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Are Earnings More Informative than Residual Income in Valuation Models?

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Abstract

The efforts to derive a theoretically correct valuation model based on accounting data has lead to the development of the Feltham and Ohlson (1995) model, which employs book values (BV) and residual income (RI) as valuation attributes. However, in empirical settings RI is often replaced by net income (NI). The present paper shows that replacing RI with NI in valuation models potentially reduces information content and significance. The results also indicate that RI has a stronger association with Market values in conjunction with Research and Development expenditures (RD) and Book value. RD is shown to enhance the explanatory power of NI and RI for market values (MV). Its inclusion in valuation models, is thus, supported by the present paper.

JEL Classification: **G30, M40**

Keywords:

Residual Income; Earnings; Market Value; RD

1. Introduction

It is well known that the true or economic value of a company is the discounted sum of all future cash flows accruing to shareholders. In this respect, the Financial Accounting Standard Board's (FASB) conceptual framework prescribes that financial statements should help investors and creditors to ''assess the amounts, timing, and uncertainty'' of future cash flows (FASB,

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1978, #1). The observable implication of this statement is that a temporal association between current financial performance and future cash flows, as well as a contemporaneous association between financial performance and security prices or price changes is expected.

However, on practical grounds, it has been shown that periodic free cash flow is an unsatisfactory measure of economic performance (O' Hanlon and Peasnell, 1998). For example for young growth firms the free cash flow is likely to be negative over short horizons requiring subjective forecasts of the timing, amount and growth in free cash flows. Beaver (1989) and DeAngelo (1991) recognize that the valuation process in practice is a three-link process and involves using previous years' earnings data to forecast future earnings, which in turn are used to estimate future cash flows and finally companies' values. This process can only be simplified if an accounting measure of performance emerges as a correct valuation attribute without the need to be transformed into future cash flows.

Since Williams (1938, see also Preinreich, 1938) conceptualized the discounted dividend valuation model many accounting researchers have tried to use accounting data in order to develop variants of it. Many of these attempts involve using dividends expressed as a function of residual income and resulted into the first accounting-based valuation models. These models share many commonalities and express the value of a company as the discounted sum of periodic residual income figures plus a term representing the accounting valuation error (Edwards and Bell, 1961; Kay, 1976; Peasnell, 1982; Edwards, Kay and Mayer, 1987; Stark, 1986; Brief and Lawson, 1991; among others). As a result of the analytical work of Ohlson (1990, 1991, and 1995) and Feltham and Ohlson (1994, 1995, and 1996) this approach has gained increased acceptance by both academics and practitioners and is now playing a significant role in capital markets-based financial accounting research.

Many of these accounting-based valuation models result in a clear theoretical link between current market values, current book values and residual income, provided that market values and present values of a company are taken to be similar concepts. However, Stark and Thomas (1998), argue that this is not the same as establishing a clear relationship between current market values, current book values and current residual income. They state that it would appear to be useful to empirically investigate the cross-sectional relationship between market values and residual income.

This study provides further empirical evidence on the information content of Residual Income (RI) and Net Income after extraordinary items (NI) by testing valuation models that use earnings and residual income as explanatory variables whilst controlling for the impact of closing book value and research and development expenditures. The latter two variables consist of control variables that have been proved to have a statistically significant information content for market values (e.g., Green, Stark and Thomas, 1996; Rees, 1997; Stark and Thomas, 1998; Akbar and Stark, 2001; Akbar and Stark, 2003). The various valuation models prevailing are estimated using closing book value as the common deflator for all variables.

The results indicate that replacing RI with NI in accounting-based valuation model potentially reduces information content and significance. The results also indicate that future RD in conjunction with BV helps RI and NI to display better explanatory power for market values.

The remainder of this paper is organized as follows. Section 2 describes the Residual Income valuation model and the tests of relative and incremental information content. Section 3 provides sources of the data. Section 4 provides the empirical results of the paper and finally section 5 concludes the paper and offers implications for future research.

2. Research Design

2.1 The model

Following Green et al., (1996) and Stark and Thomas (1998) Ohlson's (1995) methodology is employed by using a specification that can capture the effect of *RD* expenditures on market values. Their work suggests that segmenting earnings into RD expenditures and earnings plus RD expenditures could improve the ability of earnings to explain market values. By denoting MV_{it} the market values, BV_{it} the book values and NI_{it} the net income of company *i*, and RD_{it} research and development expenditures of company i we initially investigate the following accounting-based valuation model:

$$MV_{it} = b_0 + b_1 NI_{it} + error_{it} \tag{1}$$

Where $error_{it}$ is a mean zero error term.

