Economic Determinants of the Relation Between
Earnings Changes and Stock Returns

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Abstract

We investigate how the economic determinants of earnings affect the relation between earnings changes and stock returns. A positive association between earnings changes, risk changes and equilibrium expected return changes is predicted. We find statistically reliable evidence of the predicted positive association, observing risk changes over the period from one year before to one year after earnings changes. These risk changes affect securities' equilibrium expected rates of return, conditional on earnings changes, and explain a portion of the post-earnings-announcement "drift" in abnormal returns. The pattern of the remaining abnormal returns, after controlling for risk changes, is consistent neither with market efficiency nor with credible hypotheses concerning market under-utilization of earnings information.
Economic Determinants of the Relation Between Earnings Changes and Stock Returns

We investigate the economic determinants of earnings changes and their implications for the relation between earnings changes and stock returns. We show that firms' earnings changes (deflated by stock price) are a function of changes in both the market's expected (required) return for the firm's investments and the ex post rents on those investments. Ex post rents here are defined as differences between actual and expected returns. While most of the variance in earnings changes is likely due to changes in ex post rents, our analysis suggests part is due to changes in risks and thus in expected returns. For this reason, we test the prediction that there is a positive relation between earnings changes and equity risk changes. The evidence is consistent with the prediction. This result demonstrates the importance of developing hypotheses concerning the economic sources of earnings variation, when investigating the relation between earnings changes and stock returns.

Our results also have implications for the extensively documented tendency of abnormal returns to be positively correlated with previously-announced earnings changes.¹ We find that a portion of this "drift" is consistent with the effect on expected returns of equity risk changes that are associated with earnings changes. However, after controlling for risk changes, significant post-announcement abnormal returns remain. This is not consistent with market efficiency, under the maintained hypothesis that the Capital Asset Pricing Model (CAPM) correctly describes expected returns. Equally, the pattern of the observed abnormal returns is not consistent with any alternative hypotheses (that we are aware of) concerning the market's misuse of earnings information.

¹For evidence on the post-earnings announcement drift anomaly, see Litzenberger, Joy and Jones (1971), Watts (1978), Rendleman, Jones and Latane (1982), Foster, Olsen and Shevlin (1984) and Bernard and Thomas (1989), among others.
Section I discusses the economic determinants of accounting earnings changes and generates the prediction that earnings changes are associated with equity risk changes. Section II outlines our research design, provides the hypotheses tested and describes the sample selection process and data. The empirical results are given in Section III. A summary of the paper and our conclusions are provided in Section IV.

I. Economic Determinants of Earnings Changes and Their Implications

Investment Risk as a Determinant of Earnings Changes

In a research design that uses the CAPM to control for the effect of changes in interest rates and risk premia on expected returns (i.e., using the market model in the risk premium form) the remaining changes in expected returns are due to changes in relative risks. We argue that relative risks are continually changing for various reasons, including:

1. The proportions of firms' investments in individual projects or lines of business, which can differ in risk, vary continuously over time. This should affect earnings. Consider a firm that increases its sales (and thus its investment) in a higher-risk line of business. Product prices in that line of business on average reflect its higher supply price of capital. The firm's sales revenues now reflect the increased average capital cost. But, to the extent the investment is equity-financed, the firm's expenses do not. Hence, the risk change is reflected in the firm's earnings, even after controlling for investment level.

2. Firms' investment portfolio weights also change discretely. Firms enter and exit businesses. Large acquisitions and divestitures can change a firm's investment risk substantially and quickly. Studies of the relation between earnings and stock returns typically do not eliminate firms that have engaged in acquisitions or divestitures.

3. Investments' relative risks are a positive function of their operating leverages (e.g., Lev 1974 and Christie 1989). The operating leverages of individual investment projects or lines of business vary with product prices and factor costs.

4. Risks of investments in individual products or lines of business vary as they age or are repositioned in their markets.
5. Since relative risks are scaled to a mean value of unity, any changes in other investments' market weights or risks affect all other investments' relative risks.

The predicted relation between earnings changes and changes in expected returns on equity is based on the fact that accounting earnings are calculated without any deduction for the cost of equity capital. In competitive markets, product prices allow firms to earn the market's required return on investment, so sales revenues on average should reflect the cost of investment capital, but accounting expenses deduct only debt costs, leaving equity costs in earnings. Stock returns also reflect the cost of equity capital, or the market's required return on equity. Hence, we predict a functional relation between equity returns and earnings, independent of any "surprise" content of earnings announcements. To the extent changes in equity capital costs are reflected in earnings, a similar relation holds between changes in these variables. We therefore predict a positive relation between accounting earnings changes and expected return changes. A principal source of changes in expected returns is changes in risks, so we predict a positive relation between earnings changes and equity risk changes.

Most previous research on the earnings change/stock return relation (following Ball and Brown 1968) implicitly interprets earnings changes as reflecting changes in firms' economic rents, commonly describing them as earnings "news", "surprises" or "innovations" (see, for example, Foster 1977, Beaver, Clarke and Wright 1979 and Beaver, Lambert and Morse 1980). This

Some variation in investment risk is infra-marginal and specific to the firm, so not all variation in capital costs is passed on to consumers, but in competitive markets at least part of risk-induced changes in capital costs is reflected in product prices and consequently in earnings changes. In each case, investment risk changes are linked to earnings changes via the firm's product markets and the fact that accounting earnings are calculated without deducting the cost of equity capital.
interpretation has led previous research, for example, to look for the effect on the relation of earnings persistence (implying persistence in cash flows or rents) and of earnings growth. Our analysis implies that, in a CAPM context, risk changes also are associated with earnings changes.

*Changes in risks and changes in rents*

The relation between earnings changes and returns is likely to depend on the determinants of earnings changes. We focus on changes in rents and changes in expected returns as determinants of earnings changes. Assume a competitive capital market and no taxes. Let \( I_{t-1} \) be a firm's investment at time \( t-1 \) (beginning of period \( t \)). \( I_{t-1} \) is either cash outlays for investments or the market value of assets invested in the firm. The firm's product and/or input markets are not necessarily perfectly competitive so the firm can earn rents and its realized rate of return on investment, \( \rho_t \), differs from the capital market's expected return, \( r_t \), for investments of that risk, \( \rho_t \neq r_t \).

Further assume that assets left in the firm are valued for accounting purposes at their market values and that the firm has no debt. Then, by definition, accounting earnings for period \( t \), \( A_t \), is the realized return on \( I_{t-1} \):

\[
A_t = \rho_t I_{t-1} - r_t I_{t-1} + (\rho_t - r_t) I_{t-1}.
\]

In (1) accounting earnings are the sum of the market expected return on investments and the difference between the actual and the market expected return on investments. We call \( (\rho_t - r_t) \) the firm's rate of ex post rents or simply ex post rents. They in turn are comprised of expected rents and windfall gains or losses. Expected rents are expected above-competitive rates of return due to some monopoly power that obviously does not exist in competitive industries. Windfall gains or losses arise when conditions in an
industry change, in turn causing rates of return on existing investments to change. For example, unexpected variation in demand for a firm's products or unexpected variation in costs (new labor costs, production problems) give rise to windfall gains or losses. To take another example, a change in the tax code allowing greater tax deductions for new plants (but not for the old plants) in a competitive industry can cause the realized return to the old plants to drop. Windfall gains and losses can occur in both competition and monopoly.

Now allow for two forms of capital, debt and equity. Assume the debt is one period debt or that the rate on the debt \( (i_t) \) is variable and is "marked" to the market interest rate each period. Interest on debt is deducted in calculating accounting earnings, so:

\[
A_t = r_{t-1}I_t + (r_t - r_{t})I_{t-1} - i_{t-1}D_{t-1}
\]

where \( D_{t-1} \) is the value of debt at \( t-1 \). Accounting earnings now are a positive function of the expected return on investments, the rate of ex post rents and the investment level and a negative function of the amount of debt.

