Response to Unexpected Earnings and the 52-Week-High Anchoring

Yu-Hsiu Lin[a,*], Min Han Wu[a]

[a]Department of Finance and Information, Kaohsiung University of Science and Technology, Taiwan

Abstract

We examine post-earnings-announcement drift (PEAD) in the Taiwan stock market and analyze its relationship with the 52-week-high anchoring. The empirical results are as follows: First, unexpected earnings positively affect subsequent abnormal returns, whereas the proximity of a stock price to its 52-week high negatively influences subsequent abnormal returns. Second, the magnitude of subsequent abnormal returns in response to unexpected earnings is decreased when the current stock price is near its 52-week high. Finally, we reveal that a high level of foreign institutional investor ownership can mitigate the PEAD effect. However, the PEAD effect is strengthened in the subsample with high board director ownership.

Keywords: unexpected earnings, post-earnings-announcement drift, 52-week-high anchoring

JEL Classifications: G14, G40

* Corresponding author.
E-mail address: yushiu@nkust.edu.tw
Address: 415 Chien-Kung Road, Kaohsiung 807, Taiwan
The authors thank the Editor and two anonymous referees for their valuable comments to improve the quality of this paper.

1. Introduction

Ample evidence exists for post-earnings-announcement drift (PEAD) after announcements of unexpected earnings (Ball and Brown, 1968; Foster et al., 1984; Ball and Brown, 2019). Markets react to unexpected earnings news, but the initial reaction often appears to be insufficient (Daniel et al., 1998; Hong et al., 2000; Hirshleifer et al., 2011). Chan et al. (1996) and Chordia and Shivakumar (2006) examine the relationship between this PEAD effect and the momentum effect described by Jegadeesh and Titman (1993). Chan et al. (1996) demonstrate that both earnings surprises and past returns predict future returns. Neither the PEAD effect nor the momentum effect subsumes the other. Chordia and Shivakumar (2006) consider the systematic component of PEAD and momentum profits and indicate that the systematic component of PEAD explains momentum profits, but not the inverse. Consequently, they suggest that the PEAD effect dominates the momentum effect.

Evidence also suggests that investors pay attention to historical minimum and maximum prices (Grinblatt and Keloharju, 2001; Baker et al., 2012). George and Hwang (2004) consider a momentum strategy based on how close the current price is to its 52-week high (Liu et al., 2011; Li and Yu, 2012). These studies show predictably high returns associated with the nearness of the current price to its 52-week high. These authors speculate that investors revise their beliefs upward (downward) hesitantly if the price is already near (far below) its 52-week high. In the current study, we investigate the PEAD effect in the Taiwan stock market and analyze whether the nearness of the current price to its 52-week high affects investors' response to unexpected earnings. Moreover, institutional stockholdings may influence the PEAD (Bartov et al., 2000). Because foreign institutional investors play a critical role in the Taiwan stock market (Lin and Shiu, 2003), we examine the influence of foreign institutional investor and board director ownership on the PEAD effect and its association with the 52-week-high anchoring.

On the basis of a portfolio analysis, we find that the PEAD effect exists even when the proximity of a stock price to its 52-week high is controlled. A 52-week-high anchoring effect also occurs when unexpected earnings are controlled. A zero-cost trading strategy, which involves buying stocks with extremely favorable earnings surprises and prices near 52-week highs and selling stocks with extremely poor earnings surprises and prices far below 52-highs, generates a significant and positive hedge return after an earnings announcement. This strategy produces a higher hedge return in a subsample of stocks with low foreign ownership (high board director ownership) compared with a subsample of stocks with high foreign ownership (low board director ownership). Lower institutional holdings and higher insider holdings appear to be associated with a stronger PEAD effect and anchoring bias.

Regression analysis is employed to determine how the 52-week-high anchoring, foreign ownership, and board director ownership affect the PEAD or the earnings surprises effect.

Unexpected earnings have a significant and positive effect on cumulative abnormal returns (CARs). The PEAD effect exists for various regression specifications. The proximity of stock prices to 52-week highs has a negative influence on CARs. After an earnings announcement, CARs become lower (higher) if the current stock price is near (far below) its 52-week high. This negative anchoring effect differs from the momentum effect described by George and Hwang (2004) and Li and Yu (2012). We surmise that on the date of an earnings announcement, investors tend to reevaluate firms' fundamental value. Investors revise the possibility of overvaluation (undervaluation) upward when the current price is near (far below) its 52-week high. The subsequent abnormal returns are therefore negatively related to the proximity of stock prices to their 52-week highs.

Notably, we reveal that the PEAD effect is negatively affected by the proximity of stock prices to their 52-week highs. The positive effect of unexpected earnings on CARs is reduced when the current price is near its 52-week high. Specifically, when firms report favorable earnings surprises, high current prices (close to their 52-week highs) are justified and the possibility of overvaluation is reduced. Investors react more rapidly in this situation, thus curtailing the PEAD effect. When firms report negative earnings surprises, high current prices indicate a high possibility of overvaluation. Compared with a situation of low current prices, investors respond faster to this undesirable information. Therefore, the magnitude of negative CARs is reduced. The 52-week-high anchoring effect alleviates the PEAD effect in our sample.

Finally, the regression results demonstrate that foreign ownership has a negative relationship with the earnings surprises effect. The positive effect of unexpected earnings on CARs is reduced when stocks have a higher level of foreign ownership. As expected, institutional holdings can alleviate the PEAD effect. However, we observe a weak positive relationship between board director ownership and the earnings surprises effect. The PEAD effect could be strengthened when board director ownership is high.

Two other studies are closely related to the current study. George et al. (2015) examine whether investors' anchoring on the 52-week high explains why markets underreact to extreme earnings news. Using a return decomposition approach, they find that PEAD occurs only when stock prices are anchored near or far from 52-week highs. They conclude that anchoring on the 52-week high rather than earnings surprises explains a market's underreaction to extreme earnings news. In the current study, we reveal that PEAD exists when we control for the proximity of stock prices to their 52-week highs. Generally, in terms of PEAD magnitude, neither the earnings surprises effect nor the 52-week-high anchoring effect subsumes the other. Shin and Park (2018) use portfolio and regression analysis to study the PEAD effect and its relationship with the 52-week-high anchoring. They demonstrate that the nearness of the current price to the 52-week high is positively correlated with the

magnitude of PEAD; this is in contrast to our findings in the current study.

