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An empirical assessment of the residual income valuation model[1]

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Abstract

This paper provides an empirical assessment of the residual income valuation model proposed in Ohlson (Ohlson, J.A., 1995. Earnings, book values and dividends in security valuation. Contemporary Accounting Research 11, 661–687). We point out that existing empirical research relying on Ohlson's model is similar to past research relying explicitly on the dividend-discounting model. We establish that the key original empirical implications of Ohlson's model stem from the information dynamics that link current information to future residual income. Our empirical results generally support Ohlson's information dynamics. However, we find that our empirical implementation of Ohlson's model provides only minor improvements over existing attempts to implement the dividend-discounting model by capitalizing short-term earnings' forecasts in perpetuity. © 1999 Published by Elsevier Science B.V. All rights reserved.

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1. Introduction

A recent paper by Ohlson (1995) has stimulated interest in the residual income formulation of the dividend discounting valuation model. This development has potentially important implications for empirical researchers, as Ohlson's model specifies the relation between equity values and accounting variables such as earnings and book value. Existing empirical research has generally provided enthusiastic support for the model, and the model is now proposed as an alternative to the discounted cash flow model in equity valuation.[2] Existing empirical research argues that the model breaks new ground on two fronts. First, the model predicts and explains stock prices better than the models based on discounting short-term forecasts of dividends and cash flows (Bernard, 1995; Penman and Sougiannis, 1996; Francis et al., 1997). Second, the model provides a more complete valuation approach than popular alternatives (Frankel and Lee, 1998).

In this paper, we evaluate the empirical implications of Ohlson's model. Central to our analysis is the incorporation of the residual income information dynamics in Ohlson (1995). Past empirical applications of the residual income valuation model ignore Ohlson's information dynamics. In many cases, the resulting valuation models are similar to past applications of the dividend-discounting model that capitalize current or forecasted earnings, but make no appeal to book value or residual income (e.g., Whitbeck and Kisor, 1963; Malkiel and Cragg, 1970; Kothari and Zimmerman, 1995).

Consistent with Ohlson's information dynamics, we find that residual income follows a mean reverting process. In addition, we show that the rate of mean reversion is systematically associated with firm characteristics suggested by accounting and economic analysis. The rate of mean reversion is decreasing in the quality of earnings, increasing in the dividend payout ratio and correlated across firms in the same industry. We also find that incorporating information in analysts' forecasts of earnings into the information dynamics increases forecast accuracy. This result highlights the importance of information other than current residual income in forecasting future residual income.

Our pricing tests indicate that stock prices partially reflect the mean reversion in residual income. An important implication of this result is that book value conveys additional information over earnings in explaining contemporaneous stock prices. However, we also find that book value provides very little additional information about stock prices beyond that contained in analysts' forecasts of next year's earnings. This result is somewhat surprising, because analysts' forecasts of next year's earnings do not fully capture the long-term mean reversion in residual income. Further tests help reconcile these seemingly

[2] See Palepu et al. (1996) for a discussion of the application of the model to equity valuation.

contradictory results by suggesting that observed stock prices seem to display a lagged response to the long-term mean reversion in residual income.

We conclude that Ohlson's formulation of the residual income valuation model provides a parsimonious framework for incorporating information in earnings, book value and earnings forecasts in empirical research. We illustrate how many of the valuation relations implicit in past empirical research can be considered as special cases of Ohlson's model. However, we also find that past earnings and book value convey relatively little information about firm value beyond that reflected in analysts' forecasts of next year's earnings. Thus, while the model provides a unifying framework for earnings-based valuation research, our efforts at implementing the model provide only modest improvements in explanatory power over past empirical research using analysts' earnings forecasts in conjunction with the traditional dividend-discounting model. Nevertheless, an important shortcoming of past research is that the relation between earnings forecasts and future dividends has been specified in an ad hoc fashion. By formalizing the information dynamics, Ohlson's model provides a guiding framework for future valuation research.

The remainder of the paper is organized as follows. Section 2 reviews Ohlson's formulation of the residual income valuation model and identifies the model's empirical implications. Section 3 describes our research design and variable measurement. Section 4 presents the empirical results and Section 5 concludes.

2. Model development

This section provides an empirically oriented review of the residual income valuation model developed in Ohlson (1995). Our review emphasizes that the model is a restated and restricted version of the standard dividend-discounting model. Empirical applications of the model that ignore Ohlson's restrictions on the time-series properties of residual income are difficult to distinguish from empirical applications based on the standard dividend discounting model. We illustrate this point with reference to existing empirical research employing the residual income valuation model. We complete the section by outlining the key issues in the empirical implementation of Ohlson's valuation model.

2.1. Model review

The model is comprised of three basic assumptions. First, price is equal to the present value of expected dividends:

$$P_t = \sum_{\tau=1}^{\infty} \frac{\mathrm{E}_t[d_{t+\tau}]}{(1+r)^{\tau}}, \tag{1}$$

where P_t is the price of the firm's equity at time t, d_t is net dividends paid at time t, r is the (assumed constant) discount rate, $\mathrm{E}_t[\,]$ is the expected value operator conditioned on date t information.

Second, the clean surplus accounting relation:

$$b_t = b_{t-1} + x_t - d_t, \tag{2}$$

where b_t is the book value of equity at time t, and x_t is earnings for the period from $t-1$ to t.

This assumption allows future dividends to be expressed in terms of future earnings and book values. Combining the clean surplus relation in Eq. (2) with the dividend discounting model in Eq. (1) yields:

$$P_t = \sum_{\tau=1}^{\infty} \frac{\mathrm{E}_t[b_{t+\tau-1} + x_{t+\tau} - b_{t+\tau}]}{(1+r)^{\tau}}. \tag{3}$$

Simple algebraic manipulation allows Eq. (3) to be rewritten as

$$P_t = b_t + \sum_{\tau=1}^{\infty} \frac{\mathrm{E}_t[x_{t+\tau} - r.b_{t+\tau-1}]}{(1+r)^{\tau}} - \frac{\mathrm{E}_t[b_{t+\infty}]}{(1+r)^{\infty}}. \tag{4}$$

The final term in Eq. (4) is assumed to be zero, and 'residual income' or 'abnormal earnings' is defined as

$$x_t^{\mathrm{a}} = x_t - r.b_{t-1}$$

so that price can be expressed as the sum of book value and the present value of future abnormal earnings:

$$P_t = b_t + \sum_{\tau=1}^{\infty} \frac{\mathrm{E}_t[x_{t+\tau}^{\mathrm{a}}]}{(1+r)^{\tau}}. \tag{5}$$

Eq. (5) is the residual income version of the dividend-discounting model. It is important to note that Eq. (5) is just a restatement of the dividend-discounting model which in no way depends on the properties of accounting numbers other than through the clean surplus relation. For example, given a stream of future dividends, the value of b_t and the values all the $x_{t+\tau}$s could be picked as random numbers. So long as the $b_{t+\tau}$s are updated according to Eq. (2), the valuation relation in Eq. (5) will yield the present value of the dividend stream. Another way of illustrating the independence of Eq. (5) from accrual accounting concepts is to redefine b_t as the firm's cash balance at the end of period t and x_t as the net effect of all non-dividend cash flows for period t. The resulting variables clearly satisfy the clean surplus relation embodied in Eq. (2), and so the resulting 'residual cash flow valuation model' is also a legitimate reformulation of the dividend discounting formula. Thus, if accrual accounting is incrementally useful over cash accounting in the valuation process, its usefulness must stem from properties in addition to the clean surplus assumption.

From an empirical standpoint, Eq. (5) leaves the researcher in much the same position as the dividend-discounting model. The valuation relation cannot be implemented without estimates of future book values. In order to estimate future book values, the researcher must estimate future dividends. However, once future dividends are estimated, the book value and earnings estimates become redundant, and the researcher may just as well have used the dividend-discounting model in Eq. (1).

The above point is subtle, and overlooking it can lead empiricists to implement the residual income valuation model by incorporating explicit estimates of future dividends, without realizing that this makes the appeal to the residual income formulation of the dividend discounting model somewhat redundant. The point is illustrated by a recent application of the residual income valuation model in Frankel and Lee (1998). They implement Eq. (5) by forecasting abnormal earnings for three periods and taking the last period in perpetuity as follows:[3]

$$P_t = b_t + \frac{f(1)_t - r.b_t}{(1+r)} + \frac{f(2)_t - r.b(1)_t}{(1+r)^2} + \frac{f(3)_t - r.b(2)_t}{(1+r)^2.r},$$

where $f(\mathrm{i})_t$ is the period t consensus analyst forecast of earnings for period $t+i$, $b(\mathrm{i})_t$ is $b(i-1)_t + f(i)_t - d(i)_t$ (the period t forecast of book value for period $t+i$), and $d(\mathrm{i})_t$ is period t forecast of dividends for period $t+i$.

As a matter of algebra, this valuation expression reduces to

$$P_t = \frac{d(1)_t}{(1+r)} + \frac{d(2)_t}{(1+r)^2} + \frac{f(3)_t}{(1+r)^2.r}.$$

Thus, the valuation model can be viewed as an application of the dividend-discounting formula in which explicit forecasts of dividends are provided for the first two periods and dividends are assumed to equal the forecast of period $t+3$ earnings thereafter. The valuation model is readily interpretable in the context of the original dividend-discounting model, and the appeal to the residual income formulation of the dividend-discounting model is redundant. It is also noteworthy that the book value of equity drops out of this particular model.