To obtain the expression for changes in accounting earnings, \( \Delta A_t \), difference equation (2):

\[
\Delta A_t = \Delta r_{t-1}I_t + r_{t-1}\Delta I_{t-1} + \Delta(r_t - r_{t-1})I_{t-1} + (r_{t-1} - r_{t-1})\Delta I_{t-1}
- \Delta i_{t-1}D_{t-1} - i_{t-1}\Delta D_{t-1}
\]

where \( \Delta \) is the difference operator. In accounting earnings change/stock return studies, accounting earnings changes often are deflated by the market value of the firm's equity at the beginning of the period, \( E_{t-1} \). This controls for investment level. Deflating equation (3) by \( E_{t-1} \) and rearranging terms yields:

\[
\frac{\Delta A_t}{E_{t-1}} = \Delta r_{t-1}(\frac{I_{t-1}}{E_{t-1}}) + (r_{t-1} - r_{t-1})(\frac{I_{t-1}}{E_{t-1}}) + \rho_{t-1}(\frac{\Delta I_{t-1}}{E_{t-1}}) - \Delta i_{t-1}(\frac{D_{t-1}}{E_{t-1}}) - i_{t-1}(\frac{\Delta D_{t-1}}{E_{t-1}})
\]
Eqn. (4) shows that a change in \( \text{ex post} \) rents, \( \Delta(\rho_t - r_t) \), is a determinant of earnings changes. Since an unanticipated change in \( \text{ex post} \) rents also affects the rate of return on the firm and hence the rate of return on equity, a change in \( \text{ex post} \) rents is likely to be a major determinant of the association between earnings changes and rates of return on equity. However, eqn. (4) also demonstrates that a change in \( \text{ex post} \) rents is only one of the determinants of earnings changes. Those other determinants are also associated with changes in the rates of return on equity and so likely to contribute to the earnings change/equity return relation.

A change in the market expected rate of return on the firm's investments, \( \Delta r_t \), not only affects accounting earnings, it also affects the expected rate of return on equity contributing to the relation between earnings changes and equity rates of return. Another earnings change determinant, a change in the interest rate on debt, \( \Delta i_t \), is likely to be associated with changes in the levels of interest rates and equity risk and so contributes to the relation between earnings changes and equity returns.

**Effect of leverage**

In an MM world, leverage does not affect the firm's expected return, but it does affect the stock's risk and expected return. This raises the potential for another relation between earnings changes and stock returns, due to leverage. The effect of leverage in this context, however, is complex.

An immediate effect of an increase in leverage (holding the investment level constant) is the deduction of more interest in calculating earnings (note that equity costs are not deducted). In eqn. (4) this effect appears in the term \( i_t (\Delta D_{t-1} / E_{t-1}) \). Note that the leverage and leverage change for period t are determined at time t-1 and the interest on debt for period t is \( i_t D_{t-1} \). In
addition to the earnings decrease, a leverage increase causes an increase in the expected rate of return on equity. Thus the implied relation between earnings changes and equity rate of return (holding the investment level constant) is negative.

Leverage may be also increased by adding more debt and raising the investment level. In that case, accounting earnings increase by the rate of return on the additional investment. In eqn. (4) this is reflected in the \( \rho_t (\Delta I_{t-1}/E_{t-1}) \) term. Like leverage, the investment level for period \( t \) is determined at time \( t-1 \). If, as seems reasonable, the expected rate of return on the additional investment, \( r_t \), exceeds the interest rate, \( i_t \), on the additional debt, the net effect on earnings is expected to be positive. Since the leverage increase causes an increase in the expected rate of return on equity, the implied relation between earnings change and rate of return on equity is positive.

One complication is the wealth-effects for equity due to unexpected changes in interest rates, for firms with fixed-rate debt. Our simple model assumes that the debt rate is "marked to market" each period. However, the combined effects of historical-cost accounting and firms having some fixed-rate debt are that interest costs deducted from reported income understate the variation in firms' market costs of debt. Consequently, stock returns will appear more sensitive to accounting earnings changes caused by interest rate changes, than if interest rates were "marked to market" in each period. Thus the negative effect of leverage on the relation between earnings changes and stock returns is magnified.

Another complication arises because firms do not adjust their leverage continuously, when it is altered by ex post earnings outcomes (for evidence,
see Ball, Lev and Watts 1976). This induces dependence in earnings changes, stock returns and equity risk changes. The form of the dependence is a function of how firms react to leverage changes. Consider a firm whose investment risk, and thus expected return, increase in period t. On average, this generates a positive earnings change. If the increase in risk is permanent, no subsequent earnings change is implied, provided leverage is held constant (i.e., the firm adjusts its leverage to the year t-1 level). However, if the earnings increase is not paid out, and debt is paid off instead, then leverage will be lower and future earnings will increase due to lower interest expense. Hence there is a positive dependence in earnings changes, induced by financing policy. With the permanent investment risk change, the expected stock returns in period t+1, while higher than in period t-1, are less than in period t because of the reduced leverage in period t+1. This induces a negative dependence in stock returns. Firms not fully adjusting leverage also induce a negative dependence in equity risk changes (also see Ball and Kothari 1989). Overall, the effect of leverage on the relation between earnings changes and returns appears complex. The earnings change/returns studies will encounter the joint effect of investment risk and leverage on equity risks.

Implications for earnings change/stock return relation and research design

Earnings changes conventionally are interpreted as arising from changes in \textit{ex post} rents, \( \Delta(\rho_t - r_t) \), due to unexpected sales changes, production cost changes etc. They then convey information that influences only contemporary stock returns. In this way the observed contemporaneous, positive relation

\footnote{We do not expect firms to fully adjust leverage. Firms' investment levels and leverage are not independent: there is a negative relation between investment risk and leverage (see e.g., Smith and Watts 1990).}
between earnings changes and stock returns is rationalized. This interpretation ignores the effect of risk changes.

Our analysis of the determinants of earnings changes suggests that changes in investments' risks ($\Delta r_t$), and changes in leverage ($\Delta D_{t-1}/E_{t-1}$) and hence in equities' risks, also affect the earnings changes-stock returns relation. If the investment risk effect dominates and equity risk changes are positively correlated with earnings changes, equity risk changes could explain part of the relation between earnings changes and stock returns. If on the other hand the pure leverage effect dominates, the observed positive relation between earnings changes and stock returns understates the association between changes in ex post rents and stock returns.

Because the previous research concentrates on ex post rents and fails to explicitly recognize the link between earnings changes and changes in market expected investment return and leverage, its control for changes in expected equity return is inadequate. It is therefore possible that part, at least, of the observed association between earnings changes and stock returns is due to expected investment return changes and leverage changes or changes in the expected return on equity. This includes the association between earnings changes and stock returns subsequent to the earnings announcement: the post-earnings announcement drift.

II. Research Design

Our analysis suggests that risk changes associated with earnings changes can be both permanent (e.g., due to new investments) and transitory (e.g., due to lagged adjustments in capital structure). Thus, we require a research design that is sensitive to both permanent and transitory movements in risk. This, in turn, requires expected return estimates that vary with both
transitory and permanent risk changes. We use an annual-returns version of Ibbotson's (1975) technique to estimate short term risk changes and to control for risk changes in estimating abnormal returns. Annual returns are used in this context because annual-return beta estimates, which are sensitive to the return measurement interval, appear more consistent with the CAPM and are effective in identifying risk changes in a similar context.

