} = (R - \delta)(\gamma - \delta)$,
$\theta^2_{oa^-} = (R - \delta)(\gamma^2 - \delta^2)$,
$\theta^1_{vr} = 1$,
$\theta^2_{vr} = \gamma + \zeta_r$,
$\theta^2_{vi} = \kappa - (R - \delta)$,

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$f_{t1} \equiv$ one-period ahead residual income analyst forecast,
$f_{t2} \equiv$ two-period ahead residual income analyst forecast,
and all other variables are as defined above.

Valuation equation (after inferring other information):

$$GW_t = \alpha_{roi} roi_t + \alpha_{ci} ci_t + a_{oa^-} oa_{t-1} + \alpha_{f1} f_{t1} + \alpha_{f2} f_{t2} \quad (67)$$

where

$\alpha_{roi} = \lambda_{roi} - (\alpha_{f1}\theta^1_{roi} + \alpha_{f2}\theta^2_{roi})$,
$\alpha_{ci} = \lambda_{ci} - (\alpha_{f1}\theta^1_{ci} + \alpha_{f2}\theta^2_{ci})$,
$\alpha_{oa^-} = \lambda_{oa^-} - (\alpha_{f1}\theta^1_{oa^-} + \alpha_{f2}\theta^2_{oa^-})$,
$\alpha_{f1} = \lambda_{vr} - (\alpha_{f2}\theta^2_{vr})$,
$\alpha_{f2} = \lambda_{vi}/\theta^2_{vi}$,
and all other variables are as defined above.

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