The redundancy of the residual income valuation model applies more generally to studies that generate explicit forecasts of earnings and book values (and hence dividends) for several periods, and then use a terminal value assumption to complete the valuation (e.g., Frankel and Lee, 1998; Francis et al., 1997). Penman (1997) demonstrates how some of the more common terminal value

[3] Similar terminal value assumptions are used by Francis et al. (1997), Lee et al. (1998) and Penman and Sougiannis (1996).

assumptions employed in the residual income valuation model are readily interpretable in the context of the standard dividend-discounting framework. Thus, while the residual income formulation of the dividend-discounting model may have intuitive appeal because of its focus on accounting numbers, it provides no new empirical implications in and of itself.

Both Ohlson (1995) and Lundholm (1995) emphasize that the original empirical implications of Ohlson's model depend critically on the third and final assumption regarding the abnormal earnings information dynamics. This assumption places restrictions on the standard dividend-discounting model. From a theoretical perspective, the firm is still being valued by discounting future dividends. However, the third assumption specifies the nature of the relation between current information and the discounted value of future dividends. Ohlson's third assumption is that abnormal earnings satisfy the following modified autoregressive process:

$$x^{a}_{t+1} = \omega x^{a}_{t} + v_t + \varepsilon_{1,t+1}, \tag{6a}$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2,t+1}, \tag{6b}$$

where v_t is information about future abnormal earnings not in current abnormal earnings, $\varepsilon_{i,t}$ is the unpredictable, mean zero disturbance term, and ω and γ are fixed persistence parameters that are non-negative and less than one.

Combining the residual income valuation model in Eq. (5) with the information dynamics in Eqs. (6a) and (6b) yields the following valuation function:

$$P_t = b_t + \alpha_1 x^{a}_{t} + \alpha_2 v_t, \tag{7}$$

where $\alpha_1 = \omega/(1 + r - \omega)$ and $\alpha_2 = (1 + r)/[(1 + r - \omega)(1 + r - \gamma)]$.

This valuation function does not require explicit forecasts of future dividends, nor does it require additional assumptions about the computation of 'terminal value'. The information dynamics in Eqs. (6a) and (6b) along with the valuation function in Eq. (7) embody the original empirical implications of Ohlson (1995).

2.2. Empirical implementation

Empirical implementation of the information dynamics in Eqs. (6a) and (6b) and the valuation function in Eq. (7) requires three variables (b_t, x_t and v_t) and three parameters (ω, γ and r) to be provided as inputs. The first two variables, book value (b_t) and earnings (x_t), are readily available and easily measured. The remaining variable, v_t, and the three parameters are more difficult to measure. Turning first to v_t, it is well established that prices reflect information about future earnings that is not contained in current earnings. Attempts to incorporate this other information into valuation analyses date back at least as far as Beaver et al. (1980). Eq. (6a) indicates that Ohlson defines his other information variable, v_t, as the difference between the conditional expectation of abnormal earnings for period $t+1$ based on all available information and the expectation of abnormal earnings based only on current period abnormal earnings:

$$v_t = \mathrm{E}_t[x^{\mathrm{a}}_{t+1}] - \omega x^{\mathrm{a}}_t.$$

Note that the conditional expectation of period $t+1$ abnormal earnings is equal to the conditional expectation of period $t+1$ earnings less the product of period t book value and the discount rate. We measure the period t conditional expectation of period $t+1$ earnings using the consensus analyst forecast of period $t+1$ earnings, denoted f_t, so that

$$\mathrm{E}_t[x^{\mathrm{a}}_{t+1}] = f^{\mathrm{a}}_t = f_t - r.b_t.$$

The other information, v_t can then be measured as[4]

$$v_t = f^{\mathrm{a}}_t - \omega x^{\mathrm{a}}_t.$$

Finally, values for the three parameters ω, γ and r, must be established. We use the average historical return on equities to measure r. We measure ω and γ using their historical unconditional sample estimates. The estimation procedure is described in more detail in Section 3. We refer to these estimates as ω^{u} and γ^{ω}, respectively. We also develop a conditional forecast of ω using characteristics suggested by accounting and economic analysis, which we refer to as ω^{c}. Details of the estimation procedure are again provided in Section 3. The characteristics that we use are described in more detail below.

The persistence of abnormal earnings is a function of the persistence of the abnormal accounting rate of return and the growth rate in book value. Thus, variables that forecast the persistence of accounting rates of return and the growth rate in book value will determine ω. The extant accounting literature has identified a number of factors affecting the persistence of accounting rates of return. First, Brooks and Buckmaster (1976) and Freeman et al. (1982) provide evidence that extreme levels of earnings and extreme accounting rates of return mean revert more quickly. Thus, we expect that ω will be smaller for firms with extreme abnormal accounting rates of return. Second, it is well established that non-recurring special items, such as restructuring charges and asset write-downs, are less likely to persist (e.g., Fairfield et al., 1996), so we expect that ω will be lower for firms with extreme levels of special items. Third, Sloan (1996) establishes that accounting rates of return are less likely to persist for firms with extreme levels of operating accruals, so we expect that ω will be lower for firms with extreme levels of operating accruals. Economic analysis points us to two factors that are expected to relate to the persistence of abnormal earnings. First, dividend policy serves as an indicator of expected future growth in the book value of equity. Firms with growth opportunities tend to have lower payout

[4] We are grateful to Jim Ohlson for suggesting this procedure for measuring v_t (see Ohlson, 1998).

ratios. (e.g., Fazzari et al., 1988; Anthony and Ramesh, 1992). Thus, we expect that firms with low payout policies will experience growth in the book value of equity in the future, resulting in a higher ω. Second, we predict that a variety of industry-specific factors should influence the persistence of abnormal earnings. In particular, numerous studies suggest a link between industry structure and firm profitability (e.g., Scherer, 1980; Ahmed, 1994). We assume that the effect of industry specific factors should be relatively stable over time. We therefore expect that the persistence of abnormal earnings should be increasing in the historical persistence of abnormal earnings for firms in the same industry.

3. Research design

3.1. Model evaluation

We evaluate the empirical implications of Ohlson's residual income valuation model relative to several competing accounting-based valuation models. The competing valuation models generally correspond to valuation models that have been used in previous empirical research, and we show that they can all be considered as special cases of Ohlson's model. Our empirical analysis focuses on the improvements provided by Ohlson's model over these simpler and more restrictive models. The additional restrictions range from ignoring the 'other information' in analysts' forecasts of earnings altogether, to setting the persistence parameters ω and γ to their polar extremes of 0 and 1. The competing valuation models are summarized in Fig. 1.

The rows of Fig. 1 each summarize valuation models that make alternative assumptions about the value of the abnormal earnings persistence parameter, ω. The four rows consider values for ω of 0, 1, the unconditional estimate (ω^{u}) and the conditional estimate (ω^{c}), respectively. The columns of Fig. 1 each summarize valuation models that make alternative assumptions about the other information variable, v_t. The first column ignores other information altogether, and is therefore restricted to valuation models based on past abnormal earnings alone. The remaining three columns summarize valuation models that incorporate the other information variable into the valuation analysis. The columns differ with respect to the assumed value of the other information persistence parameter, γ. The three columns consider values for γ of 0, 1 and the unconditional estimate, γ^{ω}, respectively. Note that we superscript γ by the abnormal earnings persistence parameter, ω. This is because we estimate γ^{ω} from a v_t autoregression, and the measurement of v_t depends on the value used for ω.

A priori, we are able to rule out several of the combinations of assumptions about the parameters ω and γ. First, we rule out the use of ω^{c} with models incorporating the other information variable, v_t. We do this because several of the conditioning variables relate to short-term mean reversion in abnormal earnings that is not necessarily expected to persist beyond the next period. Thus, it makes little sense to apply the conditional persistence parameter for this period's abnormal earnings to the conditional expectation of next period's abnormal earnings.[5] Second, we rule out cases where one of the persistence parameters is assumed to be 1 and the other persistence parameter is assumed to be strictly positive. This combination of assumptions implies that abnormal earnings are nonstationary. We find this implication unappealing from an economic standpoint, as it suggests that abnormal profit opportunities will never be competed away. This implication is also inconsistent with past empirical evidence suggesting that accounting rates of return are mean reverting (Freeman et al., 1982; Fairfield et al., 1996).

Cells in Fig. 1 corresponding to one of the valuation models that we rule out above are labeled 'Not considered'. The remaining cells, list both the expectation of next period's abnormal earnings and the valuation function implied by the corresponding valuation model. Below, we briefly discuss each of the valuation models and provide examples of prior research using the valuation models.

$\omega = 0$, *ignore other information*

This model assumes that expectations of future abnormal earnings are based solely on information in current abnormal earnings and that abnormal earnings are purely transitory. Consequently, expected future abnormal earnings are zero and price is equal to book value. This restricted version of Ohlson's model corresponds to valuation models in which accounting earnings are assumed to measure 'value creation' (e.g., Easton and Harris, 1991). Variants of this valuation model are implicit in many 'levels' studies in which market values are regressed on book values (e.g., Barth, 1991).

$\omega = 1$, *ignore other information*

This model assumes that expectations of future abnormal earnings are based solely on current abnormal earnings and that abnormal earnings persist indefinitely. These assumptions imply that expected abnormal earnings equal current abnormal earnings and price equals current earnings capitalized in perpetuity plus any reinvested period t earnings. The intuition for including reinvested period t earnings is that they will increase the book value base that is available to generate earnings in the next period. This special case of Ohlson's model corresponds closely to the popular earnings capitalization valuation model in

[5] For example, if current abnormal earnings consist of a large negative special item, then we would expect earnings to be temporarily low this period, resulting in a low conditional persistence parameter, ω^c. However, we do not expect that a corresponding special item will be reported in next period's earnings. Thus, it makes little sense to apply the low conditional persistence of this period's abnormal earnings to the expectation of next period's abnormal earnings.