The key feature of our research design is it allows securities' expected returns to vary annually because earnings changes, which are associated with expected return changes, are measured annually. We investigate the association between firms' annual earnings changes (scaled by price) and stock returns in the year before, the year of, and the year following earnings changes, with the expected return changing over these three years for each firm. Each chronological year, all firms with December 31 fiscal year-ends are sorted into portfolios on the basis of their ranked annual earnings changes. Thus, portfolio compositions change every calendar year. Annual returns over the calendar year of the earnings change are calculated for each portfolio and used to estimate risk and abnormal return in the earnings-performance year. Annual returns for each portfolio in the years before and after the earnings-performance year are used to estimate risk and abnormal return in those years. The estimated risks for the years before, of, and after the earnings-

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4 See Ball and Kothari (1989) for further details of the research design.

5 Handa, Kothari and Wasley (1989) show that, when returns are measured annually, there is more dispersion in estimated betas, the cross-sectional risk/return intercept is more consistent with CAPM predictions, and the 'size-effect' is insignificant. Ball and Kothari (1989) show that, for portfolios formed on the basis of ranked ex post security returns, annual return betas estimated from the same procedure as used here identify associated risk (and expected return) changes. Ex post security return rankings overlap ex post earnings change rankings, so the latter results are particularly relevant here.
performance year allow us to test hypotheses about risk changes around earnings changes and abnormal returns following earnings changes.

**Portfolio formation**

We study all December 31 fiscal year-end firms that have earnings and return data for any consecutive five-year period over the 39 years 1950-1988 (the sample is described in more detail below). Each year, firms are ranked on their unexpected earnings (defined below). Firms then are assigned to decile portfolios in equal numbers in each year. Portfolio compositions change each year, since firms are reranked on their scaled earnings changes and reassigned to different earnings-change portfolios separately each year. The first portfolio therefore is rebalanced annually to contain each year's 10% worst earnings performers; and the last portfolio always contains each year's 10% best earnings performers.

**Risk and abnormal return estimates**

The earnings-performance year is the year whose earnings are used to sort firms into portfolios, and is designated as year 0 in event time. For event-year 0, annual buy-and-hold excess returns (\(-\) raw return minus riskless rate of return) on each of the decile earnings-performance portfolios are calculated for each of the 37 calendar years 1951-87. From this time series, we estimate the systematic risk (beta) and the average annual abnormal return (Jensen's alpha) for each of the decile portfolios. Note that these statistics relate only to the market pricing of a particular earnings-performance portfolio in the year in which the earnings performance occurs. No other event-time returns are used.

The above procedure is repeated for event-years -1 and +1. A time series of 37 annual excess returns for the event-year before the earnings-performance
year (event year -1) is constructed over 1950-86 for each portfolio, and market model parameters are estimated. Similarly, 37 annual excess returns over 1952-88 are used to estimate betas and abnormal returns in event-year +1. In each case, beta and abnormal return in a particular event-year are estimated from only the chronological time series of returns for that event-year.

The three resulting 37-year time series have two important properties. First, for each earnings-performance portfolio, the three event-years' time series are independent of each other, in the sense that they utilize security returns that do not overlap. Second, within each event-year time series, the individual return observations all are nonoverlapping, so the procedure does not induce autocorrelation in the market model regression residuals.

The regression used to estimate beta and abnormal return for portfolio p (p = 1-10) in event-year τ (τ = -1, 0 or 1) is:

\[(R_{pt} - R_{ft}) = \alpha_{pr} + \beta_{pr} (R_{mt} - R_{ft}) + \epsilon_{pt}\]  
(5)

where \(R_{pt}\) = equal-weighted return on portfolio p in year t, \(R_{mt}\) = equal-weighted return on the market portfolio in year t, \(R_{ft}\) = riskless rate of return in year t, \(\alpha_{pr}\) and \(\beta_{pr}\) are the intercept and slope coefficients in year τ, and \(\epsilon_{pt}\) is assumed to be normally distributed "white noise" error.

The intercept \(\alpha_{p,0}\) is an estimate of the abnormal return of portfolio p in the earnings-performance year (i.e., \(\tau = 0\)), under the maintained hypothesis of the CAPM [see Jensen (1968)]. Because portfolios are reconstructed in each earnings-change year, \(\alpha_{p,0}\) measures abnormal returns earned by the stocks in portfolio p during the earnings-performance year only: i.e., the year in which the portfolios' member firms generated the relative earnings performance used to classify them into the particular portfolio p. It thus measures abnormal
return as a function of contemporaneous earnings performance. It is not a function of returns in any year other than the earnings-performance year.

The regression slope $\beta_{p,0}$ is portfolio $p$'s relative risk during the firms' earnings-performance year. It is not influenced by returns in any other year. For example, the beta of $p - 1$ in $r = 0$ is the estimated relative risk of a portfolio that holds firms only during the year in which they ranked among the 10% worst earnings performers.

To assess the degree of risk variation from the year before to the year the firm recorded its earnings performance, we estimate eqn. (5) in year $r = -1$ also. The intercept $\alpha_{p,-1}$ estimates abnormal return and the slope $\beta_{p,-1}$ estimates relative risk, in the year prior to that in which firms experience the relative earnings performances that are the basis of their assignment to portfolios. Neither estimate is a function of security returns in any year other than this year immediately prior to the earnings performance occurring.

The above procedure is repeated for the calendar year after the earnings-performance year to estimate $\alpha_{p,+1}$ and $\beta_{p,+1}$. The intercept $\alpha_{p,+1}$ estimates abnormal return in the post-earnings-performance year and the slope estimates relative risk in the year subsequent to the earnings-performance year. Again, neither estimate utilizes data from any other event-time year.

An important feature of our research design is that it generates relative risk estimates that have precisely the periodicity (annual) of the variable being studied (annual earnings per share). This enables us to compare betas in the earnings-performance year with prior and subsequent years.

While the technique uses data over a 37-year period, it neither assumes parameter stationarity for individual stocks over the 37-year period, nor requires each stock to be available throughout the 37-year period. Parameter
stationarity is implicitly assumed at the level of the earnings/price relation for the decile earnings-performance portfolios. For example, the beta of the portfolio of each year's 10% worst earnings performers is assumed constant over chronological time, even though different stocks belong to the 10% worst earnings-performance category every calendar year. \(^6\) Stationarity thus is assumed at its least binding level: at the functional relation between earnings and market return parameters. This assumption is implicit in all "event study" designs that pool observations across firms and chronological time.

**Hypotheses**

**Hypothesis 1:** The contemporaneous equity risk change \((\beta_{p,0} - \beta_{p,-1})\) in the earnings-performance year is an increasing function of earnings-performance rank \((p)\). Our analysis suggests that earnings changes are positively related to firms' investment risk changes and either positively or negatively related to leverage changes. Because previous studies observe an apparent post-earnings announcement abnormal return drift positively associated with earnings changes, we predict that the investment risk change effect predominates, so equity risk changes are positively associated with the earnings-performance portfolio rank.

**Hypothesis 2:** The equity risk change in year +1 \((\beta_{p,+1} - \beta_{p,0})\) is a weakly increasing function of the earnings-performance rank \((p)\). If firms in year +1 completely adjust their capital structure to their respective year -1 levels, then risk changes in year +1 will be positively associated with earnings-performance. This follows because the capital structure adjustment will undo

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\(^6\) Even then, earnings-performance portfolios' parameter stability is not a critical assumption. If the parameters are not constant through time, then their estimates are statistically less precise, but they still are unbiased and consistent.
the leverage change stemming from the equity's market value change associated with the prior year's earnings performance. A complete capital structure adjustment, however, is unlikely because investment risk levels and leverage are not independent: there is a negative relation between investment risk and leverage (see e.g., Smith and Watts 1990). Thus, firms are unlikely to entirely undo the leverage changes caused by their earnings-performance. This and the other reasons discussed earlier will weaken the relation between year +1 beta changes and earnings-performance.

