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Stock returns, aggregate earnings surprises, and behavioral finance ☆

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Abstract

We study the stock market's reaction to aggregate earnings news. Prior 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 a substantially different pattern in aggregate data. First, returns are unrelated to past earnings, suggesting that prices neither underreact nor overreact to aggregate earnings news. Second, aggregate returns correlate negatively with concurrent earnings; over the last 30 years, for example, stock prices increased 5.7% in quarters with negative earnings growth and only 2.1% otherwise. This finding

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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.

JEL classification: E31; E32; G12; G14; M41

Keywords: Stock prices; Earnings; Business cycles; Discount rates; Expected returns

1. Introduction

This article studies the stock market's reaction to aggregate earnings news. Prior research shows that stock prices for individual firms react positively to earnings news but require several quarters to fully reflect the information in earnings, an empirical finding known as "post-earnings announcement drift" (see Kothari, 2001, for a literature review). Our goal is to test whether post-earnings announcement drift shows up in aggregate data and, more broadly, to understand the connection between market returns and aggregate earnings surprises.

The motivation for our study is twofold. First, we provide a simple out-of-sample test of recent behavioral theories, including Bernard and Thomas (1990), Barberis et al. (BSV) (1998), and Daniel et al. (DHS) (1998). Those studies all cite post-earnings announcement drift as a prime example of the type of irrational price behavior predicted by their models. Our reading of the theories suggests that, although they are motivated by firm-level evidence, the biases they describe should also affect aggregate returns. While we do not view our paper as a strict test of the models, our analysis is in the spirit of asking whether the theories can "explain the big picture" (Fama, 1998, p. 291). More generally, establishing whether the same behavioral biases affect firm-level and aggregate returns should help theorists refine models of price formation.

Second, we study the market's reaction to aggregate earnings news to better understand the connections among earnings, stock prices, and discount rates. A large empirical literature tests whether stock prices move in response to cash-flow news or discount-rate news, but the importance of each remains poorly understood (see, e.g., Campbell and Shiller, 1988b; Fama and French, 1989; Fama, 1990; Campbell, 1991; Cochrane, 1992; Vuolteenaho, 2002; Hecht and Vuolteenaho, 2003; Lettau and Ludvigson, 2004). Our tests provide direct evidence on the correlation between earnings growth and movements in discount rates. Further, we argue that the market's reaction to aggregate earnings news provides interesting indirect evidence.

Our initial tests mirror studies of post-earnings announcement drift in firm returns. Bernard and Thomas (1990) show that, at the firm level, price drift matches the autocorrelation structure of quarterly earnings: positive for three quarters then negative in the fourth. They conclude that investors do not understand the time-series properties of earnings (see also Barberis et al., 1998). Our first key result is that aggregate earnings are more persistent than firm earnings, yet there is no evidence of post-announcement drift in aggregate returns. Aggregate earnings growth is quite volatile and, while positively autocorrelated, appears to contain a large unpredictable component. From 1970 to 2000, the growth rate of seasonally differenced quarterly earnings (d*E*) has a standard deviation of 17.8%, 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.

Second, and perhaps more surprising, we find that aggregate returns and contemporaneous earnings growth are negatively correlated. For our main Compustat sample from 1970 to 2000, stock returns are 5.7% in quarters with negative earnings growth and only 2.1% otherwise (significantly different with a *t*-statistic of 2.0). In regressions, concurrent earnings explain roughly 5–10% of the variation in quarterly returns and 10–20% of the variation in annual returns, with *t*-statistics between −2.4 and −3.7 depending on how earnings are measured. We find similar results using earnings on the Standard and Poor's Composite Index (the S&P 500 and its predecessors) going back to the 1930s.

These results provide strong, albeit indirect, evidence that earnings and discount rates move together. Mechanically, returns must be explained either by cash-flow news (with a positive sign) or expected-return news (with a negative sign; see Campbell, 1991). Earnings surprises are positively related to cash flows, so the market reacts negatively to earnings news only if good earnings are associated with higher discount rates. In fact, we find that earnings growth is strongly correlated with several discount-rate proxies, including changes in T-bill rates (+), changes in the slope of the term structure (−), and changes in the yield spread between low- and high-grade corporate bonds (−). But only the correlation with T-bill rates has the right sign and, together, the proxies only partially explain why prices react negatively to earnings news.

The evidence suggests that discount-rate shocks that are not captured by our proxies explain a significant fraction of stock returns (see also Campbell and Shiller, 1988b; Fama, 1990; Campbell, 1991). For the horizons we study, discount-rate news actually swamps the cash-flow news in aggregate earnings. The negative reaction to good earnings is especially surprising because theoretical models often predict that discount rates drop, not increase, when the economy does well (examples include the habit-based model of Campbell and Cochrane, 1999, and the heterogeneous-investor model of Chan and Kogan, 2002). Our results complement Lettau and Ludvigson's (2004) evidence that expected returns and expected dividend growth move together.

It is useful to note that a negative reaction to aggregate earnings is entirely consistent with a positive reaction to firm earnings (a result confirmed in our data). The economic story is simple. Aggregate earnings fluctuate with discount rates because both are tied to macroeconomic conditions, while firm earnings primarily reflect idiosyncratic cash-flow news. As a result, the confounding effects of discount-rate changes show up only in aggregate returns. Put differently, cash-flow news is largely idiosyncratic while discount-rate changes are common across firms. By a simple diversification argument, discount-rate effects play a larger role at the aggregate level (see also Vuolteenaho, 2002; Yan, 2004). In short, our evidence suggests that common variation in discount rates explains an important fraction of aggregate stock market movements.

The paper proceeds as follows. Section 2 provides background for our tests. Section 3 describes the data and the time-series properties of aggregate earnings. Section 4 studies the simple relation between returns and earnings, and 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's reaction to earnings announcements; (2) a growing behavioral asset-pricing literature; and (3) research on the correlations among stock prices, business conditions, and discount rates. Prior research on post-earnings announcement drift, as well as recent behavioral theories, emphasize predictability in individual firm returns. Our study of aggregate price behavior provides a natural extension of this research.

2.1. Post-earnings announcement drift

Many studies show that returns are predictable after earnings announcements (see, e.g., Ball and Brown, 1968; Watts, 1978; Foster et al., 1984; Bernard and Thomas, 1989). Firms' stock prices react immediately to earnings reports, continue to drift in the same direction for three quarters, then partially reverse in quarter four. To illustrate, Bernard and Thomas (1990) study earnings announcements from 1974 to 1986. They rank stocks quarterly based on unexpected earnings and track returns on the top and bottom deciles for the subsequent two years. Over the first three quarters, the top decile outperforms the bottom decile by 8.1% after adjusting for risk, with abnormal returns concentrated around earnings announcements. Chan et al. (1996) further show that post-earnings announcement drift is distinct from price momentum.

2.2. Behavioral finance

Post-announcement drift is consistent with behavioral models in which prices react slowly to public news. Bernard and Thomas (1990) offer one such model, arguing that investors do not understand that today's earnings contain information about future profits. Empirically, seasonally differenced quarterly earnings are persistent, with average autocorrelations of 0.34, 0.19, 0.06, and −0.24 at lags 1–4, respectively, in their sample. Bernard and Thomas suggest that investors ignore this autocorrelation pattern and are thus 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, respectively.

Barberis et al. (1998) propose a similar model to explain price anomalies. They assume that earnings follow a random walk, but investors believe 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 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 et al. (1998) offer a third model in which investors underreact to public news, motivated by different psychological biases: overconfidence and attribution bias. Overconfidence implies that investors give too much weight to the value of their private information, while attribution bias implies that investors generally attribute success to superior skill and failure to bad luck. Together, these biases imply that prices overreact to private signals but underreact to public news (or, if public news confirms investors' private information, attribution bias leads to continued overreaction). For our purposes, DHS predict short-run continuations after earnings announcements followed by long-run reversals.

2.3. Aggregate price behavior

The studies above focus on individual stock returns, but pervasive biases should also show up in aggregate prices. Indeed, BSV and DHS both discuss market returns in motivating their models. Bernard and Thomas do not say whether their arguments apply to aggregate returns, but it seems reasonable to conclude that investors who do not understand firm earnings will not get it right at the aggregate level either. Thus, a simple extension of the existing literature is to ask whether market prices drift after aggregate earnings news. This question provides a natural out-of-sample test of the behavioral theories. DHS argue that "to deserve consideration a theory should be parsimonious, explain a range of anomalous patterns in different contexts, and generate new empirical predictions" (p. 1841). We interpret our tests in this spirit. If a theory explains 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. Of course, our empirical tests need to recognize that firm and aggregate price behavior could differ for a number of reasons.

2.3.1. Earnings predictability

According to the naïve-investor story of Bernard and Thomas, any difference in the time-series properties of firm and aggregate earnings should lead to differences in price behavior. However, we find that earnings autocorrelations are similar at the firm and aggregate levels, though aggregate earnings are somewhat more persistent. The greater persistence of aggregate earnings suggests that post-announcement drift should be stronger in market returns. But our evidence also suggests that firm-level earnings contain a transitory component that gets diversified away at the market level. If investors understand that aggregate earnings are a more reliable signal of value, they might underreact less to aggregate earnings news.

2.3.2. Public versus private information

DHS emphasize that investors respond to public signals differently than to private information. Firm-level and aggregate earnings are both publicly available, so investors should underreact to both (at least in the short run).

2.3.3. Limits to arbitrage

Many asset-pricing anomalies appear to be strongest in stocks with high trading (i.e., arbitrage) costs. That finding suggests that trading costs might be an important determinant of post-announcement drift, and any difference between these costs at the firm and aggregate levels could lead to different price behavior. The existence of options and futures for market indices would seem to reduce transactions costs and short-selling restrictions, thus mitigating aggregate post-announcement drift. However, exploiting patterns in aggregate returns can be quite risky. Levered or short positions in the market necessitate holding systematic risk, while trading strategies based on firm-level earnings generally do not (see, e.g., Chan et al., 1996). This difference would tend to accentuate post-announcement drift in aggregate returns.

