An Empirical Evaluation of Accounting Income Numbers

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Accounting theorists have generally evaluated the usefulness of accounting practices by the extent of their agreement with a particular analytic model. The model may consist of only a few assertions or it may be a rigorously developed argument. In each case, the method of evaluation has been to compare existing practices with the more preferable practices implied by the model or with some standard which the model implies all practices should possess. The shortcoming of this method is that it ignores a significant source of knowledge of the world, namely, the extent to which the predictions of the model conform to observed behavior.

It is not enough to defend an analytical inquiry on the basis that its assumptions are empirically supportable, for how is one to know that a theory embraces all of the relevant supportable assumptions? And how does one explain the predictive powers of propositions which are based on unverifiable assumptions such as the maximization of utility functions? Further, how is one to resolve differences between propositions which arise from considering different aspects of the world?

The limitations of a completely analytical approach to usefulness are illustrated by the argument that income numbers cannot be defined substantively, that they lack "meaning" and are therefore of doubtful utility.[1] The argument stems in part from the patchwork development of account-

[1] Versions of this particular argument appear in Canning (1929); Gilman (1939); Paton and Littleton (1940); Vatter (1947), Ch. 2; Edwards and Bell (1961), Ch. 1; Chambers (1964), pp. 267–68; Chambers (1966), pp. 4 and 102; Lim (1966), esp. pp. 645 and 649; Chambers (1967), pp. 745–55; Ijiri (1967), Ch. 6, esp. pp. 120–31; and Sterling (1967), p. 65.

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ing practices to meet new situations as they arise. Accountants have had to deal with consolidations, leases, mergers, research and development, price-level changes, and taxation charges, to name just a few problem areas. 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 homogeneous. It is thus alleged to be a "meaningless" figure, not unlike the difference between twenty-seven tables and eight chairs. Under this view, net income can be defined only as the result of the application of a set of procedures $\{X_1, X_2, \cdots\}$ to a set of events $\{Y_1, Y_2, \cdots\}$ with no other definitive substantive meaning at all. Canning observes:

> What is set out as a measure of net income can never be supposed to be a fact in any sense at all except that it is the figure that results when the accountant has finished applying the procedures which he adopts.[2]

The value of analytical attempts to develop measurements capable of definitive interpretation is not at issue. What is at issue is the fact that an analytical model does not itself assess the significance of departures from its implied measurements. Hence it is dangerous to conclude, in the absence of further empirical testing, that a lack of substantive meaning implies a lack of utility.

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 we use as a predictive criterion is the investment decision as it is reflected in security prices.[3] 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 Empirical Test

Recent developments in capital theory provide justification for selecting the behavior of security prices as an operational test of usefulness. An impressive body of theory supports the proposition that capital markets are both efficient and unbiased in that if information is useful in forming capital asset prices, then the market will adjust asset prices to that information quickly and without leaving any opportunity for further abnormal gain.[4] If, as the evidence indicates, security prices do in fact adjust rapidly to new information as it becomes available, then changes in security prices will re-

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[2] Canning (1929), p. 98.

[3] Another approach pursued by Beaver (1968) is to use the investment decision, as it is reflected in transactions volume, for a predictive criterion.

[4] For example, Samuelson (1965) demonstrated that a market without bias in its evaluation of information will give rise to randomly fluctuating time series of prices. See also Cootner (ed.) (1964); Fama (1965); Fama and Blume (1966); Fama, *et al.* (1967); and Jensen (1968).

flect the flow of information to the market.[5] An observed revision of stock prices associated with the release of the income report would thus provide evidence that the information reflected in income numbers is useful.

Our method of relating accounting income to stock prices builds on this theory and evidence by focusing on the information which is unique to a particular firm.[6] Specifically, we construct two alternative models of what the market expects income to be and then investigate the market's reactions when its expectations prove false.

EXPECTED AND UNEXPECTED INCOME CHANGES

Historically, the incomes of firms have tended to move together. One study found that about half of the variability in the level of an average firm's earnings per share (EPS) could be associated with economy-wide effects.[7] In light of this evidence, at least part of the change in a firm's income from one year to the next is to be expected. If, in prior years, the income of a firm has been related to the incomes of other firms in a particular way, then knowledge of that past relation, together with a knowledge of the incomes of those other firms for the present year, yields a conditional expectation for the present income of the firm. Thus, apart from confirmation effects, 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.

But not all of this difference is necessarily new information. Some changes in income result from financing and other policy decisions made by the firm. We assume that, to a first approximation, such changes are reflected in the average change in income through time.

Since the impacts of these two components of change—economy-wide and policy effects—are felt simultaneously, the relationship must be estimated jointly. The statistical specification we adopt is first to estimate, by Ordinary Least Squares (OLS), the coefficients (a_{1jt}, a_{2jt}) from the linear 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 firm j) in the market $(\Delta M_{j,t-\tau})$[8] using data up to the end of the previous year $(\tau = 1, 2, \cdots, t-1)$:

$$\Delta I_{j,t-\tau} = \hat{a}_{1jt} + \hat{a}_{2jt}\Delta M_{j,t-\tau} + \hat{u}_{j,t-\tau} \qquad \tau = 1, 2, \cdots, t-1, \qquad (1)$$

[5] One well documented characteristic of the security market is that useful sources of information are acted upon and useless sources are ignored. This is hardly surprising since the market consists of a large number of competing actors who can gain from acting upon better interpretations of the future than those of their rivals. See, for example, Scholes (1967); and footnote 4 above. This evaluation of the security market differs sharply from that of Chambers (1966, pp. 272–73).