A positive association between year +1 beta changes and earnings-performance would also be obtained if investment risk changes were positively correlated over time. But we have no a priori reason to believe that is the case and so hypothesis two is not based on a continuation of the investment risk change.⁷

**Hypothesis 3: The contemporaneous abnormal return \( (\alpha_{p,0}) \) is an increasing function of earnings-performance rank \( (p) \).** If historical cost accounting earnings changes capture the changes in the market's expectations of future cash flows as reflected in security prices, then the third hypothesis will be supported. Evidence consistent with an ordinal earnings change/return relation is documented in Beaver, Clarke and Wright (1979) using annual earnings and in Hagerman, Zmijewski and Shah (1984) using quarterly earnings.

**Hypothesis 4: The preceding year abnormal return \( (\alpha_{p,-1}) \) is an increasing function of earnings-performance rank \( (p) \).** The market return predicts earnings

⁷We can think of ways in which investment risk changes might be correlated over time. For example, a firm pursuing an acquisition program in a particular industry that acquires firms in that industry in consecutive years will have positively correlated risk changes. Also, a firm diversifying regardless of industry will have negatively correlated risk changes. Which example is more generally descriptive is a priori not obvious.
changes more than one year ahead. This hypothesis is consistent with the evidence in Beaver, Lambert and Morse (1980), Collins, Kothari and Rayburn (1987) and Freeman (1987). An ordinal relation between $\alpha_{p,-1}$ and $p$ is likely to be observed because time series earnings expectation models, rather than the market's expectations, are used to classify firms into ten earnings-performance portfolios. Previous evidence suggests that annual earnings forecasts based on prices at the beginning of the year are more timely than time series annual earnings expectation model forecasts (see Collins, Kothari and Rayburn 1987). In general, if firms are classified into earnings-performance portfolios based on the market's earnings expectation at the end of year $-1$, then in an efficient market $\alpha_{p,-1}$ and $p$ are unrelated.

**Hypothesis 5:** Post-announcement (i.e., April to December of year +1) abnormal returns are zero and independent of earnings performance rank ($p$).

This hypothesis follows from the three jointly-maintained hypotheses: (1) market efficiency; (2) that the CAPM explains securities' expected returns; and (3) that the control for risk changes associated with earnings changes is unbiased. We hasten to add that our research design is not a comprehensive test of efficiency, since it is oriented toward the third maintained hypothesis. We focus on the extent to which risk changes confound the relation between earnings changes and stock returns. This leads us to make research design tradeoffs, utilizing annual returns for risk estimation, but utilizing neither precise earnings announcement dates nor quarterly earnings announcements.\(^8\) We thus test the efficiency hypothesis in a deliberately specialized context.

\(^8\) See fn 5.
Sample selection, data and variable definitions

Sample Selection and Data: The sample is all firms with: December 31 fiscal year-end; earnings data for at least six years during 1950-88; and monthly return data on the Center for Research in Security Prices (CRSP) monthly tape. Earnings data are obtained from the Compustat Annual Industrial tape, the Research tape and the corresponding History tapes. We include only December 31 fiscal year-end firms to facilitate data analysis. We require data availability for at least six years because unexpected earnings are estimated by orthogonalizing the earnings change variable with respect to return on the market portfolio, as described below. Because we impose few sample selection criteria, we obtain a sample of 28,294 firm-years that is relatively free of survivorship bias. There is an average of 764 firms per event-year.

Unexpected earnings: We use annual primary earnings per share excluding extraordinary items and discontinued operations, and adjusted for stock splits and stock dividends. The scaled earnings change variable is defined as

$$\Delta X_{jt} = \frac{(X_{jt} - X_{jt-1})}{P_{jt-1}}$$

where $X_{jt}$ is earnings per share for firm $i$ in year $t$ and $P_{jt-1}$ is share price at the close of year $t-1$.

To obtain the unexpected earnings change, we orthogonalize the earnings change variable, $\Delta X_{jt}$, with respect to the market returns for two reasons. First, because we subsequently investigate the association between earnings and the CAPM abnormal returns, we study only the component of earnings variation that is uncorrelated with the market. Second, we avoid any spurious correlation between the assignment of securities to earnings-performance portfolios and the market return which potentially could affect beta estimates. Orthogonalization removes the market return's effect from the earnings change
variable in arriving at a measure of unexpected earnings and is implemented by estimating the following time series regression for each firm separately, using data for the available years (minimum five observations):

\[ \Delta X_{jt} = \gamma_{0j} + \gamma_{1j} (R_{mt} - R_{ft}) + \eta_{jt} \]  

where \( R_{mt} \) is the CRSP equal-weighted annual return obtained by summing monthly returns or the sample mean annual return on the available securities in year \( t \); and \( R_{ft} \) is the annual T-bill interest rate as of the beginning of each year \( t \).

Orthogonalized unexpected earnings are defined as

\[ UX_{jt} = \hat{\gamma}_{0j} + \hat{\eta}_{jt} \]  

where \( \hat{\gamma}_{0j} \) is the estimated intercept and \( \hat{\eta}_{jt} \) is the residual for year \( t \) from equation (7). The decile earnings-performance portfolios are formed on the basis of ranked \( UX_{jt} \) s in each event-year.

III. Empirical Results

Unexpected earnings and total returns: Descriptive statistics

Table 1 reports average orthogonalized unexpected earnings and total returns on the earnings-performance portfolios during event-time years \( t = -1, 0 \) and \( +1 \). The CRSP equal-weighted return and the sample mean return obtained from the earnings-performance portfolio returns also are reported. By construction, unexpected earnings increase monotonically with the earnings-performance portfolio rank. The distribution of the earnings-performance variable exhibits leptokurtosis. The worst (best) performance portfolio's earnings change as a proportion of the market value is \(-18.68\% \) (26.44\%). An implication of leptokurtosis is that the extreme earnings-performance portfolios are likely to exhibit relatively large risk non-stationarities of the type we have hypothesized.
Portfolio returns in year $r = 0$ increase monotonically with the portfolio ranking, which suggests the assignment of stocks to earnings-performance portfolios is correlated with the earnings surprise to the market. The average return on the worst (best) performance portfolio in year 0 is -2.1% (43.3%), compared with the sample mean of 17.0%. Returns in year -1 exhibit an inverted U-shaped pattern, which suggests that factors other than earnings anticipation (which predicts a monotone increasing function of $p$) are in effect. Possible other factors include systematic risk differences across portfolios, correlated omitted variables from the CAPM, and year -1 earnings-performance being correlated with the year 0 earnings-performance.

Returns in year +1 are the highest for portfolio 10, but not the lowest for portfolio 1. The January to March and April to December components of year +1 returns reveal a return seasonality for all the portfolios, consistent with previous evidence by Rozeff and Kinney (1976), among others. Much of the high return for portfolio 10 is concentrated in the January to March quarter, which could be due in part to the announcement-period return. The April to December return for portfolio 1 is 4.0%, compared to 7.5% for portfolio 10, which could be due to risk differences or post-earnings announcement drift or both.

**Risk Changes**

Table 2 reports the estimated systematic risks and standard errors of the ten earnings-performance portfolios for years -1, 0 and +1. The evidence is consistent with our earnings-performance year risk-shift hypotheses.

**Hypothesis 1: Contemporaneous risk changes.** From year -1 to year 0, estimated betas of the first six portfolios (essentially the "bad" news portfolios) decline, while betas of the remaining four portfolios increase, consistent with hypothesis 1. The correlation between $\Delta \beta_{p,0}$ and the
earnings-performance portfolio rankings is .98 with a p-value less than .01, so the null hypothesis that beta shifts are not associated with earnings changes can safely be rejected. As is the case with earnings, portfolio beta changes are leptokurtic, with extreme portfolios' beta changes individually being significantly non-zero. The worst earnings-performance portfolio's beta declines from 1.17 to 1.01; since the standard errors of $\beta_{-1}$ and $\beta_0$ are .056 and .054, and the estimates are independent, the t-statistic for the -0.16 change in beta estimate is -2.05 (p-value < .05). Similarly, the best earnings-performance portfolio's beta increases by +0.27 from 1.07 to 1.34; the standard errors of $\beta_{-1}$ and $\beta_0$ are .080 and .085, so the t-statistic for $\Delta \beta_0 = 0$ is 2.30 (p-value < .05). 9

[Table 2 here]

The evidence is consistent with our hypothesis that beta changes are an increasing function of contemporaneous earnings changes. The beta changes are significant in part because they are estimated from 37 years of data and in part because the research design is sensitive to annual earnings changes. Research designs that do not estimate betas independently for each period in event time, and that use returns measured over shorter intervals, do not observe risk shifts of this order.

