The News sentiment effect on trading behavior: A Cross-industry Analysis

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ABSTRACT

This study examines whether the news sentiment that is inherent in media reports influences the trading behavior of investors and whether it acts as a leading indicator in their decision making. Based on linguistic analysis, we construct market- and industry-level 'aggregate news sentiment indices' (*ANSIs*) on the financial news reports relating to each listed stock on the Taiwan Stock Exchange. Our analyses of the relationships between the *ANSIs* and the trading responses reveal that regardless of whether we are examining a market or industry *ANSI*, there is a significant and negative relationship between *ANSIs* and market returns; this is consistent with the overreaction trading behavior viewpoint presented in Barberis, Shleifer and Vishny (1998). Further, the *ANSIs* could well prove to be a better leading indicator of market and industry returns, particularly in states that are not characterized by extreme pessimism or optimism. We also find spillover effects between industry-level *ANSIs* and *VIX*, particularly in sluggish states. A comparison of economic states provides support for the view that the *ANSIs* are extremely sensitive to macroeconomic monitoring indicators and trading responses, particularly in stable and sluggish states.

Keywords: News sentiment; Industry; Market responses; Spillover effects; Economic state.

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1. INTRODUCTION

Emotion is an essential factor that gives rise to perceptions and subjective judgments; investors cannot make decisions without emotion, although it interferes with information realization. Although the influence on investors of the rapid growth in information relating to financial markets has been acknowledged in numerous studies,[1] identifying useful information regarding markets remains a complicated matter, in particular given firm incentives to manipulate the perceptions of outsiders. Obviously, the beliefs and analysis of investors are important because they lead to a more unpredictable market.

Previous theoretical study of investment sentiment and stock market pricing focuses on the influence on trading activity of information receivers. DeLong, Shleifer, Summers and Waldmann (1990) posit the existence of noise traders and rational arbitrageurs, whose response to expected dividends affects market trading. According to the authors, one of the potential risks of trading is driven by noise traders, who hold multiple opinions and brief to the market. When noise traders experience a negative belief shock on dividends, their arbitrage activities increase trading volume, leading to temporary negative shocks on returns.

Since the market composition of investors is complicated, responses and interactions differ with the receipt of good or bad news. A major component of the Taiwan stock market is individual investors; unlike institutional investors, they have no professional qualifications that allow them to distinguish among sources of information or to respond to investment decisions in an appropriate way. On the other hand, the Taiwan stock market is still a "plate-form" market; it is volatile and easily influenced by unusual information or shocks. Vega (2006) and Tetlock (2010) both mention the impact of news on informed and uninformed traders whose beliefs and expectations are driven by changes in volume and price. Even if there are a variety of investor

[1] Examples include Chan (2003), Vega (2006), Tetlock (2007), Tetlock, Saar-Tsechansky and Macskassy (2008), Fang and Peress (2009), Engelberg and Parsons (2011), Demers and Vega (2014), Griffin, Hirschey and Kelly (2011), Groß-Klußmann and Hautsch (2011) and Aman (2011, 2013).

types and it is difficult to capture trading behavior, it is nevertheless worth exploring the interactions of investors. Most news-related studies focus on the impact of news on specific firms, applying the results to portfolio construction. This study uses news content to determine the potential influence of irrational behavior on equity market and industries.

The differences in the influence of news between industries main depend on the response of macroeconomic conditions and information including media reports, earning announcement et al. The characters of firm and the composition of investors are different among industries. Those are correlated to the degree of sensitive and risk averse, and the relationship would lead different responses to news information and affect the whole industry activities.

We integrate unstructured news reports and stock trading data to investigate the relationship between news reports and market trading behavior, giving consideration to the current market atmosphere. More than 2.5 million financial news articles relating to each stock listed on the Taiwan Stock Exchange (TWSE) are collected; based on linguistic analysis, a measure of news sentiment is constructed to serve as a news sentiment proxy for reference in decision making. The market 'aggregate news sentiment index' (*ANSI*) is based upon the weighted market value. We then constructed industry 'aggregate news sentiment indices' (*ANSIs*) for the three categories of industry, i.e., finance (*ANSIF*), electronics (*ANSIE*) and non-finance/non-electronics (*ANSIN*), based on the weighted market value of each industry.

The primary aim of this study is to examine the relationships between the market *ANSI*, market returns and other trading responses, such as trading value, turnover ratio and the implied volatility index of the TWSE.[2] The causal impacts of the proposed *ANSIs* are further investigated under a distinct aggregate news sentiment atmosphere. Based on the difference in

[2] Trading value, which is calculated in this study as trading volume × trading price, is a weekly value comprising the sum of daily market trading values from the first to the last trading day in a week.

characteristics and interaction between markets and industries, the analysis also aims to examine whether the influence of the *ANSIs* spills over to the VIX and across industries as well as different economic states. Finally, to observe the influence of news on the market while taking into consideration the economy, we explore the relation among *ANSIs* and market responses in different economic periods.

Our results confirm that market and industry *ANSIs* can reflect the news sentiment that investors acquire from the media, with the atmosphere created by the media potentially influencing decision making and trading behavior. The key findings may be summarized as follows. There is a significant and negative relationship between *ANSIs* and market returns that is present among markets and industries; it is consistent with investor behavior when optimistic news sentiment appears, leading to overreaction and negative returns, as observed in Barberis, Shleifer and Vishny (1998). The causal analysis results confirm that the market and industry *ANSIs* could be leading indicators of market returns when the *ANSIs* do not reflect an extremely optimistic or pessimistic state. It is possible that news sentiment has greater influence on stock returns in more rational trading periods.

