Stock Returns, Aggregate Earnings Surprises, and Behavioral Finance

S.P. Kothari
Sloan School of Management, MIT
kothari@mit.edu

Jonathan Lewellen
Sloan School of Management, MIT and NBER
lewellen@mit.edu

Jerold B. Warner
Simon Graduate School of Business Administration, University of Rochester
warner@simon.rochester.edu

Revised: June 2003
First draft: September 2002

We are grateful to Jun Pan, Bill Schwert, Ross Watts, and workshop participants at Arizona State, MIT, Rochester, the 2003 APJAE Symposium in Shanghai, and the FARS 2003 Conference in Orlando for helpful comments. We also thank Irfan Safdar for excellent research assistance.

Stock Returns, Aggregate Earnings Surprises, and Behavioral Finance

Abstract

We study the stock market reaction to aggregate earnings news. Previous research shows that, for individual firms, stock prices react positively to earnings news but require several quarters to fully reflect the information in earnings. We find that the relation between returns and earnings is substantially different in aggregate data. First, returns are unrelated to past earnings, suggesting that prices neither underreact nor overreact to aggregate earnings news. Second, aggregate returns are negatively correlated with concurrent earnings; over the last 30 years, stock prices increased 6.5% in quarters with negative earnings growth and only 1.9% otherwise. This finding suggests that earnings and discount rates move together over time, and provides new evidence that discount-rate shocks explain a significant fraction of aggregate stock returns.

1. Introduction

This paper studies the relation between stock returns and aggregate earnings surprises. An extensive literature investigates the stock market reaction to individual companies' earnings announcements (e.g., Ball and Brown, 1968; Watts, 1978; Bernard and Thomas, 1989). At the firm level, stock prices react positively to earnings news but require several quarters to fully reflect the information in earnings. Our goal is to test whether post-earnings announcement drift extends to aggregate data, and more broadly, to understand the connection between stock returns and aggregate earnings surprises.

The motivation for our study is two-fold. First, we test for post-announcement drift in market returns as a simple 'out-of-sample' test of recent behavioral models. At the firm level, Fama (1998, p. 304) describes post-earnings announcement drift as an 'anomaly above suspicion.' Bernard and Thomas (1990), Barberis, Shleifer, and Vishny (1998), and Daniel, Hirshleifer, and Subrahmanyam (1998) all cite it as a prime example of market inefficiency, helping to motivate their behavioral theories. Our reading of the theories suggests that, although they are motivated by firm-level evidence, the biases they describe should also affect aggregate stock returns. As discussed further below, we do not view our study as a strict test of the models, but our investigation is in the spirit of testing whether the theories can 'explain the big picture' (Fama 1998, p. 291). More generally, comparing how the stock market reacts to firm and aggregate earnings should help theorists refine models of price behavior.

Second, we study the market's reaction to aggregate earnings news to help understand the connections among earnings, stock prices, and discount rates. A large literature in finance seeks to explain price movements using cashflow and discount-rate proxies. Economists initially believed that prices follow a random walk, and research focused mostly on cashflow news (e.g., Shiller, 1981). It is now recognized that discount rates fluctuate over time, and researchers have attempted to (1) find good proxies for discount rates, and (2) understand the connection between discount rates, business conditions, and cashflows (e.g., Campbell and Shiller, 1988; Fama and French, 1989; Fama, 1990; Campbell, 1991). We provide direct evidence on the correlation between earnings surprises and discount rates. Further, we argue that the market's reaction to earnings news provides interesting indirect evidence.

Our initial tests mirror studies of firm-level returns and earnings. We begin by studying the time-series properties of aggregate earnings. Bernard and Thomas (1990) show that firms' quarterly earnings changes are positively autocorrelated, and the pattern of autocorrelation helps explain the market's reaction to future earnings announcements. They conclude that investors do not fully understand the time-series properties of earnings (see also Barberis, Shleifer, and Vishny, 1998). Our first key result is that aggregate earnings are more persistent than individual firms' earnings, yet we find no relation between aggregate returns and past earnings surprises. Thus, unlike at the firm level, there is no evidence of delayed reaction to aggregate earnings news. It is important to note that, although aggregate earnings changes are positively autocorrelated, they exhibit substantial volatility and appear to be quite unpredictable. From 1970 – 2000, the growth rate of seasonally-differenced quarterly earnings has a standard deviation of 18.6%, about half of which can be explained by a simple time-series model of earnings growth (as measured by the regression R^2). Earnings surprises seem to be large, so our tests should have reasonable power to detect post-earnings announcement drift.

Our second main finding is that aggregate returns and concurrent earnings surprises are *negatively* correlated. For example, over the last 30 years, stock prices increased 6.5% in quarters with negative earnings growth and only 1.9% otherwise (significantly different with a t-statistic of 2.6). In regressions, concurrent earnings explain between 5% and 10% of the variation in quarterly returns, and between 10% and 20% of the variation in annual returns. The t-statistic on earnings is between –2.0 and –3.5 depending on how earnings are measured. These results provide strong, albeit indirect, evidence that cashflows and discount rates move together. Mechanically, returns must be explained by either cashflow news or expected-return news (Campbell, 1991). Earnings surprises are positively correlated with cashflow news, so an overall negative correlation with returns says that earnings must be negatively related to expected-return news (i.e., positively correlated with expected returns). In fact, we find that earnings are strongly correlated with several discount-rate proxies, including changes in Tbill rates (+), the slope of the term structure (–), and changes in the yield spread between low- and high-grade corporate bonds (–). However, only the correlation with Tbill rates has the right sign and, together, the proxies only partially explain the negative correlation between returns and earnings surprises.

These results are informative. They suggest that discount-rate shocks not captured by our proxies explain a significant fraction of stock returns (see, also, French, Schwert, and Stambaugh, 1986; Fama 1990; Campbell, 1991). Indeed, for the horizons we study, discount-rate shocks seem to swamp the cashflow news in aggregate earnings. Also, our results are inconsistent with asset-pricing models that imply discount rates and cashflows (consumption) move in opposite directions. For example, the habit-formation model of Campbell and Cochrane (1999) and the heterogeneous-preferences model of Chan and Kogan (2002) both predict that discount rates drop when the economy does well, contrary to our findings.

We emphasize that the negative reaction to aggregate earnings is entirely consistent with a positive reaction to firm earnings (and, in fact, we find a positive correlation between firm-level returns and earnings in our sample). The economic story is simple. Firm earnings largely reflect idiosyncratic cashflow news, unrelated to discount rates. Aggregate earnings are more closely tied to macroeconomic conditions and, therefore, correlate more strongly with discount rates (assuming that discount rates are driven primarily by macroeconomic conditions). Thus, it is not surprising that the confounding effects of discount rates show up only in aggregate returns. Put differently, cashflow news is fairly idiosyncratic while discount-rate changes are common across firms. By a simple diversification argument, discount-rate shocks should play a larger role at the aggregate level (see, also, Vuolteenaho, 2002). In short, our results provide a logically consistent picture of market behavior in which discount rates (and discount rate changes) explain an important fraction of stock market movements.

The paper proceeds as follows. Section 2 provides further background and motivation for our study. Section 3 describes the data and the time-series properties of aggregate earnings. Section 4 studies the simple relation between returns and earnings, reporting a battery of robustness checks. Section 5 explores the correlations among returns, earnings, and other macroeconomic variables. Section 6 concludes.

2. Background: Theory and evidence

Our study relates to three areas of research: (1) empirical research on the stock market reaction to firms' earnings announcements; (2) a growing behavioral asset-pricing literature; (3) research on the correlations among stock prices, business conditions, and discount rates. This section reviews the literature and compares our tests to prior studies. A key point is that studies of post-earnings announcement drift, as well as recent behavioral theories, emphasize predictability in the cross section of stock returns. Our study of aggregate time-series behavior provides a natural extension of this research.

2.1. Post-earnings announcement drift

Firms' stock prices move predictably after earnings announcements (e.g., Ball and Brown, 1968; Watts, 1978; Foster, Olsen, and Shevlin, 1984; Bernard and Thomas, 1989). Stock prices react quickly to earnings reports, but continue to drift in the same direction for three quarters and then partially reverse in quarter four. Bernard and Thomas (1990), for example, study quarterly earnings announcements from 1974 – 1986. Each quarter they rank stocks based on unexpected earnings and track returns on the top and bottom deciles for the subsequent two years (the sample consists of firms on CRSP/Compustat). Over the first three quarters, the top decile outperforms the bottom decile by 8.1%, adjusted for risk. Moreover, the strategy's abnormal returns are concentrated around future earnings announcements, a result that is difficult to reconcile with risk-based stories. Bernard and Thomas show that small, medium, and large stocks all exhibit this return pattern, and Chan, Jegadeesh, and Lakonishok (1996) show that post-earnings announcement drift is distinct from price momentum.

2.2. Behavioral finance

Post-announcement drift is broadly consistent with investor underreaction, and in particular, behavioral models in which investors react slowly to public announcements. Bernard and Thomas (1990) offer one version of the underreaction model: investors do not understand the time-series properties of earnings. Empirically, seasonally-differenced quarterly earnings are persistent, with average autocorrelations of 0.34, 0.19, 0.06, and -0.24 at lags 1 through 4 in their sample. Bernard and Thomas suggest that investors ignore this autocorrelation pattern and are therefore surprised by predictable changes in earnings. The price response to earnings announcements aligns closely with this prediction: a portfolio that is long good-news stocks and short bad-news stocks, based on quarterly earnings, has abnormal returns of 1.32%, 0.70%, 0.04%, and -0.66% at the four subsequent quarterly earnings announcements.

Barberis, Shleifer, and Vishny (BSV 1998) propose a model that is similar, in some respects, to that of Bernard and Thomas. BSV assume that earnings follow a random walk. Investors believe, however, that earnings alternate between two regimes, one in which earnings mean revert and one in which earnings trend. The model is designed to capture two cognitive biases identified by psychological research, the representative heuristic ('the tendency of experimental subjects to view events as typical or representative of some specific class') and the conservatism bias ('the slow updating of models in the face of new evidence'). In this model, BSV show that investors will tend to underreact to earnings news in the short run (i.e., a single report) but overreact to a string of positive or negative news.

Daniel, Hirshleifer, and Subrahmanyam (DHS 1998) present an alternative model in which investors underreact to public signals, motivated by different psychological biases: overconfidence and attribution bias. Overconfidence implies that investors overweight the value of private information. Attribution bias implies that investors tend to attribute past successes to superior skill but past failures to bad luck. DHS predict that prices will overreact to private signals but underreact to public ones. If public news confirms private information received earlier, attribution bias can lead to continued overreaction. For our purposes, DHS predict short-run continuations after earnings announcements followed by long-run reversals.

2.3. Aggregate returns and earnings

The literature above focuses on the cross section of returns, but pervasive biases should also show up in aggregate data. Indeed, BSV and DHS both discuss patterns in aggregate returns to help motivate their models. Bernard and Thomas (1990) do not say whether their ideas should extrapolate to aggregate returns and earnings, but it seems reasonable to do so: investors who cannot understand the earnings process for individual firms seem unlikely to get it right at the aggregate level. Thus, a simple extension of the existing literature is to ask if overall market returns are predictable from aggregate earnings surprises. This analysis is a natural out-of-sample test of behavioral theories: the theories arose primarily in response to firm-level evidence, but they should also help explain aggregate returns. DHS argue that 'to deserve consideration a theory should be parsimonious, explain a range of anomalous patterns in difference contexts, and generate new empirical predictions' (p. 1841). We interpret our tests in precisely this spirit. If a theory can explain both firm and aggregate returns, we are more confident that it captures a pervasive phenomenon. If a theory explains one but not the other, we can reject it as a general description of prices. More generally, establishing whether the same behavioral biases drive firm and aggregate returns should help refine models of price formation.

Before continuing to the empirical tests, it is worthwhile to consider reasons that firm and aggregate price behavior might differ. Moving to aggregate data raises a number of issues, and firm-level patterns may not simply 'aggregate up':

Earnings predictability. Bernard and Thomas argue that post-announcement drift is tied to the autocorrelation of earnings. Thus, differences in the time-series properties of firm and aggregate earnings could lead to differences in price behavior. As discussed later, however, we find that the autocorrelation patterns are similar: aggregate earnings changes are more persistent, yet earnings surprises appear to be large and volatile. (Volatility in earnings is important for the tests to have power.) If investors underweight earnings persistence, as suggested by behavioral theories, then the greater persistence of aggregate earnings should lead to greater underreaction. Alternatively, the evidence suggests that firm-level earnings contain a transitory component which gets diversified away at the market level. If investors believe that aggregate earnings are a more reliable signal of value, this could lead to less underreaction.