The observed positive relation between beta changes and earnings-performance suggests that investment risk changes dominate the offsetting effect of leverage changes on equity beta risk. To provide evidence on the

9 In an earlier version of this paper we also reported betas estimated using daily return data over only one year. Using return data for a 19-year period, the daily betas of the poor-performance portfolios declined from year -1 to 0 and they increased for the good news portfolios. The rank correlation between portfolio rank and beta shift was .91 with a p-value < .01. We cannot estimate daily return betas for the entire 37-year period used here because CRSP daily returns are available only since 1962.
leveraging link, Table 3 reports average debt/equity ratios for firms in the earnings-performance portfolios, at the end of years -1, 0 and +1. Book values of long-term debt plus preferred stock and market values of equity at the end of years -1, 0 and +1 are used in calculating the ratios.  

[Table 3 here]

Table 3 suggests that earnings performance affects firms' debt/equity ratios, but firms do not fully adjust their capital structures for the earnings-performance effect. This is consistent with the results of Ball, Lev and Watts (1976). The first six earnings-performance portfolios' leverages increase in the earnings-performance year whereas leverage decreases for the other four portfolios.  

Portfolio 1's debt/equity ratio increases from 1.07 to 1.30 whereas it decreases from 1.26 to 1.05 for portfolio 10. These individual changes are not reliably different from zero. While the individual portfolio leverage changes are not significant, they exhibit a perfect negative rank-correlation with earnings performance. This is consistent with firms making a less than full capital structure adjustment for the earnings-

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10 We use book values of long-term debt and preferred stock because market values are not available on Compustat. Data are for 27,680 firm-years, a reduction of 2.2% from the 28,294 observations used earlier, because debt and preferred stock data are not available. Firms whose debt/equity ratios exceed five are set equal to five. The tenor of the results is unchanged when alternative truncation rules are used or when outliers are included.

11 If we had used market values of debt, the rise in leverage for the bad news portfolios and the fall in leverage for the good news portfolios would have been less dramatic. The bad news portfolios' market value of debt would decrease because of increased bankruptcy risk following poor earnings performance. This would reduce the bad news portfolios' leverage ratios; and the converse is true for the good news portfolios. The net effect on the market valued leverage ratios of the good and bad news portfolios is, therefore, ambiguous. However, given the magnitude of change in the book value of debt to market value of equity ratios for the extreme portfolios, it seems unlikely that the use of market values of debt would substantially alter the results.
performance effect. However, the positive correlation between earnings performance and risk changes suggests the leverage change's effect on equity risk does not fully offset the hypothesized relation between earnings changes and investment risk changes.

To assess whether risk shifts ($\Delta \beta_{p,0}$) can be explained by mean reversion in betas (see Blume 1975 and Vasicek 1973, among others), consider the relation between $\Delta \beta_{p,0}$'s and portfolio betas in year -1. If risk shifts are due to mean reversion, then the predicted risk shift is positive for the portfolios whose year -1 beta is less than one, and negative for the other portfolios. The risk shifts reported in table 2 are consistent with mean reversion in five out of ten portfolios. For two of the five risk shifts where the sign is as predicted by mean reversion, the betas in year zero go beyond or below unity, which is inconsistent with mean reversion (mean reversion predicts betas approach one from below or above). Overall, the risk shifts do not appear to be explained primarily by mean reversion in betas.

**Hypothesis 2: Subsequent Risk Changes.** The beta change in year +1 is related to the earnings-performance portfolios, but the relation's sign is negative, the opposite of that predicted. The year +1 beta changes suggest a partial reversal vis-a-vis the beta shifts in the earnings-performance year. For the first three portfolios there is a risk increase in year +1, following the risk decrease in year 0. The next six portfolios' risks decrease in year +1 and the tenth portfolio's risk is unchanged. The rank correlation between $\Delta \beta_{p,+1}$s and the earnings-performance portfolio ranking is -.48 (p-value = .16), though none of the individual changes is significant.

To assess whether the beta changes in year +1 are affected by capital structure changes, we examine the portfolios' leverage ratios in year +1.
Given there is a less than full capital structure adjustment in the earnings-performance year, we expected some capital structure adjustment in year +1. That lagged adjustment would further increase the good news portfolios' risk and decrease the bad news portfolios' risk. However, there is no evidence in table 3 of a lagged capital structure adjustment. The absolute magnitudes of leverage changes are small: less than .05 for all the portfolios. The correlation between the portfolios' earnings-performance ranks and leverage changes in year +1 is -.44 with a p-value of .20. The negative correlation between leverage changes in year +1 and earnings performance is consistent with the negative correlation between \( \Delta \beta_{p,+1} \) and earnings performance noted above.

Referring to earnings performance and risk changes, the last column of table 2 reports the overall beta change from year -1 to +1. Beta shifts for the extreme portfolios are consistent with our first hypothesis that earnings changes are positively associated with risk changes. For portfolio 1 the beta declines by -.12 and it increases by .28 for portfolio 10. The rank correlation between portfolio rank and \( \Delta \beta_{p,-1,+1} \) is .82, which is reliably positive.

**Abnormal returns**

Table 4 reports abnormal returns on the decile earnings-performance portfolios in the three years around the earnings-performance year.

**Hypothesis 3: Contemporaneous Abnormal Returns.** In year 0 the bottom five earnings-performance portfolios earn negative abnormal returns and the top five earnings-performance portfolios earn positive abnormal returns, consistent with previous evidence. The perfect positive rank correlation between \( \alpha_{p,0} \) and earnings-performance rankings implies a reliable, contemporaneous relation between earnings changes and abnormal returns, consistent with hypothesis 3.
However, the relation is not linear. In the extreme performance portfolios the abnormal return is comparable, in absolute terms, to the (scaled) unexpected earnings, while in the interior portfolios the absolute value of the abnormal return tends to exceed that of unexpected earnings. This suggests that the commonly estimated linear relation between unexpected earnings and abnormal returns could be misspecified, even at the portfolio level. This non-linearity also is apparent in Beaver, Clarke and Wright (1979).

Table 4 here

Hypothesis 4: Prior-year Abnormal Returns. The behavior of $\alpha_{p,-1}$ is partially consistent with the security market anticipating earnings performance earlier than year 0. The $\alpha_{p,-1}$s exhibit an inverted U-shaped pattern whereas hypothesis 4 predicts they are a monotonically increasing function of portfolio ranks. As a result of the inverted U-shaped pattern of the $\alpha_{p,-1}$s, the rank correlation between $\alpha_{p,-1}$s and portfolio rank, as reported in table 4, is only .32 (p-value = .37). Apparently, phenomena other than the market anticipating earnings performance occur in year -1. The generally declining $\alpha_{p,-1}$s for the good news portfolios and -8.07% abnormal return on the best-news portfolio 10 could be due to some firms achieving 10th-portfolio earnings performance in year 1 as a result of having made write-offs in year -1. These can increase earnings performance (earnings change) in year 0 in two ways: they reduce scope for write-offs in year 0 and they reduce the base for the earnings change. Write-offs usually accompany poor earnings performance at the time, which could explain the negative abnormal return in year -1. This does not suggest there

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12 See Healy (1985) and DeAngelo (1988) for evidence on such write-offs. The phenomenon is commonly known as a "big bath."
is a profitable trading rule because some firms which have large write-offs in year -1 may also have very poor earnings performance in year 0.