Further, the economic state is considered, which leads to different responses for news sentiment and the market. The interaction of *ANSIs* and the VIX shows a significant negative relationship between the VIX and the subsequent news sentiment. In addition, only financial and non-financial/non-electronics *ANSIs* have a negative impact on the VIX during the stable period. Compared to other industries and market states, the electronics *ANSI* (*ANSIE*) is easily affected by *ANSIF*, *ANSIN* and *VIX*, in particular during the sluggish period. The evidence shows that the market *ANSI* is positive with respect to the subsequent trading value and turnover ratio during the sluggish period and is negative with respect to stock returns and *VIX* in the stable period, which is similar to *ANSIE* and *ANSIN*. By categorizing news sentiment into different groups, the market and industry *ANSIs* can act as leading indicators

of market responses, particularly during states that are not extremely pessimistic or optimistic. These findings provide support for the spillover effects of news sentiment between industries, with different magnitudes being discernible under different economic states.

The analysis and quantification of the content of public information has become an extremely important issue, with diverse field databases rapidly increasing in number. We contribute to the growing literature in the present study by constructing market- and industry-level *ANSIs* through the application of linguistic analysis with an emphasis on semantic orientation. Compared to previous papers on the impact of news on market and industry trading activity, we consider industry characteristics and distinguish among industry news items to capture closed information based on industry *ANSIs*. It is found that classified news sentiment is more informative and captures more market and industry responses, in particular when the market state is categorized as well.

The remainder of this paper is organized as follows. A summary of the related literature is provided in Section 2; Section 3 offers a description of the data and the construction of the *ANSIs* based upon linguistic analysis. The development of our hypotheses is described in Section 4, along with the primary results from our examination of the effect of market and industry *ANSIs* on market responses. Section 5 provides an examination of the asymmetric relationship between the *ANSIs* and market responses with different economic states taken into account. Finally, the conclusions drawn from this study are presented in Section 6.

2. LITERATURE REVIEW

Shiller (2000) indicates that investor behavior has been shown to be heavily influenced by news media. The effect of the news on equity markets has been of interest for a long time, although the evidence is weak in the pricing model of Roll (1988). Recently, a series of studies provided

evidence of a strong correlation between media reports and subsequent stock market reactions; this is particularly so for press releases prior to financial events, such as earnings announcements, which can have a significant impact on such market reactions.[3] Barberis, Shleifer and Vishny (1998) present a parsimonious model of investor sentiment and demonstrate underreaction of stock prices to news such as earnings announcements and overreaction of stock prices to a series of good or bad news. Unpredictable news information has a greater impact on investor behavior.

Another perspective views news as noise and a source of irrational trading behavior. DeLong, Shleifer, Summers and Waldmann (1990) posit the existence of noise traders and rational arbitrageurs, whose response to expected dividends affects market trading activity. They found that one of the potential risks from trading is driven by noise traders who possess multiple opinions and are new to the market. When noise traders experience a negative belief shock on dividends, their arbitrage activities increase volume, leading to a temporary negative shock on returns.

News coverage and positive and negative information have been investigated widely and have been applied to the construction of investment portfolios. Media coverage is also a factor, having a significant influence on the trading strategies of individual investors. Fang and Peress (2009) revealed that stocks with no media coverage earned higher returns, particularly smaller stocks and those with high individual ownership and lower analyst coverage. Their results showed that those firms with higher investor attention very easily follow market expectations, individual perceptions and private information held by the public.

Barber and Odean (2008) found a tendency among individual investors who exhibited attention-driven buying behavior to actively buy stocks on days with high trading volume,

[3] See, for example, Vega (2006), Tetlock (2007), Tetlock et al. (2008), Fang and Peress (2009), Demers and Vega (2014) and Engelberg and Parsons (2011).

days with both extremely negative and positive one-day returns, and days when stocks were in the news. They specifically noted that with regard to macroeconomic and company-specific news reported in the Wall Street Journal, there were distinct differences between the behavior of individual and institutional investors; the two types of investors employed distinct trading strategies in response to the release of good or bad news (Nofsinger, 2001). Their empirical results revealed the existence of irrational behavior by individual investors who actively bought stocks on high-attention days.

Chen, Chen and Lee (2013) used turnover volume in the local and global stock markets as proxies for local and global investor sentiment to facilitate an examination of the overall sentiment effect; their findings revealed that global sentiment had asymmetric effects on specific industries. Smales (2015b) identified a significant relationship between news sentiment and stock market returns among 12 classified industries, with this relationship fluctuating, both over time and by industry.

Sayim, Morris and Rahman (2013) examine the effect of rational and irrational investor sentiment on the stock return and volatility of US auto, finance, food, oil and utility industries. They found that the positive rational component of US individual investor sentiment tends to increase the stock return in these industries. However, the unanticipated increase in the rational component of US individual investor sentiment has a significant negative impact only on the industry volatilities of US auto and finance industries. Since the sentiment, unlike rational choice is society and culture specific, distinct impacts of investment sentiment were identified within various industries.

As the findings and statements in Sayim et al(2013) which support for the argument that behavioral models should be studied independently, therefore the general model may not necessarily be applicable to different industries. The results in Smales (2015b) also demonstrate that the risk premium can induce risk-averse investors to bear risk which is

related to non-diversifiable risk. In the present study, in addition to market-level sentiment, we aim to narrow down the market news sentiment to industry-level news sentiment by constructing news sentiment indices for specific industries.

This method for capturing news sentiment continues the discussion of a crucial issue in news-related studies. The appropriateness of the positive and negative words used in Tetlock (2007) from the Harvard Dictionary was questioned by both Engelberg (2008) and Loughran and McDonald (2011); indeed, Loughran and McDonald (2011) argued that based on the Harvard Dictionary, the negative words in 10-K filings (such as 'depreciation' and 'liability') were not negative in the context of finance and claimed that it was necessary to classify words relating to financial statements. Furthermore, based on their addition of more groups to identify relevant events for firms, Boudoukh, Feldman, Kogan and Richardson (2013) found that accuracy was greatly improved by this procedure.