Green et al. (1996) segment earnings into Earnings plus RD expenditures and into RD expenditures and provide the following model:

$$MV_{it} = b_0 + b_1 (NI_{it} + RD_{it}) + b_2 RD_{it} + error_{it} \tag{2}$$

If when estimating equation 2, the condition that $b_1 = -b_2$ is satisfied this would imply that the market, in the context of a straightforward earnings model, does not capitalize *RD* expenditures. Rather, it treats them as if the benefits accruing from such expenditures were received in the same period as the expenditures. In general, $b_2 RD$ can be interpreted as capturing *RD* capital.

The third model enhances equation 2 by adding Book Values. This can be interpreted as suggesting that both book values and earnings can explain the cross-sectional variation of market value. Hence the third model is as follows:

$$MV_{it} = b_0 + b_1(NI_{it} + RD_{it}) + b_2 RD_{it} + b_3 BV_{it} + error_{it} \quad (3)$$

Extant research, estimating equations similar to the above, shows that both equity book value and net income can explain variations in the market value, and thus omitting one or the other potentially leads to model misspecification (Easton and Harris, 1991; Kothari and Zimmerman, 1995; Feltham and Ohlson, 1995; Ohlson, 1995; Francis and Schipper, 1996; Collins et al., 1997; Barth et al., 1998; Easton, 1999; Penman, 1998).

A measure of accounting performance that prevailed as a correct valuation attribute is the residual income (or abnormal earnings), which unlike simple earnings recognizes that the capital employed by a company bears a cost that, should be accounted for. Residual income is broadly defined as the accounting earnings of the period less a charge for the use of invested capital. The charge is obtained by multiplying the cost of equity capital (k_e) with the book value of equity at the beginning of period t.

In formal terms, $RI_t = NI_t - k_e BV_{t-1}$. The Residual Income Valuation Model (RIM) that appears in the accounting literature is a special case of the above equation in which capital and earnings are defined in terms of shareholders. This form of the RIM is equivalent to the dividend discount model coupled with the Clean Surplus Relation (CSR). In formal terms, the model that results from this combination can be expressed as follows:

$$MV_t = BV_t + \sum_{s=1}^{\infty} \frac{E_t(NI_{t+s} - k_e BV_{t+s-1})}{(1+k_e)^s} \quad (4)$$

The empirical version of this model that is investigated, examines the cross-sectional relation between current Market Value, Book Value and Residual Income. If simple RI measures have a stronger link with market value relative to NI this result provides some support for those who advocate the use of RI as the basis of planning and control (Stark and Thomas, 1998). Equation (4) in empirical settings usually appears as follows:

$$MV_{it} = b_0 + b_1\left[(NI_{it} + RD_{it}) - kBV_{t-1}\right] + b_2 RD_{it} + b_3 BV_{it} + error_{it} \quad (5)$$

Or equivalently

$$MV_{it} = b_0 + b_1(RI_{it} + RD_{it} + b_2 RD_{it} + b_3 BV_{it} + error_{it} \quad (6)$$

Brief and Zarowin (1999) assume a rational expectations framework and use realized earnings to account for expected earnings. They find that the nature of earnings is an important factor that determines the superiority of the RIM model. In particular, they observe that for firms with transitory earnings, dividends have greater individual explanatory power than earnings. However, book value and earnings have about the same explanatory power as book value and dividends. This finding implies that book value compensates for the valuation irrelevancy of transitory earnings. Finally, for companies with permanent earnings, the authors support that earnings have the greater explanatory power than all the other variables, although book values and dividends are dominated by a combination of book value and earnings.

Another practical difficulty in employing the RIM with actual data is the estimation of the cost of capital. Early studies, usually assume a constant value for the cost of capital (see Lee, 1999 for a review). Instead of assuming a constant cost of capital Gebhardt et al (1999), and Brief (1999), use RIM framework to estimate the implied rate of return, which can be thought of as the ex-ante cost of equity capital. Gebhardt et al, examine the empirical properties of the internal rate of return and try to explain their results under an arbitrage pricing theory framework. Moreover, Beaver (1999) criticizes the use of a cross-sectional, time-series constant cost of capital. He argues that this practice actually translates into a residual income figure, which is nothing else but ROE minus a constant[1]. On the other hand, Stark and Thomas (1998) show that it is not the cost of capital that has information content but rather the BV at time *t-1* and that a constant k may play the role of the regression slope if RI is decomposed into its individual components.