Abnormal earnings persistence parameter	**'Other information' persistence parameter**			
	Ignore other information	$\gamma = 0$	$\gamma = 1$	$\gamma = \gamma^{\omega}$
$\omega = 0$	$E_t[x^a_{t+1}] = 0$ $P_t = b_t$	$E_t[x^a_{t+1}] = f^a_t$ $P_t = b_t + \frac{f^a_t}{(1+r)}$	$E_t[x^a_{t+1}] = f^a_t$ $P_t = \frac{f_t}{r}$	$E_t[x^a_{t+1}] = f^a_t$ $P_t = b_t + \frac{1}{(1+r-\gamma^{\omega})} f^a_t$
$\omega = 1$	$E_t[x^a_{t+1}] = x^a_t$ $P_t = \frac{x_t}{r} + x_t - d_t$	$E_t[x^a_{t+1}] = f^a_t$ $P_t = \frac{f_t}{r}$	Not considered	Not considered
$\omega = \omega^{u}$	$E_t[x^a_{t+1}] = \omega^{u} x^a_t$ $P_t = b_t + \frac{\omega^{u}}{(1+r-\omega^{u})} x^a_t$	$E_t[x^a_{t+1}] = f^a_t$ $P_t = b_t + \frac{1}{(1+r-\omega^{u})} f^a_t$	Not considered	$E_t[x^a_{t+1}] = f^a_t$ $P_t = b_t + \frac{\omega^{u}}{(1+r-\omega^{u})} x^a_t + \frac{(1+r)}{(1+r-\omega^{u})(1+r-\gamma^{\omega})} v_t$
$\omega = \omega^{c}$	$E_t[x^a_{t+1}] = \omega^{c} x^a_t$ $P_t = b_t + \frac{\omega^{c}}{(1+r-\omega^{c})} x^a_t$	Not considered	Not considered	Not considered

Fig. 1. Summary of the implications of the accounting-based valuation models examined in the empirical tests. Each cell contains the forecast of next period's abnormal earnings ($E_t[x^a_{t+1}]$) and the contemporaneous forecast of stock price (P_t) for the respective model.

Abnormal earnings for year t is defined as

$$x^a_t = x_t - r.b_t,$$

where x_t denotes earnings before extraordinary items and discontinued operations for year t;
r denotes the discount rate (assumed to be 12%);
b_t denotes book value of equity at the end of year t;
ω^u is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression;
ω^c is the predicted value of ω from the regression model specified in Table 2 and estimated using all historically available data from 1950 through the forecast year;
γ^u is the first order autoregression coefficient for the other information variable, v_t, and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression.
v_t is defined as

$$v_t = f^a_t - \omega^u x^a_t,$$

where the period t consensus analyst forecast of abnormal earnings for the next period is defined as

$$f^a_t = f_t - r.b_t$$

f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t.

which earnings are assumed to follow a random walk and the future dividend payout ratio is assumed to be 100% (e.g., Kothari, 1992; Kothari and Zimmerman, 1995). The model is considered in more detail in Ohlson (1991). An important feature of the model is that book value does not enter the valuation function.

$\omega = \omega^{u}$, *ignore other information*

This model assumes that expectations of future abnormal earnings are based solely on current abnormal earnings, and that abnormal earnings mean revert at their unconditional historical rate. Expected abnormal earnings equal current abnormal earnings multiplied by the persistence parameter, ω^{u}. Price is a linear function of book value and current abnormal earnings. The relative weight on book value (abnormal earnings) is decreasing (increasing) in the persistence parameter, $\omega = \omega^{u}$. Thus, this model combines elements of the two preceding models.

$\omega = \omega^{c}$, *ignore other information*

This model is identical to the model discussed directly above, except that the unconditional estimate of the persistence parameter (ω^{u}) is replaced by the conditional estimate of the persistence parameter (ω^{c}).

$\omega = 0$, $\gamma = 0$

This valuation model incorporates the other information in the conditional forecast of next period's abnormal earnings, but assumes that both abnormal earnings and the other information variable are purely transitory. Expected abnormal earnings are equal to the consensus analyst forecast of abnormal earnings. Note that expected abnormal earnings equal the consensus analyst forecast of abnormal earnings by construction for all of the models incorporating the other information variable. Price is equal to book value plus the discounted value of the forecast of next period's abnormal earnings. Abnormal earnings have no implications for firm value beyond next period, because forecasted abnormal earnings are assumed to be purely transitory. Consequently, current book value receives a heavy weighting in the valuation function. This model corresponds to Penman and Sougiannis' (1996) application of the residual income valuation model with a one period horizon and no terminal value.

$\omega = 1$, $\gamma = 0$

Unlike the prior model, this model assumes that forecasted abnormal earnings persist indefinitely, so price is equal to the forecast of next period's earnings capitalized in perpetuity. Variants of this model have long been popular in empirical applications of the dividend-discounting model. For example, Whitbeck and Kisor (1963) and Vander Weider and Carleton (1988) model the ratio of price to the consensus analyst forecast of next period earnings as a function of the dividend payout ratio and expected growth in earnings. More recently, this model has formed the basis for the computation of terminal values in empirical applications of the residual income valuation model using finite horizon data. Frankel and Lee (1998), Lee et al. (1998), Penman and Sougiannis (1996) and Francis et al. (1997) all compute terminal value by assuming that abnormal earnings in the terminal year either remain constant in perpetuity, or grow at some nominal rate (e.g., 4%). Note, however, that this model does not allow for mean reversion in abnormal earnings, and so does not place any weight on current book value in the valuation function.

$\omega = \omega^{u}$, $\gamma = 0$

This model allows for gradual mean reversion in next period's expected abnormal earnings by assuming that ω equals its historical unconditional value. Price is a linear function of book value and the forecast of next period's abnormal earnings. The relative weight on book value (forecasted abnormal earnings) is decreasing (increasing) in the persistence parameter, $\omega = \omega^{u}$. Thus, this model combines elements of the two preceding models. While this model is appealing in that it combines analysts' forecast data with information in book value, it has received little attention in the empirical literature. Bernard (1995) captures the spirit of this model by regressing price on book value and short-term forecasts of abnormal earnings.

$\omega = 0$, $\gamma = 1$

This valuation model is identical to the model obtained by assuming that ($\omega = 1$, $\gamma = 0$), which is discussed above. The intuition for this result is that $\omega = 0$ implies that v measures the complete expectation of next period's abnormal earnings. Assuming that $\gamma = 1$ then has the effect of allowing the expectation of next period's abnormal earnings to persist indefinitely. More generally, note that the valuation function is always symmetric in ω and γ (see Ohlson, 1998).

$\omega = 0$, $\gamma = \gamma^{\omega}$

The symmetry of the valuation function implies that this valuation model is identical to the model obtained by assuming that ($\omega = \omega^{u}$, $\gamma = 0$), which is discussed above. One apparent difference between the two models that is evident from Fig. 1 is the substitution of γ^{ω} for ω^{u} in the valuation function. The difference is reconciled by noting that when $\omega = 0$, v captures the entire expectation of next period's abnormal earnings, so that γ^{ω} reflects the persistence of next period's abnormal earnings.

$\omega = \omega^{u}$, $\gamma = \gamma^{\omega}$

The final valuation model sets both ω and γ equal to their historical unconditional values. This model represents our best attempt to implement the residual income valuation model proposed by Ohlson (1995). Allowing both abnormal earnings and the other information variable to each have their own persistence parameters produces a valuation function in which price is a linear combination of book value, current abnormal earnings and the other information variable. This valuation model implies that book value, current abnormal earnings and the other information embedded in the forecast of next period's abnormal earnings all contain incremental information about price.

3.2. Data and variable measurement

The empirical analysis uses three data sources. Historical accounting data are obtained from the COMPUSTAT files. Our primary empirical analysis uses annual financial statement data from 1976 to 1995. Stock return data are obtained from the CRSP daily files. All of our empirical tests employ with-dividend stock returns and buy-and-hold returns. Analyst forecast data is obtained from the I/B/E/S files. Combining the three databases gives us a total of 50,133 observations. The empirical analysis is conducted using per-share data. All of our tests use earnings measured before extraordinary items. Strictly speaking, excluding extraordinary items from earnings violates the clean surplus assumption underlying the theoretical development of the residual income valuation model. However, from a practical perspective, extraordinary items are nonrecurring, and so their inclusion is unlikely to enhance the prediction of abnormal earnings.[6]

Our analysis requires a measure of the discount rate, r. Note that the discount rate enters all of the models in a similar fashion, and our objective is not to evaluate alternative methods for estimating discount rates. Moreover, attempts to document predictable variation in expected returns that are consistent with the predictions of asset pricing models have met with limited success. Thus, we use a discount rate of 12%, which approximates the long-run average realized return on US equities. The relative rankings of the models in the empirical tests are robust to discount rates ranging from 9% to 15%.

The unconditional value of ω used in the Ohlson valuation model is estimated separately for each fiscal year. An abnormal earnings autoregression is estimated using all available observations from previous years, going back as far as 1950. All variables are scaled by market value of equity to control for heteroscedasticity, and the 1% most extreme observations are winsorised so that they do not have an undue influence on the regressions. The resulting estimate of the autoregressive parameter, ω^{u}, is used to implement the unconditional version of Ohlson's model.

[6] An alternative procedure would be to use a definition of earnings that incorporates extraordinary items and to then incorporate the lower persistence of the comprehensive earnings number in the persistence parameter, ω. This is the procedure that we adopt for special items.

