Does Differential Sensitivity to Aggregate Earnings Shocks Drive Post-Earnings-Announcement Drift?

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Comments are Welcome

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Abstract

This paper finds that returns to the post-earnings-announcement drift (PEAD) strategy result from differential sensitivity of individual stock returns to aggregate earnings shocks. Larger negative aggregate earnings shocks are associated with higher PEAD returns, because stocks in the PEAD's sell portfolio are more sensitive to aggregate earnings shocks than those in the buy portfolio. Such differential sensitivity to aggregate earnings shocks drives a significant portion of PEAD returns. During the 1985 to 2009 sample period, investors were on average negatively surprised by aggregate earnings shocks, leading to average positive returns to the PEAD strategy. Further analysis suggests that macroeconomic shocks (that work through aggregate earnings shocks) explain the variation in PEAD returns.

Does Differential Sensitivity to Aggregate Earnings Shocks Drive Post-Earnings-Announcement Drift?

1. Introduction

Post-earnings-announcement drift (PEAD)—the phenomenon whereby stocks with positive quarterly earnings surprises outperform stocks with negative quarterly earnings surprises over subsequent months—is arguably one of the most puzzling and enduring patterns in the cross-section of equity returns (Fama, 1998). One explanation for PEAD is that investors underreact to earnings news because they underestimate the implications of current earnings for future earnings (Bernard and Thomas, 1989, 1990). However, if the returns to the PEAD strategy are indeed driven by investor naiveté, then they should have been arbitraged away over time, especially given the profitability and pervasiveness of the PEAD strategy.[1] Yet PEAD has persisted for over 40 years, which raises questions about whether PEAD does in fact represent market mispricing or whether it is driven by other factors.

In this paper, I show that PEAD arises due to differential sensitivity of individual stock returns to aggregate earnings shocks. Specifically, I find that the returns of stocks in the PEAD's *sell* portfolio (i.e., stocks in the lowest earnings surprise decile) are significantly more sensitive to aggregate earnings shocks than those of stocks in the *buy* portfolio (i.e., stocks in the highest earnings surprise decile). Because aggregate earnings shocks have been mostly negative over the past 25 years, the sell portfolio generates more negative returns on average than the buy portfolio, giving rise to the PEAD return pattern. Consistent with this conjecture, I find that most of the returns to the PEAD strategy arise from the component of returns that is correlated with aggregate earnings shocks and that there are no significant differences across the PEAD

[1]There is mixed evidence on whether transaction costs (more broadly, limits of arbitrage) constrain arbitrageurs from exploiting PEAD returns. Richardson, Tuna, and Wysocki (2010) review this literature and conclude that PEAD strategy returns are lower after accounting for transaction costs but are still significant.

portfolios in the component of returns uncorrelated with aggregate earnings shocks. Further, the magnitude of PEAD strategy returns is significantly larger for those quarters with the most negative aggregate earnings shocks relative to those quarters with the least negative shocks. In fact, there are no significant PEAD returns in those quarters that fall in the tercile of the least negative aggregate earnings shocks.

I begin my analysis by measuring *aggregate earnings shocks*. I define aggregate earnings shocks as the component of quarterly market returns that represents changes in aggregate earnings expectations. I measure aggregate earnings shocks as the equally weighted average of individual stocks' earnings shocks, which in turn are measured as returns driven by current-period revisions to expectations of future earnings (Easton and Monahan, 2005). [2] I focus on the earnings shock component of market returns—rather than *total* market returns—because past research shows that PEAD is likely driven by the components of returns that are related to earnings expectation revisions,[3] rather than by expected returns.[4] Using various methods, in untabulated analysis I find that PEAD arises primarily from earnings shocks and not from other return components (i.e., those related to expected returns or discount rate shocks). Over the 1985 to 2009 sample period, I find that aggregate earnings shocks are mostly negative, although there is a fair amount of variation over time.

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[2] The earnings shock component is conceptually similar to the cash flow shock component in the Campbell and Shiller (1988) and Campbell (1991) return decomposition framework. Empirically I measure earnings shocks from analyst forecast revisions. Since analysts do not update their earnings forecasts in a timely fashion, earnings shock estimates derived from analyst forecasts provide a lower bound estimate of true earnings shocks (Chan and Zhao, 2010). Consistent with this argument, regressing market returns on aggregate earnings shocks and different proxies of expected returns yields a coefficient estimate in the range of 1.67-1.71, which is greater than the theoretical coefficient of 1 (Campbell and Shiller, 1988). As a robustness check, I re-estimate the results using the fitted value of returns on earnings shocks. Overall, the results using this proxy are similar to those using the proxy derived from analyst forecast revisions.

[3] See, for example, Bernard and Thomas (1989, 1990), Abarbanell and Bernard (1992), Ranjan and Sloan (1998), Soffer and Lys (1999), Brown and Han (2000), and Narayanamoorthy (2005).

[4] See, for example, Bernard and Thomas (1989, 1990), Bernard, Thomas, and Wahlen (1997), Chordia and Shivakumar (2006), and Wu and Zhang (2011).

I next determine the sensitivity of the PEAD portfolio's earnings shocks to aggregate earnings shocks by estimating *earnings shock betas*. To do so, I regress the quarterly earnings shocks of each PEAD portfolio on the aggregate earnings shocks over the 12 quarters prior to the formation of the PEAD strategy. The earnings shock beta captures the sensitivity of earnings expectation revisions in the respective PEAD portfolios to aggregate earnings expectation revisions.[5] I find that the earnings shock beta of the sell portfolio (2.49) is 2.8 times as large as that of the buy portfolio (0.89).

To examine whether the PEAD strategy returns can be attributed to the differential sensitivity of PEAD portfolio returns to aggregate earnings shocks, I conduct two separate tests. First, I decompose the PEAD strategy returns into *systematic earnings shocks,* which arise from the sensitivity of the PEAD portfolios to aggregate earnings shocks, and *the residual return*, which is uncorrelated with aggregate earnings shocks. I measure the systematic earnings shocks for each PEAD portfolio as the portfolio's respective earnings-shock beta multiplied by the aggregate earnings shocks. I find that systematic earnings shocks account for a significant portion of PEAD strategy returns (1.88% out of total PEAD returns of 2.20% per quarter). In contrast, I do not find any pattern in the residual returns for the PEAD portfolios. These results strongly suggest that PEAD arises primarily because of the differential sensitivity of the sell versus the buy PEAD portfolios to aggregate earnings shocks.

Recall that I argue that PEAD returns arise because the aggregate earnings shocks are negative on average over my sample period: the sell portfolio, which has a higher covariance with aggregate earnings shocks than the buy portfolio, generates more negative returns on

[5] Conceptually, earnings shock betas are similar to bad beta (Campbell and Vuolteenaho, 2004; Khan, 2008; Da and Warachka, 2009). The key difference is that bad beta is the covariance between portfolio returns and aggregate earnings news.

average, and this differential sensitivity gives rise to the PEAD return pattern. To confirm this conjecture, however, I need to show that the pattern in PEAD returns over time is predictably related to time-series variation in the direction/magnitude of aggregate earnings shocks. Accordingly, in my second test on whether the PEAD strategy returns can be attributed to the differential sensitivity of PEAD portfolio returns to aggregate earnings shocks, I examine returns to the PEAD strategy after partitioning the sample period on the direction/magnitude of aggregate earnings shocks. I find that the decile (quintile, quartile, tercile) of the sample quarters with the most negative aggregate earnings shocks has statistically significant PEAD returns of 4.37% (3.92%, 3.61%, 2.85%) per quarter. In contrast, the decile (quintile, quartile, tercile) of quarters with the least negative aggregate earnings shocks has statistically insignificant returns of -0.33% (0.15%, 0.04%, 0.31%) per quarter. Differences in PEAD returns between these respective partitions are statistically significant at the 5% level. These results suggest that variation in aggregate earnings shocks is associated with variation in PEAD returns; specifically, more negative aggregate earnings shocks are associated with higher PEAD returns.

As I use revisions in analysts' earnings forecasts to identify earnings shocks, one concern that arises is whether my measure of aggregate earnings shocks merely captures a form of aggregate analyst optimism rather than economic shocks that drive aggregate earnings expectation revisions. The fact that the aggregate earnings shocks are mostly negative accentuates this concern. To investigate whether my measure of aggregate earnings shocks represents systematic shocks to the economy, I examine the association between aggregate earnings shocks and various macroeconomic variables. I find that aggregate earnings shocks are significantly associated with current-period revisions to expectations about future periods' consumption growth, industrial production, and inflation. Further, macroeconomic variables explain 73% of the variation in aggregate earnings shocks.[6] These results suggest that my measure of aggregate earnings shocks is indeed picking up economic shocks that affect earnings expectations.

I also investigate whether the component of aggregate earnings shocks driven by macroeconomic shocks can better explain PEAD strategy returns than the component unrelated to macroeconomic shocks. To this end, I decompose aggregate earnings shocks into the fitted aggregate earnings shock that is driven by macroeconomic shocks, estimated as the fitted value from regressing aggregate earnings shocks on macroeconomic shocks, and the residual aggregate earnings shock that is unrelated to macroeconomic shocks. I find that fitted aggregate earnings shocks explain variation in PEAD returns better than the residual aggregate earnings shocks. Specifically, I find that quarters with more negative fitted aggregate earnings shocks have significantly higher PEAD returns than quarters with less negative fitted values. In contrast, quarters with more negative residual aggregate earnings shocks do not have statistically higher PEAD returns than quarters with less negative residual values. This evidence suggests that macroeconomic shocks (that work through aggregate earnings shocks) explain the variation in PEAD returns.

Next, I examine whether the relationship that I document between aggregate earnings shocks and PEAD returns is driven by existing explanations for PEAD returns. I find that aggregate earnings shocks explain variation in PEAD returns beyond existing explanations such as the investor naivety hypothesis in Bernard and Thomas (1989, 1990), analyst underreaction to

[6] In contrast, these variables explain only 18% of total market returns, which is only significantly correlated with the risk-free rate.

prior earnings information in Abarbanell and Bernard (1992), or the inflation illusion explanation in Chordia and Shivakumar (2005).

Overall, I find that differential sensitivity of the sell versus the buy portfolios to aggregate earnings shocks explains a significant portion of the variation in PEAD strategy returns. It is important to note that the framework that I provide is not a risk-based explanation. Even if aggregate earnings shocks are a priced risk factor (Campbell and Vuolteenaho, 2004; Ball, Sadka, and Sadka, 2009; Da and Warachka, 2009), I find that earnings shock betas for the sell portfolio are larger than those for the buy portfolio, suggesting that the PEAD strategy has negative risk exposure to aggregate earnings shocks.