Contributing to the extant literature on the impact of individual news items and its application to investment portfolios, this study presented the idea that market and industry aggregates of news sentiment could proxy as a sentiment indicator to help characterize the market atmosphere. The news analysis in this paper also recorded optimistic and pessimistic characteristic keywords and measured the news sentiment indicator for each news sample. Moreover, when distinguishing among news samples, we consider the characteristics of semantic orientation in Chinese, which may lower concerns regarding misunderstandings[4] (Lu, Chen, Ker and Wei, 2014).

The predictive ability of sentiment with respect to stock market trends can be traced to irrational investor decisions; when investors overreact to public information, the probability of irrational trading increases, thereby leading to abnormal returns and volatility. Chung et al.

[4] Lu, Y.C., Chen, J.N., Ker, S.J. and Wei, Y.C., 2014, "Methods for Sentimental Analysis of News Text," Invention Patent, P-NO 201416887, 1 May, 2014, Taiwan.

(2012) provided evidence of the asymmetric predictive power of investor sentiment on stock returns for different states of the economy, while García (2013) noted that the predictive aspects of news sentiment tended to be stronger during periods of recession. The empirical results of Smales (2015b) demonstrated the asymmetric impact of news, which varies with the business cycle and recessionary economic environments, with such asymmetry serving to increase the impact of news sentiment on volatility.[5] Finally, Tetlock (2010) demonstrated a major advantage of public news in terms of the ability to reduce information asymmetry, particularly for illiquid stocks.

The timing of news releases and their information sources affects the predictive aspect of news. Ahern and Sosyura (2014) demonstrated that both the timing and content of financial media coverage could be influenced by firms seeking to manipulate their stock price. Furthermore, both the sources of news and the recipients of related information have been shown to have different impacts on the market; for example, from their exploration of investor behavior relating to the same earnings announcement news covered by different media organizations, Engelberg and Parsons (2011) found clear evidence of a significant relationship between local media coverage and stock returns. Azuma, Okada and Hamuro (2014) use the number of electronic news articles about a stock to proxy for the stock's overall media sentiment. The evidence shows that media-covered stocks demonstrate weaker post-announcement returns than their non-media-covered counterparts.

These studies demonstrate that market conditions play an important role in the relationship between sentiment and market responses; they can promote trading activity, produce a lagged effect of market sentiment, and even present a spillover effect. These studies also call attention to areas for crucial consideration of news categories and economic

[5] The definition of 'recession' in both García (2013) and (2015b) follows the National Bureau of Economic Research (NBER) definition.

situations in future research. Our study differs from prior studies insofar as we categorize individual firm-specific news into industry-specific groups and observe the different responses between news sentiment and market responses by considering the current economic state.

We focus not only on responses in the form of stock returns but also turnover ratio and trading value; we further assume that there will be differences in terms of the influence of news between industries and investigate the asymmetric effect of news sentiment on market responses by making distinctions based on news sentiment and market state. We expect that by categorizing the process of industry news, the interactions between news reported on industry responses will be stronger; moreover, in the case of distinct news reports containing information on other industries, there will likely be spillover effects from the specific industry on variances in production, investment and stock market trading activity.

3. DATA AND VARIABLE DESCRIPTIONS

Our transaction data consist of all companies listed on the Taiwan Stock Exchange (TWSE) for the period January 2005 to December 2015; the data were obtained from the Taiwan Economic Journal (TEJ). In total, there are 2,561,948 daily news articles along with news-corpus information collected from the InfoTimes database, including the Commercial Times, China Times and Commercial Electronic Times. We identified news related to individual firms by employing the full name of the firm and the abbreviation (in both Chinese and English), as well as its stock symbol.

The trading data included stock returns, trading value and turnover ratio, as shown in Tetlock (2010). The trading volume variable is not included in the present study, specifically

as a result of the consideration of potential collinearity.[6] Furthermore, in consideration of the impact of the market fear gauge (Smales, 2013), we also incorporated the Taiwan implied volatility index (*TVIX*) into the present study essentially because the *TVIX* has come to be widely regarded as an appropriate proxy for the investor fear gauge. The *TVIX* used in this study is constructed by adjusting the latest revision of the Chicago Board Options Exchange (CBOE) *TVIX*.[7] We incorporated both the sub-index and industry characteristics into our examination, which includes the electronics sub-index, the finance sub-index and the non-finance/non-electronics sub-index.

3.1 Market and Industry Level *ANSIs*

By referring to the information quantification process of linguistic analysis adopted in Demers and Vega (2014) and Lu and Wei (2014), we identify all 'optimism' and 'pessimism' terms of each individual news article and construct the key variable 'news sentiment'. Financial jargon is included to reduce the potential bias of the textual analysis, which is similar to the approach of Loughran and McDonald (2011). We make no attempt to claim that the textual quantification approach adopted for our analysis is flawless; instead, we mainly focus on the potential influence of financial news on the market and further investigate the effects, among industries, of news reports on industry trading characteristics.

3.1.1 Firm-level analysis

For each news sample, we recorded the optimistic and pessimistic characteristic keywords and measured the news sentiment indicator for each news sample. We filtered out noise by using part-of-speech tagging, the chi-square test and artificial selection in the process of our analysis of the text documents. The characteristic term samples in our study

[6] Collinearity diagnostic tests were carried out in this study in order to avoid potential related problems; the test results revealed that when trading volume was excluded, there were no concerns with regard to potential collinearity in our subsequent analysis.

[7] The current version of the CBOE TVIX was published in 2003.

comprise a total of 963 terms for optimism and 501 terms for pessimism.[8] The news sentiment index is calculated using the 'term frequency' method, which emphasizes the number of characteristic terms appearing in a news report. During the process of distinguishing news analysis, we also consider the characteristics of semantic orientation in Chinese, which may lower concerns regarding misunderstandings[9] (Lu, Chen, Ker and Wei, 2014).