2.3.4. Shocks to discount rates

Price movements must reflect either changes in expected cash flows or changes in expected returns (Campbell, 1991). In an efficient market, the latter correspond to changes in discount rates, which are likely to be relatively more important at the aggregate level. Discount rates should be strongly correlated across stocks, largely driven by business conditions, while cash flows are likely to have a larger idiosyncratic component. A simple diversification argument suggests, therefore, that discount-rate news will make up a larger portion of market returns. Empirically, Vuolteenaho (2002) estimates that cash-flow news accounts for the bulk of individual stock returns, while Campbell suggests that it represents less than half of overall market returns (see also Campbell and Shiller, 1988b; Fama and French, 1989; Fama, 1990).

Movements in discount rates complicate the return-earnings association. A positive correlation between earnings and discount-rate news would decrease the contemporaneous return-earnings relation but enhance any lead-lag effects (i.e., in the absence of underreaction, earnings would be positively related to future returns because they are positively related to discount rates). A negative correlation between earnings and discount-rate news would have the opposite effect. We attempt to control for discount rates using several proxies suggested in the literature, including interest rates, the slope of the term structure, and the yield spread between low- and high-grade bonds. Our hope is to measure the marginal impact of an earnings surprise and to provide evidence on the connections among earnings, prices, discount rates, and business conditions.

3. Aggregate earnings, 1970–2000

The main earnings sample for our tests includes all NYSE, Amex, and NASDAQ stocks on the Compustat quarterly file from 1970 to 2000. We focus on the market's reaction to quarterly earnings news, though we also look at annual data to check robustness. The tests use seasonally differenced quarterly earnings, dE, defined as earnings in the current quarter minus four quarters prior. Earnings are measured before extraordinary items and discontinued operations, and, to ensure that fiscal quarters are aligned, the sample is restricted to firms with March, June, September, or December fiscal year ends. We scale earnings changes by lagged earnings (E), book equity (B), or price (P). Hence, firms must have earnings this quarter and book equity, price, and earnings four quarters prior.

We calculate earnings changes for the overall market in three different ways, referred to as "aggregate," "value-weighted," and "equal-weighted." The aggregate series is simply the cross-sectional sum of earnings changes for all firms in the sample, subsequently scaled by the sum of lagged market equity (dE/P-agg), lagged book equity (dE/B-agg), or lagged earnings (dE/E-agg) for the same group of firms. The equal- and value-weighted series, dE/P-ew and dE/P-vw, respectively, are instead averages of firm-level ratios, using per share numbers.[1] For descriptive purposes, we calculate earnings yield and return on equity, E/P and E/B, in a similar fashion.

In constructing the sample, we drop approximately 25% of the firms on Compustat because their fiscal quarters do not match calendar quarters. We also exclude stocks with prices below $1 and the top and bottom 0.5% of firms ranked by dE/P each quarter. These exclusions are most important for the equal-weighted series, for which small stocks and extreme outliers can have a big impact. The average number of stocks per quarter is 3288, compared with an average of about six thousand firms on the Center for Research in Security Prices (CRSP) and Compustat databases for the same period. The sample represents about 90% of total market value.

3.1. Summary statistics

Table 1 reports summary statistics for quarterly earnings, and Figs. 1 and 2 plot earnings levels and changes from 1970 to 2000. For descriptive purposes, Table 1

[1]The value-weighted series dE/P-vw is nearly identical to the aggregate series dE/P-agg (correlation of 0.992). The only difference is that dE/P-vw begins with per share numbers, while dE/P-agg is based on a firm's total earnings and market value. The two differ when the number of shares outstanding changes during the year.

Table 1
Summary statistics for quarterly returns and earnings, 1970–2000

The table reports the time-series average and standard deviation of quarterly stock returns, earnings, and earnings changes for various portfolios of stocks. All variables are in percent except for *N*, the number of firms in each portfolio. EW and VW are equal- and value-weighted returns, respectively. *E* is earnings before extraordinary items. d*E* 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 in 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 instead averages of firm-level ratios, beginning with per share numbers. The sample consists of firms with a March, June, September, or 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 d*E*/*P*. "Small stocks" and "Large stocks" are the bottom and top terciles of stocks ranked by market value. "Low-*B*/*M* stocks" and "High-*B*/*M* stocks" are the bottom and top terciles of stocks ranked by *B*/*P*. CRSP = Center for Research in Security Prices.

Portfolio	*N*	Returns		Aggregate					Value weighted			Equal weighted		
		VW	EW	*E*/*P*	*E*/*B*	**d*E*/*P***	**d*E*/*B***	**d*E*/*E***	*E*/*P*	*E*/*B*	**d*E*/*P***	*E*/*P*	*E*/*B*	**d*E*/*P***
CRSP														
Avg.	6062	3.34	3.82	—	—	—	—	—	—	—	—	—	—	—
Std. dev.	1686	8.79	12.60	—	—	—	—	—	—	—	—	—	—	—
Earnings sample														
Avg.	3288	3.22	3.53	2.27	3.58	**0.14**	**0.23**	**7.84**	2.07	4.13	**0.10**	1.34	1.90	**0.25**
Std. dev.	1505	8.59	12.07	0.89	0.66	**0.37**	**0.57**	**17.77**	0.83	0.69	**0.34**	1.57	1.29	**0.54**
Small stocks														
Avg.	1093	3.73	4.24	0.67	0.18	**0.35**	**0.30**	—	0.60	0.38	**0.45**	0.32	0.10	**0.66**
Std. dev.	499	14.80	15.36	2.25	2.09	**0.84**	**0.79**	—	2.13	2.04	**0.79**	2.27	2.05	**0.93**
Large stocks														
Avg.	1092	3.20	3.21	2.24	3.75	**0.13**	**0.23**	**7.20**	2.10	4.29	**0.09**	2.00	3.39	**0.06**
Std. dev.	498	8.40	9.73	0.85	0.66	**0.34**	**0.56**	**16.58**	0.80	0.74	**0.33**	0.96	0.75	**0.35**
Low-B/M stocks														
Avg.	1094	2.90	2.30	1.73	5.39	**0.16**	**0.49**	**10.66**	1.66	5.57	**0.14**	0.69	2.12	**0.42**
Std. dev.	499	9.50	13.93	0.70	0.92	**0.21**	**0.72**	**15.95**	0.67	1.00	**0.20**	1.45	2.42	**0.34**
High-B/M stocks														
Avg.	1093	4.27	4.71	2.83	2.14	**0.13**	**0.07**	—	2.51	2.14	**0.07**	1.28	1.06	**0.23**
Std. dev.	499	9.10	12.23	1.59	0.90	**1.03**	**0.78**	—	1.49	0.86	**1.01**	2.08	1.13	**1.15**

also compares returns for the earnings sample with CRSP index returns. Our main regressions use the CRSP value-weighted index, but the results are similar using the sample's returns.[2] From Table 1, the earnings sample has an average value-weighted return of 3.22% and an average equal-weighted return of 3.53%, somewhat lower than corresponding CRSP index returns of 3.34% and 3.82%, respectively. The difference is most likely the result of dropping firms with very low prices and extreme earnings. The return series are highly correlated, 0.991 for the two value-weighted series and 0.993 for the equal-weighted series.

[2]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, 3018 firms have return data, compared with 3288 firms in the earnings sample. Results throughout the paper are similar if we restrict the tests to firms with CRSP data.

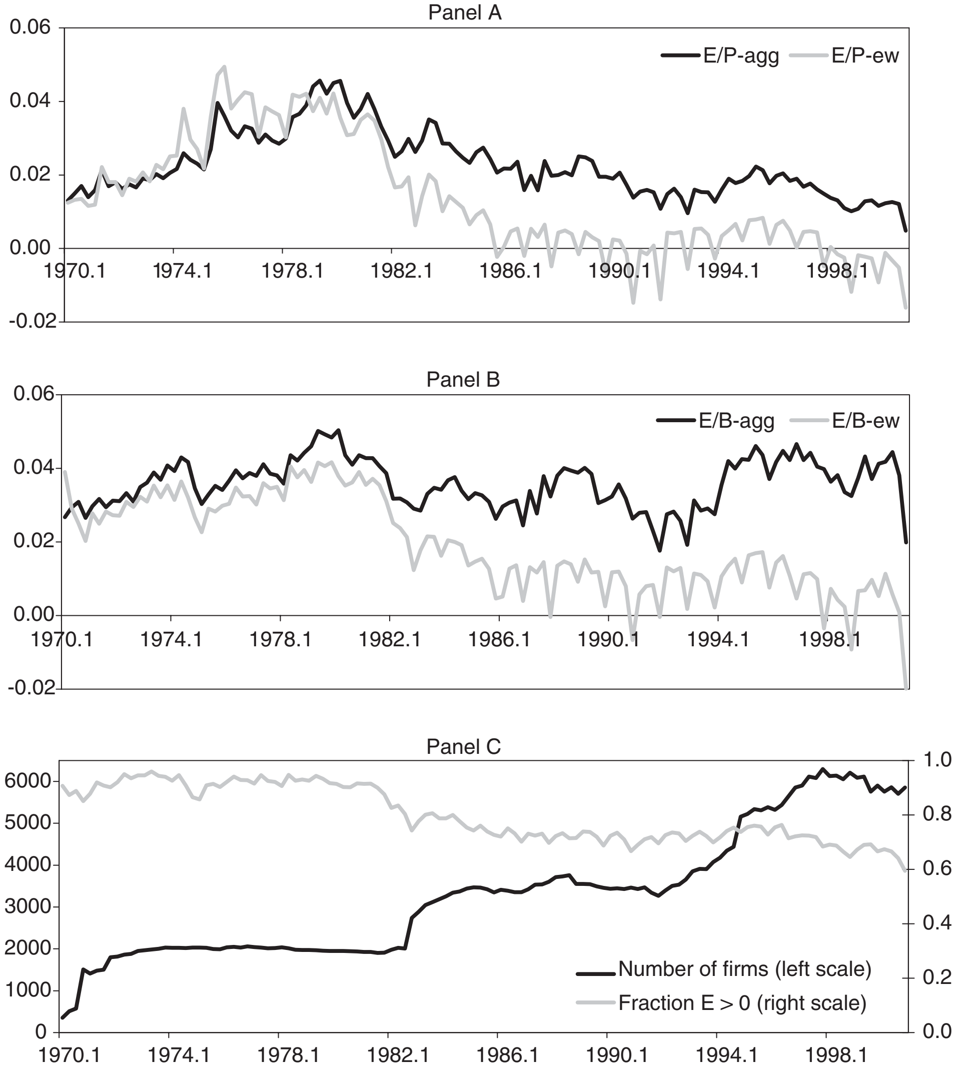

Fig. 1. Quarterly profitability, 1970–2000. Earnings, E, are before extraordinary items. Panels A and B show E scaled by the market value (P) and book value (B) of equity. Panel C shows the number of firms in the sample and the fraction with positive E. Profitability is measured two ways. Aggregate profitability, labeled "-agg", equals the sum of the numerator divided by the sum of the denominator for firms in the sample. Equal-weighted profitability, labeled "-ew", is the average of firm ratios. The sample consists of all firms on Compustat with a March, June, September, or 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). The notation ".x" denotes the xth quarter of the year.