Public vs. private information. DHS emphasize that investors respond differently to different types of information: investors overreact to private signals and underreact to public ones. Firm-level and aggregate earnings are both public information, so investors should underreact to both (at least in the short run).

Limits to arbitrage. The earnings anomaly is stronger for small firms, which tend to have higher trading costs. Thus, one explanation for post-announcement drift is that some investors are rational but arbitrage is limited due to trading costs. This story suggests that any difference between arbitrage costs for firms versus the aggregate market might lead to differences in price behavior. The existence of options and futures for market indices would seem to reduce transactions costs and short-selling restrictions, mitigating any aggregate post-announcement drift. However, underreaction to aggregate earnings would be risky to exploit. Levered or short positions in the market necessitate holding systematic risk, while trading strategies based on firm-level earnings generally do not (e.g., Chan, Jegadeesh, and Lakonishok, 1996). This difference would tend to accentuate post-announcement drift in aggregate returns.

Shocks to discount rates. Unexpected stock returns must be explained either by cashflow news or expected-return news (Campbell, 1991). In an efficient market, expected-return news is caused by changes in discount rates, and it seems likely that discount-rate shocks will be more important for aggregate returns. Discount rates should be strongly correlated across stocks, largely driven by business conditions and the market risk premium. Cashflow news is likely to have a larger idiosyncratic component. A simple diversification argument suggests, therefore, that discount-rate news will make up a relatively larger portion of market returns. Empirically, Vuolteenaho (2002) estimates that cashflow news accounts for the bulk of firm-level returns. Campbell suggests that it represents less than half of overall market returns (see, also, Campbell and Shiller, 1988; Fama and French, 1989; Fama, 1990).

Changes in discount rates complicate the return-earnings association. At the firm level, empirical tests can control for systematic movements in discount rates using market-adjusted returns. This adjustment is obviously not possible in our study of aggregate returns, where it is probably more important. Fama and French (1989) suggest that discount rates fluctuate with the business cycle, which suggests they will be correlated with earnings (see, also, Campbell, 1991). In fact, we find that aggregate earnings changes are strongly correlated with GDP and industrial production. A negative correlation between earnings and discount rates would increase the contemporaneous relation between earnings and returns, but reduce any lead-lag relation (ignoring underreaction, earnings would be negatively correlated with future returns). A positive correlation between earnings and discount rates would have the opposite effect.

We attempt to control for discount rates using several proxies, including interest rates, the slope of the term structure, and the spread between low- and high-grade bonds. The finance literature suggests that these are reasonable proxies for discount rates, though the evidence is far from conclusive (e.g., Fama and French, 1989). Our hope is to better measure the marginal impact of an earnings surprise, and to provide evidence on the correlations among earnings, prices, discount rates, and business conditions.

3. Data on aggregate earnings

This section describes the earnings series used in the empirical tests. We present summary statistics for the time series of aggregate earnings and returns, together with autocorrelations of aggregate and firm-level earnings. The autocorrelations are important for testing the behavioral theories described earlier.

3.1. Measuring aggregate earnings

Our primary tests use quarterly earnings for U.S. stocks, but we also use annual data to check the robustness of the results. The earnings series include all NYSE, AMEX, and NASDAQ stocks with data for earnings, price, and book equity on the Compustat Quarterly file from 1970 – 2000. The market return is the CRSP value-weighted index; we compound monthly index returns to obtain quarterly returns.

Details. Our tests use seasonally-differenced quarterly earnings, dE, defined as earnings in the current quarter minus four quarters earlier. Earnings are measured before extraordinary items and discontinued operations. The sample is restricted to firms with December fiscal year ends. Firms must have earnings data this quarter as well as book equity, price, and earnings data four quarters prior. As explained below, we obtain aggregate earnings changes in several ways using either lagged earnings (E), book equity (B), or price (P) as a deflator. Series based on earnings per share use data adjusted for stock splits and stock dividends.

We calculate earnings changes for the overall market using three methods: aggregate, value weighted, and equal weighted. The 'aggregate' earnings change is simply the cross-sectional sum of earnings changes for all firms in the sample. It is then scaled by the sum of lagged market value (dE/P-agg), lagged book equity (dE/B-agg), or lagged earnings (dE/E-agg) for the same group of firms. Equal- and value-weighted earnings changes, dE/P-ew and dE/P-vw, are calculated instead as averages of firm-level ratios. We begin with the change in earnings per share divided by lagged price for each firm, and then average using either equal or market-value weights (price and market value are measured four quarters prior). For descriptive purposes, we also calculate earnings yield, E/P, and return on equity, E/B, in a similar fashion.

Data restrictions. We drop approximately 40% of the firms on Compustat because they do not have a December fiscal year end. If firms' fiscal years were not aligned, aggregate earnings for a calendar quarter would be mismeasured. In calculating all the earnings variables, we exclude (i) stocks with prices below $1 per share, and (ii) each quarter the top and bottom 0.5% of the firms ranked by dE/P. These data restrictions are designed to reduce the impact of economically unimportant small stocks and extreme observations that might reflect data errors. The restrictions are most important for the equal-weighted series, and should have little effect on the aggregate and value-weighted series. The average number of stocks per quarter is 2,423, compared to an average of about 6,000 stocks on both CRSP and Compustat for the same period. Thus, the few data requirements we impose result in nearly 60% attrition.

3.2. Summary statistics

Table 1 reports summary statistics for quarterly returns and earnings from 1970 – 2000. The variables are reported in percent. Figures 1 and 2 plot the time series of deflated earnings levels and changes, respectively. In the table, we report return statistics for CRSP equal- and value-weighted indices along, with corresponding numbers for the sample firms. The analysis later in the paper uses the CRSP index returns to emphasize the generality of the results; the results are similar using the sample portfolio returns. From Table 1, the average quarterly value-weighted return on the sample stocks is 3.26%, close to the average of 3.34% on the CRSP value-weighted index. The correlation between the two series is 0.988. The equal-weighted return for the earnings sample, 3.42%, is somewhat lower than the average return on the CRSP equal-weighted index, 3.82% (correlation of 0.990). The difference is most likely due to our exclusion of low priced stocks and extreme earnings observations.[1]

The summary statistics in Table 1 and the plots in Figures 1 and 2 reveal several interesting properties. First, profitability has been fairly high. Average quarterly E/B (return on equity) is 4.14% for the value-weighted index and 1.94% for the equal-weighted index. Thus, annualized ROE since 1970 is between 8% and 16%. This range is quite broad but brackets plausible estimates of the equity cost of capital. The time series of E/P and E/B are plotted in Figure 1. The figure shows that aggregate earnings yield, E/P-agg, has declined from the early 1980s from about 4% to below 2% quarterly. E/B-agg also declined in the 1980s but has since remained stable or even increased. Thus, the bull market of the 1980s and 1990s, not an increase in conservatism, seems largely to explain the drop in aggregate earnings yield.

[Tables 1 & 2, Figures 1 & 2]

Second, small stocks have much worse earnings performance than large stocks after 1980 (see Fama and French, 1995). In Figure 1, equal-weighted E/P and ROE are always below the aggregate series in the 1980s and 1990s. The equal-weighted indices show a large decline in 1982 and, subsequently, a striking degree of fourth-quarter seasonality. Neither pattern is pronounced in the aggregate series. Panel C shows that the fraction of firms with negative earnings increases from

[1] Stock returns come from CRSP. We do not require firms in the earnings sample to have CRSP data, so the return statistics, as well as later tests that use firm returns, represent a slightly smaller subset of firms. On average, 2,216 firms have return data, compared with 2,423 firms in the full sample. Results throughout the paper are similar if we restrict the tests to only firms on CRSP.

less than 10% in 1970 to about 40% in 2000. We have explored these patterns and find little evidence that they can be attributed to the expansion of the sample in 1982 (the sample jumps from 1,490 to 2,188 firms at the end of 1982; see panel C). The firms existing prior to 1982 have earnings performance similar to the newly-added firms.

Third, aggregate earnings exhibit substantial variability through time. Figure 2 plots seasonally-differenced quarterly earnings, dE, scaled by lagged prices or lagged earnings. Panel A shows equal- and value-weighted dE/P, while Panel B shows the aggregate earnings growth rate, dE/E-agg (the cross-sectional sum of dE divided by the sum of E). The empirical tests focus on price-scaled measures since many firms have negative earnings, so we cannot meaningfully calculate equal- or value-weighted growth rates.[2] We can, however, calculate an aggregate growth rate because aggregate earnings remain positive throughout the sample. (As indicated in Table 1, portfolio earnings become negative if we look only at small stocks or only at high book-to-market stocks. We also note that aggregate *net income* – after extraordinary items and discontinued operations – becomes negative in 1993.)

Figure 2 shows that aggregate earnings growth is quite volatile. The absolute percentage growth rate is often in excess of 20%. The time-series properties appear to be fairly stable, with only marginal evidence of higher volatility in the second half of the sample. Again, we focus more on dE scaled by price or book equity, for which we can compare equal- and value-weighted indices. (Figure 2 and Table 2 show that the various series are highly correlated, suggesting that equity value is a good deflator of earnings.) Not surprisingly, earnings variability is greater for the equal-weighted portfolio than the value-weighted portfolio. Since we explore the market's reaction to earnings news, volatility in earnings is important because the power of regression-based tests hinge on the variability of the independent variable. Note, also, that seasonal differencing seems to do a

[2] The value-weighted series dE/P-vw is nearly identical to the aggregate series dE/P-agg, the sum of dE divided by the sum of market values. Their correlation is 0.992; see Table 2. The only difference is that dE/P-vw begins with *per share* numbers.

good job eliminating the seasonality in earnings.

Finally, Table 1 reports descriptive statistics for the top and bottom terciles of stocks ranked by size and B/M. Earnings are consistently higher for larger stocks. Equal- and value-weighted E/P and E/B for small firms are actually negative. However, consistent with high growth and high risk for small stocks, the earnings growth measures, dE/P and dE/B, are higher and more volatile for the small portfolio. Low-B/M stocks have higher earnings and higher growth when measured relative to book equity than high-B/M stocks, consistent with the standard value vs. growth dichotomy. Because growth is priced so highly, however, the price-scaled measures, E/P and dE/P, actually look as good or better for high-B/M stocks.

3.2. Autocorrelation of quarterly earnings

Table 3 reports autocorrelations of seasonally-differenced quarterly earnings for individual firms (Panel A) and for the aggregate market (Panel B). Firm-level autocorrelations are estimated using price-deflated earnings changes, dE/P, since growth rates are not defined for firms with negative earnings. Market-level autocorrelations are estimated using three measures: dE/B-agg, dE/P-vw, and dE/P-ew. Figure 2 and Table 2 show that, with the exception of the equal-weighted series, our various measures of market-level earnings changes are highly correlated (estimates above 0.90). Results for dE/B-agg, dE/P-vw, and dE/P-ew are representative, so we use them for the remainder of the paper.

Table 3 reports simple autocorrelations for lags 1 – 5, as well as multiple regression estimates including all lags together:

$$dE/S_t = \rho_0 + \rho_k \, dE/S_{t-k} + \varepsilon_t, \qquad (1)$$

$$dE/S_t = \rho_0 + \rho_1 \, dE/S_{t-1} + \rho_2 \, dE/S_{t-2} + \ldots + \rho_5 \, dE/S_{t-5} + \varepsilon_t, \qquad (2)$$

where S is either the market value (P) or book value (B) of equity. Firm-level autocorrelations come from Fama-MacBeth regressions (we estimate a cross-sectional slope each quarter and report the time-series average of the estimates). Market-level estimates come from time-series regressions. For firm-level data, we prefer cross-sectional to time-series regressions because they facilitate statistical tests and a firm can be included as long as it has at least one valid observation.