This paper contributes to the literature in several ways. First, I present a framework that sheds light on when PEAD strategy returns occur and document that higher negative aggregate earnings shocks are associated with higher PEAD returns. I show that a significant portion of the returns to the PEAD strategy are driven by differential sensitivity of the sell versus the buy portfolios to aggregate earnings shocks. Second, I present evidence that suggests economic shocks (which work through aggregate earnings shocks) better explain variation in PEAD returns than alternative explanations based on investor or analyst underreaction to prior earnings information. Third, I contribute to the literature that links macroeconomic variables to earnings by documenting that 73% of the variation in aggregate earnings revisions is attributable to changes in macroeconomic conditions. Finally, the framework developed in this paper can be used to understand other asset pricing anomalies for which sorting on the anomaly variable is essentially sorting on the aggregate earnings shock sensitivity.

2. Return Decomposition and Testable Implications

In this section, I rely on the return decomposition framework to understand the drivers of realized returns to the PEAD strategy. Realized returns can be decomposed into expected returns, earnings shocks,[7] and discount rate shocks (Campbell and Shiller, 1988; Campbell, 1991; Vuolteenaho, 2002).

$$r_{t+1} = E_t\,(r_{t+1}) + EN_{t+1} - DN_{t+1} \tag{1}$$

where r_{t+1} stands for realized returns for quarter $t+1$, $E(r)$ for expected returns, *EN* for earnings shocks (earnings news) and *DN* for discount rate shocks (discount rate news). Earnings shocks are defined as returns attributable to current-period revisions to expectations about future earnings. Discount rate shocks are defined as returns driven by current-period revisions to expected returns. Realized returns to the PEAD strategy (buy portfolio (B) - sell portfolio (S)) can be similarly decomposed as

$$r^B_{t+1} - r^S_{t+1} = (E^B_t(r_{t+1}) - E^S_t(r_{t+1})) + (EN^B_{t+1} - EN^S_{t+1}) - (DN^B_{t+1} - DN^S_{t+1}) \tag{2}$$

I examine each of these three components (differences in expected returns, earnings shocks, and discount rate shocks) to understand the drivers of PEAD realized returns.

Evidence from the existing literature suggests that expected returns (the first term in equation (2)) do not drive realized returns to the PEAD strategy (Bernard and Thomas, 1989, 1990; Bernard, Thomas, and Wahlen, 1997; Chordia and Shivakumar, 2006; Wu and Zhang, 2011).

[7] Financial economists often refer to earnings shocks as cash flow shocks.

Turning next to earnings shocks (the second term in equation (2)), these can be further decomposed into a systematic component that is related to aggregate earnings shocks and an idiosyncratic component as follows:

$$\begin{aligned}(EN_{t+1}^{B} - EN_{t+1}^{S}) &= (\beta_{EN,t}^{B} EN_{t+1}^{M} + \varepsilon_{t+1}^{B}) - (\beta_{EN,t}^{S} EN_{t+1}^{M} + \varepsilon_{t+1}^{S}) \\ &= (\beta_{EN,t}^{B} - \beta_{EN,t}^{S}) EN_{t+1}^{M} + \varepsilon_{t+1}^{B} - \varepsilon_{t+1}^{S}\end{aligned} \tag{3}$$

where EN_{t+1}^{M} denotes aggregate earnings shocks, $\beta_{EN,t}^{B}$ captures the sensitivity of the buy portfolio's earnings shocks to aggregate earnings shocks (*earnings shock beta for the buy portfolio*), $\beta_{EN,t}^{S}$ captures the sensitivity of the sell portfolio's earnings shocks to aggregate earnings shocks (*earnings shock beta for the sell portfolio*), and $EN_{t+1}^{M}\beta_{EN,t}$ captures the portion of earnings shocks for a portfolio that co-moves with aggregate earnings shocks.

If aggregate earnings shocks drive most of the variation in realized returns to the PEAD strategy, then mean-zero aggregate earnings shocks in a given time period should translate into mean-zero returns to the PEAD strategy. Indeed, on average aggregate earnings shocks should be mean-zero in expectation or over a long sample period. However, evidence suggests that in finite samples – even 100 years of data is considered a finite sample – aggregate earnings shocks can be non-mean zero (Elton, 1999; Fama and French, 2002; Lundblad, 2007).[8] Hence, in a finite sample, we can observe non-zero returns to the PEAD strategy.

Testable implications from equation (3) are as follows: (1) if the earnings shock beta of the buy portfolio is smaller than that of the sell portfolio (i.e., $\beta_{EN,t}^{B} - \beta_{EN,t}^{S} < 0$), then periods with higher negative aggregate earnings shocks translate into higher PEAD returns; and (2) if the

[8] Earnings shocks and/or discount rate shocks can be non-zero for long time series of data (see Elton, 1999 for a review). Lundblad (2007) shows that even 100 years of time-series data have nonzero shocks. As a recent example, over the last 40 years ending March 2009, long-term government bonds outperformed the S&P 500 index by 0.12% per year. Fama & French argue that this is an outcome of non-mean zero earnings and/or discount rate shocks (http://www.dimensional.com/famafrench/2009/08/qa-bonds-for-the-long-run.html#more).

earnings shock beta of the buy portfolio is greater than that of the sell portfolio (i.e., $\beta^{B}_{EN,t} - \beta^{S}_{EN,t} > 0$), then periods with higher positive aggregate earnings shocks translate into higher PEAD returns.

Similar arguments can be made for discount rate shocks (the third term in equation (2)), but the testable implications will have signs that run in the opposite direction given that discount rate shocks are negatively related to realized returns.

3. Data and Preliminary Analysis

3.1 Sample and Data

The sample comes from the intersection of I/B/E/S, CRSP, and Compustat for the 1985 to 2009 period. All variables except the risk (common) factors are measured at the quarterly frequency. Portfolios are formed on a calendar date basis, and hence I restrict the sample to firms with a December fiscal year-end to align the data across firms. I also restrict the sample to ordinary common shares (share codes 10, 11) that are traded on the NYSE, AMEX, or NASDAQ exchanges. I drop firms with a stock price less than $1 as well as firm-quarters with negative book values of equity. The final sample comprises 162,278 firm-quarter observations. Monthly values of the three Fama-French factors–market (MKT), size (SMB), and book-to-market (HML)–come from Professor Kenneth French's website.[9] I obtain macroeconomic data from the Federal Reserve Bank of St. Louis.

[9] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

3.2 *Replication of Returns to PEAD Strategy*

The PEAD strategy is executed by taking a long position in the decile of firms with the most positive earnings surprise (*buy portfolio*) and a short position in the decile of firms with the most negative earnings surprise (*sell portfolio*). Specifically, at the beginning of each quarter, 10 portfolios are formed on standardized unexpected earnings (SUE) and are held for three subsequent months. Figure 1 presents the timeline of variable measurement.

Standardized unexpected earnings (SUE) are estimated as reported earnings minus expected earnings, deflated by stock price. Specifically, SUE in quarter t is measured as:

$$SUE_{i,t} = \frac{(X_{it} - E_{t-1}(X_{it}))}{P_{it}} \quad (4)$$

where X_{it} is realized earnings for firm i in quarter t, $E_{t-1}(X_{it})$ is the consensus analyst forecast (median analyst forecast 90 days prior to the earnings announcement date) for firm i in quarter t[10], and P_{it} is price per share for firm i at the end of quarter t. The advantage of deflating by price rather than the standard deviation of forecast errors is that deflating by price does not require a long time series of data, mitigating problems associated with survivorship bias (Livnat and Mendenhall, 2006). This measure of SUE is similar to those used in Abarbanell and Bernard (1992), Mendenhall (2004), Francis et al. (2004), and Livnat and Mendenhall (2006).[11,12]

The starting point of my analysis is to compute realized returns to the PEAD strategy. For each SUE portfolio, I estimate equally weighted average realized returns for the 3-month period

[10] Data come from the I/B/E/S unadjusted files rather than the adjusted files to avoid potential rounding problems identified by Payne and Thomas (2003). Actual and consensus data are from I/B/E/S unadjusted files and adjustments are made using the CRSP adjustment factor.

[11] My primary analysis is restricted to firms with analyst following. As a robustness check, I also examine returns to the PEAD strategy for firms without analyst following. The sample for this analysis is drawn from CRSP and Compustat. For these firms, $E_{t-1}(X_{it})$ is replaced with earnings from a seasonal random walk model.

[12] With the exception of Livnat and Mendenhall (2006) and Mendenhall (2004), who also use I/B/E/S data, the source of analyst earnings estimate data in these studies differ. In particular, Abarbanell and Bernard (1992) extract data from Value Line, while Francis et al. (2004) obtain data from Zacks Investment Research.

starting from the portfolio formation date. Time-series means of portfolio returns are reported in Table 1. Consistent with over 40 years of literature on PEAD, I find statistically significant returns to the PEAD strategy.[13] Specifically, the sell portfolio observes returns of -1.03%, while the buy portfolio realizes returns of 1.14%. As a result, the hedge portfolio (buy-sell portfolio) has an average return of 2.16% over the three-month holding period.

3.3 Risk Exposures of PEAD Portfolios

The return decomposition framework suggests that realized returns can be decomposed into expected returns, earnings shocks, and discount rate shocks. In this section, I examine whether differences in expected returns for the buy versus sell PEAD portfolios can explain the realized returns to the PEAD strategy. Specifically, I estimate implied cost of capital and risk exposures using standard asset pricing models to measure expected returns for the PEAD portfolios.

Implied cost of capital estimates are used extensively in the accounting and finance literatures as a proxy for expected returns. I employ two different methods to estimate implied cost of capital. The first method follows Easton (2004) and is derived from the Ohlson and Juettner-Nauroth (2005) abnormal earnings growth model. The second method comes from Gebhardt, Lee, and Swaminathan (2001). Appendix describes the two estimation procedures.

In addition to implied cost of capital, I estimate risk exposures for the PEAD portfolios using two models: the Capital Asset Pricing Model (CAPM; Sharpe, 1964) and the Fama and

[13] Since Ball and Brown (1968), who first document the PEAD phenomenon, many papers document such drift for different samples and using methods; see, e.g., Jones and Litzenberger (1970), Latane, Joy, and Jone (1970), Brown and Kennelly (1972,; Joy, Litzenberger, and McEnally (1977), Latane and Jones (1979), Watts (1978), Rendleman, Jones, and Latane (1982), Foster, Olsen, and Shevlin (1984), Rendleman, Jones, and Latane (1987), and Freeman and Tse (1989), among others.