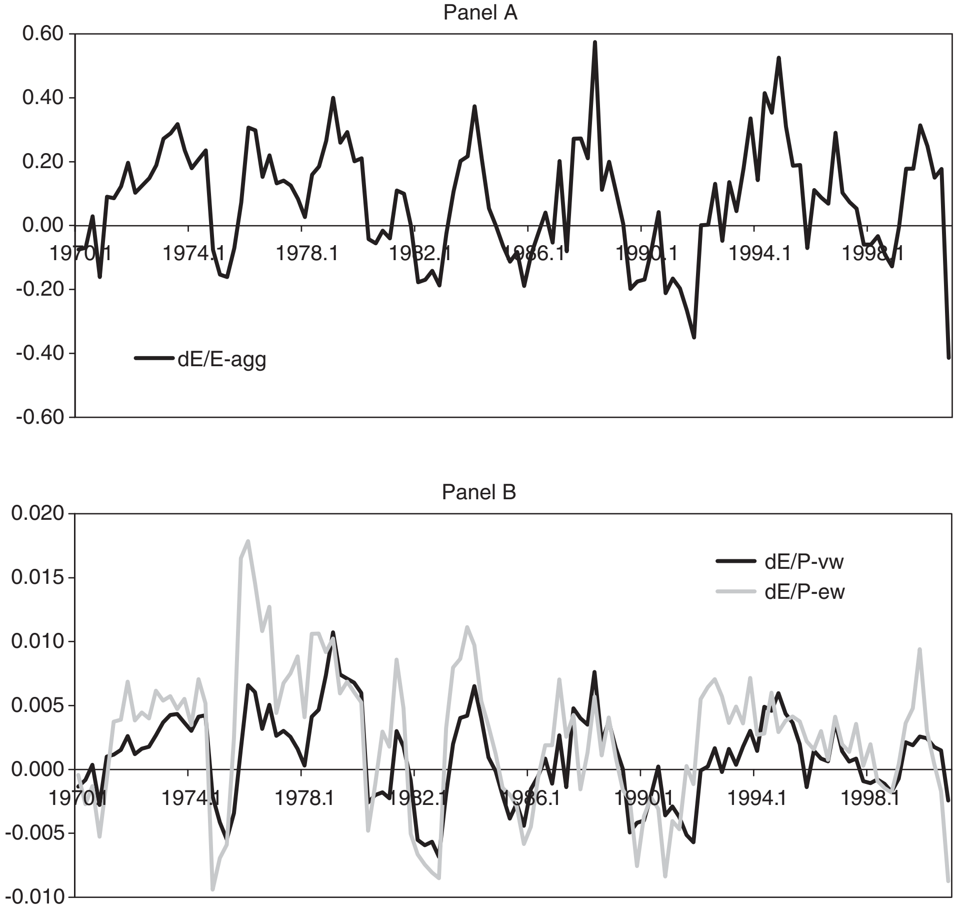

Fig. 2. Seasonally differenced quarterly earnings, 1970–2000. Earnings, E, are measured before extraordinary items. Seasonally differenced earnings, dE, are earnings this quarter minus earnings four quarters ago. Panel A shows the growth rate of aggregate quarterly earnings, dE/E-agg, defined as the sum of dE divided by the sum of earnings four quarters ago for firms in the sample. Panel B shows dE divided by market value (P) at the end of quarter -4. In Panel B, the ratio is calculated for each firm and then averaged; dE/P-vw is a value-weighted average and dE/P-ew is an equal-weighted average. The sample consists of firms with a March, June, September, or 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. The notation ".x" denotes the xth quarter of the year.

Table 1 and Figs. 1 and 2 reveal several interesting facts. First, profitability since 1970 has been fairly high. Average quarterly return on equity, E/B, is 4.13% for the value-weighted index and 1.90% for the equal-weighted index, implying annual E/B of around 8–16%. This range is broad but brackets plausible estimates of the cost of capital. Fig. 1 shows that aggregate E/B declined in the early 1980s but has since remained stable or even increased. In contrast, aggregate earnings yield, E/P-agg, declined throughout the 1980s and 1990s, dropping from about 4% to about 1% quarterly. Comparing Panels A and B, the bull market of the 1980s and 1990s, not a decrease in profitability, seems to explain most of the drop in aggregate earnings yield.

Second, small stocks have much lower profitability than large stocks after 1980 (see also Fama and French, 1995). In Fig. 1, equal-weighted E/P and E/B, which put most weight on small firms, 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 firms with negative earnings increase from less than 10% of the sample in 1970 to about 40% of the sample in 2000. In untabulated results, we find little evidence that the patterns can be attributed to the expansion of the sample in 1982 (the sample jumps from 2007 to 2738 firms at the end of 1982; see Fig. 1, panel C). Firms existing prior to 1982 have earnings performance that is similar to newly added firms.

Third, aggregate earnings exhibit substantial variability through time. Fig. 2 plots the growth rate of quarterly earnings, in Panel A, and earnings changes scaled by lagged price, in Panel B. Most of our tests focus on the price-scaled series because we cannot calculate growth rates for individual firms, since firm's earnings are often negative. We can calculate an aggregate growth rate because aggregate earnings, before extraordinary items, are positive throughout the sample. (Aggregate net income after extraordinary items does become negative in 1993. Also, as Table 1 indicates, portfolio earnings become negative for subsamples of small and high book-to-market stocks.)

Fig. 2 shows that earnings are volatile, with growth rates often more than $\pm 20\%$. The time-series properties appear to be stable during the sample, and seasonal differencing does a good job eliminating seasonality in earnings. The scaled-price series in Panel B, dE/P-ew and dE/P-vw, are highly correlated with each other and with the earnings growth rate in Panel A (see also Table 2). The equal-weighted series appears to be most variable. Earnings volatility is important for our later tests because, in the regressions, power hinges on the magnitude of earnings surprises (i.e., for a given slope, higher earnings volatility implies greater power).

Finally, Table 1 reports statistics for the top and bottom terciles of stocks ranked by size and B/M. Comparing large and small firms, earnings *levels* are higher for large stocks but earnings *growth* is higher for small stocks. Comparing low-B/M and high-B/M firms, earnings levels and growth rates are both higher for low-B/M stocks if we scale by book equity, consistent with the standard value versus growth dichotomy. Growth is priced so highly, however, that the price-scaled measures, E/P and dE/P, look as good or better for high-B/M stocks.

3.2. Autocorrelations

Table 3 explores the autocorrelation of seasonally differenced quarterly earnings. Firm-level results, in Panel A, are estimated for price-scaled earnings changes, while market-level results, in Panel B, are estimated for dE/B-agg, dE/P-vw, and dE/P-ew.

Table 2
Correlations among several measures of aggregate earnings changes, 1970–2000

Earnings (E) are measured before extraordinary items. Seasonally differenced quarterly earnings (dE) are scaled by either lagged earnings, lagged market capitalization (P), or lagged book equity (B). Earnings changes for the overall market are calculated in three ways: Aggregate numbers, identified by "-agg", equal the sum of the numerator divided by the sum of the denominator for all sample firms. Equal- and value-weighted numbers, identified by "-ew" and "-vw", respectively, are averages of firm ratios. The sample consists of firms with a March, June, September, or 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	0.938	0.914	0.992	0.783
dE/B-agg		1	0.988	0.943	0.726
dE/E-agg			1	0.923	0.707
dE/P-vw				1	0.775
dE/P-ew					1

Our aggregate tests focus on dE/B-agg, dE/P-vw, and dE/P-ew because their results are representative and, as shown in Table 2, all the aggregate series are highly correlated with each other. Table 3 reports simple autocorrelations for lags 1–5 and multiple regression estimates including all lags together:

$$\mathrm{d}E/S_t = a + b_k\, \mathrm{d}E/S_{t-k} + e_t, \tag{1}$$

$$\mathrm{d}E/S_t = a + b_1\, \mathrm{d}E/S_{t-1} + b_2\, \mathrm{d}E/S_{t-2} + \cdots + b_5\, \mathrm{d}E/S_{t-5} + e_t, \tag{2}$$

where S is either the market value (P) or book value (B) of equity. Firm-level autocorrelations come from Fama and MacBeth (1973) regressions, i.e., we estimate a cross-sectional slope each quarter and report the time-series average of the estimates. Market-level estimates come from simple time-series regressions. For firm-level data, we prefer cross-sectional regressions because they facilitate statistical tests and a firm can be included as long as it has at least one valid observation.

The firm-level autocorrelations are remarkably similar to the findings of prior research, notwithstanding differences in samples and estimation methods. From Panel A, simple autocorrelations are positive at the first three lags and negative at the fourth: 0.34, 0.18, 0.05, and −0.29, 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 at the first four lags, respectively, estimated as the average slope in firm-level time-series regressions (using firms with a minimum of ten quarterly earnings observations from 1974 to 1986).