[6] More precisely, we focus on information not common to all firms, since some industry effects are not considered in this paper.

[7] Alternatively, 35 to 40 per cent could be associated with effects common to all firms when income was defined as tax-adjusted Return on Capital Employed. [Source: Ball and Brown (1967), Table 4.]

[8] We call M a "market index" of income because it is constructed only from firms traded on the New York Stock Exchange.

where the hats denote estimates. The expected income change for firm j in year t is then given by the regression prediction using the change in the average income for the market in year t:

$$\Delta \hat{I}_{jt} = \hat{a}_{1jt} + \hat{a}_{2jt} \Delta M_{jt} .$$

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

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

It is this forecast error which we assume to be the new information conveyed by the present income number.

THE MARKET'S REACTION

It has also been demonstrated that stock prices, and therefore rates of return from holding stocks, tend to move together. In one study,[9] it was estimated that about 30 to 40 per cent of the variability in a stock's monthly rate of return over the period March, 1944 through December, 1960 could be associated with market-wide effects. Market-wide variations in stock returns are triggered by the release of information which concerns all firms. Since we are evaluating the income report as it relates to the individual firm, its contents and timing should be assessed relative to changes in the rate of return on the firm's stocks net of market-wide effects.

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 relatives of firm j's common stock[10] on a market index of returns:[11]

[9] King (1966).

[10] The monthly price relative of security j for month m is defined as dividends (d_{jm}) + closing price $(p_{j,m+1})$, divided by opening price (p_{jm}):

$$PR_{jm} = (p_{j,m+1} + d_{jm})/p_{jm} .$$

A monthly price relative is thus equal to the discrete monthly rate of return plus unity; its natural logarithm is the monthly rate of return compounded continuously. In this paper, we assume discrete compounding since the results are easier to interpret in that form.

[11] Fama, et al. (1967) conclude that "regressions of security on market returns over time are a satisfactory method for abstracting from the effects of general market conditions on the monthly rates of return on individual securities." In arriving at their conclusion, they found that "scatter diagrams for the [returns on] individual securities [vis-à-vis the market return] support very well the regression assumptions of linearity, homoscedasticity, and serial independence." Fama, et al. studied the natural logarithmic transforms of the price relatives, as did King (1966). However, Blume (1968) worked with equation (3). We also performed tests on the alternative specification:

$$\ln_e (PR_{jm}) = b'_{1j} + b'_{2j}\ln_e (L_m) + v'_{jm} , \tag{3a}$$

where $\ln_e$ denotes the natural logarithmic function. The results correspond closely with those reported below.

$$[PR_{jm} - 1] = \hat{b}_{1j} + \hat{b}_{2j}[L_m - 1] + \hat{v}_{jm} , \qquad (3)$$

where PR_{jm} is the monthly price relative for firm j and month m, L is the link relative of Fisher's "Combination Investment Performance Index" [Fisher (1966)], and v_{jm} is the stock return residual for firm j in month m. The value of $[L_m - 1]$ is an estimate of the market's monthly rate of return. The m-subscript in our sample assumes values for all months since January, 1946 for which data are available.

The residual from the OLS regression represented in equation (3) measures the extent to which the realized return differs from the expected return conditional upon 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.

SOME ECONOMETRIC ISSUES

One assumption of the OLS income regression model[12] is that M_j and u_j are uncorrelated. Correlation between them can take at least two forms, namely the inclusion of firm j in the market index of income (M_j), and the presence of industry effects. The first has been eliminated by construction (denoted by the j-subscript on M), but no adjustment has been made for the presence of industry effects. It has been estimated that industry effects probably account for only about 10 per cent of the variability in the level of a firm's income.[13] For this reason equation (1) has been adopted as the appropriate specification in the belief that any bias in the estimates a_{1jt} and a_{2jt} will not be significant. However, as a check on the statistical efficiency of the model, we also present results for an alternative, naive model which predicts that income will be the same for this year as for last. Its forecast error is simply the change in income since the previous year.

As is the case with the income regression model, the stock return model, as presented, contains several obvious violations of the assumptions of the OLS regression model. First, the market index of returns is correlated with the residual because the market index contains the return on firm j, and because of industry effects. Neither violation is serious, because Fisher's index is calculated over all stocks listed on the New York Stock Exchange (hence the return on security j is only a small part of the index), and because industry effects account for at most 10 per cent of the variability in the rate

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[12] That is, an assumption necessary for OLS to be the minimum-variance, linear, unbiased estimator.