This paper provides novel findings that differ from those of related studies. First, the magnitude of PEAD is negatively related to the proximity of the current price to the 52-week high. That is, the 52-week high anchoring bias mitigates the PEAD effect. Second, the magnitude of PEAD is negatively associated with institutional holdings, whereas institutional holdings positively affect postannouncement abnormal returns. Institutional investors are more rational than individual investors in processing unexpected earnings news, which mitigates the PEAD effect and generates more favorable valuation of firms.

Third, to our knowledge, the current study is the first to analyze the influence of insider holdings on the PEAD effect and the anchoring effect in the Taiwan stock market. Owing to corporate governance concerns, board director holdings are positively related to postannouncement abnormal returns. However, investors appear to hesitatively process unexpected earnings news announced by firms with a high level of board director ownership. The PEAD effect is more evident in the high board director ownership subsample.

The following section describes the research methodology. Section 3 presents the empirical results, including the portfolio analysis and regression results. Finally, section 4 concludes the paper.

2. Methodology

2.1. Data and Variable Construction

The sample consists of nonfinancial common stocks traded on the Taiwan Stock Exchange (TSE) from 2008 Q1 to 2019 Q2. Data include earnings announcement date, quarterly earnings, daily stock price, daily 52-week high, and other financial variables retrieved from the Taiwan Economic Journal (TEJ). Information on the stock ownership of foreign institutional investors and board directors is also obtained from the TEJ. The final sample contains 29,164 firm-quarter observations.

To determine the PEAD, we first define standardized unexpected earnings (SUE) as $SUE_{i,t} = (EPS_{i,t} - EPS_{i,t-4})/\sigma_{i,t}$ (Chan et al., 1996; George et al., 2015), where $EPS_{i,t}$ is the most recently announced earnings per share, $EPS_{i,t-4}$ is the earnings per share in the same quarter of the previous year, and $\sigma_{i,t}$ is the standard deviation of $EPS_{i,t} - EPS_{i,t-4}$ over the prior eight quarters. We then calculate the CARs over 60 trading days starting the day after the earnings announcement [CAR(1,60)]. Sample firms are formed into 25 portfolios through sorting them according to market value at the beginning of the year. Each quarter, the daily abnormal return is calculated as the specific firm's raw return minus the average return of the corresponding portfolio. In other words, abnormal return is size adjusted.

To test the 52-week-high anchoring effect, we measure the proximity of stock prices to 52-week highs as the ratio of the current stock price to its 52-week high (PRC). Specifically,

$PRC_{i,t} = P_{i,(t-1\sim t-10)} / P_{i,t-1}^{High}$ where $P_{i,(t-1\sim t-10)}$ is the average stock price of 1–10 trading days prior to the date of the most recent earnings announcement and $P_{i,t-1}^{High}$ is the highest stock price during the prior 52 weeks.[1] The financial variables analyzed are leverage (LEVER), market-to-book ratio (LMB), price-to-earnings ratio (LPE), return on assets (ROA), and market capitalization (LSIZE).

2.2. Preliminary Analysis

For a preliminary analysis of the PEAD effect and the 52-week-high anchoring effect, we sort stocks each quarter according to SUE and the nearness of a stock price to the 52-week high (PRC) independently. Stocks are sorted into quintiles according to SUE. SUE1 is the quintile with extremely negative earnings surprises, and SUE5 is the quintile with extremely positive earnings surprises. The PEAD effect indicates that the CAR(1,60) of SUE5 is greater than the CAR(1,60) of SUE1.

Similarly, stocks are sorted into quintiles according to PRC in ascending order. Stocks in PRC1 have the lowest prices relative to their 52-week highs (the lowest PRC). Stocks in PRC5 have the highest prices relative to their 52-week highs (the highest PRC). Following George and Hwang (2004) and Li and Yu (2012), we hypothesize that the CAR(1,60) of PRC5 would be greater than the CAR(1,60) of PRC1.[2] We form 25 portfolios by intersecting the SUE and PRC quintiles. (SUE1, PRC1) is the portfolio of firms that announce extremely negative unexpected earnings and have the lowest stock prices relative to their 52-week highs. (SUE5, PRC5) is the portfolio of firms that report extremely positive earnings surprises and have the highest stock prices relative to their 52-week highs. We investigate the CARs of various SUE (PRC) quintiles by focusing on a specific PRC (SUE) quintile. Through this approach, we can approximately separate the influences of earnings surprises and the 52-week-high anchoring to determine whether one effect subsumes the other.

In addition to the full sample analysis, two subsamples are categorized according to the ownership level of foreign institutional investors or board directors. In each subsample, 25 portfolios are formed by intersecting the SUE and PRC quintiles. Because the PEAD effect and the 52-week-high anchoring effect reflect a behavioral bias, we expect these effects to subside when the stockholdings of foreign institutional investors increase. It is found that the effects of ownership level of investment trusts (TSO) and dealers (DSO) are similar to those of foreign ownership. Because the sample average values of TSO and DSO are low (1% and 0.1%) relative to foreign ownership, we suggest that foreign institutional investors can represent institutional investors.

[1] We also use the stock price 1 day prior to the date of the most recent earnings announcement as the numerator in PRC. The effects of PRC on CARs remain the same.

[2] The effects of SUE and PRC on CARs are not changed when CAR(1,5) or CAR(1,20) is used to measure PEAD. Following Shin and Park (2018), we use CAR(1,60) to measure the PEAD.