The concept behind the 'news sentiment index' (*NSI*) constructed in this study is that it is a type of news sentiment reflected by news reports relating to individual stocks, the value of which is given by a number in the [-100,100] interval. The higher the news sentiment index, the more optimistic the news report relating to the individual listed stock. The individual news sentiment index for each news report is measured as follows:

$$NSI_{i,d,m} = \frac{\sum_{j=1}^{J} PPos_{i,d,m,j} - \sum_{j=1}^{J} PNeg_{i,d,m,j}}{Nprag_{i,d,m}} \times 100\% \quad (1)$$

$$NSI_{i,d} = \frac{1}{M} \sum_{m=1}^{M} NSI_{m,d} \quad (2)$$

where $NSI_{i,d,m}$ is the news sentiment with semantic orientation[10] determination process of the m^{th} news for the i^{th} firm on day d; $PPos_{j,p,d}$ is the proportion of positive sentences to total sentences in the j^{th} paragraph of the m^{th} news for the i^{th} firm on day d; $PNeg_{j,n,d}$ is the proportion of negative sentences to total sentences in the j^{th} paragraph of the m^{th} news for the i^{th} firm on day d; $Nprag_{i,t}$ is the total number of paragraphs of m^{th} news for the i^{th} firm on day d. $NSI_{i,d}$ is the average *NSI* for the i^{th} firm on day d, which can be taken as a proxy for the news sentiment level based on public information relating to i^{th} firm.

[8] Elements of the optimistic and pessimistic characteristic terms are presented for each group in Appendix Table
[9] Lu, Y.C., Chen, J.N., Ker, S.J. and Wei, Y.C., 2014, "Methods for Sentimental Analysis of News Text," Invention Patent, P-NO 201416887, 1 May, 2014, Taiwan.

3.1.2 Market- and industry-level analysis

Monthly news is known to be inefficient, while daily news may contain too much information noise for application in trading strategies. Tetlock (2011) investigated the predictability of news on returns along with reversals based upon weekly horizons; other studies of the investment strategy (such as George and Hwang, 2004; Huynh and Smith, 2013) also investigate the weekly momentum effect. We calculate the news sentiment index for each news report and construct the market and industry news sentiment indices by considering the market value weight of each listed stock in markets and industries. We suggest that relative to daily and monthly frequency news sentiment indices, a news sentiment index based upon weekly frequency may be better able to sufficiently reflect information on market and industry trading activities.

García (2013) noted that news reported on weekends has a significant impact on stock returns on the following Monday. Thus, when aggregating the weekly news sentiment, the influence of weekend news is categorized under the following week. The weekly aggregated news sentiment index equation is expressed as follows:

$$ANSI_w = \sum_{i=1}^{I} (NSI_{i,w} \times k_{i,w-1}),\ k_{i,w} = \frac{MV_{i,w}}{\sum_{i=1}^{I} MV_{i,w}},\ NSI_{i,w} = mean\,(\sum_{d=1}^{7} NSI_{i,w-d}) \qquad (3)$$

where $ANSI_w$ is the weekly market aggregate news sentiment index for week w; $k_{i,w}$ is the market value weight for the i^{th} firm in week w; and $NSI_{i,w}$ is the average *NSI* for the i^{th} firm during all seven days of the week, measured from Saturday to Friday.

The categorization of news information and the different influences of industry characteristics have already been demonstrated (Sayim, Morris and Rahman, 2013;

, 2015a). In the present study, we further calculate the *ANSIs* at the industry level, comprising the electronics sub-index, the finance sub-index and the non-finance/non-electronics sub-index. Measures for the industry-based sentiment indices,

which are similar to those at the market level, are expressed as follows:

$$ANSI_w^{ind} = \sum_{i=1}^{Iind} (NSI_{i,w} \times k_{i,w-1}^{ind}), k_{i,w}^{ind} = \frac{MV_{i,w}}{\sum_{i=1}^{Iind} MV_{i,w}}, NSI_{i,w} = mean\,(\sum_{d=1}^{7} NSI_{i,w-d}) \quad (4)$$

where $ANSI_w^{ind}$ is the weekly market aggregate news sentiment indices derived from the industry level in week w; $k^{ind}_{i,w}$ is the market value weight for the i^{th} firm of the industry in week w; and $NSI_{i,w}$ is the average *NSI* for the i^{th} firm during all seven days of the week, measured from Saturday to Friday.

The evolution paths of the level and orthogonalized aggregate news sentiment index are illustrated in Figure 1, with Panels A to D showing the evolution of the market, finance sub-indices, electronics sub-indices and non-finance/non-electronics sub-indices, respectively. Some periods show similar trends for the weekly stock indices and *ANSIs*, while distinct trends are found in other periods. Following the literature (Baker and Wurgler, 2006, Antoniou, Doukas and Subrahmanyam, 2013, Hung, 2016) on investment sentiment construction and to control the influence of macroeconomic variables, we form a news sentiment index of the orthogonalized proxy with considering the influence from market wide. We regress *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. The residuals of this regression, labeled with a superscript *, may be clearer proxies for news sentiment. The orthogonalized *ANSIs* are used in subsequent analysis in this paper.

<Figure 1 is inserted about here>

The average market value weight to whole market (number of stocks) was found to be approximately 52.62 per cent (359) for the electronics industry, 14.39 per cent (34) for the finance industry and 32.99 per cent (332) for the non-finance/non-electronics industry. The weight of the electronics industry is found to be larger than that of both the finance and non-finance/non-electronics industries.

3.2 Summary Statistics

The summary statistics on the variables used for our study sample of stocks listed on the Taiwan Stock Exchange (TWSE) are presented in Table 1; these variables include the electronics sub-index (*EleIndex*), the finance sub-index (*FinIndex*) and the non-finance/non-electronics sub-index (*NonFinEle*) in addition to market and industry characteristics comprising trading value (*TValue*) and turnover ratio (*Turn*). News related variables include weekly aggregate news sentiment indexes, total number of news articles in each week and the percentage coverage of the listed firms in media reports. Furthermore, we form a news sentiment index of the orthogonalized proxy by following Baker and Wurgler (2006). We regress *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. The residuals of this regression, labeled with a superscript *, may be clearer proxies for news sentiment.