French three-factor model (Fama and French, 1994). The CAPM beta is estimated using a time-series regression of quarterly portfolio returns on quarterly market returns:

$$r_{pt} = a + \beta_{p,CAPM} r_{mt} + \varepsilon_t \tag{5}$$

where $\beta_{p,CAPM}$ is the beta for portfolio *p* and r_{mt} is the market return. Betas are estimated using a rolling 12-quarter window. Exposures to the Fama and French three factors are estimated using a time-series regression of quarterly portfolio returns on quarterly market return, SMB, and HML factors:

$$R_{p,t} = \alpha_p + \beta_p r_{m,t} + \gamma_p SMB_t + \delta_p HML_t + \varepsilon_{pt} \tag{6}$$

where γ_p captures the common factor exposure to the size factor (SMB) and δ_p captures the common factor exposure to the book-to-market factor (HML).

Table 1 reports the time-series means of the risk exposure and implied cost of capital estimates. The results suggest that the sell portfolio is marginally riskier than the buy portfolio. Specifically, the sell portfolio has a higher CAPM beta, SMB beta, and implied cost of capital than the buy portfolio. This evidence is consistent with findings in prior literature (Bernard and Thomas, 1989, 1990; Bernard, Thomas, and Wahlen, 1997; Chordia and Shivakumar, 2006; Wu and Zhang, 2011).

The results further suggest that the relationship between SUE portfolios and risk is U-shaped. The sell portfolio is the most risky, the middle portfolio is the least risky, and the buy portfolio is slightly less risky than the sell portfolio. The middle portfolios are the least risky as a result of portfolio formation. Firms that are not doing well operationally and are volatile are in the sell portfolio, while firms that are doing well operationally and are volatile are in the buy portfolio. This leaves the most stable, low volatility firms in the middle portfolio. Hence, the middle portfolios are the least risky as compared to the extreme portfolios.

Overall, the evidence from several risk estimation methods suggests that sell portfolios are marginally riskier than buy portfolios. Expected returns are therefore unable to explain realized returns to the PEAD strategy.

4 Do Aggregate Earnings Shocks Explain PEAD Returns?

4.1 Estimation of Aggregate Earnings Shocks

Aggregate earnings shocks are defined as aggregate returns driven by current-period revisions to expectations about future aggregate earnings (Campbell and Shiller, 1988; Vuolteenaho, 2002). The aggregate earnings shock for quarter *t* is estimated as the equally weighted average of firm-level earnings shocks as follows:

$$Agg\_E\_Shock_t = \frac{1}{N_t}\sum_{i=1}^{N_t}(E\_Shock_{i,t}) \tag{7}$$

where $Agg\_E\_Shock_t$ is the aggregate earnings shock in quarter *t*, $E\_Shock_{i,t}$ is the earnings shock for firm *i* in quarter *t*, and N_t is the number of firms in quarter *t*.[14]

I estimate firm-level earnings shock following the Campbell and Shiller (1988) and Vuolteenaho (2002) return decomposition. In particular, firm-level earnings shock is defined as returns driven by current-period revisions to expectations of future earnings:

[14] As a robustness check, I also estimate the aggregate earnings shocks as the value-weighted average of firm-level earnings shocks. Value-weighting results in aggregate earnings shocks which are smoother and on average lower in magnitude. Overall, the results using value-weighted aggregate earnings shocks are similar to those using the equally-weighted aggregate earnings shocks.

$$E\_Shock_{i,t+1} = \Delta E_{t+1}\left[\sum_{n=1}^{\infty} \rho^{n-1} roe_{i,s+n}\right] \quad (8)$$

where $E\_Shock_{i,t+1}$ is the earnings shock for firm i in quarter t+1, $\Delta E_{t+1}[.]$ is the change in expectations from quarter t to t+1, s is the current year, $roe_{i,s+n}$ is the natural log of the gross accounting rate of return on equity for firm i in year $s+n$, and ρ monotonically increases in dividend yield and is slightly less than one.

I use analyst earnings forecast revisions to proxy for investor expectation revisions. Relying on analyst earnings forecasts to measure investor expectations introduces two limitations. First, while a theoretical definition of an earnings shock requires infinite-horizon earnings expectations, analyst earnings forecasts are available only for finite horizons. Further, evidence suggests that analyst forecasts for the longer term are too noisy and have low accuracy (Chan, Karceski, and Lakonishok, 2003). To overcome these limitations, I restrict attention to revisions to current-year earnings forecasts and one-year-ahead earnings forecasts, and capitalize revisions to one-year-ahead earnings forecasts as an approximation for the sum of future-period earnings expectation revisions as described below (Easton and Monahan, 2005). Second, analysts do not update their earnings forecasts in a timely fashion (Lys and Sohn, 1990; Abarbanell, 1991; Ali, Klein, and Rosenfeld, 1992; Hughes, Liu, and Su, 2008; Konchitchki, Lou, Sadka, and Sadka, 2011). As a result, earnings shock estimates derived from analyst forecasts provide a lower bound estimate of true earnings shocks (Chan and Zhao, 2010).[15]

Following Easton and Monahan (2005), I operationalize firm-level earnings shocks as follows:

[15] Another approach to estimate an earnings shock is to use the Vector Autoregression (VAR) approach as described in Campbell and Vuolteenaho (2004). Earnings shock estimates derived using this approach are subject to many limitations such as selection of state variables, method of estimation, etc. (Chen and Zhao, 2009).

$$E\_\widehat{News}_{i,t+1} = rev_{i,s} + rev_{i,s+1} + \left(\frac{\rho}{1-\rho * \omega}\right) rev_{i,s+2} \tag{9}$$

where $rev_{i,s+n} = \log\left(1 + \frac{REV_{i,s+n}}{B_{i,s+n-1}}\right)$, $REV_{i,s+n}$ is the revision to the year *s*+*n* median analyst forecast made during quarter *t*+1 for firm *i*, *s* is the current year, and B_{s+n} is the year *s*+ *n* book value of equity for firm *i*. In the above equation, the first term ($rev_{i,s}$) captures the part of earnings shocks driven by realized forecast errors for year *s* earnings reported in year *s*+1.[16] The second term ($rev_{i,s+1}$) captures the part of earnings shocks driven by revisions to current-year earnings expectations during the quarter. The final term ($(\rho/1-\rho * \omega) rev_{i,s+2}$) captures the portion of earnings shocks driven by capitalized revisions to one-year-ahead earnings expectations during the quarter. Here, ω represents the persistence in revisions to one-year-ahead earnings expectations and is estimated by running the following regression for each of the 48 Fama and French industries:

$$rev_{i,t+1} = \sigma + \omega\, rev_{i,t} + \xi_{t+1} \tag{10}$$

where $rev_{i,t}$ is the natural log of the gross accounting rate of return for firm *i* in quarter *t*, ω is estimated for each industry, and all firms within an industry are assigned the same persistence coefficient. ρ estimates are from Easton and Monahan (2005).[17] To reduce the influence of outliers, I winsorize earnings shock estimates at the 1% and 99% levels.

Figure 2 presents a time-series graph of aggregate earnings shock estimates. Aggregate earnings shocks are on average -1.21% per quarter for the 1985 to 2009 sample period.

[16] Year *s* earnings announcement made in year *s*+1 occurs only during the first quarter of year *s*+1. For the second, third, and fourth quarters this term is equal to zero.

[17] As a robustness check, following Ogneva (2010), I also estimate earnings shocks by assuming that ρ is a cross-sectional constant equal to 0.91. Earnings shocks are lower on average using this method but the main findings are qualitatively similar.

Consistent with the findings in Chava and Purnanandam (2010) and Chan, Karceski, and Lakonishok (2003), aggregate earnings shocks are on average negative.

4.2 Earnings Shock Betas for PEAD Portfolios

Given that the difference in expected returns cannot explain realized returns to the PEAD strategy, I next examine whether the second component of the return decomposition framework (i.e., earnings shocks) can explain PEAD returns. Specifically, I examine whether the earnings shocks that co-move with aggregate earnings shocks explain the PEAD returns.

As described in the return decomposition framework, the relationship between aggregate earnings shocks and PEAD returns is conditional on the differences in earnings shock betas for the buy and sell portfolio firms. In this section, I estimate the earnings shock betas for these portfolios. Earnings shock betas are defined as the covariance between portfolio earnings shocks and aggregate earnings shocks. Portfolio earnings shocks are estimated as the equally weighted average of firm-level earnings shocks. I estimate earnings shock betas using a time-series regression of quarterly portfolio earnings shocks on quarterly aggregate earnings shocks,

$$E\_Shock_{p,t} = a + \beta^{p}_{EN,t} AGG\_E\_Shock_{t} + \varepsilon_{t} \tag{11}$$

where $\beta^{p}_{EN,t}$ is the earnings shock beta for portfolio *p* and $AGG\_E\_Shock_t$ is the aggregate earnings shock for quarter *t*. Earnings shock betas are estimated using rolling 12-quarter data for each portfolio; the means of the rolling 12-quarter betas are reported in Table 1. Earnings shock betas vary significantly across the PEAD portfolios. In particular, the earnings shock beta for the sell portfolio is 2.8 times as large as that of the buy portfolio, which implies that firms in the sell portfolio are 2.8 times as sensitive to aggregate earnings shocks as firms in the buy portfolio.

Overall, the evidence suggests that the sell portfolio has a much higher earnings shock beta than the buy portfolio.

4.3 PEAD Returns in Periods with Extreme Aggregate Earnings Shocks

Because the sell portfolio is more sensitive to aggregate earnings shocks, higher negative aggregate earnings shocks translate into higher negative returns for the sell portfolio relative to the buy portfolio. This result in higher returns for the PEAD (buy-sell) strategy, that is, higher negative aggregate earnings shocks are associated with higher PEAD returns. In this section, I explore the extent to which this differential earnings shock sensitivity drives realized returns to the PEAD strategy.

Figure 2 plots the time series of realized returns to the PEAD strategy and aggregate earnings shocks. The correlation between aggregate earnings shocks and returns to the PEAD strategy is -0.20. This finding is consistent with the conjecture from the return decomposition analysis that if the buy portfolio has a smaller earnings shock beta than the sell portfolio, then higher negative aggregate earnings shocks lead to higher PEAD strategy returns.