[13] The magnitude assigned to industry effects depends upon how broadly an industry is defined, which in turn depends upon the particular empirical application being considered. The estimate of 10 per cent is based on a two-digit classification scheme. There is some evidence that industry effects might account for more than 10 per cent when the association is estimated in first differences [Brealey (1968)].

of return on the average stock.[14] A second violation results from our prediction that, for certain months around the report dates, the expected values of the v_j's are nonzero. Again, any bias should have little effect on the results, inasmuch as there is a low, observed autocorrelation in the ϑ_j's,[15] and in no case was the stock return regression fitted over less than 100 observations.[16]

SUMMARY

We assume that in the unlikely absence of useful information about a particular firm over a period, its rate of return over that period would reflect only the presence of market-wide information which pertains to all firms. By abstracting from market effects [equation (3)] we identify the effect of information pertaining to individual firms. Then, to determine if part of this effect can be associated with information contained in the firm's accounting income number, we segregate the expected and unexpected elements of income change. If the income forecast error is negative (that is, if the actual change in income is less than its conditional expectation), we define it as bad news and predict that if there is some association between accounting income numbers and stock prices, then release of the income number would result in the return on that firm's securities being less than

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[14] The estimate of 10 per cent is due to King (1966). Blume (1968) has recently questioned the magnitude of industry effects, suggesting that they could be somewhat less than 10 per cent. His contention is based on the observation that the significance attached to industry effects depends on the assumptions made about the parameters of the distributions underlying stock rates of return.

[15] See Table 4, below.

[16] Fama, et al. (1967) faced a similar situation. The expected values of the stock return residuals were nonzero for some of the months in their study. Stock return regressions were calculated separately for both exclusion and inclusion of the months for which the stock return residuals were thought to be nonzero. They report that both sets of results support the same conclusions.

An alternative to constraining the mean v_j to be zero is to employ the Sharpe Capital Asset Pricing Model [Sharpe (1964)] to estimate (3b):

$$PR_{jm} - RF_m - 1 = b'_{1j} + b'_{2j} [L_m - RF_m - 1] + v'_{jm}, \qquad (3b)$$

where RF is the risk-free ex ante rate of return for holding period m. Results from estimating (3b) (using U.S. Government Bills to measure RF and defining the abnormal return for firm j in month m now as $b'_{1j} + v'_{jm}$) are essentially the same as the results from (3).

Equation (3b) is still not entirely satisfactory, however, since the mean impact of new information is estimated over the whole history of the stock, which covers at least 100 months. If (3b) were fitted using monthly data, a vector of dummy variables could be introduced to identify the fiscal year covered by the annual report, thus permitting the mean residual to vary between fiscal years. The impact of unusual information received in month m of year t would then be estimated by the sum of the constant, the dummy for year t, and the calculated residual for month m and year t. Unfortunately, the efficiency of estimating the stock return equation in this particular form has not been investigated satisfactorily, hence our report will be confined to the results from estimating (3).

TABLE 1

Deciles of the Distributions of Squared Coefficients of Correlation, Changes in Firm and Market Income*

Variable	Decile								
	.1	.2	.3	.4	.5	.6	.7	.8	.9
(1) Net income........	.03	.07	.10	.15	.23	.30	.35	.43	.52
(2) EPS.............	.02	.05	.11	.16	.23	.28	.35	.42	.52

* Estimated over the 21 years, 1946–1966.

would otherwise have been expected.[17] Such a result $(\hat{a} < 0)$ would be evidenced by negative behavior in the stock return residuals $(\hat{v} < 0)$ around the annual report announcement date. The converse should hold for a positive forecast error.

Two basic income expectations models have been defined, a regression model and a naive model. We report in detail on two measures of income [net income and EPS, variables (1) and (2)] for the regression model, and one measure [EPS, variable (3)] for the naive model.

Data

Three classes of data are of interest: the contents of income reports; the dates of the report announcements; and the movements of security prices around the announcement dates.

INCOME NUMBERS

Income numbers for 1946 through 1966 were obtained from Standard and Poor's *Compustat* tapes.[18] The distributions of the squared coefficients of correlation[19] between the changes in the incomes of the individual firms and the changes in the market's income index[20] are summarized in Table 1. For the present sample, about one-fourth of the variability in the changes

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[17] We later divide the total return into two parts: a "normal return," defined by the return which would have been expected given the normal relationship between a stock and the market index; and an "abnormal return," the difference between the actual return and the normal return. Formally, the two parts are given by: b_{1j} + $b_{2j}[L_m - 1]$; and v_{jm} .

[18] Tapes used are dated 9/28/1965 and 7/07/1967.

[19] All correlation coefficients in this paper are product-moment correlation coefficients.

[20] The market net income index was computed as the sample mean for each year. The market EPS index was computed as a weighted average over the sample members, the number of stocks outstanding (adjusted for stock splits and stock dividends) providing the weights. Note that when estimating the association between the income of a particular firm and the market, the income of that firm was excluded from the market index.

TABLE 2

Deciles of the Distributions of the Coefficients of First-Order Autocorrelation in the Income Regression Residuals*

Variable	Decile								
	.1	.2	.3	.4	.5	.6	.7	.8	.9
(1) Net income...	−.35	−.28	−.20	−.12	−.05	.02	.12	.20	.33
(2) EPS..........	−.39	−.29	−.21	−.15	−.08	−.03	.07	.17	.35

* Estimated over the 21 years, 1946–1966.

in the median firm's income can be associated with changes in the market index.