Panel A of Table 1 reports the summary statistics on the Taiwan Stock Exchange Capitalization Weighted Stock Index (*TAIEX*) and other market characteristics on the TWSE, with Panels B, C and D reporting the summary statistics for the finance, electronics and non-finance/non-electronics sub-indices, respectively. Panel E displays the summary statistics of the volatility index (*VIX*) and monitoring indicator (*MI*).

Over the entire period, the highest average market return is 11.36% in the Non-finance/non-electronics industry, but the highest standard deviation of average market return, 3.5026%, is in the Finance industry. The standard deviation (S.D.) of the orthogonalized *WANSI* is found to be 3.1130, which is larger than those of the *WANSIF* (0.6967), *WANSIE* (1.8286) and *WANSIN* (1.1844) sub-indices. The average total number of news in each week is 4515 for the whole market and 352 for the Finance industry, which is relatively lower than the Electronics and Non-finance/Non-electronics industry. We

incorporate the impact of different economic states to investigate the relationships between news sentiment and market characteristics; the results are reported in Panel E of Table 1. We employ the monitoring indicator (*MI*) as a proxy for the market state, classifying the market scenarios as either recessionary or expansionary states.[11] The *MI* in this study is split into five groups based on scores ranging from 9 to 39, with an average indicator of 23 representing the neutral state during our study period.

<Table 1 is inserted about here>

A correlation analysis of the *ANSIs* and the trading characteristics data is reported in Table 2; the results reveal a contemporaneous positive relationship between the *ANSIs* and the trading characteristics of index returns, trading value and turnover at both the market and industry levels. The correlations between the orthogonalized Electronics *ANSI* (*ANSIE*) and the industry index returns are found to be 0.3657, thereby representing the highest and most significant correlations, compared to those between the *ANSIs* and the index returns in other industries.

<Table 2 is inserted about here>

Furthermore, the *ANSIs* are found to have a significantly negative correlation with the implied volatility index (*TVIX*) and a positive correlation with the percentage coverage of the listed firms in the media reports (*PerC*). Compared to other industries, the orthogonalized Finance industry *ANSI* (*ANISF*) presents the highest correlation with *VIX* (–0.296), again revealing a contemporaneous relationship between *WANSIF* and market atmosphere. Market

[11] The National Development Council of Taiwan reports the monitoring indicator each month, which is a business economy reference for investment and policy decision making. The components of the monitoring indicator are close to those for economic growth and the notable proxies of the state of economy activities; the indicator score is divided into five groups ranging from 9 to 45, representing a sluggish to boom market status. The monitoring indicator used in Taiwan is an aggregate indicator constructed using nine individual components, including 'monetary aggregates M1B', 'stock price index', 'industrial production index', 'non-agricultural employment', 'customs-cleared exports', 'imports of machinery and electrical equipment', 'manufacturing sales', 'sales of trade and food service' and 'the TIER Manufacturing sector composite indicator'. Details on the content and data of this indicator are available at: http://index.ndc.gov.tw/m/zh_tw.

and industrial *ANSIs* are positively correlated to trading value and trading volume.

The return of and correlation with the VIX of the financial industry shows a higher return volatility correlated to the market state. The inference is that media reports relating to financial institutions are more sensitive because the finance industry is affected by policy adjustments in response to both domestic and global events. It can also be explained by expected beliefs and view of risk in the future; Smales (2016) demonstrate the significant negative relationship between news sentiment and the change in CDS spreads of international banks. When news sentiment is positive, the CDS spread is lower, and the expected risk is lower, which could reduce uncertainty in bank performance. Another possible reason for the increased volatility in the financial sub-index is the fact that our study period covers the financial crisis period from 2007 to 2009, which had a major negative impact on all financial institutions; indeed, Panel B of Figure 1 confirms that the lowest *ANSIF* was at the end of 2008.

4. MARKET RESPONSES TO MEDIA DISSEMINATION

4.1 Market responses to industry news releases

Consistent with the correlation analysis in Table 2, the significant contemporaneous relationships between *ANSIs* are correlated with trading activities and *VIX* at both the market and industry level. The first stage in the empirical analysis is to examine the relationships between the market *ANSI*, market returns and market responses, including trading value, turnover ratio and the VIX, in the TWSE. According to the parsimonious model of investor sentiment in Barberis, Shleifer and Vishny (1998), the findings present the overreaction of stock prices to a series of good or bad news. We make the assumption that news sentiment is negatively correlated to subsequent returns based on investor expected belief and overreaction behavior in response to news.

In the following empirical analysis, we consider the information delay and the continuing effect of news information on the trading behavior of investors along with the market responses. We begin by investigating the following: (i) whether market responses are influenced by previous news sentiment levels; and (ii) whether there are differences in the impacts of industry news sentiment to such market responses. We proceed by proposing the following hypotheses:

Hypothesis 1a: *The lagged term of the ANSI is related to market responses.*

Hypothesis 1b: *The lagged term of the industry ANSIs is related to market responses.*

Hypotheses 1a and 1b are tested based upon Equations (5) and (6), respectively. We examine the interaction between the market *ANSI* and the trading activity variables using weekly data in Equation (5) and then go on to further investigate the relationship between the lagged X^{ind} and current X^{ind} in the finance, electronics and non-finance/non-electronics industries using weekly data in Equation (6).

$$X_t = c + AX_{t-1} + \varepsilon_t \tag{5}$$

$$X_t^{ind} = c + BX_{t-1}^{ind} + \varepsilon_t \tag{6}$$

where X_t ($X^{ind}{}_t$) is a vector that includes the *TAIEX* (industry) index returns, the market (industry) trading value, the market (industry) turnover ratio, the market (industry) *ANSIs* and the volatility index. A (B) is a matrix of coefficients, where α_{ij} (β_{ij}) is the coefficient of the i^{th} variable, the j^{th} variable serves as the dependent variable, and ε_t is a vector of the residuals. The lag length l of the weekly data is equal to 1, parsimoniously determined by the Akaike information criterion (AIC) and Schwarz information criterion (SIC).