To more formally test the conjecture that quarters with higher negative aggregate earnings shocks have higher PEAD returns, I partition the sample quarters into low and high aggregate earnings shock quarters. Quarters with aggregate earnings shocks in the bottom (top) decile, quintile, quartile, tercile, and half are defined as low (high) aggregate earnings shock quarters, i.e., *Low AE* (*High AE*), for the decile, quintile, quartile, tercile, and median partitions, respectively. Quarters in the low decile (quintile, quartile, tercile, median) partition have mean aggregate earnings shocks of -3.23% (-2.49%,-2.29%, -2.05%, -1.75%), respectively. Table 2 reports realized returns for the PEAD strategy in these partitions.

Realized returns for the partitions suggest that quarters with low aggregate earnings shocks (i.e., quarters with more negative aggregate earnings shocks) have positive and significant returns to the PEAD strategy. In contrast, quarters with high aggregate earnings shocks (i.e., quarters with less negative aggregate earnings shocks) have returns to the PEAD strategy that are not economically or statistically different from zero, with the exception of the median partition. Differences in PEAD returns between the high and low partitions are statistically different from each other. This evidence is consistent with the conjecture that higher negative aggregate earnings shocks are associated with higher PEAD strategy returns.

More specifically, quarters in the low aggregate earnings shock decile (quintile, quartile, tercile, median) partition have statistically significant PEAD strategy returns of 4.37% (3.92%, 3.61%, 2.85%, 3.09%), whereas quarters in the high aggregate earnings shock decile (quintile, quartile, tercile) partition have statistically insignificant PEAD strategy returns of -0.33% (0.15%, 0.04%, 0.31%). Return patterns for the buy and sell portfolios in these quarters are striking. In the low aggregate earnings shock partitions, both the buy and the sell portfolios have negative returns, but the sell portfolio has larger negative returns than the buy portfolio. In these quarters with significantly high positive PEAD returns, there is no evidence of return drift in the direction of earnings surprises for the buy portfolios. This evidence is contrary to the view that returns to the PEAD strategy arise because the sell portfolio continues to lose and the buy portfolio continues to gain. Further, in the high aggregate earnings shock partitions, returns to the buy and sell portfolios are both positive. This evidence is again contrary to the view that returns move in the direction of earnings surprises.

Even more striking, when quarters with insignificant returns to the PEAD strategy are excluded, returns to the PEAD strategy are positive as both the buy and sell portfolios have negative returns but the sell portfolio has returns that are more negative than the buy portfolio. In particular, after excluding the high aggregate earnings shocks quartile (tercile), returns to the sell portfolio are -3.36% (-4.23%), returns to the buy portfolio are -0.52% (-1.14%), and returns to the PEAD strategy are 2.85% (3.09%). In comparison, if I include the high aggregate earnings shocks quartile (tercile), returns to the sell portfolio are -1.15% and returns to the buy portfolio are 1.05%.

The evidence therefore suggests that the conventional view that sell portfolios continue to lose and buy portfolios continue to gain is supported only when the quarters with insignificant returns to the PEAD strategy are included. That is, the conventional view is an on-average effect. Periods that have significant returns to the PEAD strategy are those in which both the sell and the buy portfolios have negative returns. Periods that have insignificant returns to the PEAD strategy are those in which both the sell and the buy portfolios have positive returns. Combining these two sets of periods yields an average effect in which the sell portfolio experiences negative returns and the buy portfolio experiences positive returns. Hence, the conventional view that the sell portfolio continues to lose and the buy portfolio continues to gain does not hold as an explanation for the PEAD phenomenon.

In summary, returns to the PEAD strategy are driven by aggregate earnings shocks, and higher positive returns occur in periods with higher negative aggregate earnings shocks. Additionally, the conventional view that returns to the PEAD strategy occur because sell portfolio stocks continue to experience negative returns and buy portfolio stocks continue to experience positive returns is an average effect and cannot explain PEAD returns.

4.4 PEAD Returns and Systematic Earnings Shocks

Having established that variation in PEAD returns is associated with variation in aggregate earnings shocks, I next examine what fraction of PEAD strategy returns are driven by aggregate earnings shocks. To do so, I decompose PEAD strategy returns into systematic earnings shocks (defined as portfolio returns attributable to covariation with aggregate earnings shocks) and residual returns (defined as total returns minus systematic earnings shocks). Systematic earnings shocks are measured as follows:

$$Systematic\ earnings\ shocks_{p,t+1} = \beta^{p}_{EN,t}(AGG\_E\_Shocks_{t+1}) \tag{12}$$

where $\beta^{p}_{EN,t}$ is the earnings shock beta for portfolio *p* in quarter *t*. The earnings shock beta measures the covariance between portfolio earnings shocks and aggregate earnings shocks, divided by the variance of aggregate earnings shocks. It is estimated using rolling 12-quarter data (*t*-11 *to t*).

Table 3, Panel A reports systematic earnings shocks and residual returns for the PEAD portfolios. Of 2.2% total realized PEAD returns, 1.88% is driven by systematic earnings shocks, on average. That is, a significant portion of total returns to the PEAD strategy is attributable to aggregate earnings shocks. Further, differences in residual returns for the PEAD strategy are not statistically different from zero. This evidence suggests that a significant fraction of PEAD returns are driven by aggregate earnings shocks.

Two additional pieces of evidence further suggest that systematic earnings shocks are more stable over time and are able to capture the core returns to the PEAD strategy. First, the standard error of the systematic earnings shock estimate is one-fourth that of realized returns. Second, the regression of PEAD realized returns on systematic earnings shocks for the PEAD strategy (i.e., systematic earnings shock of the buy portfolio minus that of the sell portfolio) presented in Panel B of Table 3 shows that a 1% change in systematic earnings shocks is associated with a 0.97% change in PEAD returns. Moreover, even though the R^2 of the model is only 6.59%, the intercept is not statistically different from zero and the coefficient on systematic earnings shock is not statistically different from one. This evidence suggests that systematic earnings shocks capture the stable component of PEAD returns and the component of PEAD returns unrelated to systematic earnings shocks is not statistically different from zero.

One of the limitations of estimating the earnings shock beta for portfolio *p* (*p* is any of the 10 SUE portfolios) is that aggregate earnings shocks also contain portfolio *p*'s earnings shocks as aggregate earnings shocks are estimated using the equally weighted average of firm-level earnings shocks. Thus alternatively, I estimate the earnings shock beta for portfolio *p* after removing the firms in portfolio *p* when estimating aggregate earnings shock. Earnings shock betas estimated using this approach are lower across all portfolios compared to the estimates derived from specification (11). However, because the earnings shock betas derived using this approach are lower for both the buy and the sell portfolios, the effect on the buy-sell strategy portfolio earnings shock beta is only marginal (it is reduced by 0.06). Systematic earnings shocks estimated using this approach are reported under the column *Cross Validation and Rolling Beta* in Table 3. Overall, the results using this alternative approach to estimating earnings shock betas are similar to those using earnings shock betas derived from specification (11).

Table 3, Panel A also shows that the distribution of systematic earnings shocks has an inverted U-shape across the decile portfolios. Hence, the difference in systematic earnings shocks is higher for the middle minus sell (portfolio5 minus sell) portfolio than the hedge (buy minus sell) portfolio. However, the expected returns for the middle portfolio are significantly lower than those for the sell portfolio (as discussed in Section 3.3 and presented in Table 1). The difference in expected returns for the middle minus sell portfolio is thus significantly negative and offsets the effects of systematic earnings shocks to drive the total returns lower. In contrast, the difference in expected returns between the buy and sell portfolios is marginal. Therefore, overall realized returns for the middle minus sell portfolio are lower than those for the buy minus sell portfolio.

4.5 What Drives Aggregate Earnings Shocks? The Role of Macroeconomic Shocks

Given that I use analyst forecast revisions to measure revisions to investor expectations, one potential concern is that my measure of aggregate earnings shocks merely reflects behavioral biases in analyst forecast revisions such as optimism (Dechow and Sloan, 1997) or walking down to beatable forecasts (Richardson, Teoh, and Wysocki, 2004) rather than the economic shocks that drive the revisions in earnings expectations. In this section, I investigate the drivers of aggregate earnings shocks by examining the relationship between aggregate earnings shocks and macroeconomic shocks. Further, I investigate the extent to which the portion of aggregate earnings shocks that is attributable to macroeconomic shocks explains PEAD strategy returns.

To capture the portion of aggregate earnings shocks that is associated with economic shocks during the quarter, I regress aggregate earnings shocks on lagged, current, and future macroeconomic variables. The purpose of having future economic variables in the specification is to capture the part of aggregate earnings shocks that is driven by current-quarter revisions to expectations about future macroeconomic activities. Specifically, the relationship between aggregate earnings shocks and macroeconomic shocks is estimated as follows:

$$AGG\_E\_Shock_t = \alpha_0 + \sum_{\tau=-1}^{1} \alpha_{1,t+\tau} Cons_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{2,t+\tau} GDP_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{3,t+\tau} Term_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{4,t+\tau} Def_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{5,t+\tau} IndP_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{6,t+\tau} Rf_{t+\tau} + \sum_{\tau=-1}^{1} \alpha_{7,t+\tau} Inf_{t+\tau} + \varepsilon_t \quad (13)$$

where t is the current quarter, *AGG_E_Shock* is the aggregate earnings shock for the current quarter, *Cons* is the per capita growth rate of personal consumption, *GDP* is the per capita growth rate of gross domestic product, *Term* is the yield spread between the 10-year zero-coupon T-bond and three-month T-bills, *Def* is the yield spread between Baa- and Aaa-rated corporate bonds, *IndP* is industrial production growth, *Rf* is the three-month T-bill rate, and *Inf* is the change in the consumer price index. Economic data come from the Federal Reserve Bank of St. Louis website.

Panel B of Table 4 reports results from a regression of aggregate earnings shocks on the macroeconomic variables. I find that macroeconomic shocks explain 73% of the variation in aggregate earnings shocks. Aggregate earnings shocks are significantly associated with consumption growth, industrial production, and inflation. In contrast, these variables explain only 18% of the total market return, which is significantly correlated only with the risk-free rate (untabulated). Overall, the evidence suggests that most of the variation in aggregate earnings shocks is explained by macroeconomic shocks.

Next, I examine whether the variation in PEAD returns is attributable to fitted aggregate earnings shocks (i.e., the fitted values from the regression of aggregate earnings shocks on macroeconomic shocks) or the residual aggregate earnings shocks (i.e., the residuals from the regression of aggregate earnings shocks on macroeconomic shocks). Quarters with fitted aggregate earnings shocks in the bottom (top) decile, quintile, quartile, tercile, and half are defined as low (high) aggregate earnings shock quarters, i.e., *Low AE* (*High AE*), for the decile, quintile, quartile, tercile, and median partitions, respectively. The same approach is used to partition residual aggregate earnings shocks. Partitions of fitted aggregate earnings shocks, partitions of residual aggregate earnings shocks, and realized returns to the PEAD strategy in these partitions are reported in Panels C and D of Table 4.