The association between the levels of the earnings of firms was examined in the forerunner article [Ball and Brown (1967)]. At that time, we referred to the existence of autocorrelation in the disturbances when the levels of net income and EPS were regressed on the appropriate indexes. In this paper, the specification has been changed from levels to first differences because our method of analyzing the stock market's reaction to income numbers presupposes the income forecast errors to be unpredictable at a minimum of 12 months prior to the announcement dates. This supposition is inappropriate when the errors are autocorrelated.

We tested the extent of autocorrelation in the residuals from the income regression model after the variables had been changed from levels to first differences. The results are presented in Table 2. They indicate that the supposition is not now unwarranted.

ANNUAL REPORT ANNOUNCEMENT DATES

The *Wall Street Journal* publishes three kinds of annual report announcements: forecasts of the year's income, as made, for example, by corporation executives shortly after the year end; preliminary reports; and the complete annual report. While forecasts are often imprecise, the preliminary report is typically a condensed preview of the annual report. Because the preliminary report usually contains the same numbers for net income and EPS as are given later with the final report, the announcement date (or, effectively, the date on which the annual income number became generally available) was assumed to be the date on which the preliminary report appeared in the *Wall Street Journal*. Table 3 reveals that the time lag between the end of the fiscal year and the release of the annual report has been declining steadily throughout the sample period.

STOCK PRICES

Stock price relatives were obtained from the tapes constructed by the Center for Research in Security Prices (CRSP) at the University of Chi-

TABLE 3

Time Distribution of Announcement Dates

Per cent of firms	Fiscal year								
	1957	1958	1959	1960	1961	1962	1963	1964	1965
25	2/07[a]	2/04	2/04	2/03	2/02	2/05	2/03	2/01	1/31
50	2/25	2/20	2/18	2/17	2/15	2/15	2/13	2/09	2/08
75	3/10	3/06	3/04	3/03	3/05	3/04	2/28	2/25	2/21

[a] Indicates that 25 per cent of the income reports for the fiscal year ended 12/31/1957 had been announced by 2/07/1958.

TABLE 4

Deciles of the Distributions of the Squared Coefficient of Correlation for the Stock Return Regression, and of the Coefficient of First-Order Autocorrelation in the Stock Return Residuals*

Coefficient name	Decile								
	.1	.2	.3	.4	.5	.6	.7	.8	.9
Return regression r^2...	.18	.22	.25	.28	.31	.34	.37	.40	.46
Residual autocorrelation..	−.17	−.14	−.11	−.10	−.08	−.05	−.03	−.01	.03

* Estimated over the 246 months, January, 1946 through June, 1966.

cago.[21] The data used are monthly closing prices on the New York Stock Exchange, adjusted for dividends and capital changes, for the period January, 1946 through June, 1966. Table 4 presents the deciles of the distributions of the squared coefficient of correlation for the stock return regression [equation (3)], and of the coefficient of first-order autocorrelation in the stock residuals.

INCLUSION CRITERIA

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; and
4. *Wall Street Journal* announcement dates available.[22]

Our analysis was limited to the nine fiscal years 1957–1965. By beginning the analysis with 1957, we were assured of at least 10 observations when

[21] The Center for Research in Security Prices at the University of Chicago is sponsored by Merrill Lynch, Pierce, Fenner and Smith Incorporated.

[22] Announcement dates were taken initially from the *Wall Street Journal Index*, then verified against the *Wall Street Journal*.

estimating the income regression equations. The upper limit (the fiscal year 1965, the results of which are announced in 1966) is imposed because the CRSP file terminated in June, 1966.

Our selection criteria may reduce the generality of the results. The sub-population does not include young firms, those which have failed, those which do not report on December 31, and those which are not represented on *Compustat*, the CRSP tapes, and the *Wall Street Journal*. As a result, it may not be representative of all firms. However, note that (1) the 261 remaining firms[23] are significant in their own right, and (2) a replication of our study on a different sample produced results which conform closely to those reported below.[24]

Results

Define month 0 as the month of the annual report announcement, and API_M, the Abnormal Performance Index at month M, as:

$$API_M = \frac{1}{N} \sum_{n}^{N} \prod_{m=-11}^{M} (1 + v_{nm}).$$

Then API traces out the value of one dollar invested (in equal amounts) in all securities n ($n = 1, 2, \cdots, N$) at the end of month -12 (that is, 12 months prior to the month of the annual report) and held to the end of some arbitrary holding period ($M = -11, -10, \cdots, T$) after abstracting from market affects. An equivalent interpretation is as follows. Suppose two individuals A and B agree on the following proposition. B is to construct a portfolio consisting of one dollar invested in equal amounts in N securities. The securities are to be purchased at the end of month -12 and held until the end of month T. For some price, B contracts with A to take (or make up), at the end of each month M, only the normal gains (or losses) and to return to A, at the end of month T, one dollar plus or minus any abnormal gains or losses. Then API_M is the value of A's equity in the mutual portfolio at the end of each month M.[25]

Numerical results are presented in two forms. Figure 1 plots API_M first for three portfolios constructed from all firms and years in which the income forecast errors, according to each of the three variables, were positive (the top half); second, for three portfolios of firms and years in which the income forecast errors were negative (the bottom half); and third, for a single portfolio consisting of all firms and years in the sample (the line which wanders just below the line dividing the two halves). Table 5 includes the numbers on which Figure 1 is based.

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[23] Due to known errors in the data, not all firms could be included in all years. The fiscal year most affected was 1964, when three firms were excluded.