2.2 Tests of incremental and relative information content

Biddle et al. (1995) draw a distinction between incremental and relative information content. Incremental information content comparisons evaluate the value relevance of one measure against another when both can be used to assess the information content of a set of variables (Bowen et al., 1987). In contrast relative information content comparisons are used when interest lies in ranking some performance measures according to their information content when only one measure can be used i.e. when making mutually exclusive choices.

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[1] In terms of ROE, RI is given as $RI_t=(ROE_t-k)BV_{t-1}$. On the other hand, $NI_t=ROE_t x BV_{t-1}$. Thus, if the cost of capital is constant, RI differs from NI by a constant proportion of the BV of the previous period.

2.2.1. Tests of incremental information content

Following Bowen et al. (1987) incremental information content is assessed by examining the statistical significance of OLS slope coefficients. Specifically for equations (2) and (5) incremental information content is measured using t-tests on individual coefficients of the null hypothesis:

H_0: $a_1=0$ or $a_2=0$

Where a_1 and a_2 are the slopes of equations (2) and (5). In order to alleviate possible heteroscedasticity problem White's corrections are made in both the relative and incremental information content tests.

2.2.2. Tests of relative information content

Dechow et al. (1996) makes a distinction between nested and non-nested models[2]. For measuring the relative information content of equations (1)-(2) and (3)-(5) the adjusted R^2 is used as a measure of performance. However, Dechow et al. (1996) argue that simply comparing R^2's does not provide statistically reliable evidence for comparing equations (1)-(3) (2)-(3) and (2)-(5). In order to formally discriminate between the four competing specifications, they should be evaluated as competing non-nested models and thus Akaike and Schwarz Information Criteria are used along with adjusted R^2.

3. Data sources and Sample selection

The study uses historical accounting data obtained from the COMPUSTAT database over a fourteen-year period from 1988-2004. The companies of the financial sector were deleted due to standard reasons. Moreover, companies that had insufficient accounting data or had issued new share capital or had made stock splits were also excluded. When the annual subsamples are pooled 53276 observations are available for analysis.

The variables' used are: MV = market value of company *i* calculated 6 months after the balance sheet publication date. This is used to ensure that the information in the financial statement are reflected in the Market value. BV = book value of company *i* calculated on an issue basis, using that portion of share capital and reserves (excluding preference capital) minus intangibles attributable to the issue; NI = earnings before extraordinary items; k = cost of equity capital calculated as the geometric mean of the closing values

[2] According to Pesaran and Weeks (1999) two models are non-nested or they belong to "separate families" when none of the individual models may be obtained from the remaining either by imposition of parameter restriction or through a limiting process.

of the one year U.S. Government T-Bill and RI = calculated as Net Income for that year minus the Book Value of the previous year multiplied by the cost of equity capital (NI_t - (k BV_t)). Finally RD measures the Research and Development the RD expenses appearing in the balance sheet statement. According to Barth et al. (1999) defining NI in this way violates the clean surplus assumption of Ohlson (1995). However, it eliminates potentially confounding effects of large one-time items and is consistent with prior research (Dechow et al., 1999). Moreover, following Stark and Thomas (1998) each equation is estimated in a deflated form, using closing book values at time *t-1* as the deflator. The reason is to ameliorate any size-related heteroscedasticity that can be expected in equations (1)-(5). Moreover, the data is used in panel form and for a firm to enter the panel it must satisfy for that year the following conditions:

1. All the required data must be available from Compustat;
2. Book values for the calendar year must exceed $8.8 M and the ratio of MV to BV must not exceed 10. The second criteria is employed to both ensure that firms in or near financial distress are excluded and to “trim” extreme observations. The sample selection criteria results in a panel of 39662 observations. Table 1 shows descriptive statistics on selected variables of the sample.

4. Results

4.1 Principal findings

In this section the outcomes of estimating panel regressions (1)-(5) are presented. Regression standard errors are corrected for heteroskedasticity using White’s consistent covariance matrix. Moreover, in all years and for all models the values of Breusch-Godfrey test-statistic show no evidence of autocorrelation. Table 2 provides details of the estimates of the 4 pool regressions for the years 1988-2004. The results suggest a number of points. First, , the value of the intercept is positive and significant in the first two regressions but negative and insignificant in the latter two. Second, the book value measure exhibits significant ability in explaining market values. Third, the explanatory power of current RI is not encompassed by the information content of BV as in the case of NI. This evidenced by the coefficient of 8.15 as contrasted to the 0.00 coefficient of NI. It appears that the explanatory power of the NI is reduced when RD and/or BV are used to explain the MV. Fourth the addition of RD helps RI and NI in explaining market values. Furthermore the adjusted R^2 is greater for the regression model (5). Overall, by using the adjusted R^2 as measure of the goodness of fit, regression model (5) provides the best fit with a value of 71%

