

Earnings-Related Information, Cognitive Bias, and the Disposition Effect

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Abstract—This paper discusses the reaction of investors in the Taiwan stock market to the most probable unknown earnings-related information and the most probable known earnings-related information. As compared with the previous literature regarding the effect of an official announcement of earnings forecast revision, this paper further analyzes investors' cognitive bias toward the unknown and known earnings-related information, and the role of media during the investors' reactions to the foresaid information shocks. The empirical results show that both the unknown and known earnings-related information provides useful information content for a stock market. In addition, cognitive bias and disposition effect are the behavioral pitfalls that commonly occur in the process of the investors' reactions to the earnings-related information. Finally, media coverage has a remarkable influence upon the investors' trading decisions.

Keywords—Cognitive bias, role of media, disposition effect, earnings-related information, behavioral pitfall.

I. INTRODUCTION

IN an environment of rapid information dissemination, media coverage is not only a source of information that mass investors can easily access in daily life, but also a major channel through which investors obtain information about listed companies. Reference [1] found that the mass media reported on an increasing number of companies in recent years. Reference [2] found that media coverage helped to improve information spread among investors and market efficiency. Reference [3] pointed out that media comments contained certain information about corporate value, although they were emotional at times. Considering the important role of the media, previous studies discussed the influence of media coverage on stock prices or trading volume. Specifically, Reference [4] found that the frequency of derogatory words contained in media coverage could be used to predict corporate earnings and stock returns. Reference [5] argued that the higher the media coverage of a company is, the lower the company's stock returns are. Reference [6] found that the probability and amount of transactions is closely bound with local media coverage. Further, [7] found that the media was prone to using fewer derogatory words for local companies than for non-local companies, indicating that news content would be influenced by the nature of the company and identified a conflict of

interest between mass media and companies. According to investment practices, the mass media often report earnings-related information about a company (not the official announcement of the company's earnings) in advance of reporting the company's official announcement its earnings information, thus influencing stock prices and investor behavior. Reference [8] argued that pessimism in the media could indicate a downtrend in stock prices, and media coverage was closely bound up with stock prices. Reference [9] found that intensive media coverage of a specific company results in an intense reaction to the company's news by the market. This literature review shows that media coverage can indeed influence investors' behavioral reactions. Studying the role that media coverage in the process of investor reactions is of great significance. This will help the investors to not only have a full understanding of the influence of earnings-related information, but also improve their investment performance.

Among the information the mass media reports about listed companies, earnings-related information is always a type that can influence reactions to their stock prices. In the previous literature on the relationship between earnings announcements and stock returns, the studies focused on the influence of official earnings-related information announcements on stock prices or trading volume [10]-[14]. In other words, past studies particularly stress the information connotation of official earnings forecast announcement by listed companies (including media coverage of the official earnings forecast announcements). Before the official earnings forecast announcement to mass investors, the mass media may have reported other earnings-related information in advance (for example, a company's unfavorable earnings prospects or a substantial decline in operating revenue before the company officially announces the reduced earnings forecast). Prior studies scarcely touched the influence of this earnings-related information on investors' trading behaviors. When a succession of the same or similar news spreads in the stock market, do the most probable unknown earnings-related information and the most probable known earnings-related information contain equally useful connotations? This issue deserves in-depth research. To extend the research scope of the existing literature, it is necessary to extend the objects of research to media coverage of earnings-related information and official earnings forecast announcement.

Reference [15] believed that humans fail to process information content correctly, and even have a cognitive bias in the process of decision-making. Taking investment decision-making as an example, investors are prone to overreact or underreact to related information. Subsequent

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studies in behavioral finance also offered some evidence of investors' over- or under-reaction. Regarding underreaction, [16] found that stock prices continued to react in the same direction after the announcement of a cash dividend distribution and reduction scheme, indicating an under-reaction to this information. Reference [17] found that after Canadian companies announced stock repurchase information, their stock prices would react positively and undergo a short-term drift. Reference [18] pointed out that subsequent to an announcement of a decrease or cancellation of cash dividends, corporate stocks would have significantly negative abnormal returns for one year. Reference [19] argued that stock prices would drift due to investors' under-reaction to highly continuous industry-wide earnings subsequent to the announcement of analysts' earnings forecast revisions. Regarding overreaction, [20] were the first to find that overreaction to earnings-related information exists in the stock market. Reference [21] found that average monthly momentum-driven earnings were positive in a bull market and negative in a bear market; in particular, long-term stock prices reversed in a bull market. This phenomenon was in line with overreaction theory. According to the results from [22], the stock market has a relatively early and rapid negative overreaction to operating losses due to internal fraud, and the degree and duration of the overreaction was positively correlated with the consequent stock downgrade. As this literature sets forth, investors will underreact to earnings-related information in the short run, but overreact to earnings-related information in the long run. The previous literature provided evidence of investors' over- or under-reaction. Facing a succession of the same or similar information content (e.g., media coverage of earnings-related information and official announcements of earnings forecast), will investors have a cognitive bias (e.g., underreacting to the earlier media coverage of earnings-related information, and overreacting to the subsequent official announcement of earnings forecast)? This issue is seldom touched upon in the previous literature.