**Hypothesis 5: Post-announcement Abnormal Returns.** Average abnormal returns in the calendar years following the earnings-performance year \( \alpha_{P,+1} \), reported in table 4, generally are small but consistent with post-earnings-announcement drift. The rank correlation between \( \alpha_{P,+1} \) and the portfolio rankings is .96 \( (p < .01) \). These abnormal returns include pre-announcement and earnings-announcement effects in the early months of year +1 and thus are biased in favor of finding a post-earnings announcement drift. Virtually all firms announce their annual earnings by April 1, so we reestimate abnormal returns over the 9-month period from April to December of year +1 \( \alpha_{p+1AD} \), by regressing portfolio excess returns during April to December of year +1 on excess returns over the same period for the market index. The results suggest that the post-earnings announcement drift persists, after controlling for risk changes, but it is weaker than reported previously by Watts (1978), Foster, Olsen and Shevlin (1984) and Bernard and Thomas (1989), among others. The rank correlation between abnormal returns and portfolio rankings is .56 with a \( p \)-value of .09. The weaker drift results are due in part to (i) better control for risk changes; (ii) we assume April 1 earnings announcements; and (iii) we study only annual earnings and ignore interim earnings announcements.

To gain some insight into the ability of risk changes to explain a part of the post-announcement drift observed in constant-beta research designs, consider the effect in our study of assuming risk to be constant \( (i.e., \text{using year -1 beta estimates as estimates of beta for years 0 and +1}) \). A zero-investment portfolio that is long \( (\text{short}) \) in stocks with the 10\% largest \( (\text{smallest}) \) earnings changes experiences a relative risk change of 0.40 over the
following year \([+0.28 - (-0.12)]\). Using the realized risk premium of 9.5% on the CRSP equal-weighted portfolio over our sample period 1951-87, ignoring the risk change for the portfolio would lead us to underestimate its CAPM expected return by 3.8% \([0.40\times 9.5\%]\). Consequently, we would overestimate the post-announcement year's abnormal returns by 3.8%. In the extreme earnings-performance portfolios at least, the risk shifts we observe are large enough to have a substantial effect on estimated post-announcement abnormal returns.

Bernard and Thomas (1989, table 1) report a post-earnings announcement drift of 7.98% over 240 trading days (approximately one year) following quarterly earnings announcements, for a portfolio that is long in their best standardized-unexpected-earnings (SUE) decile and short in the worst SUE decile. During their 1974-86 sample period, the risk premium averaged 13.0%, so correlated risk changes of the magnitude we observe in our research design could potentially explain a substantial proportion of the estimated post-announcement abnormal returns. It is unlikely that risk changes can explain even a small proportion of the estimated abnormal returns that Bernard and Thomas (1989, 1990) attribute to specific days, such as 3 to 5 days immediately after the earnings announcement and those surrounding the following-quarters' earnings announcements. However, they do have the potential to explain a substantial proportion of the longer-term post-announcement drift. We caution against making fine comparisons between our study and others: there are differences in samples, time periods, scaling of the earnings variable and the use of annual versus quarterly earnings, among other considerations, which make the comparison less than perfect.

While risk changes that are correlated with earnings changes appear to explain a substantial part of the apparent post-announcement abnormal returns,
they clearly do not explain them all. On the face of it, there is clear
evidence in table 4 against the hypothesis that the market is efficient and the
CAPM describes expected returns. But the pattern of the estimated abnormal
returns in year +1 does not appear consistent with any credible alternative
hypothesis, of which we are aware. We note three intriguing features of the
year +1 abnormal returns and leave it to the reader to draw conclusions. 13

First, the abnormal returns in year +1 exhibit the same inverted-U-shaped
function of earnings performance as in year -1. While the year +1 abnormal
returns are lower in magnitude, their pattern is not consistent with a market­
under-utilization-of-earnings hypothesis.

The generally low abnormal returns earned by both extreme portfolios in
year +1 is puzzling because previous research on the post-earnings announcement
drift suggests good news firms earn positive abnormal returns (e.g., Foster et
al. 1984 and Bernard and Thomas 1989). The result, however, is consistent with
Ou and Penman (1989, table 8), who also use annual earnings data and who report
negative abnormal returns for both extreme good and bad news portfolios over a
nine-month post-earnings announcement period. This pattern begs an
explanation.

Second, the correlation between the abnormal returns in years -1 and +1 is
.72 (p-value < .02) using April to December abnormal returns in year +1 (which
are unlikely to be affected by year-zero earnings announcements). We offer no
hypotheses concerning this apparent regularity.

13 In drawing conclusions, note that the year +1 abnormal returns are ex
post estimates of abnormal returns on portfolios consisting of a large number
of stocks. As Lo and MacKinlay (1990) point out, under such circumstances,
misleading inferences may be obtained because properties of the data (i.e., ex
post earnings performance) are used to construct the portfolios.
Third, there is a symmetric seasonal pattern in the abnormal returns of the extreme-earnings portfolios. The worst news portfolio earns only -0.61% abnormal return in the January to March period of year +1, which is surprising because this period includes both pre-announcement, announcement and some post-announcement effects. The worst news portfolio earns -2.87% over the April to December period, which is consistent with a drift but, surprisingly, it is more negative than the January to March period abnormal return. This pattern is reversed for the best news portfolio. It earns a large positive abnormal return during the January to March period, but its risk-adjusted performance is comparable to the market over the April to December period. These results suggest that either stock return seasonality (e.g., the January seasonal, see Rozell and Kinney (1976), among others) or CAPM misspecification or both have contributed to the observed pattern of $\alpha_{p,+1}$.

**Diagnostic tests**

**Twenty portfolios:** We replicate the above results using 20 portfolios, primarily to test the effect of more extreme earnings changes. As expected, the risk shifts now are more pronounced in the extreme portfolios. All the results are similar to (but not independent of) those reported here.

**Sample mean portfolio return as proxy for the market return:** To assess the sensitivity of the results to alternative proxies for the market portfolio, we replicate the entire analysis using the average of the ten earnings-performance portfolio returns as the proxy for the market portfolio return. This constrains the sample average beta to equal one and the sample average abnormal return to zero. The results are virtually indistinguishable from those reported earlier using the CRSP equal-weighted market return proxy.
Analysis of years -2 and +2: We estimate systematic risk and abnormal returns for the ten earnings-performance portfolios in event-years -2 and +2. The motivation is to assess whether: (1) risk shifts are transitory or continue beyond year +1; and (2) abnormal returns on the earnings-performance portfolios are correlated through time. If abnormal returns are correlated, then CAPM misspecification seems a more likely explanation of their "drift".

The earnings-performance portfolios' systematic risk estimates in year +2 reveal that the risk changes associated with earnings changes are not permanent beyond year +1. The worst news earnings-performance portfolio's systematic risk increases whereas the best news portfolio's systematic risk declines. Riskiness of the portfolios in year +2 is generally similar to year -2. These results suggest that firms, particularly those in the extreme earnings-performance portfolios, adjust their investment-financing policies as a function of risk changes. An alternative possibility is that relative risk changes are a function of short-term earnings performance.

The earnings-performance portfolios' abnormal returns in years +2 and -2 are not highly correlated with each other, or with abnormal returns over April to December of year +1. The behavior of the abnormal returns in years -1 and +1, discussed above, therefore seems unlikely to be CAPM misspecification.

IV. Conclusions

Earnings changes have systematic economic determinants that are likely to be associated with variation in securities' equilibrium expected returns, particularly since earnings is the accounting return on equity. Therefore, research designs investigating cross-sectional or cross-temporal variation in earnings, or similar variables, are likely to induce variation in securities' equilibrium expected returns. Identifying the economic determinants of
earnings variation should improve our understanding of the earnings/price relation. A similar conclusion applies to variables other than earnings.