The conditional value of the autoregressive parameter, ω^c, is estimated in a similar manner. We first construct the five variables that are hypothesized to be associated with cross-sectional variation in the persistence of abnormal earnings. The first variable ($q1$) measures the magnitude of abnormal earnings, and is computed as the absolute value of the ratio of abnormal earnings to lagged book value. The second variable ($q2$) measures the magnitude of special items, and is computed as the absolute value of the ratio of special items to lagged book value. The third variable ($q3$) measures the magnitude of operating accruals, and is measured as the absolute value of the ratio of operating accruals to lagged total assets. Operating accruals are computed in the standard way (e.g., Sloan, 1996). The fourth variable (div) measures the dividend payout policy and is computed as the ratio of dividends to earnings over the most recent fiscal year. If the dividend payout ratio is negative due to negative earnings, we use the ratio from the most recent previous year in which the firm reported positive earnings. If the ratio is greater than one, we set it to one, because a payout ratio greater than one cannot be sustained indefinitely. The fifth variable (ind) measures the historical persistence of abnormal earnings for firms in the same industry. We use two-digit SIC codes to measure industry membership. A finer partitioning results in an unsatisfactorily low number of observations for some industries. A pooled industry-specific abnormal earnings autoregression is used to estimate the historical persistence parameter for each SIC grouping. The regressions use all available observations from 1950 through the previous year. Next, ω^c is estimated via an abnormal earnings autoregression in which each of the five determinants of ω^c are included as interactive effects:

$$x_t^a = \omega_0 + \omega_1 x_{t-1}^a + \omega_2(x_{t-1}^a q1_{t-1}) + \omega_3(x_{t-1}^a q2_{t-1}) + \omega_4(x_{t-1}^a q3_{t-1}) + \omega_5(x_{t-1}^a div_{t-1}) + \omega_6(x_{t-1}^a ind_{t-1}) + \varepsilon_t.$$

A separate regression is estimated for each fiscal year in the sample, with each regression using all available observations in the sample from previous years, going back as far as 1950. The ω^c estimate for each firm-year is then computed using the parameter estimates from this regression and the firm-years actual values of $q1$, $q2$, $q3$, div and ind:

$$\omega^c = \omega_1 + \omega_2 q1_t + \omega_3 q2_t + \omega_4 q3_t + \omega_5 div_t + \omega_6 ind_t.$$

If one of the variables required to compute ω^c is missing, then ω^c is set equal to ω^u.

Finally, we estimate γ^ω, through an 'other information' autoregression, using the same procedure that we used to estimate ω^u. One complication that arises in the estimation of γ^ω is that the measurement of the other information variable, v, depends on an assumed value of ω. Recall from Fig. 1 that we only require a measure of γ in the situation where $\omega = \omega^{u}$.[7] Hence, we need only estimate the other information autoregression with v measured using ω^{u}. We measure v_t using the estimate of ω^{u} obtained from all data available through the end of period $t-1$.

4. Empirical results

4.1. Time-series behavior of abnormal earnings

We begin our empirical analysis by evaluating how well the evolution of abnormal earnings is described by Ohlson's information dynamics. We test five aspects of the time-series behavior of abnormal earnings. First, we examine whether the autoregressive coefficient, ω, differs reliably from the polar extremes of 0 and 1. Second, we examine whether the first-order autoregressive process is sufficient for abnormal earnings by adding additional lags of abnormal earnings. Third, we relax the constraints that the autoregressive process places on the earnings and book value components of abnormal earnings. Fourth, we estimate ω^{c} by allowing the autoregressive coefficient on abnormal earnings to vary as a function of our conditioning variables. Finally, we examine whether the autoregressive coefficient, γ, differs reliably from the polar extremes of 0 and 1.

The first three tests are presented in Table 1 and employ pooled time-series and cross-sectional regression analysis. Panel A reports the results from a first-order abnormal earnings autoregression. The autoregressive coefficient, ω_1, is 0.62 with a t-statistic of 138.31. Thus, the hypotheses that $\omega_1 = 1$ and $\omega_1 = 0$ respectively are both strongly rejected. The plots in Fig. 2 illustrate the superior forecasting ability of a time-series model that incorporates the gradual mean reversion in abnormal earnings. The plots compare the predictive ability of time-series models setting ω equal to 0, 1 and ω^{u}, respectively. The figure is constructed by first ranking all sample observations on deflated abnormal earnings and equally assigning the ranked observations to deciles. The mean values of abnormal earnings for the highest and lowest deciles are then plotted over the next four years, along with the values implied by each of the models. It can be readily seen that the model using $\omega = \omega^{u}$ tracks subsequent abnormal earnings the most closely. Note also that while the model using $\omega = 0$ does a poor job of predicting short-term abnormal earnings, it does a relatively good job of tracking long-term abnormal earnings, because mean reversion in abnormal earnings is almost complete after four years.

[7] We also consider the model with ($\omega = 0$, $\gamma = \gamma^{\omega}$). In this case, γ^{ω} measures the persistence of abnormal earnings, which is given by ω^{u}.

Table 1
Autoregressive properties of abnormal earnings

Panel A: Pooled analysis with one lag

$$x^a_{i,t+1} = \omega_0 + \omega_1 x^a_{i,t} + \varepsilon_{i,t+1}$$

ω_0	ω_1	R^2
− 0.02 (− 29.04)	0.62 (138.31)	0.34

Panel B: Pooled analysis with four lags

$$x^a_{i,t+1} = \omega_0 + \omega_1 x^a_{i,t} + \omega_2 x^a_{i,t-1} + \omega_3 x^a_{i,t-2} + \omega_4 x^a_{i,t-3} + \varepsilon_{i,t+1}$$

ω_0	ω_1	ω_2	ω_3	ω_4	R^2
− 0.01 (− 12.36)	0.59 (68.31)	0.07 (7.50)	0.01 (0.86)	0.01 (1.59)	0.35

Panel C: Unconstrained estimation with one lag

$$x^a_{i,t+1} = \omega_0 + \omega_1 x^a_{i,t} + \omega_2 b_{i,t-1} + \varepsilon_{i,t+1}$$

ω_0	ω_1	ω_2	R^2
0.02 (17.16)	0.47 (80.12)	− 0.09 (− 77.64)	0.40

Notes: Sample consists of 50,133 annual observations from 1976 to 1995. All variables are scaled by the market value of equity at the end of year t. Figures in parentheses are t-statistics.
Abnormal earnings for year t is defined as:

$$x^a_t = x_t - r.b_{t-1}$$

where x_t denotes earnings before extraordinary items for year t, r denotes the discount rate (assumed to be 12%), and b_t denotes book value of equity at the end of year t.

Panel B of Table 1 reports results including additional lags of abnormal earnings to examine whether the first-order autoregressive process is sufficient. Inclusion of three additional lags of abnormal earnings has a trivial impact, increasing the explanatory power from 0.34 to 0.35. Only the second lag is statistically significant ($t = 7.50$), but the coefficient magnitude is only 0.07 versus 0.59 on the first lag. Thus, the first order autoregressive process appears to provide a reasonable empirical approximation.[8] Finally, Panel C reports the

[8] Bar-Yosef et al. (1996) investigate the appropriateness of the single lag information dynamic in a more general framework and find that a second lag achieves modest statistical significance.

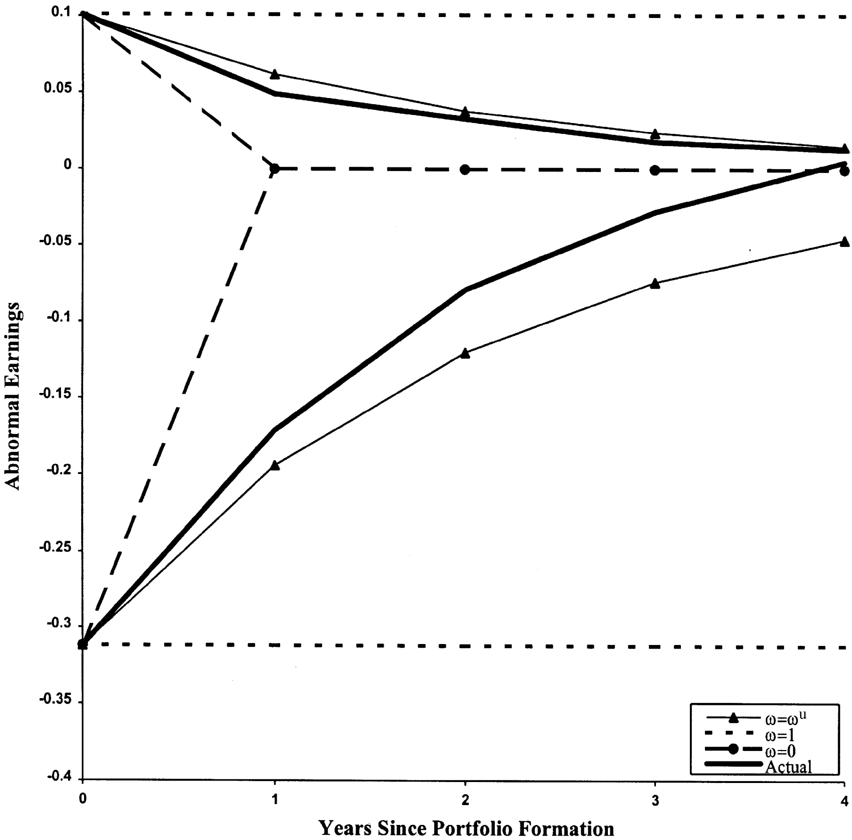

Fig. 2. Comparison of the actual time-series properties of abnormal earnings with the properties predicted by a first-order autoregressive process with alternative values for the autoregressive coefficient, ω. The graph is formed by taking observations in the extreme deciles of abnormal earnings performance in year 0 and plotting the mean level of abnormal earnings performance for each decile over the following four years. The sample consists of 50,133 observations from 1976 to 1995.

results of regressions of abnormal earnings on lagged abnormal earnings and the book value component of lagged abnormal earnings. If the first-order autoregressive process is appropriate, then the additional book value term should not load in the regression. However, we see that book value loads with a significantly negative coefficient and that the inclusion of book value leads to a decline in the coefficient on abnormal earnings. Feltham and Ohlson (1995) suggest that the negative loading on book value can be interpreted as 'aggressive' accounting. However, unreported tests reveal that this unconstrained specification is not significantly helpful in forecasting future abnormal earnings and so it is not pursued further.