This study discusses whether media coverage of a company's probable earnings forecast revisions and the official announcements earnings forecast revision in the Market Observation Post System (MOPS) of the Taiwan Stock Exchange (TWSE) has any useful connotations. In addition, this study investigates whether investors have a cognitive bias (for example, overreaction or underreaction) to this information. Compared with the previous relevant literature, the present study is distinct in two regards. First, most previous studies of regarding earnings forecasts focused on the influence of the official earnings forecast revision announcements; this study discusses the influence of media coverage of a company's earnings-related information on investors' trading behaviors prior to the official announcement in the TWSE, and analyzes the role of media in a stock market. Second, the previous literature on behavioral finance uncovered investors' cognitive bias (e.g., overreaction and underreaction) toward earnings-related information; the objects of the present study are media coverage of a company's earnings-related information (implying a probable upward or downward

revision of a company's earnings forecast) and the official earnings forecast revision announcement. Accordingly, this study analyzes the influence of earnings-related information on investors' decision-making behaviors, and fully discusses whether investors have any cognitive bias.

This paper is organized as follows. Section II briefly introduces the TWSE, cognitive bias, and the disposition effect. Section III describes the data and methodology. Section IV provides the empirical results, and Section V summarizes the research conclusions.

II. TAIWAN STOCK MARKET, COGNITIVE BIAS, AND DISPOSITION EFFECT

A. Overview of Taiwan Stock Market

Founded on October 23, 1961, the TWSE began stock transactions officially on February 9, 1962. On opening day, there were only seven companies listed in the TWSE, including such traditional industrial companies as Taiwan Cement Corporation, Taiwan Pulp & Paper Corporation, and the Taiwan Tea Corporation. With the rapid economic development and rise of high-tech industry, the scale of the TWSE expanded rapidly. For example, the number of listed companies exceeded 100, 200, 600, and 900 in 1980, 1991, 2002, and 2016, respectively; the total market value of listed companies increased from 7 billion NTDs (December 1962) to 30 trillion NTDs (June 2017). Among the TWSE listed companies, the first and second ranks belong to electronics companies and finance and insurance companies by quantity, respectively. In June 2017, the average daily trading volume was 95.7 billion NTDs.

According to TWSE rules, a listed company must announce its operating revenue of the previous month before the 10th day each month, its financial report of Quarter 1 before May 15th, its financial report of Quarter 2 before August 14th, its financial report of Quarter 3 before November 14th, and the financial report of the previous year before March 31st annually. The quarterly and financial reports contain earnings information. Investors often use the earnings information for reference in buying or selling stocks and forecasting a firm's earnings prospects. In addition to the official announcements of listed companies' earnings information from the TWSE, investors can also obtain information about listed companies' earnings forecasts or prospects through media coverage. Before the official earnings information announcement, most investors use the media coverage of the listed companies' earnings-related information for reference in their investment decisions.

Compared to the US stock market, the TWSE has a larger proportion of retail investors. Generally, retail investors are deficient in investment analysis as compared with the institutional investors, and are more prone to buy or sell stocks according to various market rumors. As compared with the investors in the US stock market, the investors in Taiwan stock market are more likely to overreact or underreact to the media coverage of the earnings-related information and the official announcement of the earnings information. Therefore, this study focuses on investors in Taiwan stock market, with the aim

of determining whether these investors have a cognitive bias toward known and unknown information.

B. Cognitive Bias

Cognitive bias refers to the incorrect thinking that investors develop toward information content because they make decisions based on irrational attitudes, subjective feelings, and personal experience. Specifically, cognitive bias manifests as investors' underreaction or overreaction to the information content. Underreaction manifests as follows: when new information spreads in the market, securities prices do not immediately adjust to a due level in the short term, but change slowly in the direction indicated by the new information; in other words, the market has a lagged reaction to the new public information. In contrast, overreaction manifests as follows: securities prices deviate from the economic fundamentals for a time while a succession of good or bad news spreads in the market. When good news spreads in succession, stock prices will be overestimated; when bad news spreads in succession, stock prices will be underestimated. The under- or overestimated stock prices will subsequently undergo a mean-reverting process; that is, the stock returns are negatively auto-correlated after a long time lag.