Our estimates of firm-level autocorrelations are remarkably similar to those reported in prior research (e.g., Bernard and Thomas, 1990, table 1). From panel A, the simple autocorrelations are positive at the first three lags and negative at the fourth lag: 0.38, 0.22, 0.08, and –0.28, respectively. All four are highly significant, with t-statistics greater than five in absolute value. In comparison, Bernard and Thomas (1990) report autocorrelations of 0.34, 0.19, 0.06, and –0.24 for the first four lags, equal to the average slope from firm-level time-series regressions, using firms with a minimum of ten quarterly earnings observations from 1974 to 1986. Thus, notwithstanding differences in estimation procedures, time periods, and data requirements, the time-series process of earnings appears to be stable.

[Table 3]

From panel B, market-level earnings are more persistent than firm-level earnings, but the pattern of the autocorrelations is quite similar. For dE/B-agg, autocorrelations at the first four lags are 0.68, 0.53, 0.25, and 0.02 (t-statistics of 9.72, 6.50, 2.69, and 0.16, respectively). The estimates are similar for dE/P-vw and dE/P-ew, although the equal-weighted series is somewhat less persistent and exhibits a small amount of reversal at lags 4 and 5. A comparison of firm and aggregate autocorrelations suggest that firm earnings contain a transitory, idiosyncratic component that gets diversified away at the market level. The systematic component of firm earnings, presumably related to business cycles, appears to be more permanent.

A highly autocorrelated aggregate earnings series is well suited for tests of behavioral theories. Underreaction should be magnified at the market level since aggregate earnings changes are more persistent. Bernard and Thomas (1990) suggest that investors do not understand the autocorrelation pattern in earnings; investors act as if earnings follow a seasonal random walk.

Under this theory, stock returns should be more predictable the greater the autocorrelation of earnings, suggesting that our tests should have good power.

Earnings surprises. In some of our tests, we would ideally like to have an estimate of the market's earnings surprise (potentially different from the true surprise). Any component of earnings anticipated by investors would not affect current returns, attenuating the slope coefficient towards zero in a regression of market returns on earnings changes. If investors believe earnings follow a seasonal random walk, the earnings change equals the earnings surprise. If investors are rational, then at a minimum we should take out the component of the earnings change that is predictable based on past earnings. Table 3 indicates that a simple AR1 model does a good job picking out the predictable component. In the multiple regressions, a few of the partial autocorrelations beyond lag 1 are significant for market-level earnings, but the increase in explanatory power is modest. For example, including five lags increases the R^2 from 0.52 to 0.57 for dE/P-vw. Thus, our later tests use an AR1 model for parsimony.

4. The reaction to earnings surprises

This section explores the stock market reaction to aggregate earnings surprises. Our tests mirror studies of post-earnings announcement drift in firm returns. Although we confirm price drift for individual firms in our sample, the aggregate price response to current and past earnings is substantially different.

4.1. Quarterly returns and earnings

In Table 4, we regress firm returns (Panel A) and market returns (Panel B) on current and past earnings changes:

$$R_{t+k} = \alpha + \beta \, dE/S_t + e_{t+k}, \tag{3}$$

where R_{t+k} is return for quarter t+k and dE/S_t is seasonally-differenced earnings for quarter t scaled by either the market value (S = P) or book value (S = B) of equity. Returns vary from k = 0 to k = 4 quarters in the future. Here, k = 0 refers to the quarter for which earnings are measured; k = 1 refers to the quarter in which (almost all) firms publicly report their quarterly earnings. These quarters both measure the contemporaneous return-earnings association: The market learns much about a firm's performance during the fiscal quarter of earnings measurement, i.e., k = 0 (see, e.g., Ball and Brown, 1968; Foster, 1977). However, earnings are not fully known at the end of the quarter – earnings announcements clearly convey information to the market – so k = 1 can also be considered contemporaneous. (A few firms may announce more than three months after fiscal-year end, so returns for k = 2 might be also reflect the market's reaction to new information. This effect should be small in recent years.)

[Table 4]

Table 4, panel A, reports Fama-MacBeth cross-sectional estimates of eq. (3) for individual firms. The table shows the time-series average and t-statistic from 124 quarterly regressions, 1970Q1 to 2000Q4. The results are consistent with prior research. Returns in both the measurement quarter and announcement quarter have a strong positive association with earnings. The slope estimates are 0.53 and 0.58 with t-statistics of 26.9 and 28.7, respectively. The market continues to react to earnings news in quarters k = 2 and k = 3, with slopes of 0.20 (t-statistic of 10.7) and 0.09 (t-statistic of 5.24). Thus, investors appear to underreact to earnings news, leading to post-announcement drift. The declining slopes at lags 2 through 4 line up with the declining autocorrelation in earnings in Table 3. However, unlike Bernard and Thomas (1990), we do not observe reversals at lags 4 or 5 to match the negative autocorrelation of earnings at these lags. Our use of quarterly returns, as opposed to 3-day announcement returns, probably weakens the tests. Bernard and Thomas find that announcement price reversals in the fourth quarter are mild, so the effect might get lost in quarterly returns.

Panel B shows results for aggregate returns. We report time-series estimates of eq. (3) for

CRSP value-weighted returns regressed on three earnings surprise measures: dE/B-agg, dE/P-ew, and dE/P-vw. The regressions either use the simple earnings change or the forecast error from an AR1 model. The panel shows two striking results: (i) the contemporaneous relation between returns and earnings is significantly negatively; and (ii) past earnings have little power to predict future returns; if anything, the predictive slopes are negative, opposite the predictions of behavioral models. We discuss these results below.

Contemporaneous relation. Regardless of which earnings measure we use, market returns in the announcement quarter, k = 1, correlate negatively with earnings surprises. For simple earnings changes, the slopes range from –3.33 to –5.23 with t-statistics between –2.41 and –2.60. Measurement error in the earnings surprise would attenuate the slopes, so these estimates are actually conservative. In fact, if we take out the component of the earnings change predictable from an AR1 model, the slopes for dE/B-agg and dE/P-vw nearly double and their t-statistics jump to about –3.4. (We also observe negative slopes for the earnings measurement quarter, k = 0, but the estimates are not significant if we take out the AR1 component. This suggests the k = 0 slopes on simple earnings changes pick up the announcement effects of the previous quarters earnings.) The significant negative reaction in the announcement quarter is surprising and contrasts strongly with the positive reaction to firm earnings.

The relation between returns and concurrent earnings is economically significant. Earnings explain 4 – 8% of quarterly returns. The standard deviation of earnings surprises from an AR1 model equals 0.45% for dE/B-agg, 0.43% for dE/P-ew, and 0.25% for dE/P-vw. Thus, a two-standard-deviation positive shock to earnings maps into a 3% – 6% decline in prices in the announcement quarter (using the slope estimates in Table 4). If earnings changes, for any of the measures, were in the bottom quartile of their distribution from 1970 – 2000, the CRSP index return was about 7%. If earnings changes were in the top quartile, the CRSP index was essentially flat, increasing by about 1%.

A simple decomposition of returns says that unexpected returns equal cashflow news plus expected-return news (Campbell, 1991). Thus, the price impact of earnings is determined by its covariance with each component. If good earnings performance is accompanied by an increase in the discount rate, and if the latter swamps the cashflow news in earnings, then the overall correlation between earnings and returns can be negative.[3]

A positive correlation between earnings and discount rates is possible, though it contradicts standard intuition about movements in discount rates over the business cycle. The standard intuition is that discount rates decrease when the economy does well (e.g., Fama and French, 1989; Cochrane and Campbell, 1999; Chan and Kogan, 2002). A counter argument is that earnings are likely to be positively related to inflation and interest rates: earnings might convey information about inflation, leading to higher interest rates, or inflation might simply lead to higher earnings in the short run since revenues should respond more quickly to inflation than (historical) accounting costs. In either case, the slope on earnings surprise in Table 4 will absorb the strong negative price reaction to unexpected inflation (Fama and Schwert, 1977; Fama, 1981; Kaul, 1987). Below, we explore the correlations among earnings, business conditions, and discount rates, and attempt to disentangle cashflow and discount-rate effects.

We also note that the negative reaction to aggregate earnings is entirely consistent with a positive reaction to firm earnings. As argued earlier, discount-rate shocks are likely to play a larger role in aggregate returns since discount rates should be driven primarily by macroeconomic conditions. To illustrate, consider a simple model of returns in which earnings surprises perfectly capture cashflow news:

---

[3] We take it for granted that earnings and cashflows are positively correlated. The autocorrelations in Table 3 suggest that aggregate earnings shocks are permanent – earnings changes are positively correlated for several quarters and show no signs of long-term reversal. Permanent shocks to earnings should eventually lead to higher dividends (see, e.g., Lintner, 1956; Campbell and Shiller, 1988b). We should also emphasize that our results pertain to relatively short run earnings surprises, i.e., quarterly and annual (see below). In the long run, prices and earnings should move together.

$$UR_i = (dE_i + dE_M) - dr_M, \quad (4)$$

where UR_i is the firm's unexpected return, dE_i is the firm-specific earnings surprise, dE_M is the aggregate earnings surprise (the total earnings surprise for the firm is $dE_i + dE_M$), and dr_M is discount-rate news (positive if discount rates go up). Market returns equal the cross-sectional average of (4), given by $UR_M = dE_M - dr_M$. Firm-specific earnings are uncorrelated with both aggregate earnings and discount-rate shocks, which we assume to be entirely macroeconomic (i.e., common across firms). From (4), it is clear that the covariance between firm returns and earnings can be positive, dominated by idiosyncratic cashflow shocks, even though the aggregate covariance is negative, dominated by discount-rate shocks. In particular, the firm-level covariance is:

$$\text{cov}(UR_i, dE_i + dE_M) = \text{var}(dE_i) + \text{cov}(UR_M, dE_M). \quad (5)$$

The first term is the covariance between returns and firm-specific earnings, necessarily positive in this model. The second term is the covariance between aggregate returns and earnings, equal to $\text{var}(dE_M) - \text{cov}(dr_M, dE_M)$. Clearly, the firm-level covariance can be positive even if the aggregate covariance is negative.

Returns and past earnings. The second key result in Table 4, panel B, is that past earnings have little power to predict future returns. There is no evidence of post-earnings announcement drift in aggregate data. In regressions with earnings *changes*, the slopes for k = 2, 3, and 4 are close to zero and always negative; in fact, slopes for the equal-weighted series, dE/P-ew, show modest evidence of being significantly negative at lags 2 and 4. If, instead, we use earnings *surprises* from an AR1 regression, only the slope at lag 4 is significant, with a t-statistic of –2.43. Again, these results contrast strongly with firm-level regressions and, more importantly, are inconsistent with underreaction to earnings news.

We emphasize that the contrast between firm and aggregate price behavior is not explained by differences in the time-series properties of earnings. Table 3 shows that market earnings are actually more persistent than firm earnings. Thus, the aggregate results are inconsistent with Bernard and Thomas' (1990) hypothesis that investors ignore the autocorrelation structure of earnings changes. We should also point out that the relation between earnings and discount-rate changes implied by our k = 1 slopes would make it easier to find post-announcement drift in returns. In particular, if earnings and discount-rate shocks are positively related, earnings would be positively correlated with future returns in the absence of any underreaction.

4.2. Robustness

The results in Table 4 are striking, especially given firm-level evidence. Therefore it is probably worthwhile to consider a few robustness checks. The bottom line is that similar results obtain for: (i) alternative definitions of earnings changes; (ii) each of the decades 70s, 80s, and 90s; (iii) using annual data; and (iv) for subsets of stocks sorted by size and B/M ratios. We also note that the firm- and market-level tests in Table 4 use the same sample of firms, so the differences cannot be attributed to differences in the data.

Alternative earnings variables. In addition to the three aggregate earnings series shown in Table 4, we also use aggregate dE scaled by past market value and past earnings (these series were described earlier). The results are quite similar to those in Table 4. For example, using the earnings growth rate, the t-statistic is –1.85 for k = 0, –2.54 for k = 1, and between –1.0 and 0.0 for the remaining lags. We also find similar results if we use net income in place of earnings before extraordinary items (this series is negative in one quarter during the sample, so we cannot construct a continuous growth rate series).

Subperiods. To check whether the results are driven by one or two observations, or by returns at the end of the sample, we repeat the tests for each of the decades 1970s, 1980s, and 1990s. Again, the results are similar to those in Table 4. The slope coefficients on earnings changes are generally negative at all lags, but not individually significant given the short sample in each decade. The coefficients on earnings *surprises* are more significant. For example, using surprises measured for dE/B-agg, the t-statistic for k = 1 is –2.07 for 1970 – 1979, –2.41 for 1980 – 1989, and –1.83 for 1990 – 2000. Estimates for the other series are also negative, but not as significant. There is never evidence of post-announcement drift in aggregate returns.

