

INVESTMENT FINANCE V

LECTURE

"An Empirical Evaluation of Accounting Income Numbers", R Ball & P Brown

The paper tests the null hypothesis that accounting numbers are 'not useful' to sharemarket investors, against the specific alternative hypothesis that they are.

They note that because accounting lacks an all-embracing theoretical framework, dissimilarities in practices have evolved. As a consequence, net income is an aggregate of components which are not homogenous - it is thus alleged to be a 'meaningless' figure.

An empirical evaluation of accounting income numbers requires agreement as to what real-world outcome constitutes an appropriate test of usefulness. Because net income is a number of particular interest to investors, the outcome they use as a predictive criterion is the investment decision as it is reflected in security prices.

Both the content and the timing of existing annual net income numbers will be evaluated since usefulness could be impaired by deficiencies in either.

An observed revision in stock prices associated with the release of the income report would thus provide evidence that the information reflected in income numbers is useful.

They proceed by constructing two alternative models of what the market expects income to be and then investigate the market's reaction when its expectations prove to be false.

Expected and unexpected income changes

Historically, the incomes of firms have tended to move together, Ball and Brown (1967) found that about half of the variability in the level of a firm's earnings per share (EPS) could be associated with economy-wide effects - at least part of the change in a firm's income from one year to the next is to be expected.

The amount of new information conveyed by the present income number can be approximated by the difference between the actual change in income and its conditional expectation.

They estimate by means of OLS coefficients of a regression of the change in firm j 's income ($\Delta I_{j,t-\tau}$) on the change in the average income of all firms (other than j ;) in the market ($\Delta M_{j,t-\tau}$) using data up to the end of the previous year ($\tau=1,2,\dots,t-1$)

$$\Delta I_{j,t-\tau} = \tilde{\alpha}_{1,jt} + \tilde{\alpha}_{2,jt} \Delta M_{j,t-\tau} + \hat{u}_{j,t-\tau}$$

$$\tau = 1, 2, \dots, t-1 \tag{1}$$

The expected income change for firm j in year t is then given by the regression prediction using the change in the average income in year t .

$$\Delta \hat{I}_{jt} = \tilde{\alpha}_{1,jt} + \tilde{\alpha}_{2,jt} \Delta M_{jt}$$

The unexpected income change, or forecast error (\hat{u}_{jt}) is the actual income change minus expected:

$$\hat{u}_{jt} = \Delta I_{jt} - \Delta \hat{I}_{jt} \tag{2}$$

This is the forecast error they assume to be the new information conveyed by the present income number.

The market's reaction

They use a discrete price relative

$$PR_{jm} = \frac{(P_{j,m+1} + d_{jm})}{P_{jm}}$$

The impact of market-wide information on the monthly rate of return from investing one dollar in the stock of firm j ; may be estimated by its predicted value from the linear regression of the monthly price relations of firm j 's common stock on a market index of returns.

$$PR_{jm} - 1 = \tilde{b}_{1j} + \tilde{b}_{2j} L_{m-1} + \hat{v}_{jm} \quad (3)$$

The nature of $[L_{m-1}]$ is an estimate of the market's monthly rate of return.

The residual from the OLS regression represented in equation (3) measures the extent to which the realised return differs from the expected return conditional on the estimated regression parameters (b_{1j} , b_{2j}) and the market index $[L_{m-1}]$. Thus, since the market has been found to adjust quickly and efficiently to new information, the residual must represent the impact of new information, about firm j alone, on the return from holding common stock in firm j .

Sample

Firms included in the study met the following criteria:

1. Earnings data available on the compustat tapes for each of the years 1946-1966.
2. Fiscal year ending December 31.
3. Price data available on the CRSP tapes for at least 100 months.
4. Wall Street Journal announcement dates available.

1957-1985: 261 firms

API_m - the Abnormal Performance Index at month M

$$API_m = \frac{1}{N} \sum_n \prod_{m=-11}^M (1 + V_{nm})$$

See Figure (1)

Top half positive forecast errors; bottom half negative forecast errors.

See Table (5)

Marked association between the size of the error in forecasting income and the API index - as signified by the Chi-Square statistic.

However, most of the information contained in reported income is anticipated by the market before the annual report is released.

The results demonstrate that the information contained in the annual income number is useful in that it is related to stock prices.

They conclude that all of the information about an individual firm which becomes available during a year, one half or more is captured in that year's income number. Its content is therefore considerable. However, the annual report does not rate highly as a

timely medium, since most of its content (85-90%) is captured by more prompt media which perhaps include interim reports.

Why did the paper have such an impact? - P Brown's view.