Some scholars tried to make an integrated interpretation of cognitive bias (including under- and overreaction) from a psychological perspective. Most representatively, [23] held the following view: 1) well-informed people who play a dominant role in determining stock prices have overconfidence and a self-attribution bias, and investors care only for news consistent with their previous cognition; 2) therefore, investors react intensely to their proprietary information and overreact to private signals of pure price impact, but react weakly to public signals. Reference [24] held the following view: 1) investors' inherent conservatism is closely correlated with the under-reaction to an earnings announcement; conservative investors were not willing to adjust their ideas and decisions to the new information objectively, so they may take a skeptical attitude toward the new information, thus underreacting to the unexpected new information; 2) if investors are in contact with positive or negative news for a long time, they are prone to develop an optimistic or pessimistic attitude toward the corporate prospect, thus over- or underestimating stock prices. According to these research results, there is a strong momentum within a certain period subsequent to a succession of contradictory news events, and a strong reversal effect in case of a persuasive news event. Reference [25] classified securities market participants into two types of boundedly rational agents: news watchers and momentum traders. In their opinion, news watchers rely entirely on their private information, while momentum traders rely only on the previous information about price changes. Reference [25] argued that news watchers manipulated the initial stock prices, and then momentum traders began reacting to the news that gradually spread in the market. In this circumstance, stock prices underreacted initially (momentum traders did not react to the news), then overreacted (momentum traders reacted to the news), and finally no longer reacted and reverted to their

fundamentals. Regarding investors' under-reaction, [11], [12], [26], [27] provide an alternative explanation: investors ignored useful information due to their limited attention or absence of mind, thus underreacting to price fluctuations. In recent years, [28] demonstrated that conservatism also accounts for market participants' under-reactions.

The previous literature provided the evidence of investors' under- or overreaction. Facing the most probable unknown earnings-related information (i.e., the initial media coverage of a company's earnings forecast revision) and the most probable known earnings-related information (i.e., the official announcement of a company's earnings forecast revision in the MOPS of the TWSE), will investors have a cognitive bias (e.g., underreacting to the earlier media coverage of earnings-related information, but overreacting to the subsequent official announcement)? This issue is seldom touched upon in the existing literature.

C. Disposition Effect

The disposition effect refers to investors' inevitable tendency to sell winning stocks too soon and hold losing stocks too long. The previous literature demonstrated that the disposition effect not only exists, but is also a common investor behavioral pitfall. Based on prospect theory [15], [29] explained why a disposition effect exists in humans. They believed that the certainty and reflection effects respectively cause investors to sell winning stocks too soon and hold losing stocks too long. When these disposition effects occur among stock market participants, the tendency to sell winning stocks too soon and hold losing stocks too long will inevitably influence their reactions to a succession of the same or similar earnings-related information.

The previous literature not only demonstrates that a disposition effect exists among stock investors, but also argued that the disposition effect influences investors' behavioral reaction and trading decisions. Reference [30] pointed out that investors' in the US stock market show a remarkable tendency to hold losing stocks in eleven months (except December) throughout the year. References [31]-[33] found that the disposition effect would cause investors to underreact to related information. Reference [34] found a disposition effect among retail investors, corporate investors, and deals in the Taiwan stock market. Reference [35] found that the disposition effect among investors influenced stock returns, stock volatility, and volume of stock trading significantly. Reference [36] believed that the disposition effect would cause a long-term reversal of stock prices. Reference [37] found that the disposition effect was one of the reasons for herding tendency among investors.

Reference [38] argued that the disposition effect was prone to occur in a stock market where investors were of low maturity, so retail investors are more susceptible to the disposition effect than institutional investors are. In the Taiwan stock market, retail investors constitute the vast majority of all investors. In view of this, it can be rationally anticipated that investors in the Taiwan stock market will have a more obvious irrational reaction to earnings-related information. In other words, investors in the Taiwan market are more likely to have

an incorrect cognition of the content contained in earnings-related information (e.g., under- or overreacting to earnings-related information) compared to investors in European or American stock markets. Accordingly, it can be further inferred that these wrong reactions in the Taiwan stock market to earnings-related information is also possibly due to the erroneous decisions of investors with a significant disposition effect.

III. DATA AND METHODOLOGY

A. Data and Research Period

This study investigates the behavioral reaction of stock investors to the most probable unknown earnings-related information and the most probable known earnings-related information. We selected the sample and retrieved the data with the following method. 1) This study first acquired the content and date of official announcements of a sample company's earnings forecast information from the MOPS of the TWSE. 2) After acquiring the date of the official announcement, we used a retrospective method to retrieve the content and dates of the initial media coverage of the earnings forecast information from the news knowledge base of the National Library of Public Information. For example, this study learned from the MOPS of the TWSE that Company A announced an upward revision of an earnings forecast on February 1, 2012 and a downward revision of an earnings forecast on June 15, 2012. Then, we retrieved the initial media coverage (dated April 10, 2012, for example) of the upward and downward revision of the earnings forecasts during February 1, 2012 to June 15, 2012 from the news knowledge base of the National Library of Public Information. Finally, the dates of the two events (including the most probable unknown information on the upward revision of the earnings forecast and the most probable known information on the upward revision of earnings forecast regarding Company A) were respectively defined as April 10, 2012 and June 15, 2012.