2.3. Regression Analysis

This subsection describes the regression models used to analyze the PEAD effect and the 52-week-high anchoring effect.

$$\begin{aligned} CAR(1,60)_{i,t} = {} & \beta_1 + \beta_2 \times SUE_{i,t} + \beta_3 \times PRC_{i,t} + \beta_4 \times SUE_{i,t} \times PRC_{i,t} + \beta_5 \times LEVER_{i,t} \\ & + \beta_6 \times LMB_{i,t} + \beta_7 \times LPE_{i,t} + \beta_8 \times ROA_{i,t} + \beta_9 \times LSIZE_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{1}$$

The dependent variable CAR(1,60) is the CARs over the 60 trading days starting the day after the earnings announcement date. $SUE_{i,t}$ and $PRC_{i,t}$ are the standardized unexpected earnings and the ratio of the current price to the 52-week high for *i* firm at quarter *t*, respectively. Control variables include LEVER (total debt/total assets), LMB (log value of market-to-book ratio), LPE (log value of price-to-earnings per share), ROA, and LSIZE (log value of market capitalization). A PEAD effect occurs if β_2 is significant and positive. If β_3 is significantly different from zero, then investors show anchoring bias toward the 52-week high. The coefficient β_4 represents the interaction between the earnings surprises effect and the 52-week-high anchoring effect. When β_4 is significantly different from zero, the PEAD effect is influenced by anchoring bias. We run the regression (1) for the full sample and two subsamples classified according to the median value of ownership level of foreign institutional investors or board directors.

$$\begin{aligned} CAR(1,60)_{i,t} = {} & \beta_1 + \beta_2 \times SUE_{i,t} + \beta_3 \times PRC_{i,t} + \beta_4 \times SO_{i,t} + \beta_5 \times SUE_{i,t} \times PRC_{i,t} \\ & + \beta_6 \times SUE_{i,t} \times SO_{it} + \beta_7 \times PRC_{i,t} \times SO_{i,t} + \beta_8 \times LEVER_{i,t} + \beta_9 \times LMB_{i,t} \\ & + \beta_{10} \times LPE_{i,t} + \beta_{11} \times ROA_{i,t} + \beta_{12} \times LSIZE_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{2}$$

The variable SO (stock ownership) is added to Eq. (2) to determine how the level of ownership of foreign institutional investors (FSO) and board directors (BSO) influences the earnings surprises effect and the 52-week-high anchoring effect. SO is defined (1) as the proportion of stockholdings of foreign institutional investors or board directors and (2) as a dummy variable characterized as $SO = 1$ if the proportion of stockholdings of foreign institutional investors or board directors for *i* firm at quarter *t* is higher than the sample median. When β_6 (β_7) is significantly different from zero, the PEAD effect (the 52-week-high anchoring effect) is associated with the ownership level of foreign institutional investors or board directors.

$$\begin{aligned} CAR(1,60)_{i,t} = {} & \beta_1 + \beta_2 \times SUE_{i,t} + \beta_3 \times PRC_{i,t} + \beta_4 \times SO_{i,t} + \beta_5 \times SUE_{i,t} \times PRC_{i,t} \\ & + \beta_6 \times SUE_{i,t} \times SO_{it} + \beta_7 \times SUE_{i,t} \times PRC_{i,t} \times SO_{i.t} + \beta_8 \times PRC_{i,t} \times SO_{i,t} \\ & + \beta_9 \times LEVER_{i,t} + \beta_{10} \times LMB_{i,t} + \beta_{11} \times LPE_{i,t} + \beta_{12} \times ROA_{i,t} + \beta_{13} \times LSIZE_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{3}$$

Equation (3) is an augmented version of Eq. (2) with the addition of the $\mathrm{SUE} \times \mathrm{PRC} \times \mathrm{SO}$ term. We add this term to determine whether the ownership level of foreign institutional investors or board directors influences the association between the earnings surprises effect and the 52-week-high anchoring effect.

3. Empirical Results

3.1. Descriptive Statistics

Table 1 displays the descriptive statistics of the variables studied. On average, CAR(1,60) is approximately zero. The median value of CAR(1,60) is −0.8%, and CAR(1,60) is left skewed. The average value of SUE is 4.6%, implying favorable earnings surprises on average. However, the standard deviation of SUE is considerable (3.927%) and the extreme values are markedly large. Consequently, SUE exhibits an extensive dispersion in our sample. The average value of PRC is 77.3%, indicating that the current price is nearly 80% of the 52-week high. The average stock ownership for foreign institutional investors and board directors is 10.4% and 21%, respectively.

Table 1: Descriptive Statistics

Variables	Mean	Median	Std.	Min	Max	N
CAR(1,60)	0.000	-0.008	0.145	-1.152	1.540	29164
SUE	0.046	0.000	3.927	-60.861	392.057	29164
PRC	0.773	0.816	0.174	0.000	0.998	29164
FSO	0.104	0.056	0.128	0.000	0.916	29164
BSO	0.210	0.176	0.138	0.000	0.890	29164
LEVER	0.437	0.441	0.179	0.005	1.028	29164
LMB	0.199	0.146	0.598	-2.523	5.159	29164
LPE	2.269	2.544	1.360	-1.171	8.251	29164
ROA	0.017	0.015	0.025	-0.721	0.928	29164
LSIZE	22.528	22.402	1.455	17.479	29.549	29164

3.2. Portfolio Analysis

Table 2 indicates the average CAR(1,60) of the 25 portfolios we form by intersecting the SUE quintiles and PRC quintiles. CARs in the SUE5 (1) quintile are all positive (negative) and are significant at the 1% level within four PRC quintiles, implying that markets underreact or exhibit a delayed response to extremely positive and negative earnings surprises. In each PRC quintile, the CAR difference between SUE5 and SUE1 is considerable. The greatest difference (5.56%) occurs in the PRC4 quintile, where CAR is 3.03% and −2.53% for SUE5 and SUE1, respectively. Additionally, CAR(1,60) monotonically decreases from SUE5 to SUE1 within the PRC2, PRC3, and PRC4 quintiles. This preliminary evidence supports the existence of the PEAD effect after the 52-week-high anchoring effect is controlled.

Table 2 also illustrates the existence of the anchoring bias. Within the SUE5, SUE3, SUE2, and SUE1 quintiles, the CAR of PRC1 is lower than the CAR of PRC5. This reflects a positive 52-week-high anchoring effect, which is consistent with George and Hwang (2004) and Li and Yu (2012). However, within the SUE4 quintile, the CAR of PRC5 is 1.32%, slightly lower than the CAR of PRC1 (1.49%). Furthermore, CARs monotonically decrease from PRC5 to PRC1 within the SUE5 and SUE3 quintiles. The greatest CAR difference between PRC5 and PRC1 is only 2.48% (in the SUE5 quintile). Therefore, the positive anchoring effect is weak and not as robust as the PEAD or earnings surprises effect.