Failure to recognize endogenous variation in equilibrium expected returns implies the assumption that earnings variation is due entirely to variation in firms' economic rents. By and large, this assumption is implicit in the "event study" literature to date and can contribute to anomalous results.  

This paper implements a research design that allows the economic determinants of earnings to vary with the same periodicity as earnings. Specifically, we estimate and control for annual, event-time betas. Our results suggest a predictable positive association between earnings changes and risk changes. The observed risk changes explain a substantial portion of the widely observed anomalous "drift" in stock prices after annual earnings announcements. However, there remain patterns in the post-announcement abnormal returns that are not consistent with market efficiency but, equally, are not explained by any credible hypotheses concerning market under-utilization of earnings information, of which we are aware.

Although it is recognized in several cross-sectional earnings/price studies (e.g., Collins and Kothari 1989, Easton and Zmijewski 1989).
Table 1

Earnings-performance portfolios’ average annual total returns in the three years around the earnings-performance year: 1951-1987

<table>
<thead>
<tr>
<th>Earnings performance Rank (p) b</th>
<th>UX p,0 %</th>
<th>Rp,-1 c (Std dvn)</th>
<th>Rp,0 c (Std dvn)</th>
<th>Rp,+1 d (Std dvn)</th>
<th>Rp,+1JM d (Std dvn)</th>
<th>Rp,+1AD d (Std dvn)</th>
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CRSP eq. wt. e

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Sample mean e

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<td>(23.0)</td>
<td>(11.7)</td>
<td>(18.0)</td>
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</table>
Table 1 (Cont’d)

Sample consists of 28,294 firm-year observations. Any firm with a December 31 fiscal year-end and with earnings and return data available on the Compustat Annual Industrial or the Compustat Research Annual and the CRSP monthly returns tape for at least five years is included in the sample. Earnings-performance years, designated as period 0 are 1951-87. Each calendar year firms are ranked on their earnings-performance and assigned to ten earnings-performance portfolios. Earnings performance, UX, is measured by orthogonalizing earnings changes (scaled by beginning of the year price) with respect to the return on the market (see eqns. (6) to (8) in the text).

Portfolio 1 consists of the 10% worst earnings performers in every calendar year and portfolio 10 consists of the 10% best earnings performers in every calendar year.

Average portfolio returns for years -1, 0 and +1 relative to the earnings-performance year. Reported values are averages of the 37 annual portfolio returns from 1951 to 1987. Buy-and-hold security returns inclusive of dividends are used.

R_{P+1JM} is the average portfolio return over a three-month period from January to March of year +1 relative to the earnings-performance years from 1951 to 1987. R_{P+1AD} is the average portfolio return over a nine-month period from April to December of year +1 relative to the earnings-performance years from 1951 to 1987. Buy-and-hold security returns inclusive of dividends are used.

Equal-weighted CRSP and sample mean returns inclusive of dividends for years -1, 0 and +1 and January to March and April to December periods of year +1 relative to the 37 earnings-performance years from 1951 to 1987.
Table 2

Relation between earnings-performance and relative systematic risk in
the three years around the earnings-performance year: 1951-87^a

<table>
<thead>
<tr>
<th>Earnings Performance Rank (p)^b</th>
<th>UX_{p,0}</th>
<th>\beta_{p,-1}^c</th>
<th>\beta_{p,0}^c</th>
<th>\beta_{p,+1}^c</th>
<th>\Delta\beta_{p,0}^d</th>
<th>\Delta\beta_{p,+1}^d</th>
<th>\Delta\beta_{p,-1,+1}^d</th>
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<td>-18.68</td>
<td>1.17 (0.056)</td>
<td>1.01 (0.054)</td>
<td>1.05 (0.059)</td>
<td>-0.16*</td>
<td>+0.04</td>
<td>-0.12</td>
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<tr>
<td>2</td>
<td>-3.76</td>
<td>1.04 (0.050)</td>
<td>0.82 (0.041)</td>
<td>0.89 (0.033)</td>
<td>-0.22*</td>
<td>+0.07</td>
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<td>0.80 (0.030)</td>
<td>0.74 (0.043)</td>
<td>0.76 (0.046)</td>
<td>-0.06</td>
<td>+0.02</td>
<td>-0.04</td>
</tr>
<tr>
<td>4</td>
<td>-0.39</td>
<td>0.73 (0.055)</td>
<td>0.69 (0.046)</td>
<td>0.68 (0.044)</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.05</td>
</tr>
<tr>
<td>5</td>
<td>+0.32</td>
<td>0.74 (0.056)</td>
<td>0.71 (0.043)</td>
<td>0.62 (0.046)</td>
<td>-0.03</td>
<td>-0.10</td>
<td>-0.12</td>
</tr>
<tr>
<td>6</td>
<td>+1.01</td>
<td>0.75 (0.051)</td>
<td>0.73 (0.042)</td>
<td>0.68 (0.049)</td>
<td>-0.02</td>
<td>-0.05</td>
<td>-0.07</td>
</tr>
<tr>
<td>7</td>
<td>+1.75</td>
<td>0.81 (0.037)</td>
<td>0.88 (0.039)</td>
<td>0.83 (0.037)</td>
<td>+0.07</td>
<td>-0.06</td>
<td>0.01</td>
</tr>
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<td>8</td>
<td>+2.93</td>
<td>0.84 (0.047)</td>
<td>0.88 (0.034)</td>
<td>0.82 (0.040)</td>
<td>+0.04</td>
<td>-0.07</td>
<td>-0.03</td>
</tr>
<tr>
<td>9</td>
<td>+5.43</td>
<td>0.98 (0.056)</td>
<td>1.05 (0.043)</td>
<td>1.04 (0.048)</td>
<td>+0.07</td>
<td>-0.01</td>
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<td>1.34 (0.085)</td>
<td>1.34 (0.074)</td>
<td>+0.27*</td>
<td>0.00</td>
<td>0.28*</td>
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<tr>
<td>Average</td>
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<td>.89</td>
<td>.87</td>
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<td>-.02</td>
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Rank Correlations with earnings-performance^e

<table>
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<tr>
<th>p-value</th>
<th>0.98</th>
<th>-0.48</th>
<th>0.82</th>
</tr>
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Table 2 (Cont’d)

* Significant at $\alpha = 5\%$

Sample consists of 28,294 firm-year observations. Any firm with a December 31 fiscal year-end and with earnings and return data available on the Compustat Annual Industrial or the Compustat Research Annual and the CRSP monthly returns tape for at least five years is included in the sample. Earnings-performance years, designated as period 0 are 1951-87. Each calendar year firms are ranked on their earnings-performance and assigned to ten earnings-performance portfolios. Earnings performance, $UX_0$, is measured by orthogonalizing earnings changes (scaled by beginning of the year price) with respect to the return on the market (see eqns. (6) to (8) in the text).

Portfolio 1 consists of the 10% worst earnings performers in every calendar year and portfolio 10 consists of the 10% best earnings performers in every calendar year.

$\beta_{p,-1}$ is estimated by regressing annual excess returns for portfolio $p$ in the -1 years on the annual excess returns for the market in the -1 years:

$\left( R_{pt} - R_{ft} \right) = \alpha_{p,-1} + \beta_{p,-1} \left( R_{mt} - R_{ft} \right) + \varepsilon_{pt}$ \hspace{1cm} for $p = 1, \ldots, N.$

$\beta_{p,0}$ and $\beta_{p,+1}$ are estimated similarly using excess returns in the earnings-performance years and in the years following the earnings-performance years.

$\Delta \beta_{p,0} = \beta_{p,0} - \beta_{p,-1}$ and $\Delta \beta_{p,+1} = \beta_{p,+1} - \beta_{p,0}$. $\Delta \beta_{p,-1,+1} = \beta_{p,+1} - \beta_{p,-1}$.