1. It was cast in the mould of a traditional equipment: question, hypothesis, data collection, hypothesis testing, conclusion.
2. It expressed a view that ran counter to the critics of accounting - i.e., it rejected the null hypothesis in a convincing way.
3. It emphasised the use of data to test a belief.
4. It reflected the then thinking in finance - EMH the maintained hypothesis.
5. It documented an association between profits and prices that has proven to be robust over time and markets.
6. It introduced a focus on income expectations and an announcement which revised those expectations.
7. It developed an approach to measuring the shareholder wealth effects of information of various types.

M J Brennan, " A perspective on Accounting and Stock Prices", *The Accounting Review* (Jan 1991)

Common sense tells us that accounting information is relevant for valuing stocks. Financial analysts pay large sums for such information, analyse it - and make forecasts about future accounting earnings in justifying their buy and sell recommendations.

Major earnings surprises are accompanied by significant changes in stock prices.

The scientific study of the relation between stock prices and accounting information commences with the classic paper by Ball and Brown (1968)

The research which has flowed from this early article can be summarised under two headings.

1. Market reaction

The impact of new information - primarily accounting information, on market prices trading volume, analysts' forecasts, and other capital market phenomena.

2. Valuation studies

The research relating share prices to currently available accounting information.

The difference between the two types of studies is not completely clear-cut.

The former type generally focuses on the relation between new accounting information and short-term changes in stock prices. Valuation studies on the other hand are on the face of it concerned with the relation between the level of stock prices and accounting variables, generally earnings. To mitigate problems arising from omitted variables,

valuation studies frequently use first differences and also consider the relation between changes in stock prices and changes in earnings.

The market reaction studies tend to analyse security returns and much shorter time intervals.

Brennan divides his paper into three sections:

1. discusses studies that relate the market reaction to the announcement of new accounting information.
2. discusses studies that deal with the role of accounting numbers in valuation.
3. Is a discussion of some models that have yet to be empirically implemented in which accounting earnings are important for valuation.

(1) Market reactions to new accounting information

Under the EMH, a natural metric for assessing the information content of accounting earnings announcement is the fraction of the annual variance of stock returns that is associated with these announcements.

Beaver (1968) found that the variance of residual returns was about 67% above normal in the week of the annual earnings announcement.

However, in aggregate, it seems likely that earnings announcements could account for more than about 5-6% of the annual residual variance. This is consistent with Ball and Brown's (1968) result.

Brennan comments that the EMH assumption that stock prices change only because of the arrival of new information is becoming more difficult to sustain. Roll's (1988) R^2 paper shows that there is considerable variance in daily returns that cannot plausibly be attributed to the arrival of new (public) information. His results suggest that new, firm-specific information accounts on average for an increase in the daily variance of only about 12%.

The implied background noise in security returns, which is not related to news, is consistent with the rational expectations models of Grundy and Nicholls (1989) and Wang (1989), which allow for both informed and uninformed rational traders and noise traders.

Suggests that the most serious challenge to financial theorists posed by recent work on market reactions to earnings announcements is the evidence of Ou and Penman (1989) that the market underutilises information that is useful in predicting future earnings and the finding by Bernard and Thomas (1989)(1990) that market reactions to the current quarter's earnings can be predicted on the basis of information contained in the previous quarter's announcement, and that this phenomenon can be explained by a model in which the market uses a naive model of the stochastic process for earnings.

Brennan asks: is it possible that modest anomalies can persist unnoticed until brought to light by the high resolution power of the computer operating on a large data base?

Evidence that B/S model appeared to work better after it was commonly adopted by traders.

Stock prices and valuation

There is a long history of the use of accounting data to explain the relative stock prices of different firms or to estimate the cost of capital for firms in a given industry by cross-

section regression of stock prices on measures of earnings and growth. These efforts were largely abandoned in the 1970s because it was found that the regression coefficients were unstable and that deviations from the regression line represented not mispricing, but rather model specification and omitted variables.

The finance profession has tended to move away from trying to relate stock prices to more fundamental variables.

In 1987, Ross suggested that the method adapted in finance is the use of close substitutes to price financial assets and contracts. APT would be an example of this.

The other move back to using fundamentals is the work triggered by Shiller which attempts to relate asset prices back to fundamentals, in his development of variance bounds tests.

The task of relating prices to fundamentals has mainly been the province of the accounting researchers.

The underlying valuation model in the literature which relates stock prices to accounting earnings information is Miller and Modigliani (1961). They demonstrated that the value of the firm's equity can be expressed either as the present value of the expected future dividend stream to the current shareholders or as the sum of the capitalised earnings and the present value of future investment opportunities.

The two approaches are equivalent because of the dividend irrelevance proposition that follows from the firm's sources and uses of funds constraint.

Most accounting researchers have treated accounting earnings as a proxy for the MM earnings concept.

This is not likely to be the case since MM assume that earnings on existing assets follow a uniform perpetual stream - their assumption in conditions of uncertainty - if earnings follow a martingale process - requires that the expected change in earnings (excluding the effects of future investments) is zero.