Partitioning on fitted aggregate earnings shocks suggests that the PEAD strategy yields higher positive returns in quarters with low fitted values of aggregate earnings shocks. That is, in periods when macroeconomic shocks drive investors to revise their aggregate earnings expectations downward, returns to the PEAD strategy are higher. In addition, the PEAD strategy yields lower and statistically insignificant returns (with the exception of the tercile and median partitions) in quarters with high fitted values of aggregate earnings shocks. That is, returns to the PEAD strategy are lower and even statistically insignificant when macroeconomic shocks drive aggregate earnings shocks close to zero or positive. These differences in PEAD returns between fitted low and high partitions are statistically different from each other with a difference in returns of 4.42% (3.04%, 2.85%, 2.62%, 1.68%) for the decile (quintile, quartile, tercile, median) splits, respectively. In contrast, even though the quarters with low residual values of aggregate earnings shocks have higher PEAD returns than those in the high residual aggregate earnings shock partition, differences in PEAD returns are not statistically different between these partitions. Overall, the evidence suggests that returns to the PEAD strategy are related to macroeconomic shocks.[18]

Finally, I investigate what fraction of PEAD returns are attributable to aggregate earnings shocks that are related to macroeconomic shocks. Specifically, I estimate systematic macro

[18]Chordia and Shivakumar (2006) examine the relation between PEAD returns and macroeconomic activity. They find that current-period PEAD returns are counter-cyclically related to future-period economic activity. Evidence presented in this paper suggests that the counter-cyclical result may be an outcome of a positive relation between aggregate earnings shocks and business cycle variables.

earnings shocks (defined as portfolio returns attributable to covariation with the aggregate earnings shocks that are driven by macroeconomic shocks). I estimate systematic macro earnings shocks as follows: (1) I estimate fitted values from the regression of aggregate earnings shocks on macroeconomic shocks (fitted aggregate earnings shocks), (2) I estimate fitted values from the regression of portfolio earnings shocks on macroeconomic shocks (fitted portfolio earnings shocks). (3) I estimate earnings shock betas by regressing past 12-quarter fitted portfolio earnings shocks on fitted aggregate earnings shocks, and (4) each quarter, I estimate systematic macro earnings shocks by multiplying earnings shock beta with fitted aggregate earnings shocks. *Residual macro earnings shocks* are estimated using the same procedure as *systematic macro earnings shocks* except that fitted values are replaced with residual values. The time-series means of systematic macro earnings shocks are reported in Panel E of Table 4. The evidence suggests that, of 2.20% total PEAD returns, systematic earnings shocks account for 1.57%, on average. That is, a significant portion of the PEAD returns can be attributable to earnings shocks driven by macroeconomic shocks.

Overall, the evidence suggests that most of the variation in aggregate earnings shocks is attributable to macroeconomic shocks, and that the aggregate earnings shocks attributable to macroeconomic shocks drive a significant portion of PEAD returns. However, it is important to note that the evidence presented here cannot completely rule out the possibility that some fraction of aggregate earnings shocks reflects some form of aggregate analyst optimism.

4.6 Do Aggregate Non-Earnings Shocks Drive PEAD Returns?

Thus far, I have shown that expected returns cannot explain PEAD returns while aggregate earnings shocks explain a significant part of realized returns to the PEAD strategy. In this section, I examine whether aggregate non-earnings shocks can explain the variation in PEAD returns. Aggregate non-earnings shocks are measured as aggregate realized returns minus aggregate earnings shocks. Aggregate non-earnings shocks capture the sum of aggregate discount rate shocks and aggregate expected returns.[19]

To examine the relationship between aggregate non-earnings shocks and PEAD returns, I make various partitions on aggregate non-earnings shocks. Quarters with aggregate non-earnings shocks in the bottom (top) decile, quintile, quartile, tercile, and half are defined as low (high) aggregate non-earnings shocks for the decile, quintile, quartile, tercile, and median partitions, respectively. In untabulated results, I do not find any relationship between aggregate non-earnings shock partitions and PEAD returns, despite the fact that aggregate non-earnings shocks vary considerably in these partitions. For example, aggregate non-earnings shocks average -10.98% for quarters in the lowest quartile and 10.48% for quarters in the highest quartile. However, the difference in the PEAD returns between these two partitions is only 0.89%, which is not statistically significant. The observation that significant variation in aggregate non-earnings shocks exists between the quartiles but very little cross-sectional variation (i.e., for the PEAD portfolios) exists within a quartile is driven by the fact that risk exposure differences between the extreme PEAD portfolios is marginal (as shown in Table 1 and discussed in Section 3.3). If risk exposure differences are marginal then the significant driver of aggregate non-earnings shocks is changes in risk premiums. However, changes in risk premiums are constant in the cross-section and therefore cannot explain returns to a cross-sectional strategy such as PEAD.

[19] As a robustness check, I also estimate aggregate non-earnings shocks as residuals from a time series regression of quarterly returns on aggregate earnings shocks. Overall the conclusions using this measure are similar to those using the measure derived using aggregate realized returns minus aggregate earnings shocks.

In summary, I do not find any relationship between aggregate non-earnings shocks and PEAD returns.

5 Alternative Explanations and Additional Analysis

5.1 Do Aggregate Earnings Shocks Explain PEAD Returns Beyond the Investor Naivety Hypothesis?

In this section, I examine whether the relationship that I document between aggregate earnings shocks and PEAD returns is driven by the investor naivety hypothesis. The investor naivety hypothesis posits that investors fail to understand the time-series properties of earnings (Bernard and Thomas, 1989, 1990).[20] According to this hypothesis, firms that have positive (negative) earnings surprises in the current quarter will also have positive (negative) earnings surprises in the next quarter; however, because investors are naïve and do not understand this phenomenon, firms with positive (negative) earnings surprises in the current quarter will surprise investors with positive (negative) earnings in the next quarter and hence will generate positive (negative) returns.

To examine whether the relationship between aggregate earnings shocks and PEAD returns is driven by investor naivety, I partition the quarters into low and high aggregate earnings shock quarters. Quarters with aggregate earnings shocks in the bottom (top) quartile are defined as low (high) aggregate earnings shock quarters, i.e., *Low AE* (*High AE*). If investor naivety explains the variation in PEAD returns, then the buy portfolio (sell portfolio) should have positive (negative) one-quarter-ahead earnings surprises and the magnitude of the one-quarter-ahead earnings surprises should vary with the magnitude of PEAD returns.

[20] Ball and Bartov (1996) and Markov and Tamayo (2006) argue that predictability does not imply irrationality; predictability could also be an outcome of parameter uncertainty, with investors/analysts learning about parameters over time.

Panel A of Table 5 reports the earnings surprises (seasonally differenced quarterly earnings) for the portfolios formed at quarter *t* as well as the one-quarter-ahead earnings surprises for these portfolios. The low aggregate earnings shock partition (*Low AE*) has PEAD returns of 3.61% on average, which is 1.7 times the PEAD return for the full sample. If investor naivety explains PEAD returns, then one should observe negative surprises for the sell portfolio and positive surprises for the buy portfolio. However, in this partition all the portfolios have negative one-quarter-ahead earnings surprises. This evidence suggests that investor naivety does not drive the relationship between aggregate earnings shocks and PEAD returns. Further, the high aggregate earnings shock partition does provide supportive evidence for the investor naivety hypothesis: the buy (sell) portfolio has positive (negative) earnings surprises. However, the returns to the PEAD strategy in this partition are both economically and statistically insignificant (0.04%). Overall, the evidence suggests that the relationship between aggregate earnings shocks and PEAD returns is not driven by investor naivety.

5.2 Do Aggregate Earnings Shocks Explain PEAD Returns Beyond Analyst Underreaction to Prior Earnings Information?

In this section, I examine whether the relationship between aggregate earnings shocks and PEAD returns is driven by analyst underreaction to prior earnings information. Abarbanell and Bernard (1992) argue that analysts underreact to prior earnings information and hence analyst forecast errors are predictable. If analyst underreaction drives PEAD returns, then one should observe positive (negative) surprises to the buy (sell) portfolio. Panel B of Table 5 reports the analyst forecast errors for the portfolios formed at quarter *t* and also the one-quarter-ahead forecast errors for these portfolios.

Examining the one-quarter-ahead analyst forecast errors for the alternative aggregate earnings shock partitions leads to several observations. First, in the low aggregate earnings shock partition, in which PEAD returns are 1.7 times the PEAD returns of the full sample, all of the PEAD portfolios have negative one-quarter-ahead analyst forecast errors. Second, despite the fact that the high aggregate earnings shock partition has positive (negative) analyst forecast errors for the buy (sell) portfolio, PEAD returns in this partition are both economically and statistically insignificantly different from zero (0.04%). The evidence therefore suggests that the relationship between aggregate earnings shocks and PEAD returns is not driven by analyst underreaction to prior earnings information.

5.3 Do Aggregate Earnings Shocks Explain PEAD Returns Beyond the Inflation Illusion Hypothesis?

In this section, I examine whether aggregate earnings shocks can explain the variation in PEAD returns after controlling for the effect of inflation illusion on PEAD returns as documented by Chordia and Shivakumar (2005). The inflation illusion hypothesis posits that investors do not understand the implications of inflation in forecasting earnings. As a result, investors forecast the same nominal earnings rather than the same real earnings in high and low inflation periods, in which case stocks prices are overvalued in low inflation periods and undervalued in high inflation periods (Modigliani and Cohn, 1979; Campbell and Vuolteenaho, 2004).

Chordia and Shivakumar (2005) find that inflation predicts returns to the PEAD strategy. Panel A of Table 6 presents results on the inflation illusion hypothesis. Quarters in which lagged inflation (lagged by one quarter) is less than the 25^{th} percentile are defined as low inflation quarters (*Low INF*) and quarters in which lagged inflation is above the 75th percentile are defined as high inflation quarters (*High INF*). Consistent with the findings of Chordia and Shivakumar (2005), I find that lagged inflation and returns to the PEAD strategy are related. Specifically, quarters with low inflation have lower one-quarter-ahead PEAD strategy returns of 1.77% while the returns to the PEAD strategy more than double to 3.47% in high inflation quarters.

Aggregate earnings shocks could be related to PEAD returns because aggregate earnings shocks and the inflation illusion are related. I investigate this possibility using two methods. First, I estimate aggregate earnings shock residuals by regressing aggregate earnings shocks on lagged inflation. The intuition is that aggregate earnings shock residuals control for the predictable part of earnings revisions that are driven by the inflation illusion effect. Second, I double sort (i.e., independently sort) on aggregate earnings shocks and lagged inflation and examine the returns to the PEAD strategy. Results are presented in Panel B of Table 6.