Table 2 analyses variation in the autoregressive coefficient, ω_1. Recall that this coefficient measures the persistence of abnormal earnings and is hypothesized to have five determinants. Persistence is hypothesized to be lower when earnings contain more transitory accounting items, measured by the empirical constructs $q1$, $q2$ and $q3$. Persistence is also hypothesized to be decreasing in the dividend yield (*div*) and increasing in the historical level of industry-wide abnormal earnings persistence (*ind*). Table 2 reports results from allowing each of the hypothesized determinants of persistence to enter as interactive variables in the abnormal earnings autoregression. Inclusion of the five interactive effects increases the explanatory power of the regression from 0.34 to 0.40. All of the interactive effects enter with their hypothesized signs and are statistically significant. These results confirm that the persistence of

Table 2
Determinants of the persistence of abnormal earnings

$$x_t^a = \omega_0 + \omega_1 x_{t-1}^a + \omega_2(x_{t-1}^a q1_{t-1}) + \omega_3(x_{t-1}^a q2_{t-1}) + \omega_4(x_{t-1}^a q3_{t-1}) + \omega_5(x_{t-1}^a div_{t-1}) + \omega_6(x_{t-1}^a ind_{t-1}) + \varepsilon_t$$

	ω_0	ω_1	ω_2	ω_3	ω_4	ω_5	ω_6	R^2
Predicted sign	?	?	−	−	−	−	+	
	− 0.02	0.61	− 0.37	− 1.21	− 0.17	− 0.11	0.61	0.40
	(− 30.97)	(13.22)	(− 28.68)	(−35.59)	(− 3.77)	(− 7.80)	(8.10)	

Notes: Sample consists of 50,133 observations from 1976 to 1995. Abnormal earnings are scaled by market value of equity at the end of year t. Figures in parentheses are t-statistics.
Abnormal earnings for year t is defined as

$$x_t^a = x_t - r.b_{t-1}$$

where x_t denotes earnings before extraordinary items and discontinued operations for year t, r denotes the discount rate (assumed to be 12%), and b_t denotes book value of equity at the end of year t;
$q1_t$ is defined as the absolute value of abnormal earnings for year t divided by book value of equity at the beginning of year t;
$q2_t$ is defined as the absolute value of special accounting items divided by book value of equity at the beginning of year t;
$q3_t$ is defined as the absolute value of accounting accruals divided by total assets at the beginning of year t;
div_t is defined as dividends paid during year t divided by earnings before extraordinary items and discontinued operations for year t;
ind_t is defined as the first order autoregressive coefficient from an abnormal earnings autoregression for all firms in the same two digit SIC code as the observation. The autoregression is conducted using all available firms on the COMPUSTAT annual tapes in the same two digit SIC code from 1950 through year t.

Table 3
Autoregressive properties of v_t, the other information embedded in analysts' forecasts of next period's abnormal earnings

Pooled analysis with one lag

$$v_{t+1} = \gamma_0 + \gamma_1 v_t + \varepsilon_{2,t+1}$$

γ_0	γ_1	R^2
0.01 (38.79)	0.32 (57.94)	0.08

Notes: Sample consists of 50,133 annual observations from 1976 to 1995. All variables are scaled by the market value of equity at the end of year t. Figures in parentheses are t-statistics.
The other information variable is defined as

$$v_t = f_t^{\mathrm{a}} - \omega^{\mathrm{u}} x_t^{\mathrm{a}}$$

where the period t consensus analyst forecast of abnormal earnings for the next period is defined as

$$f_t^{\mathrm{a}} = f_t - r.b_t$$

and abnormal earnings for period t is defined as

$$x_t^{\mathrm{a}} = x_t - r.b_{t-1}$$

f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t;
ω^{u} is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through year t in a pooled time-series cross-sectional regression;
x_t denotes earnings before extraordinary items for year t;
r denotes the discount rate (assumed to be 12%);
b_t denotes book value of equity at the end of year t.

abnormal earnings varies in a systematic and predictable manner. Consequently, the conditional estimates of ω that we use to implement Ohlson's valuation model should offer additional predictive ability with respect to future abnormal earnings.

Finally, Table 3 examines the autoregressive properties of the other information variable, v. The estimate of the first-order autoregressive coefficient on the other information, γ_1, is 0.32 with a t-statistic of 57.94. Thus, the other information mean reverts at about twice the rate of abnormal earnings. However, γ_1, is also significantly different from the polar extremes of 0 and 1 that are implicitly assumed in many of the valuation models used in past research. Thus, we expect that incorporating more precise estimates of this coefficient should improve our ability to forecast future abnormal earnings and hence predict contemporaneous stock prices.

4.2. Prediction of next period abnormal earnings

Statistics on the bias and accuracy of the predictions of next period abnormal earnings generated by each of the valuation models are reported in Table 4. The mean forecast error measures forecast bias, while the mean absolute forecast error and the mean square forecast error measure forecast accuracy. All forecast errors are deflated by market value and the extreme 1% of the forecast errors are

Table 4
Relative forecasting ability of alternative modes for predicting next year's abnormal earnings

Panel A: *Predictions for models ignoring 'other information', computed as*

$$E_t[x^a_{t+1}] = \omega x^a_t$$

	Mean forecast error	Mean absolute forecast error	Mean square forecast error
$\omega = 0$	− 0.029	0.087	0.033
$\omega = 1$	0.006	0.081	0.032
$\omega = \omega^u$	− 0.008	0.077	0.030
$\omega = \omega^c$	− 0.006	0.076	0.028

Panel B: *Prediction for models incorporating 'other information', computed as*

$$E_t[x^a_{t+1}] = f^a_t$$

	− 0.032	0.052	0.015

Notes: Sample consists of 50,133 observation from 1976 to 1995. Forecast errors are scaled by the market value of equity at the end of year t.
The forecast error for year t is computed by subtracting the forecast of abnormal earning for year $t+1$ from the realized abnormal earnings for year $t+1$.
Abnormal earnings for year t is defined as

$$x^a_t = x_t - r.b_t$$

and the period t consensus analysts' forecast of abnormal earnings for period $t+1$ is defined as

$$f^a_t = f_t - r.b_t$$

where
x_t denotes earnings before extraordinary items and discontinued operations for year t;
r denotes the discount rate (assumed to be 12%);
b_t denotes book value of equity at the end of year t;
f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t;
ω^u is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression;
ω^c is the predicted value of ω from the regression model specified in Table 2 and estimated using all historically available data from 1950 through the forecast year.

winsorised. Panel A reports forecast errors for each of the models that ignore the other information variable, v, while panel B reports forecast errors for the models that incorporate v. Recall that the forecast of next period abnormal earnings is equal to the consensus analyst estimate of abnormal earnings for all of the models that incorporate v. Hence, we only report one set of forecast errors for these models. We measure the analysts' earnings estimates using the I/B/E/S mean consensus earnings estimates provided in the month immediately following the announcement of the annual earnings data used in the time-series models. This ensures that all of the forecasting variables are measured at similar points in time.

The mean forecast error is close to zero for the models using $\omega = 1$, $\omega = \omega^{u}$ and $\omega = \omega^{c}$, and is slightly negative for the model using $\omega = 0$ ($-$ 0.029). This latter result indicates that, on average, firms fell slightly short of achieving a return on equity equal to the assumed cost of capital of 12%. The mean forecast error is also negative using the consensus analyst forecast, reflecting over-optimism in analysts' forecasts. The measures of forecast accuracy indicate that the predictive abilities of the models ignoring the other information in analysts' forecasts are all very close. The model using ω^{c} has only slightly smaller forecast errors than the model using ω^{u}, indicating that our efforts to conditionally estimate the persistence parameter add relatively little to the forecasting ability of the model. The model using $\omega = 1$ is slightly less accurate than the two versions using estimates of ω, and the model using $\omega = 0$ is the least accurate of all. The results in panel B indicate that analysts' forecasts of abnormal earnings are much more accurate than the forecasts generated by the historical time-series models. This result highlights the important role of the other information embedded in analysts' forecasts in predicting future abnormal earnings.