Annual return-earnings relation. Table 5 replicates the analysis using annual data. As with quarterly data, we report (i) the time-series properties of annual earnings changes for individual firms and for the market; and (ii) regressions of returns on current and past earnings surprises. Firm-level estimates are from Fama-MacBeth regressions and market-level estimates are from time-series regressions. We use the same variable definitions and impose similar data requirements as in the quarterly tests. Annual returns are measured from May to the following April to control for delays in earnings announcements.

The time-series properties of annual earnings from 1970 to 2000 are consistent with prior studies (e.g., Ball and Watts, 1972; Brooks and Buckmaster, 1976). For individual firms, earnings changes partially reverse over the subsequent 2 or 3 years. The autocorrelations are modest relative to those for quarterly earnings, but the statistical significance is strong, with t-statistics between –3.27 and –7.72 in the multiple regression. In contrast, market-level earnings changes seem to be permanent. Earnings are close to a random walk. The autocorrelation is positive at the first lag and negative at lags 2 and 3, but none of the estimates is significant at conventional levels. Again, the evidence suggests that firm earnings contain a transitory, idiosyncratic component that is diversified away at the aggregate level. Of course, with only 31 years of data, we have limited power in the market-level regressions. We cannot reject that the autocorrelations are all zero, but neither can we confidently reject that they are about -0.2 to -0.3.

The returns-earnings regressions, in the right-hand columns of Table 5, confirm our quarterly results. At the firm-level, returns and contemporaneous earnings are positively related, consistent with much evidence in the accounting literature. Interestingly, however, there is no evidence of delayed reaction to earnings news. Firm returns are uncorrelated with past earnings. The simple underreaction story would predict a positive slope on lagged earnings, while Bernard and Thomas's (1990) naïve expectations model predicts a negative slope to match the autocorrelation structure of earnings. It would be interesting to understand better why post-earnings announcement drift does not show up in annual data.

The market-level regressions align closely with our quarterly results. Annual returns are contemporaneously negatively correlated with all three earnings measures, defined using either the simple earnings change or residuals from an AR1 regression (which has little effect on the variables since they are almost serially uncorrelated). The adjusted R^2s are substantial, ranging from 10-18%. The t-statistics range from –2.27 to –2.55 even though we have only 31 annual observations. Further, lagged earnings exhibit no predictive power for future annual returns. This result is consistent with market efficiency, but the test cannot rule out Bernard and Thomas's (1990) naïve expectations story since market earnings are not highly autocorrelated. Overall, the results confirm inferences from quarterly regressions.

Small and large firms; value and glamour stocks. As a final check, Tables 6 and 7 replicate the quarterly tests on several subsets of stocks. We look at the top and bottom terciles of stocks ranked, separately, by size and book-to-market equity. The autocorrelations in Table 6 follow the same patterns as our earlier estimates (we report only simple autocorrelations). Firm-level earnings changes are positively autocorrelated at lags 1 – 3 and negatively autocorrelated at lags 4 and 5 for every subset. The estimates are remarkably similar across groups. Differences emerge, however, when we aggregate earnings for each portfolio. Earnings changes are most persistent for the large-stock portfolio; at lag 1, the autocorrelations are close to 0.70 for the large-stock portfolio, compared with 0.40 – 0.50 for the other groups. Also, the equal-weighted earnings series for the low-B/M portfolio exhibits a strong seasonal, reflected in an anomalous autocorrelation at lag 4 of 0.53 (t-statistic of 6.98). With that as the main exception, the pattern of autocorrelations in Table 6 is similar to evidence for market earnings.

Table 7 shows return regressions for the four groups; panel A shows Fama-MacBeth estimates for individual stocks within each group and Panel B shows time-series estimates for portfolios. At the firm level, returns are positively related to both concurrent and past earnings for stocks in every subset. Prices initially react most strongly for large firms. The point estimates for k = 0 and k = 1 are 0.91 and 0.77 (t-statistics of 18.0 and 16.1), compared with slopes between 0.30 and 0.50 for the other groups. The stronger reaction for large firms is rather surprising because (i) the earnings processes for the different groups are quite similar (Table 6, panel A), and (ii) we expect investors to have better prior information about large firms' earnings. Post-announcement drift is similar for all groups, which again is surprising since the groups differ in many dimensions that might affect the market's reaction to earnings news, including average profitability, liquidity, and earnings volatility (see Table 1). There is no evidence in our data that post-announcement drift is strongest in smaller or riskier firms.

The portfolio-level tests, in panel B, suggest interesting differences across groups. The large portfolio, and to a less extent the high-B/M portfolio, provides the most reliable evidence that portfolio returns and concurrent earnings are negatively correlated. The slopes for the large portfolio are significantly negative for both k = 0 and k = 1; the estimates for the other groups are typically negative but the statistical significance is weak. In terms of a lead-lag relation, the small portfolio provides the only evidence that past earnings predict future returns. The slope at lag 4 is significantly negative for two earnings measures, dE/P-ew and dE/P-vw, with t-statistics of –3.07 and –2.36. The t-statistics for the other portfolios are almost always between –1 and 1. These results are generally consistent with our market-level regressions.

The portfolio-level results suggest several interpretations. First, earnings changes are most permanent for the large-stock portfolio (Table 6), yet the market seems to react most negatively to their earnings news (Table 7). This combination is puzzling from a cashflow-news perspective; it suggests that the connection between discount rates and earnings changes is strongest for large stocks. Second, the small portfolio provides the most reliable evidence of market inefficiency, in that earnings changes predict returns four quarters in the future. The negative relation seems consistent with market overreaction, except that the concurrent relation between returns and earnings is flat. It is also consistent with Bernard and Thomas' (1990) naïve-expectations model since earnings changes are weakly negatively autocorrelated at this lag. The problem for their story is that none of our other results line up with it.

5. Earnings surprises, business conditions, and discount rates

The tests above establish two basic results: (i) aggregate stock returns and concurrent earnings surprises are negatively correlated; and (ii) past earnings surprises contain little information about future returns. To better understand these findings, this section explores the relations among earnings, business conditions, and discount rates. We are particularly interested in whether movements in observable discount-rate proxies can explain the negative contemporaneous return-earnings relation.

5.1. Framework

Campbell (1991) provides a convenient framework for thinking about the relations among returns, earnings surprises, and discount rates. In particular, he shows that returns R_t can be decomposed into three components:

$$R_t = r_t + \eta_{d,t} - \eta_{r,t}, \tag{6}$$

where r_t is the expected return for period t, $\eta_{d,t}$ is the shock to expected dividends, and $\eta_{r,t}$ is the shock to expected returns.[4] The last component has a negative sign because an increase in expected returns reduces the current price. Assume for the moment that we have a good proxy for unexpected

[4] Formally, $\eta_{d,t} = \sum_{k=0}^{\infty} \rho^k \Delta E_t d_{t+k}$ and $\eta_{r,t} = \sum_{k=1}^{\infty} \rho^k \Delta E_t h_{t+k}$, where ΔE_t is the change in expectation from t – 1 to t, d_t is the log dividend growth rate, h_t is the log stock return, and ρ is a number close to one determined by the stock's average dividend yield. The decomposition is only approximate.

earnings, dE_t, which implies that its covariance with r_t is nil. Eq. (6) then implies that earnings' covariance with returns is:

$$\text{cov}(dE_t, R_t) = \text{cov}(dE_t, \eta_{d,t}) - \text{cov}(dE_t, \eta_{r,t}). \quad (7)$$

The first term is positive as long as earnings and cashflow news are positively related. However, the overall covariance can be negative, as we find in the data, if earnings surprises are also positively correlated with shocks to expected returns.

In an efficient market, expected returns equal discount rates. Thus, our empirical results suggest that unexpectedly high earnings are associated with higher discount rates. A simple story is that earnings are positively related to inflation and, hence, interest rates. On the other hand, economic intuition suggests that the risk premium should be countercyclical (Fama and French, 1989). If so, we might expect earnings and discount rates to be negatively, not positively, related. Countercyclical movements in the equity premium might arise if investors try to smooth consumption (e.g., Lucas, 1978) or if aggregate risk aversion varies over the business cycle (e.g., Cochrane and Campbell, 1999; Chan and Kogan, 2002). We attempt to isolate these effects by including discount-rate proxies in the regressions. Our hope is to measure the marginal impact of an earnings surprise after controlling for discount rates.

5.2. Earnings and macroeconomic conditions

Table 8 reports correlations among aggregate earnings changes, real measures of economic activity, and several discount-rate proxies. The real activity variables include the growth rates of GDP, industrial production, and personal consumption. The discount-rate proxies include 1-year Tbill rates, the yield spread between 10-year Tbonds and 1-year Tbills (TERM), and the yield spread between low-grade and high-grade corporate debt (DEF). Fama and French (1989) find that DEF and TERM capture movements in expected stock and bond returns over the business cycle. We exclude financial ratios, like dividend yield, from our set of proxies because their movements are mechanically tied to prices (and we wish to test whether movements in the proxies can explain price changes). Finally, we include consumer sentiment, from the University of Michigan Survey Research Center, as an indicator of investor sentiment. The macroeconomic series come from the St. Louis Federal Reserve web site. The variables are all measured as annual changes or growth rates ending in the quarter that earnings are measured (we later consider quarterly changes in the variables).

Simple correlations. Panel A shows correlations between seasonally-differenced quarterly earnings and the macroeconomic variables. Not surprisingly, earnings are strongly correlated with the real activity measures, GDP, IPROD, and CONS. Earnings are most closely tied to industrial production, with correlations between 0.60 and 0.75 for the various earnings series. The estimates for GDP and CONS are somewhat lower and, in unreported regressions, we find that IPROD subsumes the correlation with the other two variables.

For our purposes, the correlation between earnings and the discount-rate proxies is more important. Aggregate earnings are positively correlated with changes in Tbill rates. The estimates are close to 0.60 for the value-weighted earnings series and 0.35 for the equal-weighted series. The correlation is in the right direction, in the sense that higher earnings seem to be associated with higher discount rates. In contrast, earnings are negatively correlated with ΔTERM and ΔDEF. These correlations have the wrong sign if, as Fama and French (1989) find, TERM and DEF are positively related to the equity premium. It is interesting that DEF, a proxy for bankruptcy risk, is most closely tied to the performance of smaller stocks, as measured by the equal-weighted earnings series. Also, earnings are positively correlated with consumer sentiment, although the correlations are relatively weak (it is not significant for dE/P-vw). In unreported results, we find that ΔSENT is positively related to returns (0.39 in quarterly data). Thus, its correlation with earnings has the wrong sign for explaining the negative return-earnings association.

Multiple regressions. Our tests below ask whether the discount-rate proxies can explain the correlation between returns and earnings. An easy way to do this test is to first regress earnings on the discount-rate proxies in order to break it into two components, one related to discount-rate news plus an orthogonal component. We then include both components in the return regression. In the return regression, the slope on the orthogonal component is identical to the slope on earnings in a regression that directly includes TBILL, TERM, and DEF; the two-stage approach simply eases the presentation and interpretation of the results.

Table 8, panel B, shows the first-stage regression of earnings changes on the discount-rate proxies and an AR1 term. We include the AR1 term to soak up any residual autocorrelation remaining after controlling for discount rates. The regressions show that ΔTBILL and ΔDEF subsume the correlation between earnings and ΔTERM. Like the simple correlations, the slopes on ΔTBILL are significantly positive, except in regressions with the equal-weighted earnings series (for that series, dE/P-ew, the slope becomes marginally significant if we drop ΔTERM from the regression). The slopes on DEF are all significantly negative. Collectively, the three discount-rate proxies explain about 40% of the volatility in earnings changes, or between 50% and 60% together with the AR1 term.

In the tests below, we modify the first-stage regression slightly to obtain the fitted value and residual used in the return regressions. In particular, we have to take a stand on when to measure changes in the discount-rate proxies. The regressions just described use annual changes, measured over the same interval as quarterly-differenced earnings (i.e., from t-4 to t). Most of the annual change is known prior to the earnings quarter and, in an efficient market, should have little impact on subsequent returns. Therefore, a better choice might be to use the quarterly change in the quarter for which earnings are measured, or in the quarter during which earnings are announced. We have tried all three methods and found similar results. In most of the reported tests, we use changes in the discount-rate proxies *in the quarter that earnings are measured*. The estimates from the first-stage are generally consistent with those in Table 8. TBILL and DEF both drop in significance, while the AR1 term becomes relatively more important.