After acquiring the event dates, this study analyzed the effect of the two events on stock prices and trading volumes. Within the research period of January 8, 1999 to December 31, 2012, we acquired data for about 144 companies with an upward earnings forecast revision and 134 companies with a downward earnings forecast revision.

Media coverage of the earnings-related information is available from the news knowledge base of the National Library of Public Information; the official announcements of the upward and downward revision of the earnings forecasts are available from the MOPS of the TWSE; and the related daily data (including closing price, stock returns, and trading volume) of the listed companies and market index are available from the Taiwan Economic Journal database.

B. Method to Investigate the Stock Price Effect

Using the event study method, this study analyzes whether a significant abnormality in stock prices can be caused by any initial media coverage of corporate earnings or official announcements of earnings forecast revisions made in the

MOPS. First, this study uses the date of initial media coverage of the probable earnings forecast revision and the date of the official earnings forecast revision announcement as event dates. Second, we use the period from the third trading day before these event dates to the fifth trading day after these event dates as the maximum event period, as well as the period from the 210th trading day before these event dates to the 91st trading day before these event dates as the estimation period. Finally, the study uses a market model to estimate expected stock returns and the *t*-test method [39] to check whether the cumulative average abnormal returns (CAARs) are significantly different from zero. The following section describes the method to check the CAARs:

$$H_0 : CAAR_{t,t+h} = 0$$

$$H_1 : CAAR_{t,t+h} \neq 0$$

$$t_{119} = CAAR_{t,t+h} / \sqrt{h+1} \sigma_{AAR} \quad (1)$$

Here, $R_{i,t}$ indicates the returns of stock *i* on the day *t*, and $AR_{i,t}$ indicates the abnormal returns of stock *i* on the day *t*. For $AR_{i,t} = R_{i,t} - (\hat{\alpha} + \hat{\beta} R_{m,t})$, the maximum event period is day *t*-3 to day *t*+5. $R_{m,t}$ indicates the market returns on the day *t*. The market model is $R_{i,t} = \alpha + \beta R_{m,t}$ and the estimation period is day *t*-210 to day *t*-91. $\hat{\alpha}$ and $\hat{\beta}$ are the estimated values of the regression coefficients α and β . AAR_t indicates the average abnormal returns across all stocks on the day *t*; $AAR_t = \sum_{i=1}^n AR_{i,t} / n$. $CAAR_{t,t+h}$ indicates the CAARs during the period from the day *t* to the day *t*+*h*; $CAAR_{t,t+h} = \sum_{T=t}^{t+h} AAR_T$.

H_0 is a null hypothesis and H_1 is an alternative hypothesis.

$$\overline{AAR} = \sum_{t=-210}^{-91} AAR_t / 120 \text{ and } \sigma_{AAR} = \sqrt{\sum_{t=-210}^{-91} (AAR_t - \overline{AAR})^2 / 119}$$

n indicates the number of sample companies and *t* is the assigned degree of freedom (119).

C. Method to Investigate Abnormal Trading Volume

The main influence of an event on the financial market is whether the event causes abnormal returns or abnormal trading volume. In addition to the price effect, this study also analyzes the effect on trading volume. Using the methods proposed by [40], [41], this study analyzes whether abnormal trading volume is respectively due to the initial media coverage of a company's earnings-related information and the official earnings forecast revision announcement in the MOPS. The methods proposed by [40], [41] are described as follows:

$$H_0 : CAAV_{t,t+h} = 0$$

$$H_1 : CAAV_{t,t+h} \neq 0$$

$$t_{119} = CAAV_{t,t+h} / \sqrt{h+1} \sigma_{AAV} \quad (2)$$

Here, $V_{i,t}$ indicates the trading volume of stock i on the day t , and $AV_{i,t}$ indicates the abnormal trading volume of stock i on the day t . $AV_{i,t} = (V_{i,t} / \bar{V}_i) - 1$ and $\bar{V}_i = \frac{1}{91} \sum_{t=-210}^{-91} V_{i,t} / 120$. AAV_t indicates the average abnormal trading volume across all stocks on the day t ; $AAV_t = \sum_{i=1}^n AV_{i,t} / n$. $CAAV_{t,t+h}$ indicates the cumulative average abnormal trading volume (CAAVs) during the period from the day t to the day $t+h$; $CAAV_{t,t+h} = \sum_{T=t}^{t+h} AAV_T$. $\overline{AAV} = \frac{1}{91} \sum_{t=-210}^{-91} AAV_t / 120$ and $\sigma_{AAV} = \frac{1}{91} \sum_{t=-210}^{-91} (AAV_t - \overline{AAV})^2 / 119$.