From Panel B, market-wide earnings are more persistent than firm earnings but the pattern of autocorrelations is similar. Estimates for dE/B-agg are representative: 0.70, 0.55, 0.30, and 0.03 at the first four lags, with t-statistics of 10.21, 6.90, 3.28, and 0.37, respectively. Comparing Panels A and B, firm earnings seem to contain a

Table 3
Autocorrelation 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. Earnings, E, are measured before extraordinary items. Seasonally differenced earnings, dE, are scaled by either lagged market equity (P) or lagged book equity (B). Aggregate earnings changes are calculated in 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, respectively, of firm dE/P ratios (the ratio is calculated for each firm, then averaged). The sample consists of firms with a March, June, September, or 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. Bold denotes estimates that are significant at a two-sided 10% level or stronger.

Earnings measure	Lag	Simple regressions			Multiple regressions		
		Slope	t-statistic	Adj. R^2	Slope	t-statistic	Adj. R^2
Panel A. Individual firms							
dE/P	1	**0.34**	20.01	—	**0.36**	19.04	—
	2	**0.18**	16.50	—	**0.12**	15.13	
	3	**0.05**	5.32	—	**0.05**	8.33	
	4	**−0.29**	−20.75	—	**−0.42**	−25.94	
	5	**−0.10**	−8.12	—	**0.14**	13.77	
Panel B. Aggregate							
dE/B-agg	1	**0.70**	10.21	0.46	**0.66**	6.48	0.53
	2	**0.55**	6.90	0.28	**0.34**	2.93	
	3	**0.30**	3.28	0.08	−0.14	−1.15	
	4	0.03	0.37	−0.01	**−0.38**	−3.37	
	5	−0.04	−0.37	−0.01	0.16	1.62	
dE/P-ew	1	**0.74**	11.61	0.52	**0.79**	8.36	0.55
	2	**0.48**	5.84	0.22	0.05	0.40	
	3	**0.20**	2.25	0.03	−0.09	−0.74	
	4	−0.03	−0.36	−0.01	**−0.24**	−2.05	
	5	−0.10	−1.04	0.00	0.12	1.27	
dE/P-vw	1	**0.75**	12.23	0.55	**0.76**	8.12	0.59
	2	**0.53**	6.88	0.28	0.17	1.47	
	3	**0.27**	3.03	0.06	−0.15	−1.28	
	4	0.02	0.25	−0.01	**−0.24**	−2.08	
	5	−0.09	−0.96	−0.00	0.10	1.08	

transitory, idiosyncratic component that gets diversified away at the market level. The results suggest that aggregate returns should be well suited for testing the Bernard and Thomas (1990) story that investors do not understand the autocorrelation of quarterly earnings. Post-announcement drift should be stronger in aggregate returns, according to their theory, because aggregate earnings are more persistent.

In some 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 and would bias our slope estimates toward zero. If investors believe earnings follow a seasonal random walk, earnings surprises are the same as earnings changes. If investors are rational, at a minimum we should take out the component of the earnings change that is predictable based on past earnings. We use an AR1 model for this purpose because Table 3 indicates that it does a good job picking out the predictable component. In multiple regressions, few of the autocorrelations beyond lag 1 are significant and the increase in R^2 is modest (adding lags 2–5 increases the R^2 from an average of 0.51 to an average of 0.56 for the three earnings series). Our tests also consider the possibility that earnings are predictable using past returns.

4. The reaction to earnings surprises

Our main tests explore how the market reacts to aggregate earnings surprises, mirroring studies of post-earnings announcement drift in firm returns. We verify drift for individual firms in our sample but find substantially different results in aggregate data.

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:

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

where R_{t+k} is return for quarter $t+k$ and $\mathrm{d}E/S_t$ 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 4 quarters in the future. Here, $k = 0$ refers to the quarter for which earnings are measured and $k = 1$ refers to the quarter in which earnings are typically announced. These quarters both measure the contemporaneous return-earnings association: The market learns much about a firm's performance during the measurement quarter, $k = 0$, but earnings announcements clearly convey information to the market as well (see, e.g., Ball and Brown, 1968; Foster, 1977). Firms sometimes announce earnings more than three months after fiscal year-end, in which case $k = 2$ also reflects the market's reaction to new information. This effect should be small in recent years.

Panel A reports Fama–MacBeth regressions for individual firms. Like prior studies, we find that returns in quarters 0–3 have a strong positive association with earnings. The slopes for the measurement and announcement quarters, 0.61 and 0.65, are largest and more than 30 standard errors above zero. The market also reacts strongly in quarters $k = 2$ and 3, with slopes of 0.22 (t-statistic of 12.8) and 0.11 (t-statistic of 6.1), respectively. Thus, investors appear to underreact to earnings news, leading to post-announcement drift. The declining slopes for lags 2–4 line up with the declining autocorrelation in earnings. As observed by Bernard and Thomas (1990), this suggests that investors do not understand earnings' persistence.

Table 4
Quarterly returns and earnings, 1970–2000

The 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 4 quarters in the future ($k = 0$ is the quarter for which earnings are measured; $k = 1$ is the quarter in which earnings are typically announced). Panel A reports estimates for individual firms, obtained from Fama–MacBeth 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 March, June, September, or 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 measure	k	Earnings change			Earnings surprise 1			Earnings surprise 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	**0.61**	32.83	—	**0.49**	28.47	—	**0.50**	28.67	—
	1	**0.65**	30.76	—	**0.67**	33.80	—	**0.67**	34.23	—
	2	**0.22**	12.78	—	**0.22**	12.93	—	**0.22**	13.77	—
	3	**0.11**	6.10	—	**0.12**	6.90	—	**0.11**	7.51	—
	4	0.01	0.52	—	**0.03**	1.81	—	**0.04**	2.30	—
Panel B. Aggregate										
dE/B-agg	0	**−2.35**	−1.70	0.02	−0.37	−0.19	0.03	0.05	0.03	0.04
	1	**−3.39**	−2.38	0.04	**−7.19**	−3.70	0.09	**−6.87**	−3.39	0.06
	2	−0.35	−0.25	−0.01	1.13	0.56	−0.01	1.54	0.73	−0.01
	3	−0.99	−0.71	−0.00	−0.25	−0.12	−0.01	0.42	0.20	−0.01
	4	−1.12	−0.79	0.00	−2.65	−1.31	−0.00	−2.11	−0.98	−0.01
dE/P-ew	0	−1.42	−0.96	−0.00	2.68	1.27	0.05	3.16	1.47	0.05
	1	**−3.84**	−2.60	0.05	**−5.06**	−2.42	0.05	**−4.48**	−2.01	0.04
	2	−2.31	−1.58	0.01	−2.00	−0.94	0.00	−1.68	−0.74	0.01
	3	−1.70	−1.16	0.00	0.74	0.35	0.01	1.74	0.77	0.04
	4	**−2.74**	−1.89	0.02	**−4.22**	−1.98	0.02	−3.76	−1.62	0.03
dE/P-vw	0	**−5.16**	−2.27	0.03	−2.79	−0.82	0.03	−1.48	−0.43	0.05
	1	**−5.43**	−2.38	0.04	**−11.67**	−3.57	0.08	**−11.29**	−3.27	0.07
	2	−0.94	−0.42	−0.01	1.16	0.34	−0.01	2.13	0.59	−0.01
	3	−1.62	−0.72	−0.00	−1.64	−0.48	−0.01	−0.37	−0.10	−0.01
	4	−1.08	−0.48	−0.01	−3.79	−1.11	−0.00	−2.49	−0.68	−0.01

"Earnings change" is the actual value of dE/S, "Earnings surprise 1" is the forecast error from an AR1 model, and "Earnings surprise 2" is the forecast error when dE/S is regressed on lagged dE/S and lagged annual returns. In the latter two cases, the fitted value and forecast error from the forecasting regression are both included in the second-stage return regression. "Adj. R^2" measures the joint explanatory power of both variables.

Panel B shows results for aggregate returns. We report estimates when CRSP value-weighted returns are regressed on either dE/B-agg, dE/P-ew, or dE/P-vw, using the simple earnings change, the forecast error from an AR1 model (Surprise 1), or the forecast error from a model that includes lagged earnings and lagged annual returns (Surprise 2). The last measure uses past returns to take out more of the anticipated component of earnings.[3] The panel shows two striking results: (1) the contemporaneous relation between returns and earnings is significantly negative; and (2) 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 findings below.

4.1.1. Contemporaneous relation

Regardless of which earnings measure we use, market returns in the announcement quarter, $k = 1$, correlate negatively with aggregate earnings. For simple earnings changes, the slopes range from -3.39 to -5.43 with t-statistics between -2.38 and -2.60. These estimates are probably conservative because any measurement error in earnings surprises should attenuate the slopes. If we take out the component of the earnings change predicted by an AR1 model, the slopes for dE/B-agg and dE/P-vw more than double and their t-statistics jump to -3.70 and -3.57, respectively. The results are similar if we remove the component of earnings predicted by past returns. The negative announcement effect is surprising and contrasts strongly with firm-level evidence.

Economically, the slope estimates for $k = 1$ are fairly large. Earnings explain 4–9% of quarterly returns and, using the point estimates in Table 4, a two-standard-deviation positive shock to earnings maps into a 4–6% decline in prices (the standard deviation of earnings surprises from an AR1 model equals 0.42% for dE/B-agg, 0.37% for dE/P-ew, and 0.23% for dE/P-vw). Historically, if earnings changes for any of the measures were in the bottom quartile of their distributions from 1970 to 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%.

Campbell (1991) shows that unexpected returns can be decomposed, mechanically, into cash-flow news and expected-return, or discount-rate, news. 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 cash-flow news in earnings, then the overall correlation between earnings and returns can be negative.[4]

[3] We experimented with various return intervals and found that annual returns do a good job summarizing the information in past prices. In the forecasting regression, the slope on lagged earnings is similar to the autocorrelation reported in Table 3 and the slope on returns has a t-statistic of 2.07 for dE/B-agg, 3.47 for dE/P-ew, and 3.17 for dE/P-vw. The R^2s are slightly higher than for a simple AR1 model.