Even if the above is the case, the simple capitalisation of current earnings omits the value of future investment opportunities - to avoid this problem, researchers have tended to follow the example of Ball and Brown (1968) and focus on the relationship between changes in stock prices and contemporaneous (unexpected) changes in earnings.

The implicit assumption in first differencing is that, while levels of the variables missing from the price-earnings relation are correlated with earnings, innovations in these variables are not correlated.

This, suggests Brennan, is a heroic assumption in a model with only a single variable included.

The early studies that followed Ball and Brown, using regression techniques, found that the elasticity of stock prices with respect to the unexpected component of annual earnings changes was only about 0.2 instead of about unity as a naive model (based on a martingale model of earnings and cash flow) would imply.

Only recently has attention turned to the determinants of earnings response coefficients. Brennan argues that the low value of the regression coefficient and the small fraction of variance explained by these cross-sections can be expected, even if earnings are an important factor in valuation.

The definition of earnings used in the studies would be of importance, suggests Brennan. There are four definitions of earnings on the Compustat tape.

Therefore, primary and fully diluted earnings from continuing operations, before and after extraordinary items.

Brennan points out that even earnings before extraordinary items include several items that are of a one-time or exceptional nature, such as losses due to restructuring of operations, asset write-downs and asset sales. Table 1 reveals that in a given year, some 2--30% of firms report losses due to these one-time events.

Table 1

Number of Companies out of 600 Disclosing Various Losses that Affect Income from Continuing Operations

Restructuring of Operations	74	81	133	103
Foreign Currency Transactions	96	78	96	114
Write-down of Assets	43	30	58	49
Sale of Assets	25	28	27	29
Litigation Settlements	17	11	11	17
Total	255	228	325	312

Source: *Accounting Trends and Techniques* (1990)

¹ Includes companies that report more than one type of loss.

It seems likely that most write-downs contain information which is useful for forecasting future earnings - to the extent that write-downs reflect on acceleration of future depreciation expense one might expect them to be associated with increases in future earnings - yet the martingale model seems to imply the reverse.

In regressing abnormal stock returns on (unexpected) earnings changes, it is necessary to deflate the RHS variable to make the equation dimensionally consistent. The two popular choices are the current (or expected) level of earnings, and the current stock price. The former deflates the current level of earnings, whereas the latter embodies the weaker assumption that the stock price is linear in current earnings.

The proportionality assumption is certainly problematic, since it implies that stock prices will be negative if earnings are - inappropriate when there is limited liability.

The linearity assumption suffers from the similar problem of implying negative stock prices.

Thus a weakness of the literature is the lack of an adequate theoretical framework for relating stock prices to accounting earnings.

Alternative approaches

In order to have a valuation model in which accounting earnings play a role, it is necessary to consider the balance sheet as well as the income statement.

A simple model along these lines assumes

1. X_t the return on equity follows a simple mean reverting process

$$dx = a(m-x)dt + sdz$$

where dz is the increment to a Gauss Wiener process

m is the long-run mean return on equity

a is the speed of adjustment

t is calendar time

The motivation for this assumption is that unusually high or low earnings in relation to equity values are unlikely to persist.

2. The total dividend payout is a function of the book value of the equity B and the return on equity $D(X,B)$

$$D(X,B) = p(X)B$$

where $p(x)$ is the payout ratio.

3. The rate of change in book equity is equal to the difference between the current earnings rate XB and the payout rate $p(x)B$

$$dB = (X - p(X))Bdt$$

It can then be shown that the market value of the firm's equity can be written as the product of the book value of the equity and a market: to book ratio that depends on the return on the equity

$$E(X,B) = v(u)B$$

The market to book ratio $V(u)$ is a non-negative increasing function of the return on equity that depends on the precise terms on which the equity holders can declare bankruptcy. In this simple model, accounting earnings do not follow a martingale so that accounting earnings is not synonymous with economic earnings and the stock price is not a linear function of earnings. Yet accounting earnings, together with the current book value, are sufficient statistics for the value of the shares.

On the usefulness of Earnings and Earnings Research: lessons and directions from two decades of empirical research", B Lev, *Journal of Accounting Research* (1989)

Assessing the usefulness of earnings to investors was the motivation of the Ball and Brown (1967) and Beaver (1968) studies.

It has since become evident that the costs of producing and disseminating information are difficult to estimate. Issues of social usefulness are largely intractable.

Earnings - the bottom line - are widely believed to be the premier information item provided in financial statements.

Lev suggests:

- a) the correlation between earnings and stock returns is very low - sometimes negligible.
- b) theoretical and methodological refinements aimed at improving the specifications of the returns/earnings relation have yielded modest results in furthering our understanding of how and to what extent earnings are used by investors.