The evidence from both methods suggests that even after controlling for inflation illusion effects, returns to the PEAD strategy are inversely related to aggregate earnings shocks. As such, aggregate earnings shocks explain PEAD returns even after controlling for the inflation illusion effect.

5.4 Do Results Hold for Firms Without Analyst Following?

Finally, I examine the robustness of the main findings to firms with no analyst following. For these firms, SUE is estimated from the seasonal random walk model, and the classification of quarters into low and high aggregate earnings shocks is the same as described in Section 4.3 (i.e., aggregate earnings shocks are derived from the firms with analyst following). The findings from the no-analyst-following firms are consistent with those for the analyst-following firms.

Specifically, aggregate earnings shocks and PEAD returns are negatively correlated: low aggregate earnings shock quarters have significant PEAD returns, while high aggregate earnings shock quarters have statistically insignificant PEAD strategy returns with the exception of the median partition.

6. Conclusions

This paper shows that returns to the post-earnings-announcement drift (PEAD) strategy are driven by the differential sensitivity of the sell versus the buy PEAD portfolio returns to aggregate earnings shocks. The higher sensitivity of the sell portfolio (relative to the buy portfolio) to aggregate earnings shocks implies that larger negative aggregate earnings shocks translate into higher negative returns for the sell portfolio than for the buy portfolio. Therefore, larger negative aggregate earnings shocks are associated with higher PEAD strategy (buy minus sell portfolio) returns. Aggregate earnings shocks on average should be mean-zero in expectation or over a long sample period. However, the 1985 to 2009 sample period is dominated by large negative aggregate earnings shocks, which explains why the PEAD strategy generates positive returns on average over this period.

The evidence presented in this paper also suggests that a significant portion of the variation in aggregate earnings shocks is explained by macroeconomic shocks. Further analysis suggests that macroeconomic shocks working through aggregate earnings shocks drive the variation in PEAD strategy returns. Specifically, when macroeconomic shocks contribute to downward revisions to aggregate earnings expectations, PEAD strategy returns are positive.

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Appendix: Estimation of Implied Cost of Capital

Implied cost of capital estimates are used extensively in the accounting and finance literature as proxies for expected returns. I use two different methods to estimate implied cost of capital. The first method follows Easton (2004) and is derived from the Ohlson and Juettner-Nauroth (2005) abnormal earnings growth model. Implied cost of capital estimated using this approach is denoted by r^{PEG}.

$$r_{i,t}^{PEG} = \sqrt{\frac{(eps_{i,s+2} - eps_{i,s+1})}{P_{i,t}}} \tag{A1}$$

where $eps_{i,s+n}$ is the n-years-ahead consensus forecast at the end of quarter t of year s, with s the current year, and P_{it} is price per share for firm i at the end of quarter t.

The second method that I use to estimate implied cost of capital follows Gebhardt, Lee, and Swaminathan (2001) and is denoted by r^{GLS}. From the following valuation equation, r^{GLS} is derived through an iterative procedure:

$$P_{it} = bps_{it} + \sum_{n=1}^{11} \frac{(roe_{i,s+n} - r_{i,t}^{GLS})b_{i,s+n-1}}{(1 + r_{i,t}^{GLS})^n} + \frac{(indROE - r_{i,t}^{GLS})b_{i,s+11}}{r_{i,t}^{GLS}(1 + r_{i,t}^{GLS})^{11}} \tag{A2}$$

where $roe_{i,s+n} = eps_{i,s+n} / bps_{i,s+n-1}$ for n=1, 2. For n>2, roe mean-reverts to the industry median roe (*IndRoe*), *IndRoe* is the median *roe* for all firms in the same industry spanning year *s-4* through year *s* with positive earnings and positive book value of equity. Industry classification follows the Fama and French (1997) industry definitions. $eps_{i,s+n}$ is the n-years-ahead consensus forecast at the end of quarter t. *bps* is book value per share and is estimated using the clean surplus relation for n>1.[21]

[21] To estimate the book value of equity using the clean surplus relation, the dividend payout ratio is required. I estimate the dividend payout ratio as dividends over earnings for profitable firms and dividends over 6% of total assets for unprofitable firms (Gebhardt, Lee, and Swaminathan, 2001).

Figure 1: Time Line for Variable Measurement

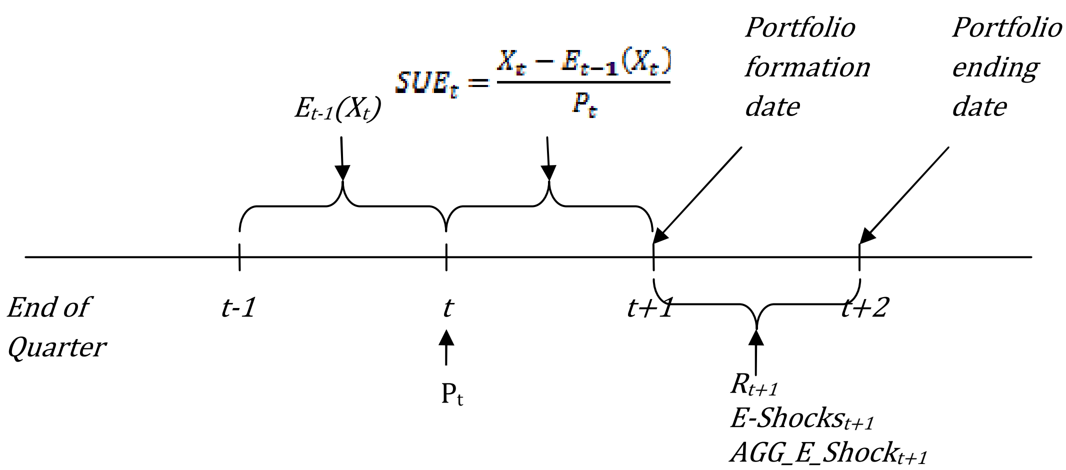

Figure 2: Time Series Graph of PEAD Strategy Returns & Aggregate Earnings Shocks

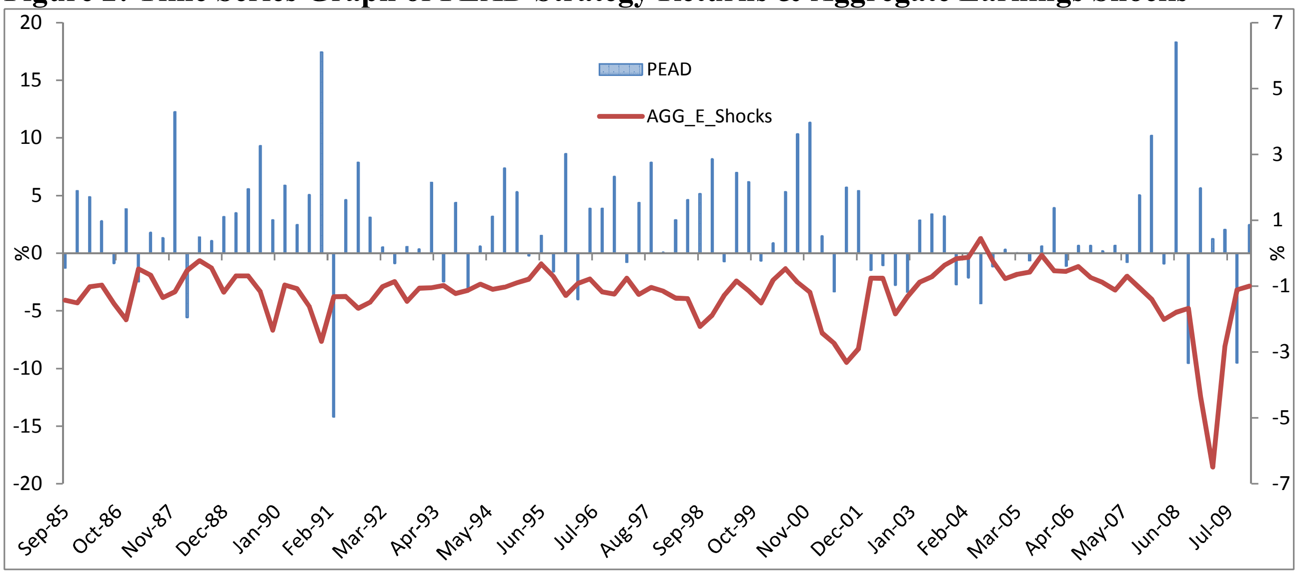

Figure 2 shows the time series of PEAD strategy returns and aggregate earnings shocks. The sample data cover the period 1985 to 2009. Every quarter, 10 portfolios are formed on SUE and are held for the subsequent three months. Returns to the highest decile of SUE minus the lowest decile of SUE are reported on the y-axis. Aggregate earnings shocks (*AGG_E_Shocks)* are aggregate returns driven by earnings expectation revisions and are measured as the equally weighted average of firm-level returns from earnings expectation revisions.