Discount rate levels vs. changes. The discussion here, and throughout the paper, focuses on the correlation between earnings and discount-rate changes, or shocks. It is also possible that earnings are correlated with the ex ante level of discount rates. The distinction between the two is critical, as seen most easily in eq (6): $R_t = r_t + \eta_{d,t} - \eta_{r,t}$. Here, r_t is the ex ante discount rate and $\eta_{r,t}$ captures the price effect of a discount-rate shock ($\eta_{r,t}$ is positive if discount rates unexpectedly rise). Thus, to explain the negative correlation with returns, earnings could either be negatively correlated with discount-rate levels, r_t, or positively correlated with discount-rate shocks, $\eta_{r,t}$. The economic interpretation of our results clearly depends on which is true.

We believe the results tell us principally about earnings' correlation with discount-rate shocks, not levels, for several reasons. First, to the extent that dE_t is a proxy for *unexpected* earnings, it must be uncorrelated with r_t (which is part of the information set prior to t). The time-series properties of earnings suggest, in fact, that a large fraction of dE_t is probably unexpected: it is quite volatile and time-series models explain only half of its variability (Table 3). Moreover, if we take out the predictable component to get a better proxy for unexpected earnings, the negative correlation with returns becomes stronger (Table 4). This suggests that the unexpected component – which can only be correlated with $\eta_{r,t}$ – drives the results.

Also, earnings surprises explain a substantial fraction of quarterly and annual returns: 4% to 8% of quarterly returns and 10% to 20% of annual returns (see Tables 4 and 5). The explanatory power seems too large to be driven by changes in the ex ante discount rate. We noted earlier, for example, that stock prices increase 6.5% in quarters with negative earnings growth and only 1.9% otherwise. The large spread, in our view, simply cannot be attributed to higher ex ante expected returns in quarters with negative earnings growth; instead, it seems much more likely to reflect the arrival of new information during the quarter – again, consistent with our focus on discount-rate shocks, not levels.

Finally, we directly test whether the ex ante level of our discount-rate proxies is important. In particular, we modify the first-stage regressions (dE regressed on changes in the discount-rate proxies) to include lagged values of TBILL, TERM, and DEF. The lagged variables are known at the beginning of the earnings measurement quarter. In the modified regressions, lagged TBILL, TERM, and DEF have little correlation with dE after controlling for contemporaneous changes in the variables and the AR1 term; the t-statistics on the lagged levels are between –1.14 and 0.93. Also, including the lagged levels has little impact on the second-stage return regressions (described below). For robustness, we also test whether lagged changes in the proxies might be important, where the change is measured over the three quarters prior to the earnings quarter (i.e., we break the annual change in Table 8 into a three-quarter change prior to the quarter and a contemporaneous quarterly change). In the first-stage regressions, lagged changes are, in fact, significantly correlated with dE; the slope on lagged ΔDEF is significantly negative, with t-statistics around –3.0, and the slope on ΔTBILL is marginally positive, with t-statistics between 0.0 and 2.0. However, as detailed below, our key results in the second-stage return regressions are unaffected. In short, we recognize that discount-rate levels could be important, but the evidence suggests that discount-rate shocks are more likely to explain our results.

5.3. Returns, earnings, and discount rates

Table 9 reports the second-stage regressions of market returns on current and past earnings changes. As discussed above, earnings changes are broken into two components. The first is the projection of earnings on the discount-rate proxies and AR1 term (‘Fitted dE/S’), and the second is the orthogonal component (‘Residual dE/S’). The slope on Residual dE/S measures the marginal impact of an earnings surprise.

The table shows that the discount-rate proxies only partially explain why the market reacts negatively to good earnings news. Returns in the earnings measurement quarter, k = 0, are positively correlated with Residual dE/S, but only the slope for the equal-weighted earnings series is significant. More striking, returns in the announcement quarter, k = 1, remain negatively correlated with earnings. The slope on Residual dE/S is significant for both dE/B-agg and dE/P-vw, with t-statistics of –2.97 and –2.84. We find similar results for alternative specifications of the discount-rate shock. For example, the t-statistics at k = 1 are –3.12. –1.53, and –2.86 for dE/B-agg, dE/P-ew, and dE/P-vw, respectively, if the first-stage regressions use ΔTBILL, ΔTERM, and ΔDEF in the announcement quarter (rather than the measurement quarter).[5] Thus, the discount-rate proxies do not fully explain the negative correlation between returns and earnings.

Annual returns. Table 10 repeats the analysis using annual returns and earnings. In the first-stage regressions, from which we obtain the two components of earnings, Tbill rates are the only significant variable when used together with TERM, DEF, and an AR1 term (like returns, the discount-rate proxies are lagged four months relative to annual earnings). Tbill rates alone explain more than 50% of annual earnings changes. For simplicity, then, we employ ΔTBILL as the only proxy for discount-rate news.

Table 10 shows two key results. First, in annual data, movements in discount rates do seem to explain the concurrent return-earnings association. For lag 0, the slope estimates on Residual dE/S are roughly one standard error below zero, compared with t-statistics around –2.5 using raw earnings changes (Table 5). This suggests that, in annual data, prices react negatively to higher earnings because they are associated with higher interest rates. It is surprising, however, that the point

[5] If the first-stage regressions use annual changes in TBILL, TERM, and DEF, as shown in Table 8, the t-statistics are –2.11, –1.14, and –1.97, respectively. If we separately include the prior three-quarter change and contemporaneous quarterly change, the t-statistics are –2.11, -1.01, and –1.94, respectively.

estimates on Residual dE/S remain negative. We would expect positive coefficients if the effects of discount-rate news had been fully removed.

The second result is that earnings are positively correlated with returns in the subsequent year (k = 1). The slope is positive for all three earnings series, and significant for both dE/B-agg (t-statistic of 1.80) and dE/P-vw (t-statistic of 2.29). Economically, the point estimate for dE/P-vw is quite large. A two-standard-deviation increase in Residual dE/P-vw (2×0.86), maps into a 13.3% increase in expected return. In fact, Residual dE/P-vw explains more than 11% of the variation in next year's return. These results provide the first evidence that aggregate prices might underreact to earnings news. However, the results are also consistent with our argument that high earnings are associated with higher discount rates. In this interpretation, earnings move with discount-rate changes not captured by our proxies.[6]

6. Conclusions

The overall message from our analysis is, in some ways, quite simple: the market's reaction to aggregate earnings is much different than the reaction to firm earnings. Taking all of the results together, we find little evidence that prices react slowly to aggregate earnings news. Recent behavioral theories that explain post-earnings announcement drift in firm returns do not seem to describe aggregate price behavior. Whether this is viewed as a rejection of the theories, or simply evidence that they apply only at the firm level, is left for the reader to judge. At a minimum, our results suggest that the models are incomplete: they provide little guidance to understand why firm and aggregate price behavior should differ. Put differently, despite recent attempts, we still do not have behavioral models that provide a general description of price behavior.

[6] We should note that the significance of the k = 1 slopes is rather tenuous. For example, the slopes on Residual dE/S are not significant if we include ΔTERM and ΔDEF in the first-stage regression (the t-statistics drop to 1.29, 0.86, and 1.31 for the three earnings series).

Our results also provide interesting evidence on the connections among prices, earnings, discount rates, and business conditions. We find a strong – economically and statistically – negative price reaction to aggregate earnings news. This finding suggests that unexpectedly high earnings are associated with higher discount rates, at least over the fairly short horizons we study. Aggregate earnings are strongly correlated with macroeconomic conditions, including measures of real activity and proxies for discount rates (Tbill rates, the term spread, and the default premium). However, the discount-rate proxies only partially explain the market's negative reaction to earnings news. Thus, the results suggest that discount-rate shocks not captured by our proxies explain a significant fraction of returns (see, also, Fama 1990; Campbell, 1991). The evidence is inconsistent with asset-pricing models which say that discount rates and cashflows should move in opposite directions (e.g., Campbell and Cochrane, 1999; Chan and Kogan; 2002).

References

Ball, Ray and Philip Brown, 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6, 159-178.

Ball, Ray, S.P. Kothari, and Ross Watts, 1993. Economic determinants of the relation between earnings changes and stock returns. *The Accounting Review* 68, 622-638.

Ball, Ray and Ross Watts, 1972. Some time-series properties of accounting income. *Journal of Finance* 27, 663-682.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny, 1998. A model of investor sentiment. *Journal of Financial Economics* 49, 307-343.

Bernard, Victor and Jacob Thomas, 1989. Post-earnings announcement drift: Delayed price response or risk premium?. *Journal of Accounting Research*, Suppl. 27, 1-36.

Bernard, Victor and Jacob Thomas, 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* 13, 305-340.

Brooks, Leroy and Dale Buckmaster, 1976. Further evidence on the time-series properties of accounting income. *Journal of Finance* 31, 1359-1373.

Campbell, John, 1991. A variance decomposition for stock returns. *Economic Journal* 101, 157-179.

Campbell, John and John Cochrane, 1999. By force of habit: A consumption-based explanation for aggregate stock market behavior. *Journal of Political Economy* 107, 205-251.

Campbell, John and Robert Shiller, 1988. The dividend-price ratio and expectations of future dividends and discount factors. *Review of Financial Studies* 1, 195-228.

Campbell, John and Robert Shiller, 1988b. Stock prices, earnings, and expected dividends. *Journal of Finance* 43, 661-676.

Chan, Louis, Narasimhan Jegadeesh, and Josef Lakonishok, 1996. Momentum strategies. *Journal of Finance* 51, 1681-1713.

Chan, Yeung Lewis and Leonid Kogan, 2002. Catching up with the Joneses: Heterogeneous preferences and the dynamics of asset prices. *Journal of Political Economy* 110, 1255-1285.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53, 1839-1885.

Fama, Eugene, 1981. Stock returns, real activity, inflation, and money. American Economic Review 71, 545-565.

Fama, Eugene, 1990. Stock returns, expected returns, and real activity. *Journal of Finance* 45, 1089-1108.

Fama, Eugene, 1998. Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics* 49, 283-306.

Fama, Eugene and Kenneth French, 1989. Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics* 25, 23-49.

Fama, Eugene and Kenneth French, 1995. Size and book-to-market factors in earnings and returns. *Journal of Finance* 50, 131-155.

Fama, Eugene and James MacBeth, 1973. Risk, return and equilibrium: Empirical tests. *Journal of Political Economy* 81, 607-636.

Fama, Eugene and G. William Schwert, 1977. Asset returns and inflation. *Journal of Financial Economics* 5, 115-146.

French, Kenneth, G. William Schwert, and Robert Stambaugh, 1987. Expected stock returns and volatility. *Journal of Financial Economics* 19, 3-29.

Foster, George, 1977. Quarterly accounting data: Time-series properties and predictive-ability results. *The Accounting Review* 52, 1-21.

Foster, George, Chris Olsen, and Terry Shevlin, 1984. Earnings releases, anomalies, and the behavior of security returns. *The Accounting Review* 59, 574-603.

Hong, Harrison and Jeremy Stein, 1999. A unified theory of underreaction, momentum trading, and overreaction in asset markets. *Journal of Finance* 54, 2143-2184.

Jegadeesh, Narasimhan and Sheridan Titman, 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48, 65-91.

Kaul, Gautam, 1987. Stock returns and inflation: The role of the monetary sector. *Journal of Financial Economics* 18, 253-276.

Lintner, John, 1956. Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review* 46, 97-113.

Shiller, Robert, 1981. Do stock prices move too much to be justified by subsequent changes in dividends?. *American Economic Review* 71, 421-436.

Vuolteenaho, Tuomo, 2002. What drives firm-level stock returns?. *Journal of Finance* 57, 233-264.

Watts, Ross, 1978. Systematic ‘abnormal’ returns after quarterly earnings announcements. *Journal of Financial Economics* 6, 127-150.