Table 2: Portfolio CARs for the Full Sample

	SUE5	SUE4	SUE3	SUE2	SUE1
PRC5	3.70%	1.32%	0.28%	-1.13%	-0.84%
	(5.81)***	(2.58)**	(0.52)	(-1.70)*	(-1.10)
PRC4	3.03%	0.78%	0.08%	-1.11%	-2.53%
	(4.97)***	(2.05)**	(0.22)	(-2.60)**	(-5.31)***
PRC3	2.35%	0.86%	-0.55%	-1.36%	-2.37%
	(3.94)***	(1.75)*	(-1.68)*	(-3.60)***	(-6.89)***
PRC2	2.24%	0.54%	-0.73%	-1.41%	-2.05%
	(4.45)***	(1.37)	(-1.51)	(-3.99)***	(-5.06)***
PRC1	1.22%%	1.49%	-0.95%	-1.73%	-2.19%
	(1.07)	(1.55)	(-1.44)	(-2.41)**	(-2.74)***

Note: Figures in parentheses are *t* statistics.

Panels A and B in Table 3 present the average CAR(1,60) of the 25 portfolios in two subsamples categorized according to whether the stock ownership level of foreign institutional investors is higher or lower than the sample median value of FSO. Similarly, the two subsamples in Table 4 are categorized according to whether the stock ownership level of board directors is higher or below the sample median value of BSO.

To highlight the effect of institutional investors' behavior on CARs, we focus on extreme portfolios (i.e., SUE5, SUE1, PRC5, and PRC1) in investigating the subsample results (Table 3). We speculate that the trading behaviors of institutional investors can mitigate the earnings surprises effect and anchoring bias. Therefore, the CAR of (SUE5, RRC5) is expected to be lower in Panel A than in Panel B, and the CAR of (SUE1, RRC1) is expected to be higher in Panel A than in Panel B. In terms of the earnings surprises effect, we presume that foreign institutional investors respond more rapidly than individual investors to unexpected earnings.

Thus, the resulting CARs in SUE5 (1) would be lower (higher) in Panel A than in Panel B. In terms of the positive anchoring effect, the CAR in PRC5 (1) would be lower (higher) in Panel A if foreign institutional investors exhibit less a 52-week high anchoring bias. The trading behaviors of institutional investors exhibit opposite influences on the CARs of (SUE1, RRC5) and (SUE5, RRC1) relative to the earnings surprises effect and the positive anchoring effect. Consequently, whether the CARs of (SUE1, RRC5) and (SUE5, RRC1) in Panel A are relatively high or low compared with those in Panel B is uncertain.

Table 3 shows that the CARs of (SUE5, RRC5) and (SUE1, RRC1) are 3.62% and −2.03%, respectively, in Panel A. The corresponding CARs are 3.66% and −2.57% in Panel B. When firms report highly favorable earnings surprises and have prices near their 52-week highs, the positive CAR in Panel A is lower than that in Panel B. When firms report extremely poor earnings surprises and have prices far below their 52-week highs, the negative CAR in Panel B is higher in absolute value. Thus, as we expect, a higher level of institutional investor ownership is associated with weaker PEAD effect and anchoring effect for the (SUE5, RRC5) and (SUE1, RRC1) portfolios.

For portfolio (SUE5, RRC1), the CAR is −0.05% in Panel A, lower than those in Panel B (1.25%). Although both CARs are not significant, the weaker earnings surprises effect associated with a higher level of foreign institutional investor ownership tends to dominate such that the CAR is lower in Panel A. The CAR of (SUE1, RRC5) is −1.65% in Panel A, which is significant at the 5% level. The corresponding CAR is nonsignificant (−0.14%) in Panel B. In this portfolio, the weaker anchoring effect associated with a higher level of foreign institutional investor ownership appears to dominate such that the CAR is lower in Panel A.

Table 4 displays the CAR results for the subsamples of high and low board director ownership. For portfolio (SUE5, RRC5), the CARs are 3.65% and 3.60% in Panels A and B, respectively. For portfolio (SUE1, RRC1), the CARs are −2.47% and −1.93% in Panels A and B, respectively. When firms announce highly favorable earnings surprises and have prices near their 52-week highs, the positive CAR in Panel A is higher than the CAR in Panel B. When firms announce extremely negative earnings surprises and have prices far below their 52-week highs, the negative CAR in Panel A is higher in absolute value. Therefore, a higher level of board director ownership is associated with stronger PEAD effect and anchoring effect. This outcome contrasts with the influence of the level of foreign institutional investor ownership (Table 3).

The CARs of portfolios (SUE5, RRC1) and (SUE1, PRC5) are 1.82% and −1.15% in Panel A, higher in absolute value than the corresponding CARs in Panel B (−0.16% and −0.98%, respectively). These four CARs are not significant. Nevertheless, the relative magnitudes may imply that a higher level of board director ownership is associated with a

stronger earnings surprises effect. Regarding the CARs of portfolios (SUE5, RRC5) and (SUE1, RRC1), we hypothesize that insiders have less incentive to seek profits through earnings announcements when their level of ownership is low. Investors therefore react more rapidly or to a greater extent to unexpected earnings announced by firms whose level of board director ownership is low.

Table 3: Portfolio CARs for Subsamples of High and Low Foreign Stockholdings

Panel A High stockholdings of foreign institutional investors					
	SUE5	SUE4	SUE3	SUE2	SUE1
PRC5	3.62%	1.14%	-0.19%	-1.32%	-1.65%
	(4.58)***	(2.23)**	(-0.31)	(-2.10)**	(-2.02)**
PRC4	2.93%	0.34%	0.17%	-1.33%	-2.47%
	(4.94)***	(0.74)	(0.38)	(-2.18)**	(-4.90)***
PRC3	3.50%	1.02%	-0.04%	-0.63%	-2.30%
	(3.18)***	(1.67)	(-0.08)	(-0.95)	(-4.7)***
PRC2	1.86%	0.37%	0.05%	-0.22%	-2.07%
	(2.15)**	(0.61)	(0.07)	(-0.50)	(-3.88)***
PRC1	-0.05%	-0.56%	-1.40%	-1.40%	-2.03%
	(-0.03)	(-0.45)	(-1.39)	(-1.67)	(-2.35)**
Panel B Low stockholdings of foreign institutional investors					
	SUE5	SUE4	SUE3	SUE2	SUE1
PRC5	3.66%	1.62%	0.94%	-0.17%	-0.14%
	(5.69)***	(2.46)**	(1.28)	(-0.13)	(-0.15)
PRC4	3.04%	1.24%	-0.29%	-1.48%	-2.38%
	(3.76)***	(2.14)**	(-0.39)	(-1.84)*	(-2.88)***
PRC3	2.12%	0.66%	-0.81%	-1.76%	-2.69%
	(2.65)**	(1.02)	(-1.59)	(-3.28)***	(-4.52)***
PRC2	2.50%	0.65%	-1.36%	-2.44%	-2.15%
	(3.57)***	(1.21)	(-2.32)**	(-4.77)***	(-4.29)***
PRC1	1.25%	2.21%	-0.94%	-1.90%	-2.57%
	(0.98)	(2.17)**	(-1.43)	(-2.22)**	(-2.49)**

Note: Figures in parentheses are *t* statistics.