4.2 Tests of model selection

The Akaike Information Criterion is often used in model selection. For non-nested alternatives-smaller values of the AIC are preferred. An alternative to the AIC is the Schwarz-Bayesian Information Criterion (SBIC) which imposes a larger penalty for additional coefficients. The values of the AIC and SBIC are shown in the last columns of Table 2. As can be seen both tests show that Model 4 is the model of choice. A criticism to the use of model selection criteria such as Akaike's is that they are deterministic i.e. the model that satisfies the given criterion is selected. However, some authors point out that this result is just the outcome of a random draw from the sample space, and as such should be treated in probabilistic terms.

5. Summary and implications

The present paper uses panel data for a large sample of U.S. firms to examine whether earnings outperform residual income in equity valuation. Four different variants of the Feltham-Ohlson model that have been used in various research settings are examined employing book values (BV), residual income (RI), earnings (NI), and research and Development expenditures (RD). The ability of each model is examined in a non-nested models framework using two information criteria (the Akaike and Schwarz Bayesian criteria).

The results indicate that on average earnings are unable to outperform residual income as valuation attributes. Moreover, it is shown that RD and BV help RI and NI to accurately capture the future prospects of a firm.

However, what is important is that book values appear to maintain sound information content in all cases. The explanatory power of BV is not encompassed by either current RI and NI. This potentially implies that BV captures future firm prospects omitted by other measures of profitability. This implication gains theoretical support by Beaver (1982) who showed that BV can be expressed as the sum of all future RI discounted at the company's accounting rate of return. Thus, the information content of BV may be thought of as an aggregate of all future RIs that cannot encompassed by the information content of individual periods' RI. However, the question as to what actually causes BV to bear significant explanatory power for market values is an issue that warrants further research.

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Table 1 : Descriptive statistics of selected variables

	MV	NI	NI+RD	RI+RD	RD	BV
Mean	3.53	0.13	0.19	0.11	0.06	1.07
Median	2.14	0.13	0.15	0.07	0.00	1.08
Std. Dev.	117.68	4.87	5.31	4.86	2.42	17.69
Skewness	-51.04	2.86	-12.72	-8.33	-6.43	-77.25
Kurtosis	7046.17	2949.69	3378.34	3708.75	9642.17	8293.90

Notes: The sample consists of 39662 observations of earnings, market capitalisation, book values and residual income observations in levels.

MV= the market value at the end of year t, BV= the book value at the end of year t, NI=earnings before extraordinary items at year t, RD= Research and Development expenditures at year t.

Table 2 : Results of pool regressions of Market Value on Book Value, Net Income and RD

$$Equation1\ \ MV_{it} = b_0 + b_1 NI_{it} + error_{it}.$$
$$Equation2\ \ MV_{it} = b_0 + b_1(NI_{it} + RD_{it}) + b_2 RD_{it} + error_{it}.$$
$$Equation3\ \ MV_{it} = b_0 + b_1(NI_{it} + RD_{it}) + b_2 RD_{it} + b_3 BV_{it} + error_{it}.$$
$$Equation4\ \ MV_{it} = b_0 + b_1(RI_{it} + RD_{it}) + b_2 RD_{it} + b_3 BV_{it} + error_{it}.$$

Model	b_0	t-stat	b_1	t-stat	b_2	t-stat	b_3	t-stat	Ad. R^2	Breusch-Godfrey Serial Correlation test	AIC	SBIC
1	1.69	2.12**	11.69	2.75***					0.24	163.78***	12.002	12.003
2	2.26	2.89***	0.00	1.96**	18.50	2.34***			0.15	0.14	12.217	12.218
3	-2.20	-1.58	0.00	2.44***	10.30	1.48	4.68	4.23***	0.61	0.38	11.429	11.430
4	-2.46	-1.62	8.15	2.82***	5.08	1.19	4.46	3.56***	0.71	0.58	11.135	11.136

Notes: The sample consists of 39662 observations of earnings, market capitalisation, book values and residual income observations in levels. ***, ** and * indicates 1%, 5% and 10% significance level. The Breusch-Godfrey Serial Correlation test has an asymptotic F distribution under the null hypothesis.

MV= the market value at the end of year t, BV= the book value at the end of year t, NI=earnings before extraordinary items at year t, RD= Research and Development expenditures at year t.