Table 1

Summary statistics, quarterly returns and earnings, 1970 – 2000

This table summarizes U.S. stock returns and corporate earnings from 1970 – 2000. The variables are measured quarterly for each portfolio; the table reports the time-series average and standard deviation of the portfolio numbers (in percent, except for N). N is the number of firms in the portfolio. EW and VW are equal- and value-weighted returns. E is earnings before extraordinary items; dE is seasonally-differenced earnings, equal to earnings this quarter minus earnings four quarters ago. P is the market value of equity and B is the book value. The denominator in all ratios is lagged four quarters. The portfolio values are measured three ways: The 'Aggregate' numbers equal the sum of the numerator divided by the sum of the denominator for firms in the portfolio. The 'Equal weighted' and 'Value weighted' numbers are averages of firm ratios; the ratio is calculated for each firm, then averaged. The sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P. 'Small' and 'Large' are the bottom and top terciles of stocks ranked by market value; 'Low B/M' and 'High B/M' are the bottom and top terciles of stocks ranked by B/P.

		Returns		Aggregate					Value weighted			Equal weighted		
	N	VW	EW	E/P	E/B	dE/P	dE/B	dE/E	E/P	E/B	dE/P	E/P	E/B	dE/P
CRSP														
avg.	6,062	3.34	3.82	--	--	--	--	--	--	--	--	--	--	--
std. dev.	1,686	8.79	12.60	--	--	--	--	--	--	--	--	--	--	--
Sample														
avg.	2,423	3.26	3.42	2.29	3.59	0.15	0.25	8.26	2.10	4.14	0.10	1.30	1.94	0.30
std. dev.	1,163	8.38	11.40	0.91	0.72	0.39	0.59	18.58	0.84	0.72	0.36	1.68	1.41	0.55
Small														
avg.	808	3.48	3.85	1.22	0.60	0.42	0.39	--	0.48	0.33	0.56	0.04	-0.12	0.86
std. dev.	388	14.10	14.81	2.98	2.62	1.18	1.14	--	2.44	2.40	0.90	2.79	2.64	1.13
Large														
avg.	808	3.24	3.22	2.32	3.76	0.14	0.25	7.90	2.14	4.30	0.10	2.07	3.45	0.08
std. dev.	388	8.22	9.22	0.88	0.71	0.37	0.58	17.60	0.81	0.77	0.35	0.94	0.77	0.38
Low B/M														
avg.	808	2.89	2.35	1.78	5.42	0.17	0.54	12.11	1.71	5.58	0.16	0.63	2.07	0.60
std. dev.	388	9.52	13.34	0.71	0.88	0.23	0.73	16.69	0.68	1.05	0.22	1.55	2.55	0.69
High B/M														
avg.	808	4.31	4.43	3.27	2.36	0.19	0.11	--	2.56	2.19	0.09	1.22	1.10	0.22
std. dev.	388	8.91	11.72	1.70	0.94	1.13	0.81	--	1.49	0.88	1.02	2.40	1.34	1.21

Figure 1
Profitability, 1970 – 2000

This figure shows corporate profitability from 1970 – 2000. Earnings are measured quarterly before extraordinary items. Panels A and B show earnings scaled by the market value (E/P) and book value (E/B) of equity. Panel C shows the number of firms in the sample and the fraction with positive earnings. Profitability is measured two ways: The aggregate numbers, labeled '-agg', equal the sum of the numerator divided by the sum of the denominator for firms in the sample. The equal-weighted numbers, labeled '-ew,' are simple averages of firm ratios. The sample consists of firms on Compustat with a December fiscal year-end and with earnings, book equity, share price, and shares outstanding data, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by E/P (Panel A) or E/B (Panel B).

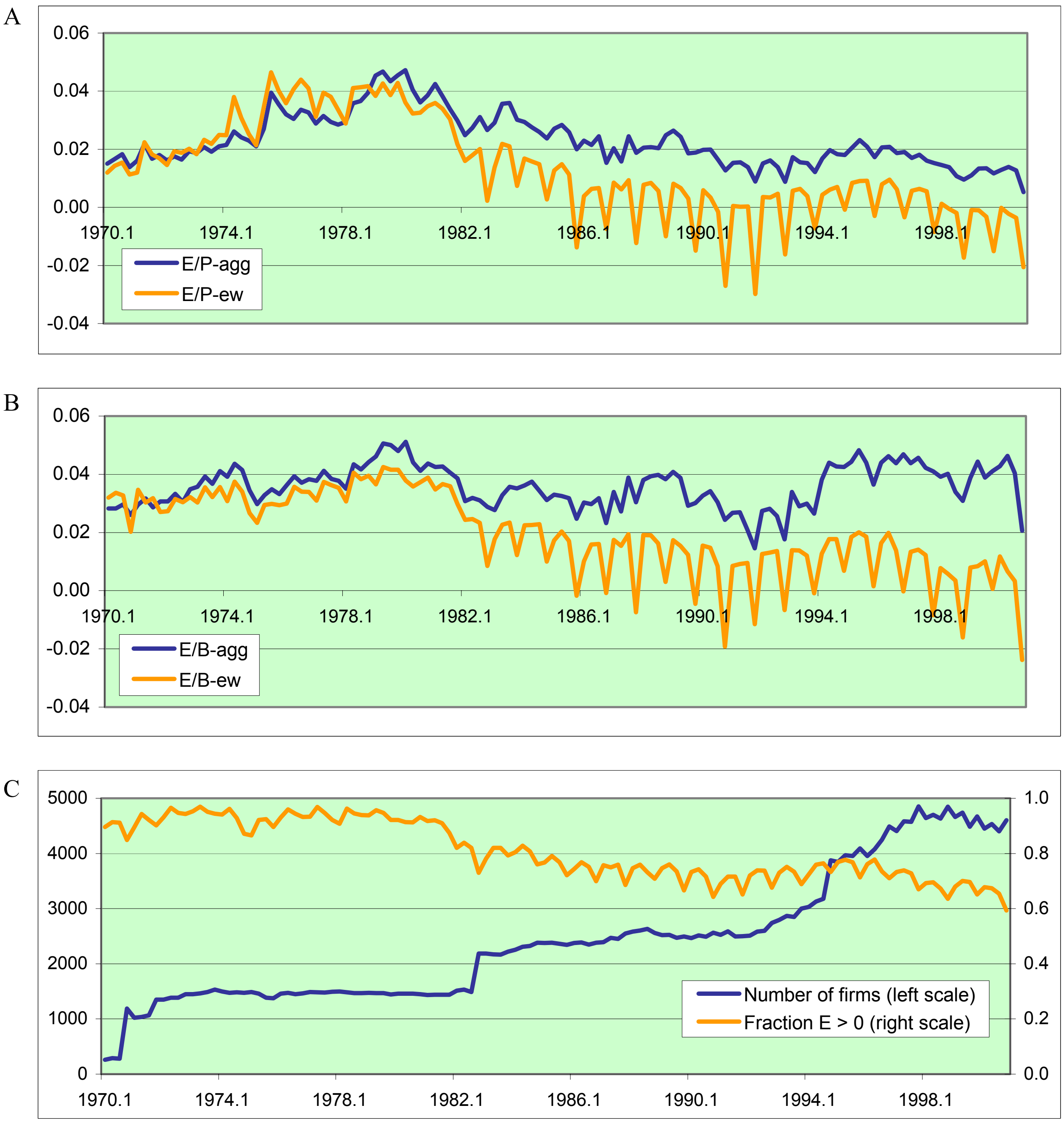
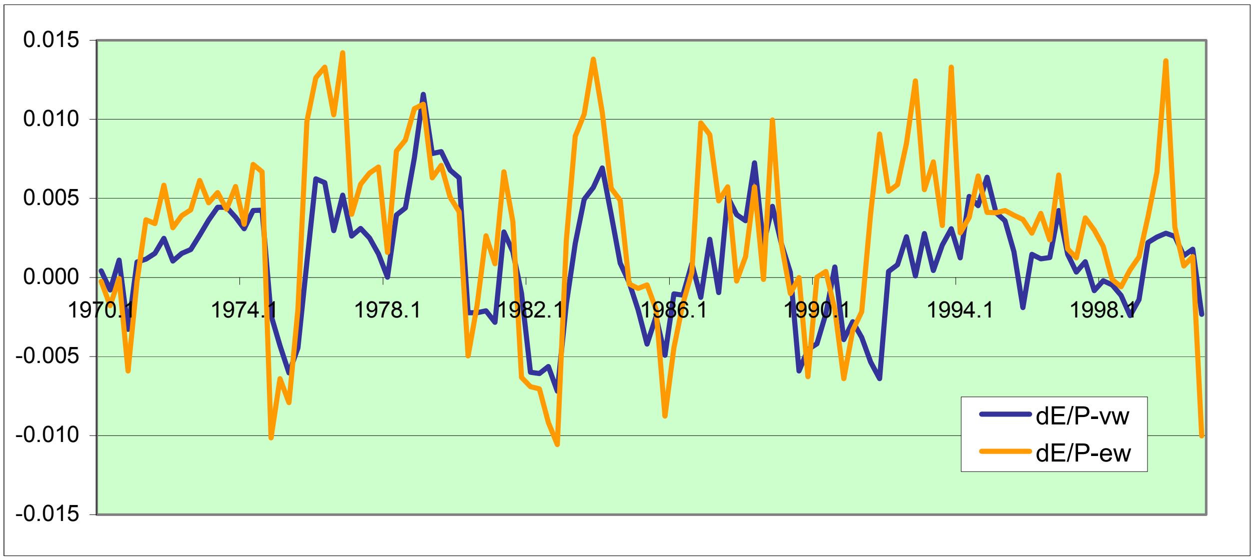


Figure 2
Change in quarterly earnings, 1970 – 2000

This figure shows seasonally-differenced quarterly earnings for U.S. firms from 1970 – 2000. Earnings are measured before extraordinary items. Seasonally-differenced earnings, dE, are earnings this quarter minus earnings four quarters ago. Panel A shows dE divided by market value (P) at the end of quarter –4. The ratio is calculated firm-by-firm and then averaged; dE/P-vw is a value-weighted average and dE/P-ew is an equal-weighted average. Panel B shows the growth rate of aggregate quarterly earnings, dE/E-agg, defined as the sum of dE divided by the sum of earnings four quarters ago for firms in the sample. The sample consists of firms with December fiscal year ends and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

Panel A



Panel B

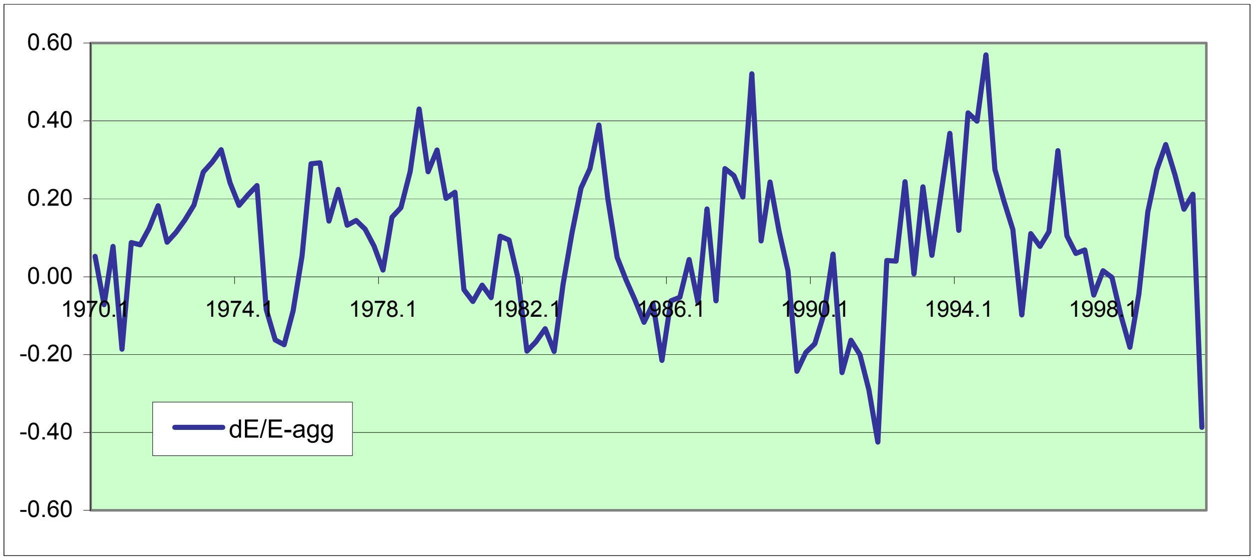


Table 2
Correlations, changes in quarterly earnings, 1970 – 2000

This table reports correlations among various measures of seasonally-differenced aggregate quarterly earnings, 1970 – 2000. E is earnings before extraordinary items; dE is seasonally-differenced earnings, equal to earnings this quarter minus earnings four quarters ago. P is the market value of equity and B is the book value. The denominator in all ratios is lagged four quarters. The portfolio values are measured three ways: The aggregate numbers, identified by '-agg', equal the sum of the numerator divided by the sum of the denominator for firms in the sample. Equal- and value-weighted numbers, identified by '-ew' and '-vw,' are averages of firm ratios. The sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

	dE/P-agg	dE/B-agg	dE/E-agg	dE/P-vw	dE/P-ew
dE/P-agg	1	0.935	0.910	0.992	0.713
dE/B-agg		1	0.986	0.940	0.670
dE/E-agg			1	0.920	0.658
dE/P-vw				1	0.713
dE/P-ew					1