Table 4: Portfolio CARs for Subsamples of High and Low Board Director Stockholdings

Panel A High stockholdings of board directors					
	SUE5	SUE4	SUE3	SUE2	SUE1
PRC5	3.65%	2.07%	0.43%	-1.41%	-1.15%
	(4.75)***	(2.77)***	(0.62)	(-1.81)*	(-1.49)
PRC4	3.08%	0.30%	0.59%	-1.70%	-2.70%
	(3.77)***	(0.58)	(1.21)	(-2.87)***	(-4.08)***
PRC3	2.55%	0.83%	-0.98%	-1.56%	-2.58%
	(3.58)***	(1.13)	(-1.63)	(-2.99)***	(-5.01)***
PRC2	2.45%	0.57%	-0.12%	-1.90%	-1.53%
	(3.08)***	(1.03)	(-0.18)	(-3.37)***	(-2.49)**
PRC1	1.82%	1.52%	-1.07%	-1.29%	-2.47%
	(1.29)	(1.28)	(-1.48)	(-1.51)	(-2.20)**
Panel B Low stockholdings of board directors					
	SUE5	SUE4	SUE3	SUE2	SUE1
PRC5	3.60%	0.49%	-0.09%	-0.90%	-0.98%
	(5.30)***	(0.87)	(-0.15)	(-1.25)	(-0.97)
PRC4	2.71%	1.20%	-0.40%	-0.26%	-2.26%
	(3.99)***	(2.20)**	(-0.67)	(-0.49)	(-4.58)***
PRC3	2.23%	0.90%	0.26%	-1.18%	-2.14%
	(3.04)***	(1.79)*	(0.46)	(-2.00)*	(-4.71)***
PRC2	1.76%	0.75%	-1.15%	-1.07%	-2.41%
	(2.67)**	(1.15)	(-2.11)**	(-2.12)**	(-4.11)***
PRC1	-0.16%	1.57%	-0.44%	-2.14%	-1.93%
	(-0.11)	(1.53)	(-0.48)	(-2.33)**	(-2.24)**

Note: Figures in parentheses are *t* statistics.

Finally, we construct a zero-cost trading strategy that involves buying an extreme portfolio (SUE5, PRC5) and selling another extreme portfolio (SUE1, PRC1). The hedge return obtained is 5.65% (3.62% + 2.03%) for stocks with high foreign ownership and 6.23% (3.66% + 2.57%) for stocks with low foreign ownership. The arbitrage return that can be

earned by employing the PEAD effect and anchoring bias is reduced when the level of foreign institutional investor ownership is high. Table 4 indicates that the hedge return of the zero-cost strategy is 6.12% (3.65% + 2.47%) for stocks with high board director ownership and 5.53% (3.60% + 1.93%) for stocks with low board director ownership. The arbitrage return that can be earned by employing the PEAD effect and anchoring bias is enhanced when the level of board director ownership is high.

3.3. Regression Results

In this subsection we examine the effect of earnings surprises and the proximity of stock price to the 52-week high on CARs by employing regression analysis. Table 5 displays the regression results of Eq. (1) for the full sample and four subsamples. Similar to classifications in Tables 3 and 4, "High (Low) FSO" represents the subsample in which the level of stock ownership of foreign institutional investors is higher (lower) than the median value of the sample FSO, and "High (Low) BSO" represents the subsample in which the stock ownership of board directors is higher (lower) than the median value of the sample BSO.

SUE has a significant and positive influence on CARs, except for in the low-BSO subsample. The estimated coefficient 0.0088 for the high-BSO subsample is the highest one, suggesting that a high level of board director ownership may be associated with the strongest PEAD effect. The estimated coefficient of the proximity of stock price to the 52-week high (PRC) is significant and negative for the full sample and the four subsamples. Thus, CARs subsequent to the date of an earnings announcement decrease as current prices approach their 52-week highs. We speculate that investors tend to reassess the fundamental value of firms near the date of an earnings announcement. Investors presume a higher possibility of overvaluation (undervaluation) when the stock price is near (far below) the 52-week high; therefore, subsequent CARs are negatively related to PRC. This negative anchoring effect appears to contradict the portfolio analysis results. Nevertheless, the relative magnitudes of the CARs among the middle PRC portfolios (PRCs 2, 3, and 4) are indeterminate. The positive anchoring effect is found only between extreme portfolios PRC5 and PRC1.

We specifically aim to determine how the anchoring bias would influence the earnings surprises effect, which is represented by the slope of the $\mathrm{SUE} \times \mathrm{PRC}$ term. The estimated coefficient is significant and negative for the full sample and three subsamples. For the full sample, the association between SUE and the CAR can be described as

$$\frac{\mathrm{d}CAR}{\mathrm{d}SUE} = 0.0060 - 0.0059 \times PRC \,. \tag{4}$$

This regression result confirms that the proximity of a stock price to its 52-week high exhibits a negative incremental effect on the magnitude of PEAD. When firms report favorable earnings surprises along with a large PRC, investors tend to respond more rapidly to unexpected earnings because fundamental news coincides with the performance of stock

prices. Another possibility is that the news may have been leaked and somewhat reflected in prices. Subsequent CARs would decrease under these circumstances. When firms report negative earnings surprises along with large PRC, investors also tend to respond more rapidly to the unexpected earnings because at that stage, a considerably high possibility of overvaluation exists. In either case (positive or negative earnings surprises), the magnitude of PEAD ($\mathrm{d}CAR/\mathrm{d}SUE$) declines in PRC. Notably, we find that the anchoring bias can alleviate the PEAD effect. However, the result for the low-BSO subsample differs: no PEAD effect is observed in this subsample because the coefficients of both SUE and $\mathrm{SUE} \times \mathrm{PRC}$ terms are not significant. Finally, two control variables, ROA and LSIZE, exhibit a strong relationship with CARs. Firms with higher ROAs or lower market capitalizations would have higher CARs.