4.3. Explanation of contemporaneous stock prices

The relative ability of the competing valuation models to explain contemporaneous stock prices is evaluated in Table 5. Panel A of Table 5 reports results for the four models ignoring the other information. All of these models generate large positive mean forecast errors, indicating that they undervalue equities relative to the stock market. The undervaluation is smallest for the model using $\omega = 0$ (forecast error = 0.291) and greatest for the model using $\omega = 1$ (forecast error = 0.378). The measures of forecast accuracy are similar for the models using $\omega = 0$, $\omega = \omega^{u}_{\omega}$ and $\omega = \omega^{c}$, respectively. However, the model using $\omega = 1$ is considerably less accurate than the other three models. To understand this result, recall from Fig. 2 that the model using $\omega = 1$ model generates poor forecasts of long-run abnormal earnings. Since expectations of long-run abnormal earnings are included in the computation of stock price, this model therefore generates relatively poor forecasts of stock price. The mediocre showing of the

Table 5
Relative forecasting ability of alternative modles for explaining contemporaneous stock prices

Panel A: *Price estimates for models ignoring 'other information', computed as*

$$P_t = b_t + \frac{\omega}{1+r-\omega} x_t^a$$

	Mean forecast error	Mean absolute forecast error	Mean square forecast error
$\omega = 0$	0.291	0.461	0.284
$\omega = 1$	0.378	0.519	0.363
$\omega = \omega^u$	0.320	0.461	0.284
$\omega = \omega^c$	0.326	0.465	0.291

Panel B: *Price estimates for models incorporating 'other information', computed as*

$$P_t = b_t + \frac{\omega}{1+r-\omega} x_t^a + \frac{1+r}{(1+r-\omega)(1+r-\gamma)} v_t$$

	Mean forecast error	Mean absolute forecast error	Mean square forecast error
$(\omega = 0, \gamma = 0)$	0.285	0.445	0.266
$(\omega = 1, \gamma = 0)$ and $(\omega = 0, \gamma = 1)$	0.227	0.402	0.232
$(\omega = \omega^u, \gamma = 0)$ and $(\omega = 0, \gamma = \gamma^\omega)$	0.278	0.427	0.248
$(\omega = \omega^u, \gamma = \gamma^\omega)$	0.259	0.419	0.241

Notes: Sample consists of 50,133 observations from 1976 to 1995. Forecast errors are scaled by stock price at the end of year t

The forecast error for year t is computed by subtracting the forecast stock price for year t from the observed market stock price at the end of the month following the announcement of earnings for year t.

Abnormal earnings for year t is defined as

$$x_t^a = x_t - r.b_t$$

where x_t denotes earnings before extraordinary items and discontinued operations for year t, r denotes the discount rate (assumed to be 12%), and b_t denotes book value of equity at the end of year t;

ω^u is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression;

ω^c is the predicted value of ω from the regression model specified in Table 2 and estimated using all historically available data from 1950 through the forecast year;

γ^ω is the first order autoregression coefficient for the other information variable, v_t, and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression.

v_t is defined as

$$v_t = f_t^a - \omega^u x_t^a$$

where the period t consensus analyst forecast of abnormal earnings for the next period is defined as

$$f_t^a = f_t - r.b_t$$

f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t.

model using $\omega = \omega^c$ is somewhat surprising. Table 4 illustrates that this model generates the most accurate forecasts of next period's abnormal earnings among the four models ignoring the other information. Thus, the poor showing of this model in the pricing tests raises the possibility that stock prices do not reflect rational expectations of future abnormal earnings. We explore this issue in more detail later in the paper.

Panel B of Table 5 reports results for the models incorporating the information in analysts' forecasts. The mean forecast errors indicate that these models also undervalue relative to the market. However, the undervaluations are not as large as they were for the models ignoring other information. The undervaluations are surprising, because the results in Table 3 indicate that the analysts' forecasts of future abnormal earnings are overoptimistic. All of the models incorporating the other information have lower forecast errors than the models using historical data. These results are consistent with the superior predictive accuracy of analysts' forecasts with respect to future abnormal earnings. Of the models incorporating other information, the model using ($\omega = 1$, $\gamma = 0$) provides the most accurate forecasts of stock prices. Recall from Fig. 1 that this model simply capitalizes the forecast of next period's earnings in perpetuity and ignores information in book value. This result is surprising, because book value contains additional information about long-run abnormal earnings that should be rationally reflected in stock prices. Thus, the strong showing of the model using ($\omega = 1$, $\gamma = 0$) in the pricing tests again raises the possibility that stock prices do not reflect rational expectations of future abnormal earnings.

In Table 6, we investigate the ability of the information variables used in the valuation models to explain stock prices without imposing the restrictions implied by the valuation models. Panel A of Table 6 reports results of annual cross-sectional regressions of stock price on historical book value and earnings. These two explanatory variables are the information variables used in the valuation models that ignore other information. Both book value and earnings load positively and significantly in the regressions. The fact that book value loads in addition to earnings indicates that book value contains value relevant information beyond that already in earnings. We can obtain further insights from the regressions by comparing the estimated coefficients to values implied by Ohlson's model in conjunction with representative parameter values. The formulae for the predicted valuation coefficients on book value and earnings are taken from Ohlson (1995), (p. 670). Using $r = 12\%$ (long-run historical average) and $\omega = 0.62$ (historical average from (Table 1) gives:

$$\beta_1 = 1 - r.\omega/(1 + r - \omega) = 0.85; \text{ and}$$

$$\beta_2 = (\omega + \omega.r)/(1 + r - \omega) = 1.39.$$

The corresponding mean values (standard errors) on the empirical regression coefficients are $\beta_1 = 0.40$ (0.074) and $\beta_2 = 3.88$ (0.262). Thus, stock prices appear

Table 6
Unconstrained regressions of stock price on the variables used in the valuation models

Panel A: *Regressions of price on book value and earnings*

$$P_t = \alpha + \beta_1 b_t + \beta_2 x_t + \varepsilon_t$$

Coeff.	Mean	Std. err.	Min.	Q1	Med.	Q3	Max
α	9.72	0.408	7.65	8.07	9.57	10.92	13.63
β_1	0.40	0.074	− 0.18	0.05	0.51	0.68	0.81
β_2	3.88	0.262	2.43	3.07	3.68	4.74	6.27
R^2	0.40	0.015	0.40	0.51	0.53	0.59	0.67

Panel B: *Regressions of price on book value, earnings and the consensus analyst forecast of next year's earnings*

$$P_t = \alpha + \beta_1 b_t + \beta_2 x_t + \beta_3 f_t + \varepsilon_t$$

Coeff.	Mean	Std. Err.	Min.	Q1	Med.	Q3	Max
α	4.25	0.353	1.64	3.00	4.53	5.09	7.05
β_1	0.24	0.035	− 0.06	0.09	0.26	0.39	0.42
β_2	0.05	0.150	− 0.82	− 0.53	0.03	0.56	1.34
β_3	5.79	0.256	3.97	4.85	5.89	6.64	8.07
R^2	0.69	0.019	0.56	0.61	0.68	0.74	0.86

Notes: Statistics reported are based on the estimates from 20 annual cross-sectional regressions from 1976 to 1995. Sample consists of 50,133 observations from 1976 to 1995. All variables are measured on a per-share basis.

P_t denotes the stock price measured at the end of the month following the announcement of earnings for year t.

x_t denotes earnings before extraordinary items and discontinued operations for year t.

b_t denotes book value of equity at the end of year t.

f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t.

to place too low a weight on book value and too high a weight on earnings. The value of ω required to justify the empirical regression coefficients is approximately $\omega = 0.85$. One interpretation of these results is that they are driven by a misspecification in Ohlson's valuation model. An alternative interpretation is that stock prices do not reflect rational expectations, because investors overestimate the persistence of abnormal earnings.

The regressions reported in panel B of Table 6 employ the information variables used in the valuation models incorporating other information. In addition to book value and earnings, these regressions also include the consensus analyst forecast of next period's earnings. The explanatory power of these regressions are considerably higher than in panel A, indicating that the analysts' forecasts contain incremental information about firm value. Book value loads positively and significantly, though the coefficient is much smaller than in the regressions excluding the analyst forecast variable. This result indicates that book value contains some value relevant information beyond that in analysts' forecasts of next year's earnings. Earnings loads with a small and statistically insignificant coefficient, suggesting that analysts' forecast of next year's earnings subsume value relevant information in current earnings. Finally, the analysts' forecast of next year's earnings loads with a positive and statistically significant coefficient.

We can again obtain further insights from the regressions by comparing the estimated coefficients to values implied by Ohlson's model in conjunction with representative parameter values. The formulae for the predicted valuation coefficients on book value and earnings are from Ohlson (1998) (p. 14). Using $r = 12\%$ (long-run historical average) and $\omega = 0.62$ (historical average from Table 1) and $\gamma = 0.32$ (historical average from Table 3) gives:

$$\beta_1 = [(1+r)(1-\omega)(1-\gamma)]/[(1+r-\omega)(1+r-\gamma)] = 0.72,$$

$$\beta_2 = [-(1+r).\omega.\gamma]/[(1+r-\omega)(1+r-\gamma)] = -0.55, \text{ and}$$

$$\beta_3 = (1+r)/[(1+r-\omega)(1+r-\gamma)] = 2.80.$$

The corresponding mean values (standard errors) on the empirical regression coefficients are $\beta_1 = 0.24$ (0.035), $\beta_2 = 0.05$ (0.150) and $\beta_3 = 5.79$ (0.256). Thus, stock prices place too low a weight on book value and too high a weight on the analysts' forecast of next year's earnings. For example, a (ω,γ) combination of approximately (0.95,0.00) would be required to approximate the empirical regression coefficients. One interpretation of these results is that they are driven by a misspecification in Ohlson's valuation model. An alternative interpretation is that stock prices do not reflect rational expectations, because investors tend to overestimate the persistence of short-term earnings forecasts. We investigate this possibility in the next section.