Table 1: Post-Earnings-Announcement Drift Portfolio Characteristics: Realized Returns, Risk Exposures, Expected Returns, and Earnings Shock Betas

Portfolio	SUE	Returns	CAPM-Beta	SMB-Beta	HML-Beta	ICC_GLS	ICC_PEG	E-Beta
Sell	-3.84	-1.03	1.37	1.80	0.08	2.69	4.37	2.49
2	-0.40	0.26	1.06	1.22	0.11	2.39	3.43	1.01
3	-0.15	0.82	1.02	1.10	-0.07	2.25	3.05	0.78
4	-0.06	0.24	0.97	0.77	-0.09	2.22	2.91	0.56
5	0.00	0.79	1.10	0.88	-0.41	2.15	2.63	0.49
6	0.04	0.85	1.08	1.02	-0.33	2.07	2.62	0.56
7	0.09	0.80	1.05	1.05	-0.28	2.17	2.77	0.50
8	0.17	1.03	1.12	1.19	-0.17	2.25	2.96	0.63
9	0.34	1.18	1.17	1.24	-0.11	2.33	3.21	0.76
Buy	1.53	1.14	1.27	1.49	0.01	2.50	3.94	0.89
Buy_Sell	5.37	2.16	-0.10	-0.31	-0.08	-0.19	-0.43	-1.60
t-stat	(11.47)***	(4.31)***	(-2.74)***	(-3.81)***	(-0.52)	-(0.54)	(-5.82)***	(8.46)***

Table 1 reports the realized returns, risk exposures, expected returns, and earnings shock betas of portfolios sorted on standardized unexpected earnings (*SUE*). Sample data cover the period 1985 to 2009. The sample includes firms with December fiscal year-end and portfolios are formed at the beginning of each quarter. Every quarter, 10 portfolios are formed on SUE and portfolios are held for the subsequent three months. All variables are measured at the quarterly frequency. *Returns* are calculated as the continuously compounded three-month return estimated after the portfolio formation date. *CAPM-Beta* is the market beta. *SMB-Beta* and *HML-Beta* are the size and book-to-market factor betas. *ICC_GLS* is the implied cost of capital measure derived from the GLS model (Gebhart et al., 2001). *ICC_PEG* is the implied cost of capital measure derived from the PEG model (Easton, 2004). *E-Beta* is the earnings shock beta, calculated as the covariance between portfolio earnings shocks and aggregate earnings shocks, divided by the variance of aggregate earnings shocks. Betas are estimated at the portfolio level using rolling 12-quarter data and the time-series means of the rolling betas are reported. ***indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 2: PEAD Strategy Returns for Low and High Aggregate Earnings Shock Quarters

		Decile Partition		Quintile Partition		Quartile Partition		Tercile Partition		Median Partition	
	Full	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE
AGG_ES	-1.21	-3.23	-0.16	-2.49	-0.37	-2.29	-0.44	-2.05	-0.53	-1.75	-0.67
PEAD Portfolio Returns											
Sell	-1.03	-11.21	6.24	-11.40	4.54	-10.09	6.29	-6.73	5.40	-5.82	3.87
2	0.26	-5.45	4.10	-6.49	3.97	-5.87	4.91	-3.72	4.36	-2.76	3.35
3	0.82	-6.32	2.91	-4.38	2.99	-3.62	4.27	-2.02	3.78	-1.43	3.11
4	0.24	-7.13	2.96	-6.02	2.89	-4.55	3.49	-2.63	3.55	-2.26	2.73
5	0.79	-6.19	4.04	-4.83	3.86	-3.70	4.63	-1.69	3.76	-1.07	2.65
6	0.85	-7.02	3.04	-5.83	3.16	-4.53	4.33	-2.58	3.71	-1.41	3.15
7	0.80	-5.91	3.15	-4.81	3.26	-3.91	4.42	-2.34	3.86	-1.48	3.13
8	1.03	-6.00	4.12	-5.32	3.77	-4.35	4.65	-2.37	4.24	-1.32	3.82
9	1.18	-6.09	4.26	-5.60	3.67	-4.44	5.12	-2.81	4.42	-1.68	4.09
Buy	1.14	-6.84	5.91	-7.48	4.69	-6.48	6.33	-3.88	5.71	-2.73	5.10
Buy_Sell	2.16	4.37	-0.33	3.92	0.15	3.61	0.04	2.85	0.31	3.09	1.22
t-stat	(4.31)***	(2.57)**	(-0.41)	(2.73)***	(0.23)	(2.99)***	(0.05)	(2.59)**	(0.55)	(3.69)***	(2.35)**
Diff		4.71		3.77		3.57		2.54		1.87	
t-stat		(2.50)**		(2.39)**		(2.57)**		(2.06)**		(1.89)*	

Table 2 reports the time-series means of returns to SUE-sorted portfolios for the full sample as well as for the sample partitioned into low and high aggregate earnings shock quarters. The sample includes firms with December fiscal year-end and portfolios are formed at the beginning of each quarter. Every quarter, 10 portfolios are formed on SUE and portfolios are held for the subsequent three months. Aggregate earnings shocks are aggregate returns driven by earnings expectation revisions and are measured as the equally weighted average of firm-level returns from earnings expectation revisions. Quarters with aggregate earnings shocks in the bottom (top) decile, quintile, quartile, tercile, and half are defined as low (high) aggregate earnings shocks, i.e., Low AE (High AE), for the decile, quintile, quartile, tercile, and median partitions, respectively. *AGG_ES* is the average aggregate earnings shock for the partition. Realized returns are measured at the quarterly frequency and the time-series means are reported. Returns are calculated as the continuously compounded three-month return estimated after the portfolio formation date. Sample data for this analysis cover the period 1985 to 2009. *** indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 3: Systematic Earnings Shocks and PEAD Strategy Returns

Panel A: Decomposition of PEAD Realized Returns into Systematic Earnings Shocks and Residual Returns

		Rolling Beta			Cross Validation and Rolling Beta		
Portfolio	Realized Returns	Rolling E-Beta	Systematic Earnings Shocks	Residual Returns	Cross Validation E-Beta	Systematic Earnings Shocks	Residual Returns
Sell	-1.15	2.49	-3.01	1.86	2.31	-2.85	1.70
2	0.22	1.01	-1.29	1.51	0.93	-1.14	1.36
3	0.73	0.78	-0.94	1.67	0.70	-0.87	1.59
4	-0.22	0.56	-0.70	0.48	0.48	-0.59	0.37
5	0.66	0.49	-0.64	1.30	0.36	-0.45	1.11
6	0.59	0.56	-0.70	1.28	0.51	-0.63	1.22
7	0.59	0.50	-0.63	1.22	0.46	-0.57	1.16
8	0.94	0.63	-0.79	1.74	0.57	-0.70	1.64
9	0.86	0.76	-1.00	1.86	0.69	-0.85	1.71
Buy	1.05	0.89	-1.13	2.18	0.77	-0.95	2.00
Buy_Sell	2.20	-1.60	1.88	0.32	-1.54	1.90	0.30
t-stat	(4.02)***	(8.46)***	(12.67)***	(0.61)	(8.21)***	(12.71)***	(0.57)
Standard Err	0.55	0.13	0.15	0.52	0.12	0.15	0.53

Panel B: Regression of PEAD Realized Returns on Systematic Earnings Shocks for the PEAD Strategy

$$PEAD_t = \lambda_0 + \lambda_1 Systematic\_Earnings\_Shocks\_for\_PEAD\_Strategy_t + \varepsilon_t$$

	const	Systematic_ Earnings _Shocks_ for_PEAD_Strategy	Adj R^2
PEAD Strategy Returns	0.38	0.97	
t-stat	(0.53)	(2.44)**	6.59%
H_0: Coefficient on Systematic_Earnings _Shocks_for_PEAD_Strategy=1		$p\ value = 0.95$	

Table 3 reports the time-series means of realized returns and systematic earnings shocks to SUE- sorted portfolios. The sample includes firms with December fiscal year-end and portfolios are formed at the beginning of each quarter. Every quarter, 10 portfolios are formed on SUE and portfolios are held for the subsequent three months. Realized returns and systematic earnings shocks are measured at the quarterly frequency and the time-series means are reported. Returns are calculated as the continuously compounded three-month return estimated after the portfolio formation date. Aggregate Earnings Shock is the aggregate return driven by earnings expectation revisions and is measured as the equally weighted average of firm-level returns from earnings expectation revisions. Systematic earnings shocks are estimated as follows:

$$Systematic\ earnings\ shocks_{p,t+1} = \beta^{p}_{EN,t}(AGG\_E\_Shock_{t+1}),$$

where $\beta^{p}_{EN,t}$ is the earnings shock beta for portfolio *p* in quarter *t*. Earnings shock beta is estimated using rolling 12-quarter data (*t*-11 *to t*) and measured as the covariance between portfolio earnings shocks and aggregate earnings shocks, divided by the variance of aggregate earnings shocks. Time-series means of rolling earnings shock betas are reported under the column *Rolling E-Beta*. Because of the rolling 12-quarter data restriction to estimate the earnings shock betas, the sample data for this analysis cover the period 1988 to 2009. Residual returns are defined as realized returns minus systematic earnings shocks. Systematic earnings shocks using the cross validation method are estimated using the earnings shock betas derived as follows: (1) aggregate earnings shocks are re-estimated after omitting the firms in portfolio *p,* and (2) the earnings shock beta is estimated using the aggregate earnings shocks from (1). Time-series means of earnings shock betas estimated using this approach are reported under the column *Cross Validation E-Beta.*

Panel B reports the regression of PEAD strategy realized returns on systematic earnings shocks for the PEAD strategy. *Systematic_earnings_shocks_for_PEAD_strategy* are defined as the buy portfolio's systematic earnings shocks minus the sell portfolio's earnings shocks. *** indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 4: Aggregate Earnings Shocks and Macroeconomic Variables

Panel A: Descriptive Statistics

Variable(*100)	Mean	10%	25%	Median	75%	90%	STDDEV
AGG_E_Shock	-1.21	-2.23	-1.40	-1.05	-0.74	-0.23	0.90
MKT_Ret	2.78	-9.87	-1.06	3.68	7.88	13.57	8.89
Cons	0.63	0.26	0.47	0.63	0.82	1.09	0.39
GDP	1.26	0.60	0.99	1.33	1.64	2.05	0.66
IndP	0.48	-1.24	0.25	0.72	1.26	1.77	1.28
Term	1.80	0.33	0.87	1.71	2.80	3.32	1.16
Def	0.99	0.64	0.71	0.91	1.16	1.36	0.41
RF	1.07	0.29	0.70	1.19	1.37	1.78	0.55
INF	0.72	0.33	0.54	0.75	0.95	1.18	0.52

Panel B: Multiple Regression: Aggregate Earnings Shocks and Macroeconomic Variables

$$AGG\_E\_Shock_t = \alpha_0 + \sum_{\tau=-1}^{1}\alpha_{1,t+\tau}Cons_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{2,t+\tau}GDP_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{3,t+\tau}Term_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{4,t+\tau}Def_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{5,t+\tau}IndP_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{6,t+\tau}Rf_{t+\tau} + \sum_{\tau=-1}^{1}\alpha_{7,t+\tau}Inf_{t+\tau} + \varepsilon_t$$

	Quarter (Lag/Lead)		
	t-1	t	t+1
Cons	1.02	1.48	0.81
	(1.86)*	(2.66)****	(1.51)
GDP	0.15	0.15	-0.17
	(1.15)	(1.21)	(-1.29)
Term	-0.01	0.06	-0.18
	(-0.06)	(0.25)	(-1.08)
Def	0.04	-0.5	-0.44
	(0.15)	(-1.07)	(-1.24)
IndP	0.06	-0.05	0.21
	(0.70)	(-0.57)	(2.47)**
Rf	-0.72	-0.61	0.66
	(-1.48)	(-0.92)	(-1.37)
Inf	-0.25	-0.77	-0.79
	(-0.64)	(-1.97)*	(-2.05)**
Intercept	-0.39	Adj R^2	72.66%
	(-0.93)		