Table 3
Autocorrelation of quarterly earnings, 1970 – 2000

This table reports autocorrelations of seasonally-differenced quarterly earnings, 1970 – 2000. Panel A reports estimates for individual firms, obtained from Fama-MacBeth cross-sectional regressions. Panel B reports estimates for the market portfolio, obtained from time-series regressions. E is earnings before extraordinary items; dE is seasonally-differenced earnings, equal to earnings this quarter minus earnings four quarters ago. P is the market value of equity and B is the book value. The denominator in all ratios is lagged four quarters. Aggregate earnings changes are measured three ways: dE/B-agg equals the sum of dE divided by the sum of B for firms in the sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios (the ratio is calculated for each firm, then averaged). The sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

		Simple regressions			Multiple regressions		
	Lag	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2
Panel A: Individual firms							
dE/P	1	0.38	18.48	--	0.40	18.39	--
	2	0.22	14.58	--	0.14	11.20	
	3	0.08	5.67	--	0.06	6.47	
	4	-0.28	-16.82	--	-0.42	-22.83	
	5	-0.11	-7.03	--	0.16	12.93	
Panel B: Aggregate							
dE/B-agg	1	0.68	9.72	0.43	0.64	6.33	0.50
	2	0.53	6.50	0.25	0.32	2.72	
	3	0.25	2.69	0.05	-0.19	-1.57	
	4	0.02	0.16	-0.01	-0.27	-2.34	
	5	-0.07	-0.78	-0.00	0.10	0.98	
dE/P-ew	1	0.64	8.81	0.39	0.61	6.33	0.43
	2	0.40	4.62	0.14	0.11	1.05	
	3	0.14	1.49	0.01	0.00	0.01	
	4	-0.15	-1.62	0.01	-0.30	-2.76	
	5	-0.21	-2.26	0.03	0.04	0.40	
dE/P-vw	1	0.73	11.54	0.52	0.73	7.75	0.57
	2	0.52	6.65	0.26	0.22	1.93	
	3	0.23	2.55	0.04	-0.22	-1.92	
	4	-0.00	-0.03	-0.01	-0.18	-1.62	
	5	-0.12	-1.30	0.01	0.07	0.80	

Table 4
Quarterly returns and earnings, 1970 – 2000

This table reports the slope estimate, t-statistic, and adjusted R^2 when quarterly stock returns are regressed on seasonally-differenced quarterly earnings:

$R_{t+k} = \alpha + \beta \, dE/S_t + e_{t+k}$,

where dE is seasonally-differenced earnings and S is either the market value (P) or book value (B) of equity. Earnings are before extraordinary items. R_{t+k} varies from k = 0 to k = 5 quarters in the future (k = 0 is the quarter for which earnings are measured; k = 1 is the quarter that earnings are announced). Panel A reports estimates for individual firms, obtained from Fama-MacBeth cross-sectional regressions. Panel B reports estimates for the market portfolio, obtained from time-series regressions. The market return is the CRSP value-weighted index. dE/B-agg equals the sum of dE divided by the sum of B for all firms in the earnings sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. The earnings sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P. Bold denotes estimates that are significant at a two-sided 10% level or stronger.

		Earnings change[a]			Earnings surprise[a]		
	k	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2
Panel A: Individual firms							
dE/P	0	**0.53**	26.94	--	**0.42**	22.63	--
	1	**0.58**	28.70	--	**0.61**	29.92	--
	2	**0.20**	10.66	--	**0.20**	10.84	--
	3	**0.09**	5.24	--	**0.11**	6.82	--
	4	0.00	0.03	--	0.02	1.20	--
Panel B: Aggregate							
dE/B-agg	0	**-2.42**	-1.82	0.02	-0.52	-0.30	0.03
	1	**-3.33**	-2.46	0.04	**-6.33**	-3.49	0.08
	2	-0.26	-0.19	-0.01	0.55	0.29	-0.01
	3	-0.72	-0.53	-0.01	-0.04	-0.02	-0.01
	4	-0.98	-0.73	0.00	-2.06	-1.09	-0.01
dE/P-ew	0	-1.30	-0.90	0.00	1.54	0.85	0.04
	1	**-3.75**	-2.60	0.05	**-3.70**	-2.04	0.05
	2	**-2.81**	-1.97	0.02	-3.03	-1.65	0.01
	3	-1.36	-0.95	0.00	1.15	0.63	0.03
	4	**-3.14**	-2.23	0.03	**-4.48**	-2.43	0.03
dE/P-vw	0	**-4.98**	-2.31	0.03	-2.59	-0.83	0.04
	1	**-5.23**	-2.41	0.04	**-10.10**	-3.34	0.07
	2	-0.80	-0.37	-0.01	0.51	0.16	-0.01
	3	-1.34	-0.63	-0.01	-1.41	-0.45	-0.01
	4	-0.90	-0.42	-0.01	-3.05	-0.97	-0.01

[a] Earnings change is the actual value of dE/P or dE/B. Earnings surprise is the forecast error from an AR(1) regression. The slope is estimated by including a lag of dE/P or dE/B in the regressions; the adj. R^2 measures the joint explanatory power of the two lags.

Table 5
Annual returns and earnings, 1970 – 2000

This table reports autocorrelations of annual earnings changes (left panel) and slope estimates from the following regression (right panel):

$R_{t+k} = \alpha + \beta \text{ } dE/S_t + e_{t+k}$,

where R_t is the annual return ending in April of year t+1, dE_t is the earnings change from t-1 to t, and S is either the market value (P) or book value (B) of equity. Earnings are before extraordinary items. R_{t+k} varies from k = 0 to k = 2 years in the future (when k = 0, returns and earnings are contemporaneous). Panel A reports estimates for individual firms, obtained from Fama-MacBeth cross-sectional regressions. Panel B reports estimates for the market portfolio, obtained from time-series regressions. The market return is the CRSP value-weighted index. dE/B-agg equals the sum of dE divided by the sum of B for all firms in the earnings sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. The earnings sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

		Autocorrelations						$R_{t+k} = \alpha + \beta \text{ } dE/S_t + e_{t+k}$					
		Simple regressions			Multiple regressions			Earnings change[a]			Earnings surprise[a]		
	k	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2
Panel A: Individual firms													
dE/P	0							**0.56**	18.61	--	**0.62**	16.85	--
	1	**-0.16**	-5.90	--	**-0.21**	-7.72	--	0.03	1.16	--	0.03	1.21	--
	2	**-0.11**	-2.92	--	**-0.18**	-5.00		-0.00	-0.12	--	0.01	0.15	--
	3	-0.04	-1.44	--	**-0.07**	-3.27		0.01	0.34	--	0.01	0.21	--
Panel B: Aggregate													
dE/B-agg	0							**-3.56**	-2.38	0.13	**-3.72**	-2.44	0.15
	1	0.18	1.01	0.00	0.17	0.92	0.02	1.61	1.01	0.00	1.34	0.79	-0.02
	2	-0.13	-0.72	-0.02	-0.11	-0.60		1.58	0.96	0.00	0.97	0.57	-0.02
	3	-0.30	-1.68	0.06	-0.25	-1.37		1.72	1.06	0.00	1.41	0.84	-0.05
dE/P-ew	0							**-3.54**	-2.49	0.15	**-3.39**	-2.27	0.10
	1	0.15	0.86	-0.01	0.15	0.80	-0.05	0.53	0.34	-0.03	0.20	0.12	-0.03
	2	-0.10	-0.56	-0.02	-0.11	-0.56		1.69	1.07	0.01	1.23	0.74	-0.04
	3	-0.15	-0.80	-0.01	-0.11	-0.57		0.94	0.59	-0.02	0.18	0.11	-0.07
dE/P-vw	0							**-5.33**	-2.55	0.15	**-5.25**	-2.53	0.18
	1	0.07	0.42	-0.03	0.05	0.28	-0.02	2.81	1.26	0.02	2.69	1.15	-0.01
	2	-0.13	-0.74	-0.01	-0.12	-0.64		1.23	0.53	-0.03	0.74	0.31	-0.05
	3	-0.25	-1.41	0.03	-0.23	-1.26		1.67	0.73	-0.02	1.15	0.50	-0.07

[a] Earnings change is the actual value of dE/P or dE/B. Earnings surprise is the forecast error from an AR(1) regression. The slope is estimated by including a lag of dE/P or dE/B in the regressions; the adj. R^2 measures the joint explanatory power of the two lags.

Table 6
Size and B/M portfolios: Autocorrelation of quarterly earnings, 1970 – 2000

This table reports autocorrelations of seasonally-differenced quarterly earnings for (1) small and large stocks, defined as the bottom and top terciles of firms ranked by market capitalization, and (2) low and high B/M stocks, defined as the bottom and top terciles of firms ranked by the ratio of book equity (B) to market equity (P). E is earnings before extraordinary items; dE is seasonally-differenced earnings, equal to earnings this quarter minus earnings four quarters ago. The denominator in all ratios is lagged four quarters. The portfolio variables are measured three ways: dE/B-agg equals the sum of dE divided by the sum of B for all firms in the portfolio; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios (the ratio is calculated for each firm, then averaged). The sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

		Small			Large			Low B/M			High BM		
	Lag	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2
Panel A: Individual firms													
dE/P	1	**0.38**	15.29	--	**0.38**	17.66	--	**0.43**	15.18	--	**0.37**	15.19	--
	2	**0.21**	10.22	--	**0.22**	12.47	--	**0.25**	11.30	--	**0.21**	11.10	--
	3	**0.06**	2.32	--	**0.11**	5.94	--	**0.08**	2.14	--	**0.08**	4.36	--
	4	**-0.34**	-17.29	--	**-0.22**	-10.75	--	**-0.24**	-11.05	--	**-0.37**	-16.22	--
	5	**-0.12**	-6.72	--	**-0.09**	-4.85	--	**-0.08**	-4.52	--	**-0.12**	-6.00	--
Panel B: Portfolios													
dE/B-agg	1	**0.41**	4.77	0.15	**0.69**	10.08	0.45	**0.42**	4.87	0.16	**0.45**	5.47	0.19
	2	**0.25**	2.74	0.05	**0.52**	6.41	0.25	**0.32**	3.49	0.08	**0.43**	5.09	0.17
	3	0.09	0.94	0.00	**0.28**	3.15	0.07	0.05	0.56	-0.01	**0.18**	1.91	0.02
	4	**-0.18**	-1.91	0.02	0.07	0.71	0.00	**-0.21**	-2.25	0.03	0.00	-0.03	-0.01
	5	**-0.17**	-1.73	0.02	-0.03	-0.32	-0.01	-0.04	-0.45	-0.01	-0.03	-0.31	-0.01
dE/P-ew	1	**0.44**	5.29	0.18	**0.66**	9.32	0.41	**0.19**	2.09	0.03	**0.54**	6.84	0.27
	2	**0.28**	3.12	0.07	**0.53**	6.66	0.26	0.13	1.49	0.01	**0.40**	4.61	0.14
	3	0.08	0.82	0.00	**0.25**	2.80	0.05	-0.02	-0.22	-0.01	**0.18**	1.94	0.02
	4	0.01	0.07	-0.01	0.02	0.17	-0.01	**0.53**	6.98	0.29	0.01	0.11	-0.01
	5	-0.14	-1.49	0.01	-0.09	-1.02	0.00	-0.01	-0.08	-0.01	-0.15	-1.61	0.01
dE/P-vw	1	**0.50**	6.14	0.23	**0.73**	11.58	0.52	**0.52**	6.72	0.27	**0.51**	6.46	0.25
	2	**0.34**	3.81	0.10	**0.51**	6.48	0.25	**0.36**	4.24	0.12	**0.38**	4.52	0.14
	3	0.13	1.36	0.01	**0.24**	2.75	0.05	**0.16**	1.74	0.02	0.05	0.57	-0.01
	4	-0.07	-0.74	0.00	0.03	0.29	-0.01	-0.04	-0.47	-0.01	**-0.17**	-1.88	0.02
	5	-0.14	-1.49	0.01	-0.09	-0.93	0.00	0.02	0.20	-0.01	**-0.19**	-2.08	0.03