The results of Hypotheses 1a and 1b are reported in Table 3, with Panels A to D reporting the results on the overall market and the finance, electronics and non-finance/non-electronics industries, respectively. The empirical results in Table 3 reveal significantly negative

relationships between the lagged terms of the *ANSIs* and stock returns for the overall market and for the finance, electronics and non-finance/non-electronics industries; the higher the news sentiment level, the higher the subsequent stock returns. The results are consistent with the argument of overreaction of stock price to news sentiment in Barberis et al. (1998). Consistent with the highest correlation with *ANSIF* and VIX, only *ANSIFs* present a significant negative correlation to VIX, which implies that the higher the previous news sentiment level, the lower the current level of the investor fear gauge and vice versa.

A negative correlation exists between media coverage of market (*PerC*), electronics (*PerCE*) and non-finance/non-electronics (*PerCN*) industries. The evidence reveals that greater market attention would drive irrational trading behavior, causing a lower subsequent return consistent with Fang and Peress (2009) and Azuma, Okada and Hamuro (2014). On the other hand, media coverage is positively correlated to contemporaneous trading value and turnover ratio but is negatively correlated to the subsequent trading value and turnover ratio. The results show that the market would revise appropriately with a market overreaction. On the other hand, media coverage is negatively correlated to *VIX* at the market and industry level, which shows that the greater the media coverage of individual listed firms, the higher the relative optimism of the market atmosphere. In addition to the influence of news on market activities, the empirical results show that the previous turnover ratio and *VIX* are negatively correlated to news sentiment and media coverage. The phenomenon could be explained as the revision response of overexpectation in market activity.

<Table 3 is inserted about here>

The evidence presented thus far indicates that the news sentiment level extracted from public news relating to individual stocks clearly has an influence on stock return trading characteristics and *VIX*. The higher media coverage could increase contemporaneous trading activity, which would subsequently revise. Our results suggest that when news is released,

market participants may adjust their trading decisions by referring to the entire information content, leading to the initiation of trading behavior and thereby providing support for Hypotheses 1a and 1b that the lag term of the market *ANSI* and industry *ANSIs* are related to trading value, turnover and the volatility index. Conversely, however, the impact of *ANSIs* is found to be stronger and more significant on the industry *ANSIs* than the market *ANSI*, and this is particularly the case for the electronics industry. We infer that the specific industry categories could capture accurate information from the news, presenting stronger predictability in market trading activity.

4.2 Granger Causality Tests on Industry *ANSIs* and Market Responses

Numerous studies have drawn parallel conclusions on the complicated relationship between financial markets, firm performance and the stock market. Tetlock (2007), for example, found that news arrivals had a direct impact on investor behavior, while investor trading activity was also found to affect the variance in news. Such complicated interactions between news arrivals and financial markets have led to many studies focusing on the key factors affecting the influence of the variance in news; these studies report disparate results on the different categorizations of news and market responses.[12]

To investigate the interaction between news sentiment and market responses, we obtain the classified market responses under different magnitudes of news sentiment. As can be seen in table 4, most of the responses (average returns, Tvalue, turn, *VIX*, *ANSIs* and *PerC*) between the highest and lowest news sentiment categories reveal strong significant differences; thus, the evidence indicates that news sentiment may have a diverse influence on market responses when different news sentiment levels are categorized.

<Table 4 is inserted about here>

From the observation of the significant diverse market responses under the classified

[12] See Fang and Peress (2009), Tetlock (2010), Smales (2013) and García (2013).

news sentiment in table 4, we further investigate the different degrees of the interactive relationship between news sentiment and market responses by inducing a causality identification analysis in Table 5.

The tendency within the majority of studies has been to either identify media coverage as positive or negative or to distinguish among the stock return, trading activities and volatility levels. In this section, we go on to categorize news sentiment into five groups, returns (*Ret*), trading value (*TValue*), turnover ratio (*Turn*), implied volatility (*VIX*) and the percentage media coverage of listed firms (*PerC*) in the media reports for both the market and industry weekly data; we then summarize the average market responses. The purpose behind this categorization process is to explore and identify the strongest impact of news on market trading activity.

The relationship between the *ANSIs* and the market responses proposed in Hypotheses 1a and 1b are examined using a VAR model. The two sample *t*-tests in Table 4 further indicate distinct differences in the market responses when news sentiment is at higher and lower levels. We now examine whether the *ANSIs* could be leading indicators of market responses in different industries and at different news sentiment levels. Thus, we test our next hypothesis using pairwise Granger causality (Granger, 1969; Sims, 1972), as shown below:

Hypothesis 2: *The ANSI is a leading indicator of market responses.*

We implement the following equation for testing Hypothesis 2:

$$\begin{aligned} ANSI_t &= c_1 + \sum_{p=1}^{L} a_{1p} ANSI_{t-p} + \sum_{p=1}^{L} b_{1p} X_{t-p} + \varepsilon_{1t}, \\ X_t &= c_2 + \sum_{p=1}^{L} a_{2p} ANSI_{t-p} + \sum_{p=1}^{L} b_{2p} X_{t-p} + \varepsilon_{2t}, \end{aligned} \tag{7}$$

where *ANSI* refers to the weekly level of the market and industry *ANSIs* (*ANSI*, *ANSIF*, *ANSIE*, *ANSIN*). The variables (*X*) in the lower equation comprise index returns, trading

value, turnover ratio, the volatility index and the percentage coverage of listed firms (*PerC*) in media reports. The lagged term is equal to 1, parsimoniously determined by the Akaike information criterion (AIC) and Schwarz information criterion (SIC).