IV. EMPIRICAL RESULTS

A. Effect of Unknown Earnings-Related Information on Stock Returns

TABLE I
CAARs FOR THE EVENT WINDOWS ON STOCKS WITH THEIR FIRST
APPEARANCE OF RISING/DECLINING EARNINGS FORECASTS IN NEWSPAPER
REPORTS

PANEL A: CAARs FOR THE EVENT WINDOWS ON THE STOCKS WITH ITS FIRST APPEARANCE OF RISING EARNINGS FORECAST IN NEWSPAPER REPORTS		
Event windows	CAARs	t-statistic
(-3,-1)	0.5504	1.4027
(-2,-1)	1.1464	3.5785***
(-1,0)	1.8846	5.8827***
(0,1)	1.3443	4.1962***
(0,2)	1.1620	2.9615***
(0,3)	1.1279	2.4895**
(0,5)	1.4851	2.6765***
PANEL B: CAARs FOR THE EVENT WINDOWS ON STOCKS WITH THEIR FIRST APPEARANCE OF A DECLINING EARNINGS FORECAST IN NEWSPAPER REPORTS		
Event windows	CAARs	t-statistic
(-3,-1)	-1.4876	-3.1996***
(-2,-1)	-1.3966	-3.6790***
(-1,0)	-2.1136	-5.5677***
(0,1)	-2.0725	-5.4595***
(0,2)	-2.6437	-5.6862***
(0,3)	-3.0380	-5.6588***
(0,5)	-3.5380	-5.3809***

Note: ***, **, and * represent significance at the 10%, 5%, and 1% levels, respectively.

Regarding the stock price effect surrounding the disclosure of the unknown information related to positive earnings surprises, Panel A of Table I shows that the CAARs for the event windows (0,1), (0,2), (0,3), and (0,5) after the first appearance in newspaper reports of a rising earnings forecast for a firm are all significantly greater than zero. This implies that the first appearance of a rising earnings forecast for a firm in newspaper reports provides useful informational content to the equity market. This also indicates that the first appearance of a rising earnings forecast for a firm in newspaper reports may be the unknown earnings-related information for the majority of investors in Taiwan's stock market. Of particular note, Panel A of Table I indicates that in all event windows after the most probable unknown earnings-related information, the CAARs are all significant positive values. This shows that

investors underreact to the most probable unknown earnings-related information. On the other hand, for the stock price reaction to the first appearance of declining earnings forecasts, Panel B of Table I shows that after its first appearance in newspaper reports, the CAARs for the event windows (0,1), (0,2), (0,3), and (0,5) are all significantly negative. This shows that the initial media coverage of a downward earnings forecast revision will indeed influence investors' willingness to hold shares and produce significantly negative abnormal returns. Compared to Panel A of Table I, the CAARs for the event windows after the initial media coverage of a declining earnings forecast for a firm show that investors will react to the negative information until at least the 20th day after the event dates, indicating that the market reacts to the negative information for a long time. After the initial media coverage of a declining earnings forecast, the reported company's stock prices nevertheless show significantly negative abnormal returns, indicating that investors may also underreact to the initial media coverage of a declining earnings forecast.

B. Effect of Known Earning-Related Information on Stock Returns

For the stock price effect of known earnings information related to positive earnings surprises, Panel A of Table II shows that the CAARs for the event windows (0,1), (0,2), (0,3), and (0,5) after the official announcement of a rising earnings forecast for a firm are all significantly greater than zero. This implies that the official announcement of a rising earnings forecast for a firm; that is, the most probable known information, still causes a significant positive price reaction and provides evidence supporting a certification effect. This also indicates that the most probable known earnings-related information for a certain firm still plays an important role in the decision-making of investors in Taiwan's stock market due to the TWSE's reputation and possible investor overreaction to the official announcement of a rising earnings forecast.

Regarding the stock price reaction to official announcements of a downward earnings forecast revision, Panel B of Table II indicates that the CAARs in all event windows are significantly negative after the official announcement of a downward earnings forecast revision. Even facing the most probable known negative information, investors trust the TWSE's reputation; therefore, the stock prices of a company with a downward earnings forecast revision will nevertheless show significantly negative abnormal returns. In other words, these results are not only consistent with the argument of the certification effect, but also imply that investors in the Taiwan stock market may overreact to the official announcement of a downward earnings forecast revision in the MOPS of the TWSE.

In summary, the empirical results in Table I and Table II show that the initial media coverage or the official announcement provides useful information for investors, and the related media coverage will indeed influence the stock returns. This finding is consistent with prior arguments [1], [6], [8] that the media plays an important role in a stock market.