Panel C: PEAD Strategy Returns for Low and High Fitted Aggregate Earnings Shock Quarters

		Decile Partition		Quintile Partition		Quartile Partition		Tercile Partition		Median Partition	
	Full	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE
Fitted_AGG_ES	-1.21	-3.04	-0.13	-2.38	-0.34	-2.24	-0.42	-2.01	-0.54	-1.74	-0.68
PEAD Portfolio Returns											
Sell	-1.02	-11.21	2.31	-10.82	3.82	-11.18	3.48	-8.07	2.87	-5.11	3.08
Buy	1.14	-6.83	2.27	-7.05	4.55	-7.18	4.63	-4.11	4.21	-2.12	4.39
Buy_Sell	2.16	4.38	-0.04	3.77	0.73	4.00	1.15	3.96	1.34	2.99	1.31
t-stat	(4.31)***	(2.57)**	(-0.04)	(2.53)**	0.68	(3.03)***	0.97	(3.70)***	(1.87)*	(3.86)***	(2.95)***
Diff		4.42		3.04		2.85		2.62		1.68	
t-stat		(2.26)**		(1.89)*		(1.97)*		(2.22)**		(1.78)*	

Panel D: PEAD Strategy Returns for Low and High Residual Aggregate Earnings Shock Quarters

		Decile Partition		Quintile Partition		Quartile Partition		Tercile Partition		Median Partition	
	Full	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE	Low AE	High AE
Residual_AGG_ES	0.00	-0.58	0.57	-0.45	0.47	-0.41	0.42	-0.35	0.36	-0.25	0.25
PEAD Portfolio Returns											
Sell	-1.02	-5.09	1.12	-2.91	2.29	-4.22	2.44	-4.17	3.41	-3.34	1.31
Buy	1.14	-2.43	2.11	-0.77	3.50	-1.89	3.72	-1.23	5.43	-0.54	2.82
Buy_Sell	2.16	2.66	0.99	2.14	1.21	2.33	1.28	2.94	2.02	2.80	1.51
t-stat	(4.31)***	(2.15)**	(0.25)	(2.87)***	(1.12)	(3.29)***	(1.37)	(4.08)***	(1.97)*	(4.31)***	(2.01)**
Diff		1.67		0.93		1.05		0.92		1.29	
t-stat		(0.39)		(0.71)		(0.89)		(1.24)		(0.74)	

Panel E: Systematic Macro Earnings Shocks, Residual Macro Earnings Shocks and PEAD Strategy Returns

		Rolling Beta	
Portfolio	Realized Returns	Systematic Macro Earnings	Residual Macro Earnings
Sell	-1.15	-2.65	-0.03
2	0.22	-1.26	-0.01
3	0.73	-0.86	-0.05
4	-0.22	-0.53	-0.08
5	0.66	-0.50	-0.02
6	0.59	-0.80	0.01
7	0.59	-0.65	0.01
8	0.94	-0.77	0.01
9	0.86	-0.95	0.01
Buy	1.05	-1.08	-0.01
Buy_Sell	2.20	1.57	0.01
t-stat	(4.02)***	(12.28)***	(0.16)
Standard Err	0.55	0.13	0.06

Panel A of Table 4 reports descriptive statistics for aggregate earnings shocks and macroeconomic variables. Aggregate earnings shocks (*AGG_E_Shock)* are aggregate returns driven by earnings expectation revisions and are measured as the equally weighted average of firm-level returns from earnings expectation revisions. *MKT_Ret* is the equally weighted sample firm return. Macroeconomic data are obtained from the Federal Reserve Bank of St. Louis. *Cons* is the per capita growth rate of personal consumption. *GDP* is the per capita growth rate of gross domestic product. *Term* is the yield spread between the 10-year zero-coupon T-bond and the three-month T-bill. *Def* is the yield spread between Baa- and Aaa-rated corporate bonds. *IndP* is industrial production growth. *Rf* is the three-month T-bill rate. *Inf* is the change in the consumer price index.

Panel B of Table 4 reports the relationship between aggregate earnings shocks and macroeconomic variables. ***indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Panel C of Table 4 reports the time-series means of returns to the SUE-sorted portfolios for the full sample as well as for the sample partitioned into low and high fitted aggregate earnings shock quarters. Fitted aggregate earnings shocks are the fitted value from regressions of aggregate earnings shocks on macroeconomic variables. Quarters with fitted aggregate earnings shocks in the bottom (top) decile, quintile, quartile, tercile, and half are defined as low (high) fitted aggregate earnings shocks, i.e., Low AE (High AE), for the decile, quintile, quartile, tercile, and median partitions, respectively. *Fitted_AGG_ES* is the average fitted aggregate earnings shock for the partition.

Panel D of Table 4 reports the PEAD returns for the residual aggregate earnings shock partitions. Residual aggregate earnings shocks are the residual value from regressions of aggregate earnings shocks on macroeconomic variables. *Residual_AGG_ES* is the average residual aggregate earnings shock for the partition.

Panel E of Table 4 reports the time-series means of *systematic macro earnings shocks* (defined as portfolio returns attributable to covariance with aggregate earnings shocks that are driven by macroeconomic shocks). Systematic macro earnings shocks are estimated by (1) estimating fitted values from the regression of aggregate earnings shocks on macroeconomic shocks (fitted aggregate earnings shocks); (2) estimating fitted values from the regression of portfolio earnings shocks on macroeconomic shocks (fitted portfolio earnings shocks); (3) estimating earnings shock betas by regressing the past 12-quarter fitted portfolio earnings shocks on fitted aggregate earnings shocks; and (4) each quarter, estimating systematic macro earnings shocks by multiplying earnings shock betas by fitted aggregate earnings shocks. *Residual macro earnings shocks* are estimated using the same procedure as for the *systematic macro earnings shocks* except that fitted values are replaced with residual values.

Table 5: Investor Naivety and Analyst Underreaction to Prior Earnings Information

Panel A: Investor Naivety: Seasonal Random Walk Earnings for Low and High Aggregate Earnings Shock Quarters

Random Walk Earnings Changes: Portfolios Formed at Quarter t				
Portolio	Low AE		High AE	
RW (*100)	t	t+1	t	t+1
SELL	-5.13	-5.77	-1.92	-0.58
2	-0.58	-1.39	-0.26	-0.04
3	-0.33	-0.86	0.11	0.07
4	-0.28	-0.58	0.20	0.18
5	-0.08	-0.15	0.24	0.18
6	0.01	-0.30	0.26	0.26
7	0.03	-0.21	0.35	0.37
8	0.05	-0.22	0.47	0.45
9	0.10	-0.64	0.76	0.46
BUY	0.89	-0.48	1.72	1.77
PEAD returns		3.61%		0.04%

Panel B: Analyst Underreaction: Analyst Forecast Errors for Low and High Aggregate Earnings Shock Quarters

Analyst Forecast Errors: Portfolios Formed at Quarter t				
Portolio	Low AE		High AE	
AF (*100)	t	t+1	t	t+1
SELL	-5.03	-3.78	-2.99	-1.18
2	-0.45	-1.16	-0.36	-0.23
3	-0.18	-0.27	-0.12	-0.07
4	-0.09	-0.21	-0.04	-0.02
5	-0.01	-0.09	0.01	0.00
6	0.03	-0.35	0.06	0.03
7	0.08	0.01	0.11	0.05
8	0.16	-0.07	0.20	0.06
9	0.33	-0.09	0.37	0.13
BUY	1.55	-0.43	1.64	0.27
PEAD returns		3.61%		0.04%

Panel A of Table 5 reports the seasonally differenced quarterly earnings for the Low AE and High AE subsamples. Quarters with aggregate earnings shocks in the bottom (top) quartile are defined as quarters with low (high) aggregate earnings shocks, i.e., Low AE (High AE). Every quarter, 10 portfolios are formed on SUE. One-quarter-ahead seasonally differenced quarterly earnings are tracked for each portfolio and time-series means are reported under the column (t+1). SUE_t is measured as current earnings minus four-quarter-ago earnings, scaled by price per share at the end of quarter t. PEAD returns are the returns to the PEAD strategy in these partitions.

Panel B reports the quarterly analyst forecast errors for the Low AE and High AE subsamples. The estimation methodology is the same as in Panel A, except that seasonally differenced quarterly earnings are replaced with analyst forecast errors. Analyst forecast errors are measured as earnings minus median analyst forecasts 90 days prior to the earnings announcement, scaled by price per share at the end of quarter t.

Table 6: The Inflation Illusion Hypothesis

Panel A: Inflation Illusion Hypothesis Test

	Lagged Inflation		Inflation Adjusted AGG_E_Shocks	
Portfolio	Low INF	High INF	Low AE	High AE
Sell	-0.29	-5.57	-7.88	5.79
2	0.65	-2.94	-4.28	4.68
3	0.61	-1.49	-2.17	3.87
4	-1.16	-2.96	-2.88	2.44
5	1.47	-0.75	-2.12	3.87
6	0.09	-0.17	-2.71	3.74
7	0.60	-0.68	-2.61	4.26
8	0.94	-0.68	-2.59	4.59
9	0.50	-1.13	-3.16	4.52
Buy	1.48	-2.11	-4.92	5.91
Buy_Sell	1.77	3.47	2.96	0.13
t-stat	(2.04)**	(2.51)**	(2.14)**	(0.16)

Panel B: Double Sorts on Lagged Inflation and Aggregate Earnings Shocks

		AGG_E_Shocks			
		Low	High	Diff	t-stat
L_Inflation	Low	3.01 (3.74)***	0.39 (0.47)	2.62	(2.26)**
	High	3.19 (1.96)*	1.91 (2.84)***	1.28	(0.78)
	Diff	0.18	1.52		
	t-stat	(0.10)	(1.45)		

Panel A of Table 6 reports the time-series means of returns to the SUE-sorted portfolios in low and high lagged inflation quarters. INF is the quarter-over-quarter change in the consumer price index. Quarters with lagged inflation less than the 25th percentile are defined as low inflation periods (Low INF) and those above the 75th percentile are defined as high inflation periods (High INF). Inflation-adjusted aggregate earnings shocks are the residuals from the regression of aggregate earnings shocks on lagged inflation. *** indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Panel B reports the PEAD returns to the 2x2 double sorts between lagged inflation and aggregate earnings shocks. All quarters are divided into four groups based on independent sorts on the lagged inflation and aggregate earnings shocks. For each group, time-series averages of the returns to the PEAD strategy are estimated. Diff is the time-series average of the difference in returns between extreme groups. All numbers are in percentages. *t*-statistics are reported next to the coefficient estimates in brackets. *** indicates significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.