Table 5: Regression Results for the Full Sample and Subsamples

	Full sample	High FSO	Low FSO	High BSO	Low BSO
SUE	0.0060	0.0071	0.0069	0.0088	0.0020
	(3.769)***	(2.600)***	(2.617)***	(3.553)***	(0.767)
PRC	-0.0261	-0.0388	-0.0262	-0.0377	-0.0290
	(-3.497)***	(-3.703)***	(-2.366)**	(-3.397)***	(-2.788)***
$\mathrm{SUE} \times \mathrm{PRC}$	-0.0059	-0.0071	-0.0072	-0.0092	-0.0006
	(-3.060)***	(-2.271)**	(-2.121)**	(-3.222)***	(-0.191)
LEVER	-0.0123	-0.0330	0.0033	-0.0072	0.0021
	(-1.099)	(-1.902)*	(0.211)	(-0.437)	(0.126)
LMB	0.0014	0.0165	-0.0108	0.0085	-0.0024
	(0.412)	(2.812)***	(-2.233)**	(1.511)	(-0.461)
LPE	0.0007	0.0012	0.0000	0.0018	-0.0012
	(0.894)	(1.040)	(0.039)	(1.718)*	(-1.166)
ROA	0.2093	0.2158	0.1878	0.2631	0.1661
	(4.611)***	(3.320)***	(2.857)***	(3.763)***	(2.652)***
LSIZE	-0.0594	-0.0761	-0.0555	-0.0663	-0.0639
	(-20.348)***	(-14.914)***	(-13.460)***	(-14.201)***	(-14.359)***
C	1.3588	1.8098	1.2225	1.5076	1.4686
	(20.205)***	(15.017)***	(13.303)***	(14.161)***	(14.308)***
Adj. R	2.98%	3.87%	3.09%	2.89%	3.88%

Note: The dependent variable is CAR(1,60), which is the CAR over the 60 trading days starting the day after the earnings announcement date. Figures in parentheses are t statistics.

Table 6 displays the empirical results of regression Eq. (2) and (3) when the variable SO is FSO. In the "LFSO" column, the independent variable FSO is the stock ownership level of foreign institutional investors. In the "FSO dummy" column, the independent variable FSO is a dummy variable defined as $FSO = 1$ if the stock ownership level of foreign institutional investors is higher than the median value of the sample FSO.

The first two columns report the regression results that ignore the influence of anchoring bias PRC. Consistent with the previous results, we find that SUE positively affects CARs at 1% significance, exhibiting a considerably strong PEAD effect in the Taiwan stock market. Moreover, the coefficient of the FSO term in the LFSO column is significant and positive (0.0375), indicating that a higher level of foreign institutional investor ownership is associated with higher CARs. The coefficient of the $\mathrm{SUE} \times \mathrm{FSO}$ term in the LFSO column is −0.0068, which is significant at the 1% level, validating the portfolio analysis results in Table 3 that indicate that a high level of foreign institutional investor ownership mitigates the earnings surprise effect. The association between SUE and CARs can be described (in the LFSO column) as follows:

$$\frac{\mathrm{d}CAR}{\mathrm{d}SUE} = 0.0024 - 0.0068 \times FSO . \tag{5}$$

On average, as FSO increases by 1%, the positive effect of SUE on CAR decreases by 0.0068%. The positive effect may even become negative when FSO is considerably high. After the average value of the sample FSO (10.4%) is substituted into Eq. (5), the average marginal effect of SUE on CAR is approximately 0.0017. By comparison, the marginal effect of SUE on CAR is 0.0013 in the FSO dummy column.

The following two columns in Table 6 display the regression results of Eq. (2). This regression model takes into account the anchoring bias (PRC) and its interaction with the earnings surprises effect ($\mathrm{SUE} \times \mathrm{PRC}$). First, the influences of SUE, FSO, and $\mathrm{SUE} \times \mathrm{FSO}$ on CAR found in the first two columns remain. Second, PRC significantly and negatively affects CAR at the 5% level in both columns; additionally, the estimated coefficient of the $\mathrm{SUE} \times \mathrm{PRC}$ term is significant and negative (−0.0067) in the FSO dummy column. As in Table 5, our sample exhibits a negative anchoring effect near the date of an earnings announcement. Furthermore, the magnitude of PEAD decreases when stock prices approach their 52-week highs. Finally, the estimated coefficient of the $\mathrm{PRC} \times \mathrm{FSO}$ term is not significant; thus, no reliable relationship is observed between anchoring bias and the level of foreign institutional investor ownership. When the average values of FSO (10.4%) and PRC (77.3%) are substituted into the estimated regression, the marginal effects of SUE on CAR are 0.0029 ($= 0.0035 - 0.0062 \times FSO$) and 0.0013 ($= 0.0065 - 0.0067 \times PRC$) in the LFSO and FSO dummy columns, respectively.

The final two columns in Table 6 display the regression results of Eq. (3). This regression model adds the $\mathrm{SUE}\times\mathrm{PRC}\times\mathrm{FSO}$ term in Eq. (2) to determine whether the level of foreign institutional investor ownership affects the association between the earnings surprises effect and anchoring bias. The estimated coefficient of this term is positive and significant at the 10% level in the LFSO column but not significant in the FSO dummy column. The association between SUE and CAR in the final two columns can be described as follows:

$$\frac{\mathrm{d}CAR}{\mathrm{d}SUE}=0.0057-0.037\times FSO+0.0351\times PRC\times FSO\,. \tag{6}$$

$$\frac{\mathrm{d}CAR}{\mathrm{d}SUE}=0.0054-0.0052\times PRC\,. \tag{7}$$

In Eq. (7) (the FSO dummy column), CAR increases in SUE, whereas the drift amount decreases when PRC increases. This earnings surprises effect is similar to our findings in regression model Eq. (2). After substituting the sample average values of PRC into Eq. (7), the average marginal effect of SUE on CAR is approximately 0.0014, which is close to the regression model Eq. (2) value of 0.0013.