Spearman rank correlations between the earnings-performance portfolio rank and $\Delta \beta_{p,0}$, $\Delta \beta_{p,+1}$ and $\Delta \beta_{p,-1,+1}$ are reported under respective columns. $p$-values that the correlations are zero are reported assuming ten degrees of freedom.
### Table 3

Earnings-performance portfolios' debt to equity ratios in the three years around the earnings-performance year: 1951-1987

<table>
<thead>
<tr>
<th>Rank (p)</th>
<th>UX_{p,0}</th>
<th>D/E_{p-1}</th>
<th>D/E_{p,0}</th>
<th>D/E_{p+1}</th>
<th>ΔD/E_{p,0}</th>
<th>ΔD/E_{p+1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18.68</td>
<td>1.07</td>
<td>1.30</td>
<td>1.30</td>
<td>.23</td>
<td>.00</td>
</tr>
<tr>
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<td>(.12)</td>
<td>(.14)</td>
<td>(.13)</td>
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</tr>
<tr>
<td>2</td>
<td>-3.76</td>
<td>.70</td>
<td>.81</td>
<td>.85</td>
<td>.11</td>
<td>.04</td>
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<tr>
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<td>(.07)</td>
<td>(.09)</td>
<td>(.09)</td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>-1.48</td>
<td>.65</td>
<td>.72</td>
<td>.74</td>
<td>.07</td>
<td>.02</td>
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<tr>
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<td>(.07)</td>
<td>(.07)</td>
<td>(.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-0.39</td>
<td>.57</td>
<td>.61</td>
<td>.64</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.06)</td>
<td>(.06)</td>
<td>(.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.32</td>
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<td>.56</td>
<td>.58</td>
<td>.02</td>
<td>.02</td>
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<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.01</td>
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<td>.55</td>
<td>.57</td>
<td>.01</td>
<td>.02</td>
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<td>(.05)</td>
<td>(.05)</td>
<td>(.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.75</td>
<td>.59</td>
<td>.58</td>
<td>.60</td>
<td>-.01</td>
<td>.02</td>
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<td>(.06)</td>
<td>(.05)</td>
<td>(.06)</td>
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<tr>
<td>8</td>
<td>2.93</td>
<td>.68</td>
<td>.66</td>
<td>.67</td>
<td>-.02</td>
<td>.01</td>
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<td></td>
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<td>(.06)</td>
<td>(.06)</td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td>5.43</td>
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<td>(.07)</td>
<td>(.07)</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>26.44</td>
<td>1.26</td>
<td>1.06</td>
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<td>(.13)</td>
<td>(.10)</td>
<td>(.10)</td>
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</table>

Rank Correlations with earnings-performance:
-1.00, -.44

p-value
< .01, .20
Table 3 (Cont’d)

a Sample consists of 27,680 firm-year observations. Any firm with a December 31 fiscal year-end and with earnings, long-term debt and preferred stock and return data available on the Compustat Annual Industrial or the Compustat Research Annual and the CRSP monthly returns tape for at least five years is included in the sample. Earnings-performance years, designated as year 0, are 1951-87. Each calendar year firms are ranked on their earnings-performance and assigned to ten earnings-performance portfolios. Earnings performance, UX0, is measured by orthogonalizing earnings changes (scaled by beginning of the year price) with respect to the return on the market (see eqns. (6) to (8) in the text).

b Portfolio 1 consists of the 10% worst earnings performers in every calendar year and portfolio 10 consists of the 10% best earnings performers in every calendar year.

c \(D/E_{-1}\) is defined as the ratio of book value of long-term debt plus preferred stock to the market value of common equity, both at the end of year -1 relative to the earnings-performance year. Reported values are averages of 37 annual portfolio debt to equity ratios and their standard errors. In calculating portfolio debt to equity ratios, firms whose ratios exceeded five are set equal to five. \(D/E_{0}\) and \(D/E_{1}\) are similarly calculated using debt and equity values at the end of year 0 and the years following the earnings-performance years.

d \(\Delta D/E_{p,0} = D/E_{p,0} - D/E_{p,-1}\) and \(\Delta D/E_{p,1} = D/E_{p,1} - D/E_{p,0}\).

e Spearman rank correlations between the earnings-performance portfolio rank and \(\Delta D/E_{p,0}\) and \(\Delta D/E_{p,1}\) are reported under respective columns. p-values that the correlations are zero are reported assuming ten degrees of freedom.
Table 4

Earnings-performance and abnormal returns in the three years around the earnings-performance year: 1951-87

<table>
<thead>
<tr>
<th>Earnings Performance Rank (p)</th>
<th>UXp,0 %</th>
<th>αp,-1 (Std err)</th>
<th>αp,0 (Std err)</th>
<th>αp,+1 (Std err)</th>
<th>αp,+1JM (Std err)</th>
<th>αp,+1AD (Std err)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18.68</td>
<td>-5.48**</td>
<td>-18.85**</td>
<td>-2.24</td>
<td>-18.38</td>
<td>-2.87*</td>
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<td>(1.65)</td>
<td>(1.56)</td>
<td>(1.70)</td>
<td>(1.66)</td>
<td>(1.18)</td>
</tr>
<tr>
<td>2</td>
<td>-3.76</td>
<td>-1.65</td>
<td>-10.91**</td>
<td>-2.41*</td>
<td>-1.29*</td>
<td>-1.29</td>
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<tr>
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<td>(1.18)</td>
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<td>(.52)</td>
<td>(.75)</td>
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<td>-7.74**</td>
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<td>(1.24)</td>
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<td>(.93)</td>
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<td>4.04**</td>
<td>3.75*</td>
<td>-.25</td>
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<td>(1.22)</td>
<td>(1.41)</td>
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Rank Correlations with earnings-performance e .32 1.00 .96 .82 .56
p-value .37 < .01 < .01 < .01 .09
Table 4 (Cont'd)

** Significant at 1%
* Significant at 5%

Sample consists of 28,294 firm-year observations. Any firm with a December 31 fiscal year-end and with earnings and return data available on the Compustat Annual Industrial or the Compustat Research Annual and the CRSP monthly returns tape for at least five years is included in the sample. Earnings-performance years, designated as period 0 are 1951-87. Each calendar year firms are ranked on their earnings-performance and assigned to ten earnings-performance portfolios. Earnings performance, UX is measured by orthogonalizing earnings changes (scaled by beginning of the year price) with respect to the return on the market (see eqns. (6) to (8) in the text).

Portfolio 1 consists of the 10% worst earnings performers in every calendar year and portfolio 10 consists of the 10% best earnings performers in every calendar year.

α_p,-l is estimated by regressing annual excess returns for portfolio p in the -l years on the annual excess returns for the market in the -l years:

\[ (R_{pt} - R_{ft}) = \alpha_{p,-1} + \beta_{p,-1}(R_{mt} - R_{ft}) + \epsilon_{pt} \]

for p = 1, ..., N.

α_p,0 and α_p,+1 are estimated similarly using excess returns in the earnings-performance years and in the year following the earnings-performance years.

α_p,+1JM is abnormal return over the three months from January to March of +1 years. α_p,+1JM is estimated for each portfolio by regressing the January to March excess returns in +1 year on the excess returns on the market for the same period.

α_p,+1AD is abnormal return over the nine months from April to December of +1 years. α_p,+1AD is estimated for each portfolio by regressing the April to December excess returns in +1 year on the excess returns on the market for the same period.

Spearman rank correlations between the earnings-performance portfolio rank and α_p,-l, α_p,0, α_p,+1, α_p,+1JM and α_p,+1AD are reported under respective columns. p-values that the correlations are zero are reported assuming ten degrees of freedom.
References


Ball, R., 1990, What do we know about market "efficiency"?, working paper, University of Rochester.


Christie, A., 1989, Equity risk, the opportunity set, production costs and debt, working paper, University of Rochester.