Therefore, it is advisable not to ignore its role when discussing the influence of earnings-related information. Investors are very likely to regard initial media coverage as the transfer of new information, which will cause investors to change their expectations of the company's earnings prospects, thus bringing about abnormal stock returns. In addition, the official earnings forecast information in the MOPS of the TWSE may be known market information. Considering that the TWSE has a considerable reputation, investors will nevertheless react to such earnings forecast information. Consequently, an official announcement of an upward or downward earnings forecast revision will produce significantly abnormal stock returns, and the direction of the earnings forecast revision is positively correlated with the abnormal stock returns. This finding is consistent with the argument of the certification effect. Finally, investors react to the initial media coverage more remarkably than to the official announcement, implying that the unknown information has a greater influence than the certification effect of the known information.

TABLE II
CAARS FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF RISING/DECLINING EARNINGS FORECASTS

PANEL A: CAARS FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF RISING EARNINGS FORECASTS		
Event windows	CAARs	t-statistic
(-3,-1)	0.2516	0.6835
(-2,-1)	0.4631	1.5407
(-1,0)	0.8499	2.8273***
(0,1)	1.5563	5.1770***
(0,2)	1.3624	3.7005***
(0,3)	1.2169	2.8626***
(0,5)	1.2263	2.3552**
PANEL B: CAARS FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF DECLINING EARNINGS FORECASTS		
Event windows	CAARs	t-statistic
(-3,-1)	-0.7235	-1.7781*
(-2,-1)	-0.4187	-1.2602
(-1,0)	-0.9143	-2.7523***
(0,1)	-2.3594	-7.1022***
(0,2)	-3.1052	-7.6318***
(0,3)	-3.8051	-8.0990***
(0,5)	-4.4046	-7.6547***

Note: ***, **, and * represent significance at the 10%, 5%, and 1% levels, respectively.

C. Effect of Known Earnings-Related Information on Trading Volume

Regarding the influence of official announcements of an upward earnings forecast revision, Panel A of Table III shows that the CAAVs for the event windows (0,1), (0,2), (0,3), and (0,5) after the official announcement of a rising earnings forecast are all significantly greater than zero. This result shows that the abnormal trading volume of corporate stocks increases significantly after the company officially announces an upward earnings forecast revision. In other words, the trading frequency of such stocks increases significantly because investors are eager to sell stocks with an upward earnings forecast revision.

Regarding the influence of the official announcement of a

downward earnings forecast revision, Panel B of Table III shows that the CAAVs for the event windows (0,1), (0,2), (0,3), and (0,5) after the official announcement of a declining earnings forecast are all insignificantly different from zero. This result shows that the trading volume of corporate stocks does not change significantly after the company officially announces a downward earnings forecast revision. In other words, there is no abnormal change in the trading frequency of stocks with a downward earnings forecast revision, nor any obvious sale of such stocks.

The results in Tables II and III show that after the official announcement of an upward (downward) earnings forecast revision, the corresponding stocks produce significantly positive (negative) abnormal returns and significantly positive (insignificantly) abnormal trading volume. This shows that investors sell winning stocks with an upward earnings forecast revision too soon (hold losing stocks with a downward earnings forecast revision too long), indicating that a disposition effect among the investors in the Taiwan stock market.

TABLE III
CAAVs FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF RISING/DECLINING EARNINGS FORECASTS

PANEL A: CAAVs FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF RISING EARNINGS FORECASTS		
Event windows	CAAVs	t-statistic
(-3,-1)	1.9393	9.0309***
(-2,-1)	1.4498	8.2688***
(-1,0)	1.8676	10.6516***
(0,1)	2.7374	15.6127***
(0,2)	3.7599	17.5090***
(0,3)	4.6119	18.5994***
(0,5)	6.3320	20.8504***
PANEL B: CAAVs FOR THE EVENT WINDOWS OF STOCKS WITH OFFICIAL ANNOUNCEMENTS OF DECLINING EARNINGS FORECASTS		
Event windows	CAAVs	t-statistic
(-3,-1)	0.1895	0.9047
(-2,-1)	0.1664	0.9727
(-1,0)	-0.0388	-0.2267
(0,1)	-0.0455	-0.2663
(0,2)	0.0078	0.0373
(0,3)	-0.0081	-0.0336
(0,5)	0.2701	0.9116

Note: ***, **, and * represent significance at the 10%, 5%, and 1% levels, respectively.

V. CONCLUSIONS

This study examines the influence of initial media coverage of earnings-related information and official announcements of earnings forecast revisions on stock prices and trading volume, and explores whether investors have a cognitive bias toward such information (e.g., under- or overreacting to such information). Compared to the previous relevant literature, this study is distinct in two aspects. First, most prior research focuses on the influence of official announcements of earnings forecast revisions; this study investigates the influence of the initial media coverage of a probable earnings forecast revision (unofficial announcement) prior to the official announcement, and emphatically analyzes the media's role in a stock market.