In Eq. (6) (the LFSO column), the marginal effect of FSO on PEAD is $-0.037+0.0351\times PRC$, which equals −0.0099 on average. Generally, a high level of foreign institutional investor ownership mitigates the earnings surprises effect. Additionally, the marginal effect of PRC on PEAD is $0.0351\times FSO$. Consequently, CAR increases in SUE, and the drift amount increases when stock price is near its 52-week high. This positive influence of PRC on $\mathrm{d}CAR/\mathrm{d}SUE$ is contrary to our findings obtained using Eq. (7) and presented Table 5. We suggest that the negative relationship between PRC and the earnings surprises effect is more reliable than the positive relationship. First, the results of both regression Eq. (1) and (2) confirm the negative relationship. The positive relationship occurs only in regression Eq. (3) and when the independent variable FSO is defined as the level of ownership of foreign institutional investors. Second, the coefficient of the $\mathrm{SUE}\times\mathrm{PRC}\times\mathrm{FSO}$ term is only marginally significant (*t* value=1.767). Overall, the average marginal effect of SUE on CAR is approximately 0.0047 after the sample average values of FSO and PRC are substituted into Eq. (6). The average marginal effect would be approximately 0.0019 if the coefficient of the $\mathrm{SUE}\times\mathrm{PRC}\times\mathrm{FSO}$ term is ignored.

Table 6: Regression Results-Ownership of Foreign Institutional Investors

	LFSO	FSO dummy	LFSO	FSO dummy	LFSO	FSO dummy
SUE	0.0024 (7.056)***	0.0013(4.276)***	0.0035(1.988)**	0.0065(3.822)***	0.0057(2.648)***	0.0054(2.384)**
PRC			-0.0210(-2.447)**	-0.0224(-2.485)**	-0.0219(-2.548)**	-0.0221(-2.450)**
FSO	0.0375(2.147)**	0.0027(0.868)	0.0902(2.155)**	0.0103(1.175)	0.0749(1.753)*	0.0116(1.296)
SUE × PRC			-0.0014(-0.602)	-0.0067(-3.077)***	-0.0041(-1.479)	-0.0052(-1.795)*
SUE × FSO	-0.0068(-4.806)***	-0.0004(-0.904)	-0.0062(-3.755)***	0.0004(0.737)	-0.0370(-2.115)**	0.0030(0.854)
SUE × PRC × FSO					0.0351(1.767)*	-0.0032(-0.759)
PRC × FSO			-0.0602(-1.293)	-0.0094(-0.865)	-0.0430(-0.904)	-0.0106(-0.977)
LEVER	0.0103(0.924)	0.0105(0.943)	0.0123(1.107)	0.0121(1.089)	0.0120(1.078)	0.0123(1.099)
LMB	0.0009(0.272)	0.0016(0.480)	0.0009(0.266)	0.0014(0.404)	0.0008(0.236)	0.0014(0.412)
LPE	0.0006(0.832)	0.0005(0.872)	0.0007(0.984)	0.0006(0.871)	0.0008(1.024)	0.0006(0.862)
ROA	0.1809(4.033)***	0.1854(4.131)***	0.2050(4.518)***	0.2093(4.610)***	0.2030(4.471)***	0.2093(4.611)***
LSIZE	-0.0602(-20.116)***	-0.0595(-20.258)***	-0.0610(-20.318)***	-0.0598(-20.306)***	-0.0609(-20.285)***	-0.0599(-20.315)***
C	1.3510(19.923)***	1.3384(20.034)***	1.3859(20.152)***	1.3643(20.151)***	1.3845(20.130)***	1.3648(20.158)***
Adj R	3.01%	2.92%	3.05%	2.98%	3.06%	2.98%

Note: The dependent variable is CAR(1,60), which is the CAR over the 60 trading days starting the day after the earnings announcement date. Figures in parentheses are t statistics.

Next, we run regression Eq. (2) and (3) when the variable SO is BSO; the results are provided in Table 7. In the "LBSO" column, the independent variable BSO is the ownership level of board directors. In the "BSO dummy" column, the independent variable BSO is a dummy variable defined as $BSO = 1$ if the ownership level of board directors is higher than the median value of the sample BSO. The results in the first two columns are similar to those in Table 6: CAR is positively related to SUE at the 1% level of significance, indicating a strong PEAD effect. The coefficient of BSO in the LBSO column is significant and positive (0.0865). Markets evaluate firms with a high level of board director ownership more favorably. The coefficients of $\text{SUE} \times \text{BSO}$ in both columns are negative but nonsignificant. Thus, the ownership level of board directors is not associated with the earnings surprises effect, whereas a high level of foreign institutional investor ownership mitigates the earnings surprises effect (Table 6). In these two columns, the average marginal effects of SUE on CARs are approximately 0.0018 and 0.0014.

The following two columns in Table 7 display the regression results of Eq. (2). The results correspond to those in Table 6, except that the coefficients of the $\text{SUE} \times \text{BSO}$ term in both columns are not significant. Ownership level of board directors has no significant influence on the magnitude of PEAD. The empirical results of regression Eq. (3) indicate notable differences from the corresponding results in Table 6. First, SUE has no direct influence on CARs. The coefficients of SUE in both columns are positive but not significant. In the LBSO column, the coefficients of three interactive terms ($\text{SUE} \times \text{PRC}$, $\text{SUE} \times \text{BSO}$, and $\text{SUE} \times \text{PRC} \times \text{BSO}$) are all nonsignificant. Consequently, no PEAD effect occurs when the independent variable BSO is defined as the ownership level of board directors.

In the BSO dummy column, the coefficients of two interactive terms ($\text{SUE} \times \text{BSO}$ and $\text{SUE} \times \text{PRC} \times \text{BSO}$) are significant at the 10% level. We can characterize the marginal effect of SUE on CARs in this column as follows:

$$\frac{\mathrm{d}CAR}{\mathrm{d}SUE} = 0.0062 \times BSO - 0.0077 \times PRC \times BSO . \tag{8}$$

According to Eq. (8), SUE affects CAR indirectly through BSO and PRC channels. BSO positively affects the magnitude of PEAD ($\mathrm{d}CAR/\mathrm{d}SUE$); this is in sharp contrast to the effect of FSO. For high-BSO firms ($BSO = 1$), $\mathrm{d}CAR/\mathrm{d}SUE = 0.0062 - 0.0077 \times PRC$, which equals 0.00025 after the mean value of PRC is substituted into the equation. For low-BSO firms ($BSO = 0$), $\mathrm{d}CAR/\mathrm{d}SUE = 0$. We reveal that a high level of board director ownership strengthens the earnings surprises effect when BSO is defined as a dummy variable. This confirms the portfolio analysis results in Table 4. The marginal effect of PRC on $\mathrm{d}CAR/\mathrm{d}SUE$ is $-0.0077 \times BSO$. A negative association exists between PRC and the magnitude of PEAD, but only for high-BSO firms.