[24] The replication investigated 75 firms with fiscal years ending on dates other than December 31, using the naive income-forecasting model, over the longer period 1947–65.

[25] That is, the value expected at the end of month T in the absence of further abnormal gains and losses.
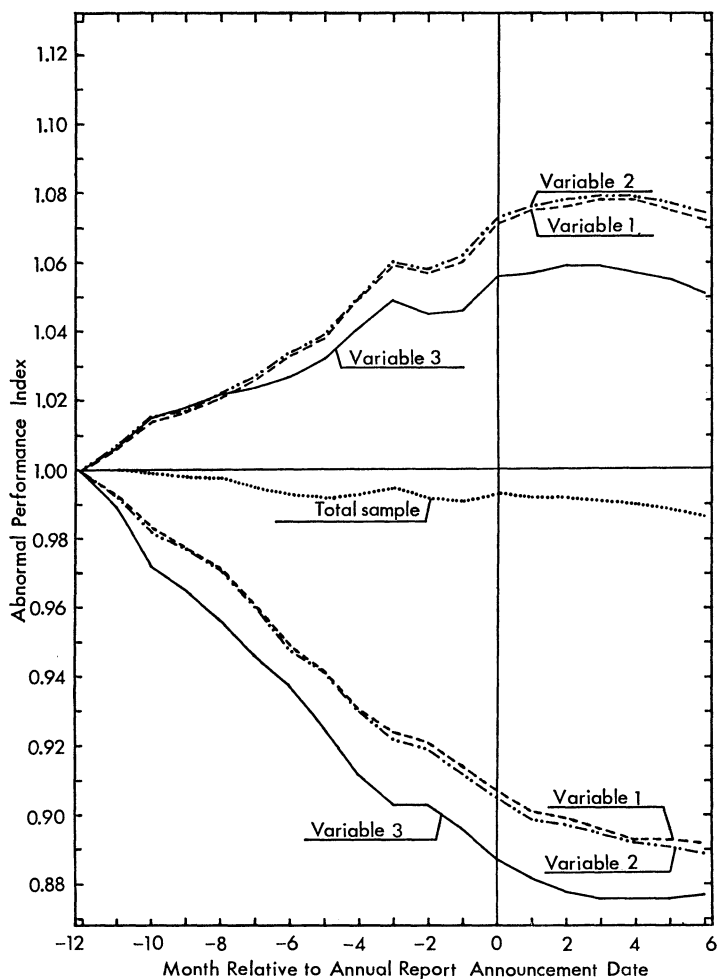
FIG. 1 Abnormal Performance Indexes for Various Portfolios

Since the first set of results may be sensitive to the distributions of the stock return disturbances,[26] a second set of results is presented. The third column under each variable heading in Table 5 gives the chi-square statistic for a two-by-two classification of firms by the sign of the income forecast error, and the sign of the stock return residual for that month.

OVERVIEW

As one would expect from a large sample, both sets of results convey essentially the same picture. They demonstrate that the information contained in the annual income number is useful in that if actual income differs

[26] The empirical distributions of the stock return residuals appear to be described well by symmetric, stable distributions that are characterized by tails longer than those of the normal distribution [Fama (1965); Fama, et al. (1967)].

TABLE 5

Summary Statistics by Month Relative to Annual Report Announcement Date

Month rela-tive to annual report an-nouncement date	Regression model						Naive model			Total sample
	Net income			EPS			EPS			
	(1)[a]	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	
−11	1.006	.992	16.5	1.007	.992	20.4	1.006	.989	24.1	1.000
−10	1.014	.983	17.3	1.015	.982	20.2	1.015	.972	73.4	.999
−9	1.017	.977	7.9	1.017	.977	3.7	1.018	.965	20.4	.998
−8	1.021	.971	9.5	1.022	.971	12.0	1.022	.956	9.1	.998
−7	1.026	.960	21.8	1.027	.960	27.1	1.024	.946	9.0	.995
−6	1.033	.949	42.9	1.034	.948	37.6	1.027	.937	19.4	.993
−5	1.038	.941	17.9	1.039	.941	21.3	1.032	.925	21.0	.992
−4	1.050	.930	40.0	1.050	.930	39.5	1.041	.912	41.5	.993
−3	1.059	.924	35.3	1.060	.922	33.9	1.049	.903	37.2	.995
−2	1.057	.921	1.4	1.058	.919	1.8	1.045	.903	0.1	.992
−1	1.060	.914	8.2	1.062	.912	8.2	1.046	.896	5.7	.991
0	1.071	.907	28.0	1.073	.905	28.9	1.056	.887	35.8	.993
1	1.075	.901	6.4	1.076	.899	5.5	1.057	.882	9.4	.992
2	1.076	.899	2.7	1.078	.897	1.9	1.059	.878	8.1	.992
3	1.078	.896	0.6	1.079	.895	1.2	1.059	.876	0.1	.991
4	1.078	.893	0.1	1.079	.892	0.1	1.057	.876	1.2	.990
5	1.075	.893	0.7	1.077	.891	0.1	1.055	.876	0.6	.989
6	1.072	.892	0.0	1.074	.889	0.2	1.051	.877	0.1	.987

[a] Column headings:

(1) Abnormal Performance Index—firms and years in which the income forecast error was positive.