Second, the previous literature on behavioral finance uncovered investors' cognitive biases toward information shocks; the objects of the present study are the media coverage of a company's earnings-related information and the official announcement of an earnings forecast revision. Accordingly, this study gives an in-depth analysis of investors' cognitive bias, including under- and overreactions.

The empirical results from this study are summarized as follows. 1) In the eyes of investors, the initial media coverage of an earnings forecast revision means a release of new information, so stock prices are positively correlated with the direction of the earnings forecast revision; the official announcement of the earnings forecast revision not only provides useful information for the stock market, but also supports the certification effect. 2) The effect of the official earnings forecast revision announcement on stock prices and trading volume shows a disposition effect among investors. 3) According to the empirical results for the stock price effect of known and unknown earnings-related information, investors have a cognitive bias toward both types of earnings-related information; for example, they under-react in the early stage but overreact in the later stage.

According to the empirical results of this study, related media coverage indeed plays an important role in a stock market. Therefore, a company must attach more importance to media coverage, and take appropriate measures quickly against false media reports to prevent an excessive fluctuation in its stock price and trading volume due to this false news. Moreover, the empirical results also show that there are behavioral pitfalls (including a disposition effect and cognitive bias) in the process of investors' reactions to the known and unknown earnings-related information. Therefore, investors' investment decisions are indeed influenced by their behavioral pitfalls.

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REFERENCES

- [1] W. S. Chan, "Stock price reaction to news and no-news: Drift and reversal after headlines," *J. Financial Econ.*, vol. 70, no. 2, pp. 223-260, 2003.
- [2] J. Peress, "The media and the diffusion of information in financial markets: Evidence from newspaper strikes," *J. Finance*, vol. 69, no. 5, pp. 2007-2043, 2014.
- [3] K. Ahmad, J. Han, E. Hutson, C. Kearney, and S. Liu, "Media-expressed negative tone and firm-level stock returns," *J. Corp. Finance*, vol. 37, pp. 152-172, Apr. 2016.
- [4] P. C. Tetlock, M. Saar-Tsechansky, and S. Macskassy, "More than words: Quantifying language to measure firms' fundamentals," *J. Finance*, vol. 63, no. 3, pp. 1437-1467, 2008.
- [5] L. Fang and J. Peress, "Media coverage and the cross-section of stock returns," *J. Finance*, vol. 64, no. 5, pp. 2023-2052, 2009.
- [6] J. E. Engelberg and C. A. Parsons, "The causal impact of media in financial markets," *J. Finance*, vol. 66, no. 1, pp. 67-97, 2011.
- [7] U. G. Gurun and A. W. Butler, "Don't believe the hype: Local media slant, local advertising, and firm value," *J. Finance*, vol. 67, no. 2, pp. 561-598, 2012.
- [8] P. C. Tetlock, "Giving content to investor sentiment: The role of media in the stock market," *J. Finance*, vol. 62, no. 3, pp. 1139-1168, 2007.