Table 7
Size and B/M portfolios: Quarterly returns and earnings, 1970 – 2000

This table reports slope estimates from the regression $R_{t+k} = \alpha + \beta\ dE/S_t + e_{t+k}$, where dE is seasonally-differenced quarterly earnings and S is either the market value (P) or book value (B) of equity. Earnings are before extraordinary items. R_{t+k} varies from k = 0 to 5 quarters in the future (k = 0 is the quarter for which earnings are measured). The table reports estimates for (1) small and large stocks, defined as the bottom and top terciles of firms ranked by market equity, and (2) low and high B/M stocks, defined as the bottom and top terciles of firms ranked by B/P. The portfolio variables are measured three ways: dE/B-agg equals the sum of dE divided by the sum of B for firms in the portfolio; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. The sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

		Small			Large			Low B/M			High BM		
	k	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2	Slope	T-stat	Adj. R^2
Panel A: Individual firms													
dE/P	0	**0.31**	19.95	--	**0.91**	17.99	--	**0.51**	15.17	--	**0.36**	22.98	--
	1	**0.41**	20.40	--	**0.77**	16.12	--	**0.51**	15.84	--	**0.45**	22.80	--
	2	**0.14**	9.49	--	**0.20**	4.16	--	**0.20**	7.53	--	**0.15**	8.78	--
	3	**0.06**	4.15	--	**0.10**	2.13	--	**0.09**	3.06	--	**0.08**	4.13	--
	4	-0.02	-1.35	--	0.04	0.77	--	-0.02	-0.53	--	0.01	0.40	--
Panel B: Portfolios													
dE/B-agg	0	0.13	0.12	-0.01	**-2.55**	-2.03	0.03	-0.88	-0.75	0.00	-0.59	-0.60	-0.01
	1	-0.08	-0.07	-0.01	**-2.76**	-2.15	0.03	-1.78	-1.45	0.01	-1.24	-1.24	0.00
	2	-1.30	-1.14	0.00	0.07	0.05	-0.01	1.13	0.96	0.00	-0.23	-0.23	-0.01
	3	0.02	0.01	-0.01	-0.78	-0.61	-0.01	-1.26	-1.10	0.00	-0.12	-0.12	-0.01
	4	-1.69	-1.48	0.01	-0.88	-0.69	0.00	0.13	0.12	-0.01	0.06	0.06	-0.01
dE/P-ew	0	-0.06	-0.06	-0.01	**-3.78**	-1.94	0.02	0.56	0.45	-0.01	-0.13	-0.20	-0.01
	1	0.02	0.02	-0.01	**-5.32**	-2.71	0.05	1.03	0.83	0.00	**-1.68**	-2.49	0.04
	2	-1.56	-1.39	0.01	-1.75	-0.89	0.00	0.17	0.14	-0.01	-0.63	-0.94	0.00
	3	-1.05	-0.94	0.00	-1.37	-0.71	0.00	-1.30	-1.11	0.00	0.08	0.12	-0.01
	4	**-3.34**	-3.07	0.07	-0.84	-0.43	-0.01	-1.55	-1.33	0.01	-0.81	-1.20	0.00
dE/P-vw	0	0.20	0.14	-0.01	**-4.84**	-2.32	0.03	-4.16	-1.07	0.00	-0.37	-0.47	-0.01
	1	-1.09	-0.75	0.00	**-4.36**	-2.07	0.03	-4.60	-1.17	0.00	**-1.36**	-1.72	0.02
	2	-1.87	-1.32	0.01	-0.31	-0.15	-0.01	3.09	0.83	0.00	-0.44	-0.56	-0.01
	3	-0.82	-0.58	-0.01	-1.50	-0.73	0.00	-4.07	-1.11	0.00	-0.43	-0.55	-0.01
	4	**-3.28**	-2.36	0.04	-0.99	-0.48	-0.01	1.28	0.35	-0.01	-0.36	-0.45	-0.01

Table 8
Earnings and the macroeconomy, 1970 – 2000

This table reports correlations between seasonally-differenced quarterly earnings and various macroeconomic series. Panel A shows simple correlations and Panel B shows regression coefficients (t-statistics in parentheses). E is earnings before extraordinary items; dE is seasonally-differenced earnings, scaled by either the market value (P) or book value (B) of equity: dE/B-agg equals the sum of dE divided by the sum of B for firms in the sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. TBILL is the 1-year Tbill rate. TERM is the yield spread between 10-year Tbonds and 1-year Tbills. DEF is the yield spread between Baa- and Aaa-rated corporate bonds. SENT is consumer sentiment from the University of Michigan Survery Research Center. GDP and CONS are per-capita growth rates of gross domestic product and personal consumption, respectively. IPROD is growth in industrial production. The prefix 'Δ' denotes four quarter changes in the variables. The earnings sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price below $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P.

	Nominal dE			Real dE[a]		
	dE/B-agg	dE/P-ew	dE/P-vw	dE/B-agg	dE/P-ew	dE/P-vw
Panel A: Correlations						
ΔTBILL	0.571	0.349	0.598	0.487	0.265	0.497
ΔTERM	-0.463	-0.347	-0.523	-0.454	-0.332	-0.522
ΔDEF	-0.332	-0.585	-0.371	-0.423	-0.662	-0.494
ΔSENT[b]	0.200	0.365	0.131	0.258	0.392	0.202
GDP[a]	0.441	0.400	0.538	0.591	0.608	0.668
IPROD	0.599	0.673	0.652	0.666	0.717	0.744
CONS[a]	0.333	0.291	0.421	0.475	0.526	0.524
Panel B: $dE_t = \alpha + \beta\ \Delta TBILL_t + \gamma\ \Delta TERM_t + \lambda\ \Delta DEF_t + \rho\ dE_{t-1} + \varepsilon$						
ΔTBILL	**0.09**	0.04	**0.04**	**0.07**	0.02	**0.03**
	(3.24)	(1.39)	(2.72)	(2.41)	(0.73)	(1.78)
ΔTERM	0.03	0.00	-0.01	0.02	-0.01	-0.02
	(0.60)	(0.09)	(-0.29)	(0.36)	(-0.23)	(-0.69)
ΔDEF	**-0.34**	**-0.55**	**-0.22**	**-0.39**	**-0.64**	**-0.26**
	(-3.39)	(-4.95)	(-3.96)	(-3.85)	(-5.70)	(-4.79)
dE_{t-1}	**0.48**	**0.39**	**0.53**	**0.50**	**0.35**	**0.53**
	(6.10)	(4.62)	(7.53)	(6.42)	(4.29)	(7.71)
Adj. R^2	0.52	0.49	0.61	0.52	0.53	0.62
Adj. R^2 without AR1	0.38	0.41	0.44	0.36	0.46	0.43

[a] Real dE/B and dE/P are calculated using inflation-adjusted earnings, book values, and market values. GDP and CONS are measured as nominal or real growth rates corresponding to the definition of dE/B and dE/P. TBILL, TERM, and DEF are always nominal rates.
[b] ΔSENT is available from 1979 – 2000.

Table 9
Controlling for discount rates: Quarterly returns and earnings, 1970 – 2000

This table reports slope estimates when quarterly stock returns are regressed on seasonally-differenced earnings broken into two components:

$R_{t+k} = \alpha + \beta$ Fitted$(dE/S_t) + \gamma$ Residual$(dE/S_t) + e_{t+k}$,

where dE is seasonally-differenced earnings, S is either the market value (P) or book value (B) of equity, and the two components of dE/S are obtained from the regression:

$dE/S_t = \alpha + \beta\ \Delta TBILL_t + \gamma\ \Delta TERM_t + \lambda\ \Delta DEF_t + \rho\ dE/S_{t-1} + \varepsilon_t$.

Fitted(dE/S_t) is the fitted value from this regression and Residual(dE/S_t) is the residual. The variables ΔTBILL, ΔTERM, and ΔDEF are 1-quarter changes in the variables, measured in the quarter of earnings measurement. Earnings are before extraordinary items. R_{t+k} varies from k = 0 to 5 quarters in the future (k = 0 is the quarter for which earnings are measured; k = 1 is the quarter that earnings are announced). R_t is the return on the CRSP value-weighted index. dE/B-agg equals the sum of dE divided by the sum of B for all firms in the earnings sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. The earnings sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P. Bold denotes estimates that are significant at a two-sided 10% level or stronger.

		Fitted dE/S		Residual dE/S		
	k	Slope	T-stat	Slope	T-stat	Adj. R^2
dE/B-agg	0	**-6.30**	-3.45	1.41	0.77	0.08
	1	-1.37	-0.76	**-5.77**	-2.97	0.06
	2	-1.93	-1.05	1.76	0.89	0.00
	3	-1.14	-0.61	-0.20	-0.10	-0.01
	4	-0.17	-0.09	-1.85	-0.93	-0.01
dE/P-ew	0	**-6.86**	-3.44	**3.57**	1.89	0.10
	1	**-5.01**	-2.51	-3.02	-1.55	0.05
	2	-2.93	-1.45	-2.44	-1.23	0.01
	3	**-4.20**	-2.09	1.47	0.75	0.02
	4	-1.55	-0.76	**-4.53**	-2.28	0.03
dE/P-vw	0	**-9.08**	-3.27	0.76	0.23	0.07
	1	-2.58	-0.95	**-9.27**	-2.84	0.05
	2	-2.84	-1.02	2.30	0.69	0.00
	3	-1.09	-0.39	-1.65	-0.49	-0.01
	4	0.29	0.10	-2.53	-0.75	-0.01

Table 10
Controlling for discount rates: Annual returns and earnings, 1970 – 2000

This table reports the slope estimates, t-statistics, and adjusted R^2 when annual stock returns are regressed on earnings changes broken into two components:

$$R_{t+k} = \alpha + \beta \text{ Fitted}(dE/S_t) + \gamma \text{ Residual}(dE/S_t) + e_{t+k},$$

where R_t is the annual return ending in April of year t+1, dE is the earnings change from year t-1 to t, and S is either the market value (P) or book value (B) of equity. The two components of dE/S are obtained from the regression:

$$dE/S_t = \alpha + \beta \Delta TBILL_t + \varepsilon.$$

Fitted(dE/S_t) is the fitted value from this regression and Residual(dE/S_t) is the residual. ΔTBILL is the annual change in one-year Tbill rates ending in April of t+1. Earnings are before extraordinary items. R_{t+k} varies from k = 0 to 3 years in the future (k = 0 is the contemporaneous return). R_t is the return on the CRSP value-weighted index. dE/B-agg equals the sum of dE divided by the sum of B for all firms in the earnings sample; dE/P-ew and dE/P-vw are equal- and value-weighted averages of firm dE/P ratios. The earnings sample consists of firms with a December fiscal year end and with earnings, book equity, share price, and shares outstanding data on Compustat, excluding stocks with price < $1 and, subsequently, the top and bottom 0.5% of firms ranked by dE/P. Bold denotes estimates that are significant at a two-sided 10% level or stronger.

		Fitted dE/S		Residual dE/S		
	k	Slope	T-stat	Slope	T-stat	Adj. R^2
dE/B-agg	0	**-4.27**	-2.02	-2.21	-0.97	0.09
	1	-0.86	-0.38	**4.42**	1.80	0.04
	2	2.05	0.86	0.38	0.15	-0.05
	3	1.00	0.43	1.51	0.61	-0.06
dE/P-ew	0	**-4.49**	-2.03	-2.30	-1.15	0.11
	1	-0.64	-0.26	1.29	0.58	-0.06
	2	2.19	0.88	0.71	0.32	-0.04
	3	1.11	0.45	-0.27	-0.13	-0.07
dE/P-vw	0	**-5.86**	-2.04	-3.97	-1.23	0.11
	1	-1.19	-0.40	**7.74**	2.29	0.11
	2	2.95	0.91	-1.75	-0.48	-0.04
	3	1.41	0.44	0.71	0.20	-0.07