The results of the Granger causality test on Hypothesis 2 for both the market and industry *ANSIs* are summarized in Table 5, where the *ANSIs* are not found to Granger-cause the variables in *X* if the lagged values $ANSI_{t-p}$ do not enter the *X* equation. Similarly, the *ANSIs* are not found to Granger-cause the variables in *X* if, as a group, all of the $a_{2p}= 0$, based upon a standard *F*-test. Finally, *X* is not found to Granger-cause the *ANSIs* if all $b_{1p}= 0$. The results for the market level are presented in Panel A and those for the finance, electronics and non-finance/non-electronics industry are in Panel B, Panel C and Panel D, respectively.

<Table 5 is inserted about here>

After the classification of news sentiment, we find that in most news sentiment scenarios, the weekly *ANSI* Granger-causes the returns both at the market and industry level when the previous *ANSI* is recovering from a period of deep pessimism. The phenomenon is pronounced in quintile 3 and quintile 4, which displays relative optimism but not of an exceptionally high or low status. It indicates that news sentiment tends to lead stock returns in the relative relational period. Furthermore, the trading value and turnover ratio are driven by news sentiment when the market investment atmosphere is extremely high. The results reveal that the higher the news sentiment, the higher the market trading activity. In addition, the results indicate that there are bidirectional Granger cause relationships between news sentiment and finance industry returns in quintile 1 and quintile 3, which is interesting and worth pursuing in future research.

In summary, by categorizing news sentiment into different groups, market and industry *ANSIs* can act as leading indicators of market responses, particularly at the medium pessimistic (quintile 3) and relative optimistic (quintile 4) levels. The aggregate news sentiment index can help to initiate trading value and turnover, which means that the *ANSIs*

affect the expectations of investors and have a direct impact on trading behavior. Observations on news sentiment could be an effective proxy to distinguish market atmosphere and may also be of use in supporting decision making by investors by determining whether the market is overheating.

Prior studies have tended to focus on media coverage of individual firms, the effects on trading characteristics and their application to investment decision making.[13] Our study focuses on the effects of aggregate news sentiment on trading behavior at the market and industry level. The aggregate media effect takes into account the lagged market value weighting, which dilutes the media coverage effect on individual firms. Given the empirical results of the media effect shown and our main objectives, the media effect variables are not included in this study.[14]

5. ANALYSIS WITH CONSIDERATION OF ECONOMIC STATES

In the previous sections, we highlighted the influence of aggregate news sentiment on market trading activities, both at the market and industry level, as well as its market leading role. In the following analysis, we further investigate the interaction of *ANSIs* and VIX to observe the spillover effect of sentiment. The hypotheses examined in the following section take various economic states into consideration, all of which are categorized based on the monitoring indicator. Given that the indicator is constructed using economic activities that effectively reflect changes in the economic climate, it can therefore serve as an important decision-making reference. We have two objectives in this section: First, we aim to examine the interaction between industry news sentiment and market volatility, in which the monitoring indicator is involved; and second, we investigate whether news sentiment presents dissimilar influences on market responses during different market states.

[13] See Chan (2003), Barber and Odean (2008) and Fang and Peress (2009).
[14] Although not tabulated here, the empirical analysis results are available from the authors upon request.

5.1 Spillover Effects of Sentiment between Industries

The mechanism of information and potential influence dissemination is complicated and difficult to measure. The interaction between industry *ANSIs* and *VIX* is investigated, with the economic states taken into consideration; industry *ANSIs* and *VIX* are expected to influence the news sentiment on other industries, albeit with different magnitudes of influence based upon the current state of the economy.[15] Market volatility is the representative proxy for the market states; thus, we simultaneously analyze the interaction between the news sentiment effect and the market state proxies.

Hypothesis 3: *There will be spillover effects from news sentiment between industries, with distinct magnitudes in sluggish, stable and boom states.*

Hypothesis 3 is estimated by the following equation:

$$X_t^{NSI} = c + SX_{t-1}^{NSI} + \varepsilon_t \tag{8}$$

where $X^{NSI}{}_t$ is a vector that includes the industry *ANSIs* (*ANSIF*, *ANSIE*, *ANSIN*), and the *VIX*; S is a matrix of coefficients where δ_{ij} is the coefficient of the i^{th} variable, the j^{th} variable serves as the dependent variable and ε_t is a vector of the residuals. The lag length l of the weekly data is equal to 1, parsimoniously determined by the Akaike information criterion (AIC) and Schwarz information criterion (SIC).

The empirical results also show that the spillover effects of news sentiment between industries have distinct impacts under different economic states. The results reported in Table

[15] The market state is classified into sluggish, stable and boom periods by the monitoring indicator. A sluggish state means that the monitoring indicator is categorized at the lowest level from 9-22; the stable state means that the monitoring indicator is categorized at the middle levels from 23-31; and the boom state means that the monitoring indicator is categorized at the highest level from 32-45. Details on the content and data of this indicator are available at: http://index.ndc.gov.tw/m/zh_tw.

6 show some evidence of the spillover effects of the *ANSIs* between industries and *VIX*, in particular in the sluggish period. For instance, electronics industry news sentiment (*ANSIE*) is affected by the *VIX* and the finance industry news sentiment (*ANSIF*), with a negative impact. However, the non-finance/non-electronics industry news sentiment (*ANSIN*) presents a positive influence on both *ANSIF* and *ANSIE*. The finance and non-finance/non-electronics industries exhibit significant interactions in the sluggish state.

We find that news sentiment exhibits information transmission regardless of whether the market is in any particular economic state and that the lag term of *VIX* has a significantly negative effect on the current *ANSIF*; that is, the *ANSIF* may be lower (higher) with an increase (reduction) in the investor fear gauge. On the contrary, *VIX* has a significantly negative influence from *ANSIF* only in the stable period. However, Panels B, C and D of Table 8 show that, regardless of the market state, the spillover effects derived from the finance and non-finance/non-electronics industry may have little or no impact on the news sentiment derived from the electronics industry.