[4] We take it for granted that earnings and cash flows are positively correlated. Table 3 suggests that aggregate earnings shocks are permanent (earnings changes are positively autocorrelated for several quarters and show no sign of long-term reversal) and, as such, should eventually lead to higher dividends (Lintner, 1956; Campbell and Shiller, 1988a). We also emphasize that our results pertain to relatively short-run earnings surprises, i.e., quarterly and annual. In the long run, prices and earnings should move together.

A positive correlation between earnings and discount rates is possible but contradicts standard intuition about business cycle variation in the risk premium. The standard intuition is that discount rates decrease when the economy does well (see, e.g., Fama and French, 1989; Cochrane and Campbell, 1999; Chan and Kogan, 2002). A counterargument 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 lead to higher earnings in the short run if revenues respond more quickly than accounting costs to inflation (Ball et al., 1993). If so, the slope on earnings in Table 4 absorbs the strong negative reaction to inflation shown by Fama and Schwert (1977) and Fama (1981). We explore the correlations among earnings, business conditions, and discount rates in Section 5, and attempt to disentangle the cash-flow and discount-rate effects.

We also note that a negative reaction to aggregate earnings is entirely consistent with a positive reaction to firm earnings. To illustrate, consider a simple model of returns in which (i) earnings surprises perfectly capture cash-flow news, and (ii) discount-rate changes are driven by macroeconomic conditions and are therefore common across firms. In this case,

$$\mathrm{UR}_i = (\mathrm{d}E_i + \mathrm{d}E_M) - \mathrm{d}r_M, \tag{4}$$

where UR_i is the firm's unexpected return, $\mathrm{d}E_i$ is the firm-specific earnings surprise, $\mathrm{d}E_M$ is the systematic earnings surprise, and $\mathrm{d}r_M$ is discount-rate news (positive if discount rates go up). Discount-rate shocks are assumed to be entirely macroeconomic, so $\mathrm{d}E_i$ is uncorrelated with both aggregate earnings and discount rates. Market returns equal the cross-sectional average of eg. (4), $\mathrm{UR}_M = \mathrm{d}E_M - \mathrm{d}r_M$. In this model, the covariance between firm returns and earnings is

$$\mathrm{cov}(\mathrm{UR}_i, \mathrm{d}E_i + \mathrm{d}E_M) = \mathrm{var}(\mathrm{d}E_i) + \mathrm{cov}(\mathrm{UR}_M, \mathrm{d}E_M). \tag{5}$$

The first term is the covariance between returns and firm-specific earnings, which is necessarily positive. The second term is the covariance between aggregate returns and earnings. It is clear that the firm-level covariance can be positive, dominated by idiosyncratic cash-flow shocks, even if the aggregate covariance is negative, dominated by discount-rate effects.

4.1.2. Returns and past earnings

The second key result in Panel B is that earnings have little power to predict future market returns; that is, there is no evidence of post-earnings announcement drift in aggregate data. The slopes for $k = 2$, 3, and 4 are close to zero and predominately negative, opposite the predictions of behavioral models. Only the slopes on $\mathrm{d}E/P$-ew show modest significance with t-statistics between -0.74 and -1.58 at lag 2 and t-statistics between -1.62 and -2.74 at lag 4. The results are inconsistent with underreaction to aggregate 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, aggregate returns do not support Bernard and Thomas' (1990) hypothesis that investors ignore the autocorrelation structure of earnings. Moreover, the positive relation between earnings and discount-rate changes implied by our $k = 1$ slopes should make it easier to find post-announcement drift in returns: if earnings and discount-rate shocks are positively related, earnings would be positively correlated with future returns even in the absence of any underreaction.

4.2. Robustness checks

The aggregate results are rather surprising, so it seems worthwhile to consider a few robustness checks. The bottom line is that we find similar results for alternative definitions of earnings; each of the decades 1970s, 1980s, and 1990s; annual regressions; S&P 500 earnings going back to the 1930s; and size-sorted portfolios.

4.2.1. Alternative earnings variables

In addition to the three earnings series shown in Table 4, we ran regressions with aggregate $\mathrm{d}E$ scaled by lagged market values or lagged earnings. The results are similar to those in Table 4. For example, in regressions with aggregate earnings growth, $\mathrm{d}E/E$, the t-statistics are -1.69 and -2.47 for $k = 0$ and 1, respectively, and between -1.00 and -0.30 for the remaining lags. We find similar but somewhat weaker results if we use net income in place of earnings before extraordinary items.

4.2.2. 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 from an AR1 model are more significant. For example, using surprises based on $\mathrm{d}E/B$-agg, the t-statistic at $k = 1$ equals -1.95 for 1970–1979, -2.62 for 1980–1989, and -2.05 for 1990–2000. Estimates for the other series are also negative, but not as significant. We never find evidence of post-announcement drift in aggregate returns.

4.2.3. Annual returns and earnings

Table 5 replicates the analysis using annual data. We report return regressions for both individual firms and the market, along with earnings autocorrelations. The variable definitions and data requirements are like those for the quarterly tests except that the sample is restricted to firms with December fiscal year-ends (to make sure that fiscal years align). Annual returns are measured from May to the following April to control for delays in earnings announcements.

The time-series properties of annual earnings are consistent with prior studies (see, e.g., Ball and Watts, 1972; Brooks and Buckmaster, 1976). Earnings changes for individual firms are negatively autocorrelated for two to three years, with t-statistics as large as -7.58. At the same time, aggregate earnings are indistinguishable from a random walk. Earnings changes for the overall market are positively autocorrelated at lag 1 and negatively autocorrelated at lags 2 and 3, but none of the estimates is

Table 5
Annual returns and earnings, 1970–2000
The table reports autocorrelations of annual earnings changes (left panel) and slope estimates from the following regression (right panel):

$$R_{t+k} = \alpha + \beta\, \mathrm{d}E/S_t + e_{t+k},$$

where R_t is the annual return ending in April of year $t+1$, $\mathrm{d}E_t$ 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 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. $\mathrm{d}E/B$-agg equals the sum of $\mathrm{d}E$ divided by the sum of B for all firms in the earnings sample; $\mathrm{d}E/P$-ew and $\mathrm{d}E/P$-vw are equal- and value-weighted averages, respectively, of firm $\mathrm{d}E/P$ 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 $\mathrm{d}E/P$. Bold denotes estimates that are significant at a two-sided 10% level or stronger.

Earnings measure	k	Earnings autocorrelations						$R_{t+k} = \alpha + \beta\, \mathrm{d}E/S_t + e_{t+k}$					
		Simple regressions			Multiple regressions			Earnings change			Earnings surprise		
		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													
$\mathrm{d}E/P$	0							**0.66**	21.59	—	**0.72**	20.56	—
	1	**−0.16**	−5.58	—	**−0.23**	−7.58	—	0.04	1.39	—	0.04	1.43	—
	2	**−0.10**	−2.76	—	**−0.18**	−4.99		−0.00	−0.04	—	−0.01	−0.20	—
	3	−0.03	−1.50	—	**−0.06**	−3.05		0.02	0.64	—	0.01	0.47	—
Panel B. Aggregate													
$\mathrm{d}E/B$-agg	0							**−3.64**	−2.41	0.14	**−3.81**	−2.49	0.16
	1	0.18	0.98	−0.00	0.17	0.88	0.02	1.60	0.99	−0.00	1.31	0.77	−0.02
	2	−0.13	−0.69	−0.02	−0.10	−0.51		1.59	0.96	−0.00	0.98	0.57	−0.02
	3	−0.31	−1.69	0.06	−0.27	−1.37		1.72	1.04	0.00	1.42	0.84	−0.05
$\mathrm{d}E/P$-ew	0							**−3.38**	−2.41	0.14	**−3.36**	−2.27	0.10
	1	0.20	1.11	0.01	0.24	1.14	−0.05	0.36	0.24	−0.03	−0.08	−0.05	−0.04
	2	−0.09	−0.45	−0.03	−0.11	−0.50		1.59	1.03	0.00	1.16	0.71	−0.05
	3	−0.14	−0.71	−0.02	−0.09	−0.44		0.85	0.54	−0.03	0.18	0.11	−0.07
$\mathrm{d}E/P$-vw	0							**−5.44**	−2.57	0.16	**−5.41**	−2.58	0.18
	1	0.08	0.44	−0.03	0.06	0.32	−0.03	2.78	1.23	0.02	2.64	1.15	−0.02
	2	−0.13	−0.71	−0.02	−0.12	−0.58		1.27	0.54	−0.03	0.76	0.32	−0.06
	3	−0.26	−1.37	0.03	−0.24	−1.21		1.65	0.71	−0.02	1.14	0.49	−0.07

"Earnings change" is the actual value of $\mathrm{d}E/S$ and "earnings surprise" is the forecast error from an AR1 model. In the latter case, the return regression is estimated including a lag of $\mathrm{d}E/S$ in the regression and "Adj. R^2" measures the joint explanatory power of the two lags.

significant. Of course, with only 31 years of data, the aggregate autocorrelations are estimated imprecisely. We cannot reject that the autocorrelations are all zero, but neither can we confidently reject that they are −0.2 or −0.3.

The return regressions in Table 5 largely reinforce our quarterly results. At the firm level, returns and contemporaneous earnings are positively related, but there is no evidence of delayed reaction to earnings news. A simple underreaction story predicts a positive slope on lagged earnings, while the Bernard and Thomas (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 at annual horizons.

The market-level regressions also match our quarterly results. Annual market returns are contemporaneously negatively correlated with all three earnings measures, defined using either the simple earnings change or residuals from an AR1 regression (which makes little difference). The adjusted R^2s are substantial, between 10% and 18%, and the t-statistics range from −2.27 to −2.57 even though we have only 31 annual observations. Further, lagged earnings exhibit no predictive power for future annual returns. This result is consistent with both market efficiency or the Bernard and Thomas (1990) naïve expectations story, because market earnings are not highly autocorrelated. Overall, the results confirm inferences from quarterly regressions.