4.4. Prediction of future stock returns

Thus far, our pricing tests have focused on the ability of the competing valuation models to predict contemporaneous stock prices. In this section, we consider whether the values implied by the competing models are able to predict future stock returns. These additional tests are motivated by the apparent inconsistencies between the abnormal earnings prediction results in Table 4 and the valuation results in Tables 5 and 6. In particular, the results in Table 4 indicate that the model using $\omega = \omega^{c}$ provides more accurate forecasts of future abnormal earnings than the models using $\omega = \omega^{u}$ and $\omega = 0$. However, the results in Table 5 indicate that the reverse holds true with respect to the ability of the models to explain observed stock prices. Moreover, the evidence in Table 6 is consistent with the expectations embedded in stock prices underestimating the mean reversion in abnormal earnings. In the tradition of fundamental analysis, we therefore provide tests of whether observed stock prices tend to revert toward the 'fundamental' or 'intrinsic' values implied by particular models. These tests entertain the possibility of temporary stock mispricing that can be systematically predicted by particular valuation models. The tests are constructed by taking the ratio of the intrinsic model values to observed equity values. Decile portfolios are then formed using the ranked ratios. Lower deciles consist of stocks that are overpriced relative to intrinsic value, and are therefore expected to experience lower future stock returns. Higher deciles consist of stocks that are underpriced relative to intrinsic value, and are therefore expected to experience higher future stock returns. Note that the ratio formed for the model using $\omega = 0$ is just the book-to-market ratio, while the ratio formed for the model using $\omega = 1$ is proportional to the earnings-to-price ratio. The predictive ability of these ratios with respect to future stock returns is already well documented.

The results are presented in Table 7. Panel A reports the one-year-ahead returns for ratios formed on the valuation models ignoring other information.

Table 7
Predictive ability of ratios of implied model values to observed market values with respect to stock returns over the following year

Panel A: *Implied values ignoring 'other information', computed as*

$$P_t = b_t + \frac{\omega}{1 + r - \omega} x_t^{a}$$

Portfolio	$\omega = 0$	$\omega = 1$	$\omega = \omega^{u}$	$\omega = \omega^{c}$
1 (Lowest)	0.143	0.159	0.140	0.136
2	0.171	0.143	0.174	0.159
3	0.153	0.161	0.152	0.165
4	0.169	0.158	0.162	0.159
5	0.181	0.160	0.170	0.173
6	0.170	0.166	0.181	0.175
7	0.191	0.182	0.180	0.187
8	0.196	0.202	0.197	0.194
9	0.206	0.222	0.203	0.212
10 (Highest)	0.215	0.235	0.234	0.235
Hedge	0.072	0.076	0.094	0.099
(t-statistic)	(1.94)	(2.24)	(2.39)	(2.44)

Table 7 (continued)

Panel B: Implied values incorporating 'other information', computed as

$$P_t = b_t + \frac{\omega}{1+r-\omega} x_t^a + \frac{1+r}{(1+r-\omega)(1+r-\gamma)} v_t$$

Portfolio	$(\omega = 0, \gamma = 0)$	$(\omega = 1, \gamma = 0)$ and $(\omega = 0, \gamma = 1)$	$(\omega = \omega^u, \gamma = 0)$ and $(\omega = 0, \gamma = \gamma^\omega)$	$(\omega = \omega^u, \gamma = \gamma^\omega)$
1 (Lowest)	0.149	0.157	0.154	0.162
2	0.176	0.145	0.165	0.159
3	0.147	0.154	0.154	0.154
4	0.162	0.177	0.161	0.158
5	0.178	0.179	0.174	0.171
6	0.175	0.173	0.175	0.175
7	0.178	0.181	0.173	0.185
8	0.211	0.210	0.213	0.203
9	0.201	0.208	0.206	0.204
10 (Highest)	0.220	0.210	0.224	0.224
Hedge	0.071	0.054	0.070	0.062
(t-statistic)	(1.77)	(1.44)	(1.71)	(1.34)

Notes: Each year, observations are ranked and assigned in equal numbers to deciles based on the ratio of implied model value to observed market value of equity. Equal-weighted buy-hold stock returns are then computed for each decile portfolio over the subsequent 12 months, beginning three months after the end of the fiscal year from which the historical forecast data are obtained. The table reports the mean of the 20 years of annual portfolio returns. T-statistics are based on the time-series standard errors of the 20 annual portfolio returns. Sample consists of 50,133 observations from 1976 to 1995. Abnormal earnings for year t is defined as

$$x_t^a = x_t - r.b_t,$$

where x_t denotes earnings before extraordinary items and discontinued operations for year t, r denotes the discount rate (assumed to be 12%), and b_t denotes book value of equity at the end of year t;

ω^u is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression;

ω^c is the predicted value of ω from the regression model specified in Table 2 and estimated using all historically available data from 1950 through the forecast year;

γ^ω is the first order autoregression coefficient for the other information variable, v_t, and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression.

v_t is defined as

$$v_t = f_t^a - \omega^u x_t^a,$$

where the period t consensus analyst forecast of abnormal earnings for the next period is defined as

$$f_t^a = f_t - r.b_t$$

f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t.

The hedge portfolio return, which is the difference between the return for portfolio 10 and the return for portfolio 1, summarizes the predictive ability of each model with respect to future returns. The return interval begins 3 months after the fiscal year end of the year from which the historical data is obtained. Statistical inference is conducted using the standard error of the annual mean hedge portfolio returns over the 20 years in the sample period. The model using $\omega = \omega^c$ displays the greatest predictive ability, with a hedge portfolio return of 9.9% ($t = 2.44$). The model using $\omega = \omega^u$ is second, with a hedge portfolio return of 9.4% ($t = 2.39$), while the model using $\omega = 1$ is third with a hedge portfolio return of 7.6% ($t = 2.24$). The model using $\omega = 0$ displays the lowest predictive ability, with a hedge portfolio return of 7.2% ($t = 1.94$). The superior predictive ability with respect to future stock returns of the model using $\omega = \omega^c$ potentially explains why this model performs poorly in the pricing tests (Table 5), despite its superior predictive ability with respect to future abnormal earnings (Table 4). It appears that the expectations reflected in stock prices fail to fully anticipate the rate of mean reversion in abnormal earnings that is captured by this model. However, this explanation should be interpreted with caution due to the low statistical significance of the results.

Panel B reports the one-year-ahead returns for ratios computed using valuation models incorporating the other information in analysts' earnings forecasts. The hedge portfolio returns are uniformly lower, ranging from 7.1% ($t = 1.77$) for the model using ($\omega = 0, \gamma = 0$) to 5.4% ($t = 1.44$) for the model using ($\omega = 1, \gamma = 0$). These results contrast sharply with the contemporaneous stock price results in Table 5. While valuation models incorporating information in analysts' forecasts have the greatest ability to explain contemporaneous stock prices, valuation models ignoring this information have the greatest predictive ability with respect to future stock returns. Moreover, the valuation model using ($\omega = 1, \gamma = 0$) is the best at explaining contemporaneous stock prices, but the worst at predicting future stock returns. These relations are exactly what would be expected if analysts' earnings estimates are naively incorporated in stock prices even when they do not fully reflect all information in current abnormal earnings about future abnormal earnings. However, the results in Table 7 are indirect and their statistical significance is weak. Moreover, Kothari and Warner (1997) and Barber and Lyon (1997) provide evidence that statistical tests using long horizon stock returns are poorly specified. Table 8 therefore reports results of more direct tests of the hypothesis that investors price predictable errors in analysts' forecasts.

The regressions in panel A of Table 8 examine the extent to which each of the models ignoring other information in analysts' forecasts detects errors in analysts' forecasts of one-period-ahead earnings. The regressions in panel B then examine whether the errors identified in the analysts' forecasts appear to be accompanied by corresponding errors in stock prices. The results in panel

A indicate that the models using $\omega = 1$, $\omega = \omega^{u}$ and $\omega = \omega^{c}$ all identify systematic errors in analysts' earnings forecasts. The results in panel B indicate that these systematic forecast errors are reflected in stock prices, though the statistical significance of these results is weak. Frankel and Lee (1998) also report that analysts' earnings forecasts contain predictable errors that are not rationally anticipated in stock prices. Thus the hypothesis that investors naively price predictable errors in analysts' forecasts provides a promising explanation for the results obtained in this paper.

Table 8
Panel A

Analysis of the relation between forecast errors in abnormal earnings predictions from analysts' consensus earnings estimates and forecasts of abnormal earnings that ignore the other information in analysts' consensus earnings estimates.

The earnings forecasts that ignore the other information are generated by the model. $x^{a}_{i,t+1} = \omega x^{a}_{i,t} + \varepsilon_{i,t+1}$. Statistics reported are based on the estimates from 20 annual cross-sectional regressions from 1976 to 1995. Sample consists of 50,133 observations from 1976 to 1995. All variables are measured on a per-share basis.

Regression model estimated is

$$(x^{a}_{t+1} - f^{a}_{t}) = \delta_0 + \delta_1(\omega x^{a}_{t} - f^{a}_{t}) + e_{t+1}$$

Coeff.	Mean	Std. error	Min.	Q1	Med.	Q3	Max
$\omega = 0$							
δ_0	− 0.03	0.005	− 0.08	− 0.04	− 0.03	− 0.03	0.00
δ_1	− 0.13	0.083	− 0.63	− 0.40	− 0.16	0.06	0.71
R^2	0.05	0.018	0.00	0.01	0.01	0.08	0.26
$\omega = 1$							
δ_0	− 0.02	0.003	− 0.04	− 0.03	− 0.02	− 0.01	0.00
δ_1	0.40	0.036	0.13	0.29	0.42	0.45	0.64
R^2	0.11	0.017	0.01	0.04	0.12	0.16	0.24
$\omega = \omega^{u}$							
δ_0	− 0.02	0.004	− 0.05	− 0.04	− 0.03	− 0.01	0.00
δ_1	0.42	0.043	0.14	0.25	0.44	0.51	0.74
R^2	0.08	0.024	0.01	0.03	0.07	0.12	0.40
$\omega = \omega^{c}$							
δ_0	− 0.02	0.004	− 0.04	− 0.03	− 0.02	− 0.01	0.00
δ_1	0.48	0.043	0.16	0.35	0.49	0.58	0.76
R^2	0.12	0.022	0.01	0.05	0.10	0.16	0.35

Table 8 (continued)

Panel B

Analysis of the relation between stock returns in the year following the release of analysts' consensus forecasts and forecasts of abnormal earnings that ignore the other information in analysts' consensus earnings forecasts.