(2) Abnormal Performance Index—firms and years in which the income forecast error was negative.

(3) Chi-square statistic for two-by-two classification by sign of income forecast error (for the fiscal year) and sign of stock return residual (for the indicated month).

Note: Probability (chi-square $\geq$ 3.84 | $\chi^2 = 0$) = .05, for 1 degree of freedom.
Probability (chi-square $\geq$ 6.64 | $\chi^2 = 0$) = .01, for 1 degree of freedom.

from expected income, the market typically has reacted in the same direction. This contention is supported both by Figure 1 which reveals a marked, positive association between the sign of the error in forecasting income and the Abnormal Performance Index, and by the chi-square statistic (Table 5). The latter shows it is most unlikely that there is no relationship between the sign of the income forecast error and the sign of the rate of return residual in most of the months up to that of the annual report announcement.

However, most of the information contained in reported income is anticipated by the market before the annual report is released. In fact, anticipation is so accurate that the actual income number does not appear to cause any unusual jumps in the Abnormal Performance Index in the announcement month. To illustrate, the drifts upward and downward begin at least 12 months before the report is released (when the portfolios are first

TABLE 6
Contingency Table of the Signs of the Income Forecast Errors—by Variable

Sign of income forecast error	Sign of income forecast error					
	Variable (1)		Variable (2)		Variable (3)	
	+	−	+	−	+	−
Variable (1)						
+	1231	—	1148	83	1074	157
−	—	1109	83	1026	399	710
Variable (2)						
+	1148	83	1231	—	1074	157
−	83	1026	—	1109	399	710
Variable (3)						
+	1074	399	1074	399	1473	—
−	157	710	157	710	—	867

constructed) and continue for approximately one month after. The persistence of the drifts, as indicated by the constant signs of the indexes and by their almost monotonic increases in absolute value (Figure 1), suggests not only that the market begins to anticipate forecast errors early in the 12 months preceding the report, but also that it continues to do so with increasing success throughout the year.[27]

SPECIFIC RESULTS

1. There appears to be little difference between the results for the two regression model variables. Table 6, which classifies the sign of one variable's forecast error contingent upon the signs of the errors of the other two variables, reveals the reason. For example, on the 1231 occasions on which the income forecast error was positive for variable (1), it was also positive on 1148 occasions (out of a possible 1231) for variable (2). Similarly, on the 1109 occasions on which the income forecast error was negative for variable (1), it was also negative on 1026 occasions for variable (2). The fact that the results for variable (2) strictly dominate those for variable (1) suggests, however, that when the two variables disagreed on the sign of an income forecast error, variable (2) was more often correct.

While there is little to choose between variables (1) and (2), variable (3) (the naive model) is clearly best for the portfolio made up of firms with negative forecast errors. A contributing factor is the following. The naive model gives the same forecast error as the regression model would give if

[27] Note that Figure 1 contains averages over many firms and years and is not indicative of the behavior of the securities of any particular firm in any one year. While there may be, on average, a persistent and gradual anticipation of the contents of the report throughout the year, evidence on the extent of autocorrelation in the stock return residuals would suggest that the market's reaction to information about a particular firm tends to occur rapidly.

(a) the change in market income were zero, and (b) there were no drift in the income of the firm. But historically there has been an increase in the market's income, particularly during the latter part of the sample period, due to general increase in prices and the strong influence of the protracted expansion since 1961. Thus, the naive model [variable (3)] typically identifies as firms with negative forecast errors those relatively few firms which showed a decrease in EPS when most firms showed an increase. Of the three variables, one would be most confident that the incomes of those which showed negative forecast errors for variable (3) have in fact lost ground relative to the market.

This observation has interesting implications. For example, it points to a relationship between the magnitudes of the income forecast errors and the magnitudes of the abnormal stock price adjustments. This conclusion is reinforced by Figure 1 which shows that the results for positive forecast errors are weaker for variable (3) than for the other two.

2. The drift downward in the Abnormal Performance Index computed over all firms and years in the sample reflects a computational bias.[28] The bias arises because

$$E[\prod_m (1 + v_m)] \neq \prod_m [1 + E(v_m)],$$

where E denotes the expected value. It can readily be seen that the bias over K months is at least of order $(K - 1)$ times the covariance between v_m and v_{m-1}.[29] Since this covariance is typically negative,[30] the bias is also negative.

While the bias does not affect the tenor of our results in any way, it should be kept in mind when interpreting the values of the various API's. It helps explain, for example, why the absolute changes in the indexes in the bottom panel of Figure 1 tend to be greater than those in the top panel; why the indexes in the top panel tend to turn down shortly after month 0; and finally, why the drifts in the indexes in the bottom panel tend to persist beyond the month of the report announcement.

3. We also computed results for the regression model using the additional definitions of income:

        (a) cash flow, as approximated by operating income,[31] and

        (b) net income before nonrecurring items.

Neither variable was as successful in predicting the signs of the stock return

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[28] The expected value of the bias is of order minus one-half to minus one-quarter of one per cent per annum. The difference between the observed value of the API computed over the total sample and its expectation is a property of the particular sample (see footnote 26).