4.2.4. The S&P 500

Our main tests use Compustat data for two reasons: (1) to allow an easy comparison between firm and aggregate results, and (2) to ensure the quality and timing of accounting information. At the same time, Compustat data restrict us to a fairly short sample, 1970–2000. To check whether this period is special, we repeat the tests using earnings on the S&P 500 (and its predecessors) going back to 1936, the earliest year for which quarterly earnings data are available. We regress CRSP returns on either the earnings growth rate, $\mathrm{d}E/E$, or the earnings change scaled by lagged market value, $\mathrm{d}E/P$. The data come from various issues of Standard and Poor's *Analyst's Handbook*.

As shown in Table 6, the results for 1970–2000 are similar to our earlier estimates. The slopes on $\mathrm{d}E/P$ at lags 0 and 1 are −5.00 and −4.78 (t-statistics of −2.28 and −2.16), respectively, compared with estimates in Table 4 of −5.16 and −5.43. More important, the negative reaction to earnings news shows up out-of-sample from 1936 to 1969 and in all of the time periods we consider. Prior to 1970, the negative price reaction is delayed, appearing most strongly at lags 1 and 2. This suggests that earnings news reached the market more slowly in the early period, perhaps because quarterly reports were less common (quarterly reports were required by NYSE in 1939 and by the Securities and Exchange Commission in 1970; see Leftwich et al., 1981). The slopes for $k = 2$ are especially strong, with t-statistics between −2.10 and −2.42 for the various series. After 1956, when the index expanded to five hundred firms, the slopes on earnings changes $\mathrm{d}E/E$ and $\mathrm{d}E/P$ are significant for $k = 0$ and 1, with t-statistics between −1.94 and −2.55, and negative but not significant for the remaining lags. In short, the negative reaction to aggregate earnings news is not unique to either our time period or our sample of firms.

Table 6
Quarterly returns and S&P 500 earnings, 1936–2000

The table reports the slope estimate and t-statistic when quarterly stock market returns are regressed on seasonally differenced quarterly earnings for Standard and Poor's (S&P) Composite Index:

$$R_{t+k} = \alpha + \beta \, \mathrm{d}E/S_t + e_{t+k},$$

where $\mathrm{d}E$ is seasonally differenced earnings and S is either lagged earnings (E, in panel A) or lagged market value (P, in panel B) of the S&P 500 and its predecessors (the index was expanded to five hundred firms in 1957). The regression is estimated over four sample periods: 1936–2000, 1957–2000, 1970–2000, and 1936–1969. The market return is the CRSP value-weighted index, varying from $k = 0$ to 4 quarters in the future ($k = 0$ is the quarter for which earnings are measured; $k = 1$ is the quarter in which earnings are typically announced). "Earnings change" is the actual value of $\mathrm{d}E/S$ and "earnings surprise" is the forecast error from an AR1 model. In the latter case, the return regression is estimated including a lag of $\mathrm{d}E/S$ in the regression. Bold denotes estimates that are significant at a two-sided 10% level.

	k	Earnings change				Earnings surprise			
		1936–2000	1957–2000	1970–2000	1936–1969	1936–2000	1957–2000	1970–2000	1936–1969
Panel A. Earnings growth, $\mathrm{d}E/E$									
Slope	0	−0.03	**−0.06**	**−0.06**	−0.00	0.02	−0.03	−0.04	**0.06**
	1	**−0.06**	**−0.08**	**−0.07**	**−0.06**	**−0.06**	**−0.11**	**−0.12**	−0.03
	2	**−0.04**	−0.01	−0.01	**−0.06**	−0.04	0.01	0.02	**−0.08**
	3	−0.02	−0.03	−0.02	−0.02	−0.01	−0.03	−0.01	−0.00
	4	−0.03	−0.02	−0.02	−0.03	−0.04	−0.03	−0.03	−0.04
t-stat	0	−1.12	−1.94	−1.72	−0.04	0.73	−0.75	−0.84	1.68
	1	−2.85	−2.33	−1.91	−2.18	−2.24	−2.58	−2.64	−0.93
	2	−1.73	−0.39	−0.18	−2.31	−1.48	0.13	0.42	−2.42
	3	−0.93	−0.93	−0.63	−0.68	−0.25	−0.82	−0.28	−0.00
	4	−1.22	−0.51	−0.58	−1.13	−1.40	−0.73	−0.69	−1.25
Panel B. Earnings changes scaled by lagged price, $\mathrm{d}E/P$									
Slope	0	−1.39	**−4.82**	**−5.00**	0.20	0.49	−2.84	−3.51	2.10
	1	**−2.70**	**−4.95**	**−4.78**	−1.83	−2.21	**−7.23**	**−8.35**	−0.07
	2	**−2.15**	−1.36	−0.93	**−2.85**	**−2.56**	0.04	0.89	**−4.01**
	3	−1.03	−2.21	−1.74	−0.69	−0.78	−4.01	−2.83	0.12
	4	−0.94	−0.09	−0.11	−1.30	−1.71	−1.20	−1.03	−1.97
t-stat	0	−1.18	−2.49	−2.28	0.14	0.32	−1.10	−1.19	1.21
	1	−2.30	−2.55	−2.16	−1.34	−1.45	−2.77	−2.91	−0.04
	2	−1.82	−0.69	−0.43	−2.10	−1.67	0.01	0.30	−2.31
	3	−0.87	−1.13	−0.80	−0.50	−0.51	−1.52	−0.96	0.07
	4	−0.79	−0.04	−0.05	−0.94	−1.11	−0.45	−0.35	−1.12

4.2.5. Size portfolios

As a final check, Table 7 repeats the analysis separately for big and small stocks, defined as the top and bottom terciles of firms ranked by market equity (these tests use our main Compustat sample). Earnings autocorrelations, in the left columns, have the same patterns as our earlier estimates. At the firm level, autocorrelations are positive at lags 1–3 and negative at lag 4 for both small and large stocks. Estimates

Table 7
Size portfolios: quarterly returns and earnings, 1970–2000

The sample is split into large and small portfolios, defined as the top and bottom terciles of firms ranked by market equity. The left panel reports autocorrelations of seasonally differenced quarterly earnings and the right panel reports slope estimates from $R_{t+k} = a + b\,dE/S_t + e_{t+k}$, where R_{t+k} is the quarterly return ($k = 0$ is the quarter for which earnings are measured), dE is seasonally differenced quarterly earnings, and S is either the market value (P) or book value (B) of equity. Panel A shows estimates for individual firms and Panel B shows estimates for portfolios. Portfolio earnings are measured in 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, respectively, of firm dE/P ratios. The sample consists of firms with a March, June, September, or 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.

Earnings measure	Lag	Earnings autocorrelations						$R_{t+k} = \alpha + \beta\,dE/S_t + e_{t+k}$					
		Small stocks			Large stocks			Small stocks			Large stocks		
		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							**0.37**	26.51	—	**1.00**	22.79	—
	1	**0.32**	15.85	—	**0.38**	19.42	—	**0.45**	25.97	—	**0.83**	19.37	—
	2	**0.16**	12.32	—	**0.23**	14.62	—	**0.18**	12.32	—	**0.21**	4.58	—
	3	**0.04**	3.25	—	**0.11**	7.06	—	**0.06**	3.93	—	**0.13**	2.91	—
	4	**−0.35**	−18.26	—	**−0.23**	−12.38	—	0.01	0.42	—	0.01	0.32	—
Panel B. Portfolios													
dE/B-agg	0							2.67	1.58	0.01	**−2.53**	−1.89	0.02
	1	**0.64**	8.27	0.36	**0.72**	10.78	0.49	**−4.14**	−2.33	0.04	**−2.93**	−2.14	0.03
	2	**0.41**	4.56	0.14	**0.53**	6.71	0.27	−1.50	−0.82	−0.00	−0.18	−0.13	−0.01
	3	**0.18**	1.84	0.02	**0.30**	3.34	0.08	−0.74	−0.40	−0.01	−1.14	−0.86	−0.00
	4	−0.03	−0.32	−0.01	0.06	0.60	−0.01	**−3.47**	−1.90	0.02	−1.37	−1.02	0.00
dE/P-ew	0							1.43	0.99	−0.00	**−4.37**	−2.06	0.03
	1	**0.68**	9.92	0.44	**0.71**	10.74	0.48	−1.49	−1.01	0.00	**−6.29**	−2.97	0.06
	2	**0.36**	4.12	0.12	**0.55**	7.06	0.29	−0.63	−0.42	−0.01	−2.13	−1.01	0.00
	3	0.07	0.73	−0.00	**0.28**	3.10	0.07	−0.61	−0.94	−0.01	−1.75	−0.83	−0.00
	4	−0.14	−1.50	0.01	0.04	0.39	−0.01	**−2.73**	−1.90	0.02	−1.22	−0.58	−0.01
dE/P-vw	0							1.56	0.92	−0.00	**−5.25**	−2.34	0.04
	1	**0.68**	9.71	0.43	**0.74**	12.07	0.54	**−3.04**	−1.76	0.02	**−4.63**	−2.04	0.03
	2	**0.40**	4.59	0.14	**0.52**	6.65	0.26	−0.97	−0.56	−0.01	−0.69	−0.31	−0.01
	3	0.11	1.22	0.00	**0.28**	3.14	0.07	−0.58	−0.34	−0.01	−1.81	−0.82	−0.00
	4	−0.11	−1.15	0.00	0.04	0.47	−0.01	−2.80	−1.63	0.01	−1.34	−0.60	−0.01

for the two groups are similar, but small stocks' earnings are somewhat less persistent. The same conclusion holds when we aggregate earnings for the portfolios. The large-stock portfolio has, for the various earnings series, first-order autocorrelations around 0.72 and second-order autocorrelations around 0.55, compared with 0.66 and 0.40 for the small-stock portfolio. Overall, the time-series properties are similar to those for the entire market.