The earnings forecasts that ignore the other information are generated by the model $x^a_{i,t+1} = \omega x^a_{i,t} + \varepsilon_{i,t+1}$. Stock returns are equal-weighted buy–hold returns over the 12 months beginning three months after the end of the fiscal year from which the historical forecast data are obtained. Statistics reported are based on the estimates from 20 annual cross-sectional regressions from 1976 to 1995. Sample consists of 50,133 observations from 1976 to 1995. All variables are measured on a per-share basis.

Regression model estimated is

$$Ret_{t+1} = \phi_0 + \phi_1(\omega x^a_t - f^a_t) + e_{t+1}$$

Coeff.	Mean	Std. error	Min.	Q1	Med.	Q3	Max
$\omega = 0$							
ϕ_0	0.18	0.037	− 0.06	0.11	0.14	0.27	0.56
ϕ_1	− 0.03	0.096	− 0.73	− 0.36	− 0.08	0.28	0.80
R^2	0.01	0.001	0.00	0.00	0.00	0.01	0.02
$\omega = 1$							
ϕ_0	0.18	0.035	− 0.05	0.11	0.15	0.27	0.52
ϕ_1	0.07	0.066	− 0.05	− 0.15	0.01	0.28	0.65
R^2	0.01	0.002	0.00	0.00	0.00	0.01	0.04
$\omega = \omega^u$							
ϕ_0	0.18	0.036	− 0.05	0.11	0.15	0.27	0.53
ϕ_1	0.10	0.077	− 0.44	− 0.15	0.01	0.36	0.76
R^2	0.01	0.002	0.00	0.00	0.00	0.01	0.03
$\omega = \omega^c$							
ϕ_0	0.18	0.036	− 0.05	0.11	0.16	0.27	0.53
ϕ_1	0.14	0.070	− 0.34	− 0.15	0.05	0.46	0.88
R^2	0.01	0.002	0.00	0.00	0.01	0.01	0.04

Notes: Abnormal earnings for year t is defined as

$$x^a_t = x_t - r.b_t$$

where x_t denotes earnings before extraordinary items and discontinued operations for year t, r denotes the discount rate (assumed to be 12%), and b_t denotes book value of equity at the end of year t. The consensus analyst forecast of abnormal earnings for the next period is defined as

$$f^a_t = f_t - r.b_t$$

where f_t denotes the I/B/E/S consensus forecast of earnings for year $t+1$ measured in the first month following the announcement of earnings for year t.

Ret_{t+1} is the equal-weighted, buy–hold, with-dividend stock return over the 12 months beginning three months after the end of the fiscal year t.

ω^u is the first order autoregression coefficient for abnormal earnings and is estimated using all historically available data from 1950 through the forecast year in a pooled time-series cross-sectional regression.

ω^c is the predicted value of ω from the regression model specified in Table 2 and estimated using all historically available data from 1950 through the forecast year.

5. Conclusions

This paper provides an empirical assessment of the residual income valuation model proposed in Ohlson (1995). We begin by pointing out that existing empirical applications of the residual income valuation model are generally similar to past applications of traditional earnings capitalization models. We argue that the key original empirical implications of Ohlson's model arise from the information dynamics that describe the formation of abnormal earnings expectations. Our empirical tests indicate that while the information dynamics are reasonably empirically descriptive, a simple valuation model that capitalizes analysts' earnings forecasts in perpetuity is better at explaining contemporaneous stock prices. Subsequent tests suggest that the superior explanatory power of the simple capitalization model may arise because investors over-weight information in analysts' earnings forecasts and under-weight information in current earnings and book value.

Despite the ambiguous empirical support for the model, we believe that the model provides a useful framework for empirical research for several reasons. First, as shown in this paper, the model provides a unifying framework for a large number of previous 'ad hoc' valuation models using book value, earnings and short-term forecasts of earnings. In doing so, the model highlights the implicit assumptions that previous models make about the relation between current accounting variables and future abnormal earnings. Second, the model provides a basic framework upon which subsequent research can build. For example, Feltham and Ohlson (1995) generalize the model to incorporate growth and accounting conservatism. Third, the focus of the model on the relation between current information variables and future abnormal earnings is heuristically appealing. Previous valuation models based on the dividend-discounting model often make unrealistic assumptions about dividend policy. For example, Kothari and Zimmerman (1995) assume a 100% payout ratio. Ohlson's model illustrates that valuation models focusing *directly* on forecasting future abnormal earnings avoid having to forecast the timing of future dividend payments.[9]

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[9] We emphasize the word 'directly' in this sentence. Forecasts of the earnings and book value components of abnormal earnings contain a forecast of future dividend payments through the clean surplus relation. Thus, the researcher must focus *directly* on forecasting future abnormal earnings, rather than on forecasting its components. This simplification embodies the notion that dividend policy is irrelevant to the extent that reinvested earnings generate the cost of capital.

References

Ahmed, S.A., 1994. Accounting earnings and future economic rents: an empirical analysis. Journal of Accounting and Economics 17, 377–400.

Anthony, J.H., Ramesh, K., 1992. Association between accounting performance measures and stock prices. Journal of Accounting and Economics 15, 203–228.

Bernard, V., 1995. The Feltham–Ohlson framework: Implications for empiricists. Contemporary Accounting Research 11, 733–747.

Bar-Yosef, S., Callen, J.L., Livnat, J., 1996. Modeling dividends, earnings and the book value of equity: an empirical investigation of the Ohlson valuation dynamics. Review of Accounting Studies 1, 207–224.

Barber, B.M., Lyon, J.D., 1997. Detecting abnormal long-run stock returns: The empirical power and specification of tests statistics. Journal of Financial Economics 43, 341–372.

Barth, M.E., 1991. Relative measurement errors among alternative pension asset and liability measures. Accounting Review 66, 433–463.

Beaver, W., Lambert, R., Morse, D., 1980. The information content of security prices. Journal of Accounting and Economics 2, 3–28.

Brooks, L.D., Buckmaster, D.A., 1976. Further evidence of the time-series properties of accounting income. Journal of Finance 31, 1359–1373.

Easton, P.D., Harris, T.S., 1991. Earnings as an explanatory variable for returns. Journal of Accounting Research 29, 19–36.

Fairfield, P.M., Sweeney, R.J., Yohn, T.L., 1996. Accounting classification and the predictive content of earnings. Accounting Review 71, 337–355.

Fazzari, S., Hubbard R.G., Peterson, B., 1988. financing constraints and corporate investment. Brookings Papers on Economic Activity, pp. 141-195.

Feltham, G.A., Ohlson, J.A., 1995. Valuation and clean surplus accounting for operating and financial activities. Contemporary Accounting Research 11, 689–732.

Francis, J., Olsson P., Oswald, D., 1997. Comparing the accuracy and explainability of dividend, free cash flow and abnormal earnings equity valuation models. Working Paper, University of Chicago.

Frankel R., Lee, C.M.C., 1998. Accounting valuation, market expectation, and cross-sectional stock returns. Journal of Accounting and Economics, (forthcoming).

Freeman, R.N., Ohlson, J.A., Penman, S.H., 1982. Book rate of return and the prediction of earnings changes. Journal of Accounting Research 20, 639–653.

Kothari, S.P., 1992. Price-earnings regressions in the presence of prices leading earnings: earnings level versus earnings change specifications and alternative deflators? Journal of Accounting and Economics 15, 173–202.

Kothari, S.P., Warner, J.B., 1997. Measuring long-horizon security performance. Journal of Financial Economics 43, 301–339.

Kothari, S.P., Zimmerman, J., 1995. Price and return models. Journal of Accounting and Economics 20, 155–192.

Lee, C.M., Myers C.J., Swaminathan, B., 1998. What is the intrinsic value of the Dow? Working Paper, Cornell University.

Lundholm, R., 1995. A tutorial on the Ohlson and Feltham/Ohlson models. Contemporary Accounting Research 11, 749–761.

Malkiel, B., Cragg, J., 1970. Expectations and the structure of share prices. American Economic Review 60, 601–617.

Ohlson, J.A., 1991. The theory of value and earnings, and an introduction to the Ball and Brown Analysis. Contemporary Accounting Research 8, 1–19.

Ohlson, J.A., 1995. Earnings, book values and dividends in security valuation. Contemporary Accounting Research 11, 661–687.

Ohlson, J.A., 1998. Earnings, book values and dividends in equity valuation: An empirical perspective. Working paper, Columbia University.
Palepu, K.G., Bernard V.L., Healy, P.M., 1996. Business analysis and valuation using financial statements. South-Western College Publishing Co., Cincinnati, Ohio.
Penman, S.H., 1997. A synthesis of equity valuation techniques and the terminal value calculation for the dividend discounting model, Working Paper, University of California, Berkeley.
Penman, S.H., Sougiannis, T., 1996. A comparison of dividend, cash flow and earnings approaches to equity valuation. Working Paper, University of California, Berkeley.
Scherer, F.M., 1980. Industrial Market Structure and Firm Performance. Rand McNally College Publishing Co., Chicago, IL.
Sloan, R.G., 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings?. Accounting Review 71, 289–315.
Vander Weider, J.H., Carleton, W.T., 1988. Investor growth expectations: Analysts vs. history. Journal of Portfolio Management 14, 78–82.
Whitbeck, V., Kisor, M., 1963. A new tool in investment decision making. Financial Analysts Journal 19, 55–62.