[29] In particular, the approximation neglects all permutations of the product $v_s \cdot v_t$, $s = 1, 2, \cdots, K-2, t = s+2, \cdots, K$, as being of a second order of smallness.

[30] See Table 4.

[31] All variable definitions are specified in Standard and Poor's *Compustat Manual* [see also Ball and Brown (1967), Appendix A].

residuals as net income and EPS. For example, by month 0, the Abnormal Performance Indexes for forecast errors which were positive were 1.068 (net income, including nonrecurring items) and 1.070 (operating income). These numbers compare with 1.071 for net income [Table 5, variable (1)]. The respective numbers for firms and years with negative forecast errors were 0.911, 0.917, and 0.907.

4. Both the API's and the chi-square test in Table 5 suggest that, at least for variable (3), the relationship between the sign of the income forecast error and that of the stock return residual may have persisted for as long as two months beyond the month of the announcement of the annual report. One explanation might be that the market's index of income was not known for sure until after several firms had announced their income numbers. The elimination of uncertainty about the market's income subsequent to some firms' announcements might tend, when averaged over all firms in the sample, to be reflected in a persistence in the drifts in the API's beyond the announcement month. This explanation can probably be ruled out, however, since when those firms which made their announcements in January of any one year were excluded from the sample for that year, there were no changes in the patterns of the overall API's as presented in Figure 1, although generally there were reductions in the χ^2 statistics.[32]

A second explanation could be random errors in the announcement dates. Drifts in the API's would persist beyond the announcement month if errors resulted in our treating some firms as if they had announced their income numbers earlier than in fact was the case. But this explanation can also probably be ruled out, since all announcement dates taken from the *Wall Street Journal Index* were verified against the *Wall Street Journal*.

A third explanation could be that preliminary reports are not perceived by the market as being final. Unfortunately this issue cannot be resolved independently of an alternative hypothesis, namely that the market does take more time to adjust to information if the value of that information is less than the transactions costs that would be incurred by an investor who wished to take advantage of the opportunity for abnormal gain. That is, even if the relationship tended to persist beyond the announcement month, it is clear that unless transactions costs were within about one per cent,[33]

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[32] The general reduction in the χ^2 statistic is due largely to the reduction in sample size.

[33] This result is obtained as follows. The ratio API_m/API_{m-1} is equal to the marginal return in month m plus unity:

$$\frac{API_m}{API_{m-1}} = (1 + r_m).$$

Similarly,

$$\frac{API_m}{API_{m-2}} = \frac{API_m}{API_{m-1}} \cdot \frac{API_{m-1}}{API_{m-2}} = (1 + r_m) \cdot (1 + r_{m-1}),$$

there was no opportunity for abnormal profit once the income information had become generally available. Our results are thus consistent with other evidence that the market tends to react to data without bias, at least to within transactions costs.

THE VALUE OF ANNUAL NET INCOME RELATIVE TO OTHER SOURCES OF INFORMATION[34]

The results demonstrate that the information contained in the annual income number is useful in that it is related to stock prices. But annual accounting reports are only one of the many sources of information available to investors. The aim of this section is to assess the relative importance of information contained in net income, and at the same time to provide some insight into the timeliness of the income report.

It was suggested earlier that the impact of new information about an individual stock could be measured by the stock's return residual. For example, a negative residual would indicate that the actual return is less than what would have been expected had there been no bad information. Equivalently, if an investor is able to take advantage of the information either by selling or by taking a short position in advance of the market adjustment, then the residual will represent, ignoring transactions costs, the extent to which his return is greater than would normally be expected.

If the difference between the realized and expected return is accepted as also indicating the value of new information, then it is clear that the value of new, monthly information, good or bad, about an individual stock is given by the absolute value of that stock's return residual for the given month. It follows that the value of all monthly information concerning the average firm, received in the 12 months preceding the report, is given by:

$$TI_0 = \frac{1}{N} \sum_{j}^{N} \left[\prod_{m=-11}^{0} (1 + |v_{jm}|) \right] - 1.00,$$

and, in general,

$$\frac{API_m}{API_s} = (1 + r_{s+1}) \cdots (1 + r_m).$$

Thus, the marginal return for the two months after the announcement date on the portfolio consisting of firms for which EPS decrease would have been $0.878/0.887 - 1 \cong -.010$; similarly, the marginal return on the portfolio of firms for which EPS increased would have been $1.059/1.056 - 1 \cong .003$. After allowing for the computational bias, it would appear that transactions costs must have been within one per cent for opportunities to have existed for abnormal profit from applying some mechanical trading rule.

[34] This analysis does not consider the *marginal* contribution of information contained in the annual income number. It would be interesting to analyze dividends in a way similar to that we have used for income announcements. We expect there would be some overlap. To the extent that there is an overlap, we attribute the information to the income number and consider the dividend announcement to be the medium by which the market learns about income. This assumption is highly artificial in that historical income numbers and dividend payments might both simply be reflections of the same, more fundamental informational determinants of stock prices.

where TI denotes total information.[35] For our sample, averaged over all firms and years, this sum was 0.731.

For any one particular stock, some of the information between months will be offsetting.[36] The value of net information (received in the 12 months preceding the report) about the average stock is given by:

$$NI_0 = \frac{1}{N} \sum_{j}^{N} \left| \prod_{m=-11}^{0} (1 + v_{jm}) - 1.00 \right|,$$

where NI denotes net information. This sum was 0.165.