The right-hand columns show return regressions for the two groups. Panel A shows Fama–MacBeth estimates for individual firms 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. Prices initially react most strongly for large firms, with point estimates of 1.00 and 0.83 for $k = 0$ and 1 (t-statistics of 22.8 and 19.4), respectively, compared with slopes of 0.37 and 0.45 for small stocks. The stronger reaction for large firms is surprising because the earnings processes for the two groups are similar and investors are likely to have better prior information about large firms' earnings. Post-announcement drift is about the same for small and large stocks, which again is surprising because the groups differ in many dimensions that might affect the market's reaction to earnings news, including average profitability, liquidity, and earnings volatility.

The portfolio-level tests, in Panel B, suggest interesting differences across groups. Large stocks provide stronger evidence that portfolio returns and concurrent earnings are negatively correlated. The slopes for the large-stock portfolio are significantly negative for both $k = 0$ and 1, with t-statistics between –1.89 and –2.97, while the slopes for small stocks are significantly negative only at $k = 1$. In terms of a lead-lag relation, small stocks provide the only evidence that portfolio earnings predict (negatively) future returns. The slopes at lags 2–4 are all negative, with significance at lag 4 for two earnings measures, dE/B-agg and dE/P-ew (t-statistics of -1.90 and -2.36, respectively). These results are generally consistent with our market-level regressions.

The portfolio evidence suggests several conclusions. First, earnings are most persistent for the large-stock portfolio, yet the market reacts most negatively to its earnings news, a combination that is puzzling from a cash-flow perspective. It suggests that large-stock earnings are more strongly correlated with discount rates. Second, the small-stock portfolio provides the most reliable evidence of market inefficiency, in that earnings changes predict returns four quarters in the future. The negative relation seems to indicate market overreaction, except that the contemporaneous relation between returns and earnings is flat. None of the portfolio results lines up with behavioral theories, either the Bernard and Thomas (1990) naïve-investor model or an underreaction story.

5. Earnings, business conditions, and discount rates

Our return regressions establish two key results: (1) aggregate earnings and stock returns are contemporaneously negatively related; and (2) earnings surprises contain little information about future returns. To better understand these results, we explore the relations among earnings, business conditions, and discount rates. We are particularly interested in whether movements in discount-rate proxies can explain the contemporaneous return-earnings association.

5.1. Framework

Campbell (1991) provides a convenient framework for thinking about these issues. In particular, he shows that returns R_t can be decomposed into three components.

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

where r_t is the expected return for period t, $\eta_{\mathrm{d},t}$ is the shock to expected dividends, and $\eta_{\mathrm{r},t}$ is the shock to expected returns (the last component has a negative sign because an increase in expected returns reduces the current price).[5] Eq. (6) implies that earnings' covariance with returns depends on its covariances with r_t, $\eta_{\mathrm{d},t}$, and $-\eta_{\mathrm{r},t}$. If we have a good proxy for unexpected earnings, $\mathrm{d}E_t$, the covariance with r_t is necessarily zero, so Eq. (6) implies

$$\mathrm{cov}(\mathrm{d}E_t, R_t) = \mathrm{cov}(\mathrm{d}E_t, \eta_{\mathrm{d},t}) - \mathrm{cov}(\mathrm{d}E_t, \eta_{\mathrm{r},t}). \tag{7}$$

The first term is positive as long as higher earnings are associated with higher dividends. But the overall covariance can be negative, as we find in the data, if higher earnings are associated with an increase in expected returns, i.e., if $\mathrm{cov}(\mathrm{d}E_t, \eta_{\mathrm{r},t})$ is positive.

Assuming investors are rational, expected returns are the same as discount rates. Thus, the correlation between $\mathrm{d}E_t$ and $\eta_{\mathrm{r},t}$ suggests that discount rates rise when earnings are strong (see also Lettau and Ludvigson, 2004). One possibility is that high earnings lead to higher real or nominal interest rates. The negative price impact of higher real interest rates is clear, but Modigliani and Cohn (1979) argue that prices react even to purely nominal interest-rate changes because investors mistakenly discount real earnings at nominal rates (see Nissim and Penman, 2003; Campbell and Vuolteenaho, 2004, for recent evidence). On the other hand, finance theory suggests that the risk premium should be countercyclical and, thus, negatively related to earnings, opposite the effect implied by our regressions. Countercyclical movements in the equity premium might arise if investors try to smooth consumption (see, e.g., Lucas, 1978) or if aggregate risk aversion varies over the business cycle (see, e.g., Campbell and Cochrane, 1999; Chan and Kogan, 2002).[6] 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-rate effects.

5.2. *Earnings and business conditions*

Table 8 reports correlations among earnings, economic activity, and several discount-rate proxies. Our measures of economic activity include the growth rates of gross domestic product (GDP), industrial production (IPROD), and personal

[5]Formally, $\eta_{\mathrm{d},t} = \sum_{k=0}^{\infty} \rho^k \Delta E_t d_{t+k}$ and $\eta_{\mathrm{r},t} = \sum_{k=1}^{\infty} \rho^k \Delta E_t h_{t+k}$, 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 asset's average dividend yield. The decomposition is only approximate.

[6]This is not to say that pro-cyclical variation in the discount rate is impossible. Cochrane (2001), for example, observes that discount rates should covary positively with expected growth rates (i.e., be pro-cyclical) if investors have constant relative risk aversion greater than one (see also Yan, 2004). The intuition is that, when growth rates are high, investors naturally want to consume more today and, in equilibrium, have to be induced to save through higher rates of return.

Table 8

Earnings and the macroeconomy, 1970–2000

The 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 quarterly earnings. P is the market value and B is the book value 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 one-year T-bill rate. TERM is the yield spread between ten-year T-bonds and one-year T-bills. DEF is the yield spread between Baa- and Aaa-rated corporate bonds. SENT is consumer sentiment from the University of Michigan Survey Research Center, available from 1979–2000. 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. 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 to match the definition of dE/B and dE/P, while TBILL, TERM, and DEF are always nominal rates. The earnings sample consists of firms with a March, June, September, or 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. Bold denotes regression slope estimates that are significant at a two-sided 10% level.

	Nominal dE			Real dE		
	dE/B-agg	dE/P-ew	dE/P-vw	dE/B-agg	dE/P-ew	dE/P-vw
Panel A. Correlations						
ΔTBILL	0.579	0.395	0.610	0.491	0.322	0.505
ΔTERM	−0.469	−0.363	−0.532	−0.464	−0.366	−0.535
ΔDEF	−0.325	−0.526	−0.360	−0.420	−0.635	−0.488
ΔSENT	0.185	0.392	0.124	0.243	0.437	0.196
GDP	0.475	0.574	0.566	0.607	0.668	0.681
IPROD	0.605	0.670	0.656	0.677	0.751	0.754
CONS	0.363	0.490	0.444	0.485	0.603	0.535
Panel B. $\mathrm{d}E_t = \alpha + \beta\,\Delta TBILL_t + \gamma\,\Delta TERM_t + \lambda\,\Delta DEF_t + \rho\,\mathrm{d}E_{t-1} + \varepsilon$						
ΔTBILL	**0.09**	0.03	**0.04**	**0.06**	0.02	**0.02**
	(3.29)	(1.16)	(2.80)	(2.36)	(0.87)	(1.78)
ΔTERM	0.03	0.01	−0.01	0.02	−0.00	−0.02
	(0.65)	(0.16)	(−0.26)	(0.35)	(−0.04)	(−0.75)
ΔDEF	**−0.32**	**−0.36**	**−0.20**	**−0.36**	**−0.45**	**−0.24**
	(−3.38)	(−3.63)	(−3.87)	(−3.82)	(−4.64)	(−4.72)
dE_{t-1}	**0.51**	**0.57**	**0.55**	**0.54**	**0.49**	**0.55**
	(6.49)	(7.36)	(8.00)	(7.00)	(6.13)	(8.30)
Adjusted R^2	0.54	0.56	0.64	0.54	0.58	0.64
Adjusted R^2 without AR1	0.38	0.37	0.44	0.36	0.45	0.44

consumption (CONS). Our discount-rate proxies include the one-year T-bill rate, the yield spread between ten-year and one-year T-bonds (TERM), and the yield spread between low-grade and high-grade corporate debt (DEF). The latter two proxies are motivated by Fama and French's (1989) evidence that variables similar to DEF and TERM capture movements in expected stock and bond returns over the business cycle. We exclude valuation ratios, such as dividend yield, from our set of proxies because they are tied mechanically to prices (and we wish to test whether the proxies explain price changes). Finally, we also report correlations for the University of Michigan's consumer sentiment index. The variables are all measured as annual changes or growth rates ending in the quarter that earnings are measured.

Panel A shows simple correlations between earnings and the macro-variables. Not surprisingly, earnings are strongly related to the growth 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. Co-movement with GDP and CONS is somewhat weaker and, in unreported tests, we find that IPROD subsumes the correlation with the other two variables.

The behavior of discount rates is more important for our purposes. Earnings are strongly positively correlated with ΔTBILL (estimates between 0.32 and 0.61) and negatively correlated with ΔTERM and ΔDEF (estimates between −0.33 and −0.64). The correlation with ΔTBILL suggests that higher earnings are associated with higher discount rates, but the correlations with ΔTERM and ΔDEF 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, measured by the equal-weighted earnings series. Also, earnings are weakly positively related to consumer sentiment. Untabulated results show that ΔSENT is positively related to returns (0.39 in quarterly data), so its correlation with earnings has the wrong sign for explaining why the market reacts negatively to earnings news.

Our tests below ask whether changes in discount rates can explain the correlation between returns and earnings. An easy way to do this is to break earnings into a component related to discount-rate news and an orthogonal component by first regressing earnings on the discount-rate proxies. We then include both components in the second-stage return regression. In the second-stage regression, the slope on the orthogonal component is identical to the slope on earnings if we directly include ΔTBILL, ΔTERM, and ΔDEF in the regression; the two-stage approach simply eases the presentation and interpretation of the results.