- [9] H. Aman, "An analysis of the impact of media coverage on stock price crashes and jumps: Evidence from Japan," *Pac.-Basin Finance J.*, vol. 24, pp. 22-38, Sept. 2013.
- [10] P. Brown J. W. Kennelly, "The informational content of quarterly earnings: An extension and some further evidence," *J. Bus.*, vol. 45, no. 3, pp. 403-415, 1972.
- [11] S. Dellavigna and J. M. Pollet, "Investor inattention and Friday earnings announcements," *J. Finance*, vol. 64, no. 2, pp. 709-749, 2009.
- [12] D. Hirshleifer, S. S. Lim, and S. H. Teoh, "Driven to distraction: Extraneous events and underreaction to earnings news," *J. Finance*, vol. 64, no. 5, pp. 2289-2325, 2009.
- [13] W. R. Landsman, E. L. Maydew, and J. R. Thornock, "The information content of annual earnings announcements and mandatory adoption of IFRS," *J. Account. & Econ.*, vol. 53, no. 1-2, pp. 34-54, 2012.
- [14] M. Pevzner, F. Xie, and X. Xin, "When firms talk, do investors listen? The role of trust in stock reactions to corporate earnings announcements," *J. Financial Econ.*, vol. 117, pp. 190-223, 2015.
- [15] D. Kahneman and A. Tversky, "Prospect theory: An analysis of decision under risk," *Econometrica*, vol. 47, no. 2, pp. 263-291, 1979.
- [16] R. Michaely, R. H. Thaler, and K. L. Womack, "Price reactions to dividend initiations and omissions: Overreaction or drift?" *J. Finance*, vol. 50, no. 2, pp. 573-608, 1995.
- [17] D. Ikenberry, J. Lakonishok, and T. Vermaelen, "Stock repurchases in Canada: Performance and strategic trading," *J. Finance*, vol. 55, no. 5, pp. 2373-2397, 2000.
- [18] Y. I. Liu, S. H. Szewczyk, and Z. Zantout, "Underreaction to dividend reductions and omissions?" *J. Finance*, vol. 63, no. 2, pp. 987-1020, 2008.
- [19] K. W. Hui and P. E. Yeung, "Underreaction to industry-wide earnings and the post-forecast revision drift," *J. Account. Res.*, vol. 51, no. 4, pp. 701-737, 2013.
- [20] W. F. M. DeBondt and R. Thaler, "Does the stock market overreact?" *J. Finance*, vol. 40, no. 3, pp. 793-805, 1985.
- [21] M. J. Cooper, R. C. Gutierrez, and A. Hameed, "Market states and momentum," *J. Finance*, vol. 59, no. 3, pp. 1345-1365, 2004.
- [22] L. Biell and A. Muller, "Sudden crash or long torture: The timing of market reactions to operational loss events," *J. Bank. & Finance*, vol. 37, no. 7, pp. 2628-2638, 2013.
- [23] K. Daniel, D. Hirshleifer, and A. Subrahmanyam, "Investor psychology and security market under- and overreactions," *J. Finance*, vol. 53, no. 6, pp. 1839-1885, 1998.
- [24] N. Barberis, A. Shleifer, and R. Vishny, "A model of investor sentiment," *Financial Econ.*, vol. 49, no. 3, pp. 307-343, 1998.
- [25] H. Hong and J. C. Stein, "A unified theory of underreaction, momentum trading, and overreaction in asset markets," *J. Finance*, vol. 54, no. 6, pp. 2143-2184, 1999.
- [26] L. Peng, "Learning with information capacity constraints," *J. Financial & Quant. Anal.*, vol. 40, no. 2, pp. 307-329, 2005.
- [27] L. Peng and W. Xiong, "Investor attention, overconfidence and category learning," *Financial Econ.*, vol. 80, no. 3, pp. 563-602, 2006.
- [28] D. Choi and S. K. Hui, "The role of surprise: Understanding overreaction and underreaction to unanticipated events using in-play soccer betting market," *J. Econ. Behav. & Org.*, vol. 104, pp. 614-629, Nov. 2014.
- [29] H. Shefrin and M. Statman, "The disposition to sell winners too early and ride losers too long: Theory and evidence," *J. Finance*, vol. 40, no. 3, pp. 777-790, 1985.
- [30] T. Odean, "Are investors reluctant to realize their losses?" *J. Finance*, vol. 53, no. 5, pp. 1775-1798, 1998.
- [31] M. Grinblatt and B. Han, "Prospect theory, mental accounting, and momentum," *Financial Econ.*, vol. 78, no. 2, pp. 311-339, 2005.
- [32] A. Frazzini, "The disposition effect and underreaction to news," *J. Finance*, vol. 61, no. 4, pp. 2017-2046, 2006.
- [33] J. Birru, "Confusion of confusions: A test of the disposition effect and momentum," *Rev. Financial Stud.*, vol. 28, no. 7, pp. 1849-1873, 2015.
- [34] B. M. Barber, Y. T. Lee, Y. J. Liu, and T. Odean, "Is the aggregate investor reluctant to realise losses? Evidence from Taiwan," *Eur. Financial Manag.*, vol. 13, no. 3, pp. 423-447, 2007.
- [35] W. N. Goetzmann and M. Massa, "Disposition matters: Volume, volatility, and price impact of a behavioral bias," *J. Portf. Manag.*, vol. 34, no. 2, pp. 103-125, 2008.
- [36] N. C. Brown, K. D. Wei, and R. Wermers, "Analyst recommendations, mutual fund herding, and overreaction in stock prices," *Manag. Sci.*, vol. 60, no. 1, pp. 1-20, 2013.
- [37] C.-H. Chang and S.-J. Lin, "The effects of national culture and behavioral pitfalls on investors' decision-making: Herding behavior in international

- stock markets," *Int. Rev. Econ. & Finance*, vol. 37, pp. 380-392, 2015.
- [38] R. Dhar and N. Zhu, "Up close and personal? An individual level analysis of the disposition effect," *Manag. Sci.*, vol. 52, no. 5, pp. 726-740, 2006.
- [39] S. J. Brown and J. B. Warner, "Using daily stock returns: The case of event studies," *Financial Econ.*, vol. 14, no. 1, pp. 3-31, 1985.
- [40] K. L. Womack, "Do brokerage analysts' recommendations have investment value?" *J. Finance*, vol. 51, no. 1, pp. 137-167, 1996.
- [41] C.-H. Chang and K. C. Chan, "Investment banks' stock ratings, call warrant issuance, and responses from heterogeneous investors: Evidence from Taiwan," *Int. Rev. Econ. & Finance*, vol. 20, no. 4, pp. 733-743, 2011.

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