Table 7: Regression Results-Ownership of Board Directors

	LBSO	BSO dummy	LBSO	BSO dummy	LBSO	BSO dummy
SUE	0.0018 (3.569)***	0.0014(4.527)***	0.0059(3.664)***	0.0060(3.590)***	0.0043(1.418)	0.0026(1.036)
PRC			-0.0254(-2.267)**	-0.0235(-2.598)***	-0.0250(-2.220)**	-0.0222(-2.455)**
BSO	0.0865(5.277)***	0.0046(1.406)	0.0972(2.791)***	0.0092(1.046)	0.0990(2.833)***	0.0118(1.333)
SUE × PRC			-0.0053(-2.609)***	-0.0059(-2.753)***	-0.0032(-0.833)	-0.0014(-0.441)
SUE × BSO	-0.0029(-1.524)	-0.0006(-1.341)	-0.0016(-0.780)	-0.0000(-0.033)	0.0040(0.435)	0.0062(1.816)*
SUE × PRC × BSO					-0.0076(-0.604)	-0.0077(-1.838)*
PRC × BSO			-0.0123(-0.297)	-0.0059(-0.522)	-0.0412(-0.343)	-0.0087(-0.804)
LEVER	-0.0087(-0.778)	-0.0095(-0.851)	-0.0105(-0.943)	-0.0114(-1.019)	-0.0106(-0.948)	-0.0116(-1.038)
LMB	0.0004(0.104)	0.0015(0.433)	0.0001(0.040)	0.0012(0.350)	0.0002(0.048)	0.0012(0.362)
LPE	0.0004(0.563)	0.0005(0.652)	0.0006(0.791)	0.0006(0.875)	0.0006(0.792)	0.0006(0.876)
ROA	0.1804(4.022)***	0.1848(4.119)***	0.2056(4.531)***	0.2086(4.594)***	0.2053(4.524)***	0.2071(4.561)***
LSIZE	-0.0583(-20.021)***	-0.0590(-20.250)***	-0.0586(-20.070)***	-0.0592(-20.270)***	-0.0587(-20.079)***	-0.0593(-20.294)***
C	1.2954(19.404)***	1.3259(19.919)***	1.3223(19.481)***	1.3501(19.999)***	1.3230(19.488)***	1.3506(20.006)***
Adj R	3.02%	2.93%	3.07%	2.98%	3.07%	2.99%

Note: The dependent variable is CAR(1,60), which is the CAR over the 60 trading days starting the day after the earnings announcement date. Figures in parentheses are *t* statistics.

Overall, the results of Eq. (8) are similar to those of Eq. (1) (Table 5), where a PEAD effect does not exist for the low-BSO subsample. Finally, we briefly compare the influence of the $\mathrm{SUE}\times\mathrm{PRC}\times\mathrm{SO}$ term between FSO and BSO. The slope estimates are significant in the LFSO column (0.0351) and the BSO dummy column (−0.0077), with marginal significance (*t* value=1.767 and −1.838). Consequently, the influence of SO on the relationship between SUE and PRC ($\partial^2(CAR)/\partial(SUE)\partial(PRC)$) is weak. Additionally, we suggest that directly comparing the influence of FSO [$0.0351\times FSO$ in Eq. (6)] with BSO [$-0.0077\times BSO$ in Eq. (8)] is inappropriate because the significance occurs in different scenarios (i.e., different definitions of FSO and BSO).

4. Conclusions

Using a sample of common stocks listed on the TSE, the current study examines the PEAD effect and the 52-week-high anchoring effect. Furthermore, we analyze how the 52-week-high anchoring influences the magnitude of PEAD. We also discuss whether the ownership of foreign institutional investors and board directors influences the magnitude of PEAD and the association between the PEAD effect and the 52-week-high anchoring effect.

Empirical evidence shows a strong PEAD effect in our sample. Unexpected earnings positively affect subsequent abnormal returns, implying that investors underreact or have a delayed response to unexpected earnings. The 52-week-high anchoring exhibits a negative influence on subsequent abnormal returns. Subsequent abnormal returns become lower (higher) when the stock price is near (far below) the 52-week high. We surmise that investors tend to reassess the fundamental value of firms near the date of an earnings announcement. This reassessment may result in contrarian trading relative to the 52-week high and explain the negative anchoring effect.

Moreover, we identify a negative relationship between the magnitude of PEAD and the 52-week-high anchoring. A decreased magnitude of PEAD is observed when the current price is near the 52-week high. When the current price is considerably high, the announcement of unexpected favorable earnings justifies the price level and reduces the possibility of overvaluation. Investors respond more quickly, thus lowering the extent of subsequent positive abnormal returns. When the current price is considerably high but the firm announces unexpected poor earnings, investors also react rapidly to the negative information because of the high possibility of overvaluation. This again reduces the extent of subsequent negative abnormal returns.

A smaller magnitude of PEAD is also associated with a higher level of foreign institutional investor ownership. Foreign institutional investors react more rapidly to unexpected earnings news, and the magnitude of PEAD is thus lowered. However, a greater magnitude of PEAD is observed in the subsample with high board director ownership. We

speculate that investors may be more doubtful of unexpected earnings news released by firms with a high level of insider ownership. Consequently, investors react more slowly to such information, generating greater magnitudes of PEAD.

We reveal that the evidence regarding the influence of the 52-week-high anchoring on PEAD differs from that provided by George et al. (2015) and Shin and Park (2018). Future studies can determine whether the influence of the 52-week-high anchoring is asymmetrical after positive and negative earnings surprises. Future research can analyze how the characteristics of firms could influence the association between the PEAD effect and the 52-week-high anchoring effect.

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