The impact of the annual income number is also a net number in that net income is the result of both income-increasing and income-decreasing events. If one accepts the forecast error model,[37] then the value of information contained in the annual income number may be estimated by the average of the value increments from month -11 to month 0, where the increments are averaged over the two portfolios constructed from (buying or selling short) all firms and years as classified by the signs of the income forecast errors. That is,

$$II_0 = \frac{N1(API_0^{N1} - 1.00) - N2(API_0^{N2} - 1.00)}{(N1 + N2)},$$

where II denotes income information, and $N1$ and $N2$ the number of occasions on which the income forecast error was positive and negative respectively. This number was 0.081 for variable (1), 0.083 for variable (2), and 0.077 for variable (3).

From the above numbers we conclude:

(1) about 75 per cent [(.731 − .165)/.731] of the value of all information appears to be offsetting, which in turn implies that about 25 per cent persists; and

(2) of the 25 per cent which persists, about half [49 %, 50 %, and 47 %—calculated as .081/.165, .083/.165, and .077/.165—for variables (1)–(3)] can be associated with the information contained in reported income.

Two further conclusions, not directly evident, are:

(3) of the value of information contained in reported income, no more than about 10 to 15 per cent (12 %, 11 %, and 13 %) has not been anticipated by the month of the report;[38] and

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[35] Note that the information is reflected in a value increment; thus, the original $1.00 is deducted from the terminal value.

[36] This assertion is supported by the observed low autocorrelation in the stock return residuals.

[37] Note that since we are interested in the "average firm," an investment strategy must be adopted on every sample member. Because there are only two relevant strategies involved, it is sufficient to know whether one is better off to buy or to sell short. Note also that the analysis assumes the strategy is first adopted 12 months prior to the announcement date.

[38] The average monthly yield from a policy of buying a portfolio consisting of all firms with positive forecast errors and adopting a short position on the rest would have resulted in an average monthly abnormal rate of return, from -11 to -1, of

(4) the value of information conveyed by the income number at the time of its release constitutes, on average, only 20 per cent (19 %, 18 %, and 19 %) of the value of all information coming to the market in that month.[39]

The second conclusion indicates that accounting income numbers capture about half of the net effect of all information available throughout the 12 months preceding their release; yet the fourth conclusion suggests that net income contributes only about 20 per cent of the value of all information in the month of its release. The apparent paradox is presumably due to the fact that: (a) many other bits of information are usually released in the same month as reported income (for example, via dividend announcements, or perhaps other items in the financial reports); (b) 85 to 90 per cent of the net effect of information about annual income is already reflected in security prices by the month of its announcement; and (c) the period of the annual report is already one-and-one-half months into history.

Ours is perhaps the first attempt to assess empirically the relative importance of the annual income number, but it does have limitations. For example, our results are systematically biased against findings in favor of accounting reports due to:

1. the assumption that stock prices are from transactions which have taken place simultaneously at the end of the month;
2. the assumption that there are no errors in the data;
3. the discrete nature of stock price quotations;
4. the presumed validity of the "errors in forecast" model; and
5. the regression estimates of the income forecast errors being random variables, which implies that some misclassifications of the "true" earnings forecast errors are inevitable.

Concluding Remarks

The initial objective was to assess the usefulness of existing accounting income numbers by examining their information content and timeliness. The mode of analysis permitted some definite conclusions which we shall briefly restate. Of all 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 income report does not rate highly as a timely medium, since most of its content (about 85 to 90 per cent) is captured by more prompt media which perhaps include interim reports. Since the efficiency of the capital market

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0.63%, 0.66%, and 0.60% for variables (1), (2), and (3) respectively. The marginal rate of return in month 0 for that same strategy would have been 0.92%, 0.89%, and 0.94% respectively. However, relatively much more information is conveyed in the month of the report announcement than in either of the two months immediately preceding the announcement month or in the two months immediately following it. This result is consistent with those obtained by Beaver (1968).

[39] An optimum policy (that is, one which takes advantage of all information) would have yielded an abnormal rate of return of 4.9% in month 0.

is largely determined by the adequacy of its data sources, we do not find it disconcerting that the market has turned to other sources which can be acted upon more promptly than annual net income.

This study raises several issues for further investigation. For example, there remains the task of identifying the media by which the market is able to anticipate net income: of what help are interim reports and dividend announcements? For accountants, there is the problem of assessing the cost of preparing annual income reports relative to that of the more timely interim reports.

The relationship between the magnitude (and not merely the sign) of the unexpected income change and the associated stock price adjustment could also be investigated.[40] This would offer a different way of measuring the value of information about income changes, and might, in addition, furnish insight into the statistical nature of the income process, a process little understood but of considerable interest to accounting researchers.

Finally, a mechanism has been provided for an empirical approach to a restricted class of the controversial choices in external reporting.

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[40] There are some difficult econometric problems associated with this relationship, including specifying the appropriate functional form, the expected statistical distributions of the underlying parameters, the expected behavior of the regression residuals, and the extent and effects of measurement errors in both dependent and independent variables. (The functional form need not necessarily be linear, if only because income numbers convey information about the covariability of the income process.)

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