Table 8, Panel B, shows the first-stage regression of earnings on the discount-rate proxies and an AR1 term (to soak up residual autocorrelation remaining after controlling for discount rates). ΔTBILL and ΔDEF are both highly significant and drive out any 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 ΔTERM is dropped 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 use annual changes measured over the same interval as the earnings change (from $t-4$ to t). Most of the annual change is known prior to t 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 find similar results using all three specifications. In 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.

5.3. Returns, earnings, and discount rates

Table 9 reports the second-stage regressions of returns on current and past earnings surprises. The projection of earnings on the discount-rate proxies and AR1 term is labeled "Fitted $\mathrm{d}E/S$" and the orthogonal component is labeled "Residual $\mathrm{d}E/S$." The slope on Residual $\mathrm{d}E/S$ measures the marginal impact of an earnings surprise after controlling for discount rates.

Our discount-rate proxies only partially explain why the market reacts negatively to good earnings news. The slopes on Residual $\mathrm{d}E/S$ are typically less negative, or more positive, than the corresponding slopes in Table 4. But the most important finding is that returns in the announcement quarter, $k = 1$, remain negatively correlated with earnings news, with t-statistics on Residual $\mathrm{d}E/S$ between -1.93 and -3.17. Table 9 also provides no evidence of post-earnings announcement drift in aggregate returns. Thus, our discount-rate proxies do not eliminate the negative reaction to earnings news or change our conclusions about post-announcement drift.

Alternative specifications for discount-rate changes, in the first-stage regressions that provide Residual $\mathrm{d}E/S$, give similar results. If we measure ΔTBILL, ΔTERM, and ΔDEF in the announcement instead of measurement quarter, the t-statistics on Residual $\mathrm{d}E/S$ for $k = 1$ are -3.33, -1.90, and -3.05 for the three earnings series. If we instead use annual changes in TBILL, TERM, and DEF, as in Table 8, the t-statistics for $k = 1$ are -2.33, -1.65, and -2.23.

5.3.1. Annual returns

Table 10 repeats the analysis using annual returns and earnings. In unreported first-stage regressions, only T-bill rates are significant when used together with TERM, DEF, and an AR1 term (like returns, the discount-rate proxies are lagged four months relative to annual earnings). ΔTBILL alone explains more than 50% of annual earnings changes. For this reason, we use ΔTBILL as the only proxy for discount-rate news in Table 10.

The table shows two key results. First, movements in interest rates largely explain the negative reaction to earnings news in annual data. The slopes on Residual $\mathrm{d}E/S$ for lag 0 are roughly one standard error below zero, compared with t-statistics around -2.5 using raw earnings changes (see Table 5). Thus, prices seem to react negatively to annual earnings news because high earnings are tied to high interest rates. But the point estimates on Residual $\mathrm{d}E/S$ remain negative, so ΔTBILL does not fully remove the discount-rate effects in earnings.

Second, 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 $\mathrm{d}E/$

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

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

$$R_{t+k} = \alpha + \beta \text{ Fitted } \mathrm{d}E/S_t + \gamma \text{ Residual } \mathrm{d}E/S_t + e_{t+k},$$

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

$$\mathrm{d}E/S_t = \alpha + \beta\,\Delta\mathrm{TBILL}_t + \gamma\,\Delta\mathrm{TERM}_t + \lambda\,\Delta\mathrm{DEF}_t + \rho\,\mathrm{d}E/S_{t-1} + \varepsilon_t.$$

Fitted dE/S is the fitted value from this regression and Residual dE/S is the residual. The variables ΔTBILL, ΔTERM, and ΔDEF are one-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 4 quarters in the future ($k = 0$ is the quarter for which earnings are measured). 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, respectively, of firm dE/P ratios. The earnings sample consists of firms with a March, June, September, or 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 measure	k	Fitted dE/S		Residual dE/S		Adj. R^2
		Slope	t-stat	Slope	t-stat	
dE/B-agg	0	**−6.29**	−3.39	1.87	0.96	0.08
	1	−1.50	−0.83	**−6.66**	−3.17	0.07
	2	−2.25	−1.21	2.61	1.21	0.01
	3	−1.22	−0.65	−0.52	−0.24	−0.01
	4	0.11	0.06	−2.50	−1.15	−0.01
dE/P-ew	0	**−5.92**	−3.32	**5.65**	2.51	0.11
	1	**−3.80**	−2.11	**−4.48**	−1.93	0.05
	2	**−3.06**	−1.68	−0.69	−0.29	0.01
	3	**−3.41**	−1.87	1.34	0.57	0.02
	4	−1.71	−0.93	**−4.30**	−1.81	0.02
dE/P-vw	0	**−9.24**	−3.24	1.15	0.32	0.07
	1	−2.79	−1.00	**−10.91**	−3.06	0.06
	2	−3.13	−1.10	3.30	0.90	0.00
	3	−1.25	−0.44	−1.99	−0.54	−0.01
	4	0.47	0.16	−3.28	−0.89	−0.01

B-agg (t-statistic of 1.78) and dE/P-vw (t-statistic of 2.25). The estimate for dE/P-vw is economically large. An increase in Residual dE/P-vw by two standard deviations ($2 \times 0.84\%$) maps into a 13.1% increase in expected return. Residual dE/P-vw explains more than 10% of the variation in next year's return. These results provide the first evidence that aggregate prices underreact to earnings news, but they are also consistent with our argument that high earnings are associated with higher discount

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

The table reports slope estimates when annual stock returns are regressed on annual 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

$$dE/S_t = \alpha + \beta\, \Delta\text{TBILL}_t + \varepsilon.$$

Fitted dE/S is the fitted value from this regression and Residual dE/S is the residual. ΔTBILL is the annual change in one-year T-bill 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, respectively, 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 measure	k	Fitted dE/S		Residual dE/S		Adj. R^2
		Slope	t-stat	Slope	t-stat	
dE/B-agg	0	**−4.28**	−2.02	−2.33	−1.01	0.10
	1	−0.86	−0.38	**4.44**	1.78	0.04
	2	2.06	0.86	0.38	0.15	−0.05
	3	1.00	0.43	1.51	0.60	−0.06
dE/P-ew	0	**−4.22**	−2.03	−2.14	−1.06	0.10
	1	−0.61	−0.26	1.08	0.49	−0.06
	2	2.05	0.87	0.65	0.30	−0.04
	3	1.05	0.46	−0.27	−0.13	−0.07
dE/P-vw	0	**−5.90**	−2.04	−4.14	−1.26	0.11
	1	−1.20	−0.40	**7.80**	2.25	0.10
	2	2.97	0.91	−1.75	−0.47	−0.04
	3	1.43	0.44	0.63	0.17	−0.07

rates. Further, the significance of the $k=1$ slopes is tenuous. For example, the t-statistics drop to 1.30, 0.82, and 1.30 for the three earnings series if we include ΔTERM and ΔDEF in the first-stage regression.

5.3.2. Discount-rate levels versus changes

The tests just described focus on changes in discount rates, but the ex ante level of discount rates might also fluctuate with earnings. The distinction is important, as seen in Eq. (6): $R_t = r_t + \eta_{d,t} - \eta_{r,t}$. The discount-rate level, r_t, enters with a positive sign, but the discount-rate shock, $\eta_{r,t}$, enters with a negative sign. Thus, to explain a negative correlation with returns, earnings could be negatively correlated with discount-rate levels or positively correlated with discount-rate shocks. The interpretation of our results clearly depends on which is true.

We believe the results tell us principally about discount-rate shocks for several reasons. First, if dE_t is a good proxy for unexpected earnings, it must be uncorrelated with anything known prior to t, including r_t. Our evidence in Section 3 suggests that a large fraction of dE_t is, in fact, unexpected: dE_t is quite volatile and time-series models explain only half of its variability. Moreover, when we remove the predictable component to get a better proxy for unexpected earnings, the negative correlation with returns becomes stronger (Table 4). This suggests that unexpected earnings, which can only be correlated with $\eta_{r,t}$, drive our results.

Second, dE_t explains a large fraction of quarterly and annual returns: 4% to 9% of quarterly returns and 10% to 18% of annual returns (see Tables 4 and 5). The explanatory power seems too large to be driven by the ex ante level of discount rates. As noted earlier, for example, quarterly returns are roughly 7% when earnings growth is poor (bottom quartile) but only 1% when earnings growth is strong (top quartile). In our view, the large difference in returns more likely reflects the arrival of new information during the quarter instead of differences in ex ante expected returns, again consistent with our focus on discount-rate shocks, not levels.

Finally, we directly test whether the level of discount rates is important by including in the regressions the lagged values of TBILL, TERM, and DEF. In the first-stage earnings regressions, lagged TBILL, TERM, and DEF have little correlation with dE after controlling for contemporaneous changes in the variables and the AR1 term; the three level variables are never significant and add almost nothing to the regression R^2. Not surprisingly, then, the second-stage return regressions are also similar to those reported in Table 9. In sum, the ex ante level of discount rates seems unlikely to explain the negative correlation between returns and earnings.

6. Conclusions

The overall message from our analysis is, in some ways, quite simple: The market's reaction to aggregate earnings differs dramatically from its 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 prices. We leave it to the reader to judge whether the results should be viewed as a rejection of the theories or simply evidence that they apply only at the firm level. At a minimum, our results suggest that recent behavioral models are incomplete because they provide little guidance for understanding why firm and aggregate price behavior should differ.

Our results also provide new evidence on the connections among prices, earnings, discount rates, and business conditions. The strong negative reaction to aggregate earnings news suggests that discount rates rise when earnings are unexpectedly high, an effect that dominates the cash-flow news in quarterly and annual earnings. In fact, we do find that earnings are strongly correlated with changes in several proxies for discount rates, including T-bill rates, the term spread, and the default spread. However, these variables only partially explain the market's negative reaction to earnings news, which suggests that discount-rate shocks not captured by our proxies explain a significant fraction of returns (see also Fama, 1990; Campbell, 1991; Cochrane, 1992). The results are inconsistent with theoretical models that predict that discount rates and cash flows should move in opposite directions (see, e.g., Campbell and Cochrane, 1999; Chan and Kogan, 2002).

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