<Table 6 is inserted about here>

The overall results in Table 8 show that the finance industry is more correlated to *VIX* than are the electronics and non-finance/non-electronics industry in stable periods; moreover, the results of the sluggish period are similar to the whole period, and it seems to contain more information than the stable and boom period. The above findings provide support for the spillover effects of news sentiment between industries, with different magnitudes being discernible under different economic states.

5.2 Asymmetric Effects of News Sentiment on Market Responses

García (2013) confirmed that media coverage has stronger predictive ability on stock returns during a recessionary period, while Smales (2015b) subsequently demonstrated the significant influence of gold futures news on market volatility during a period of recession. The following analyses focus on the asymmetric effect of economic states, with an examination of whether the relationship between the *ANSIs* and trading responses differ under changing economic situations. The economic states are then split into sluggish, stable and boom periods using monitoring indicators to facilitate an investigation into the lead-lag effects between the *ANSIs* and trading responses. The hypothesis of the asymmetric effect of news sentiment is shown below:

Hypothesis 4: *The relationships between the ANSIs and market responses are asymmetric in different market states.*

We can now categorize the state of the economy and then investigate the relationships that exist between the *ANSIs* and the market responses during sluggish, stable and boom market periods, with the results of market, finance, electronics and non-finance/non-electronics summarized in Table 7, 8, 9 and 10, respectively. The empirical results of the boom period, stable period and sluggish period are reported in Panel A, Panel B and Panel C, respectively.

The empirical results indicate that the lagged news sentiment market level (*ANSI*) has a significant negative impact on returns and is positive with respect to *VIX* during the stable period. This implies that the relative optimistic news sentiment would lead to negative subsequent returns, which indicates overreaction in trading activity. When the market is overheated, market volatility increases because of revisions of expectations in the future. However, *ANSIs* have a positive impact on the subsequent trading value and turnover ratio

during the sluggish period. On the other hand, higher media coverage leads to lower market returns, trading value and turnover ratio and *VIX* during the sluggish period. Insignificant results between the impact of news sentiment on market activity are shown in the boom period. Obviously, the asymmetry effect of news sentiment and market responses exists across market states.

<Table 7 is inserted about here>

The results remain consistent, regardless of whether news sentiment is measured by the market or industry *ANSIs*. As with the finding at the market level, *ANSI* at the finance and electronics industry level are both positive with respect to the subsequent trading value during the sluggish period. Moreover, the non-finance/non-electronic *ANSI* has a negative impact on subsequent return and a positive impact on subsequent *VIX*, which is similar during the stable period to analysis at the market level. The monitoring indicator reflects the expectations of investors with regard to the state of the economy, and indeed, the *ANSIs* are found to be more sensitive to the monitoring indicator during stable and sluggish periods, leading to more pessimistic expectations.

In summary, when the economic state is taken into consideration, market and industry *ANSIs* may have an impact on market- and industry-level trading responses; the results are found to be more significant in stable and sluggish periods. We therefore confirm the asymmetric effects of news sentiment on market responses during boom, stable and sluggish states, thereby providing support for Hypothesis 4.

<Table 8 is inserted about here>

<Table 9 is inserted about here>

<Table 10 is inserted about here>

6. CONCLUSIONS

We conduct linguistic analysis to extract representative information from Chinese news reports and to construct market- and industry-level aggregate news sentiment indices (*ANSIs*) incorporating public news relating to each of the individual stocks listed on the TWSE. We provide fully integrated analyses including news reports and trading activity from the market to industry level, proposing alternative hypotheses to examine the influence of the categorized industry news on market trading activity and observing the distinct interactions between industry news sentiment indices in different market scenarios.

The evidence indicates that the industry-level news sentiment exhibits a lagged information effect and spillover effect, with these effects being quite distinct under different economic states. The significant and negative relationship between *ANSIs* and market returns is consistent with investor behavior when optimistic news sentiment appears, which leads to overreaction in trading behavior and generates negative returns consistent with Barberis, Shleifer and Vishny (1998). By categorizing news sentiment into different groups, the market and industry *ANSIs* can act as leading indicators of market responses, particularly in states that are not characterized by extreme pessimism or optimism. Finally, similar to García (2013), comparisons of economic states provide support for the view that the *ANSIs* are extremely sensitive to the macroeconomic monitoring indicator and trading responses, particularly in stable and sluggish states. The distinct levels of sensitivity to news and the asymmetric influences of the *ANSIs* at different market atmosphere levels are consistent with the viewpoint of Smales (2015a); moreover, different industry responses are shown in Smales (2015b).

The empirical results confirm that the market and industry *ANSIs* could reflect the news sentiment that investors acquire from public media, with the atmosphere inherent in the media potentially influencing their decision-making and trading behavior. The evidence supports the

fact that classified news sentiment is more informative and can capture more market and industry responses, in particular when the market state is categorized as well.

Our findings complement the extant literature on news sentiment and the effects on the stock market by taking into consideration the news categories and the interactions under different economic states. Appropriate corporate governance practices could be used to apply market- and industry-level news sentiment levels as a means of monitoring the market, with both individual and institutional market participants potentially adjusting their trading decisions by referring to current news sentiment levels. Firms providing financial information may also be able to further improve their finance models and functions to fulfill potential market demand through the application of up-to-date news information.

The primary limitations of the present study are the information sources and the technological quality of the textual analysis. Continued research is required, which would necessarily involve extensive public information sources such as additional commercial newspapers, magazines, news columns and even video sources relating to economic and investment activity. The validity and reliability of the information samples, along with the accuracy of the textual analysis, will no doubt prove to be the key determinants of such future research.

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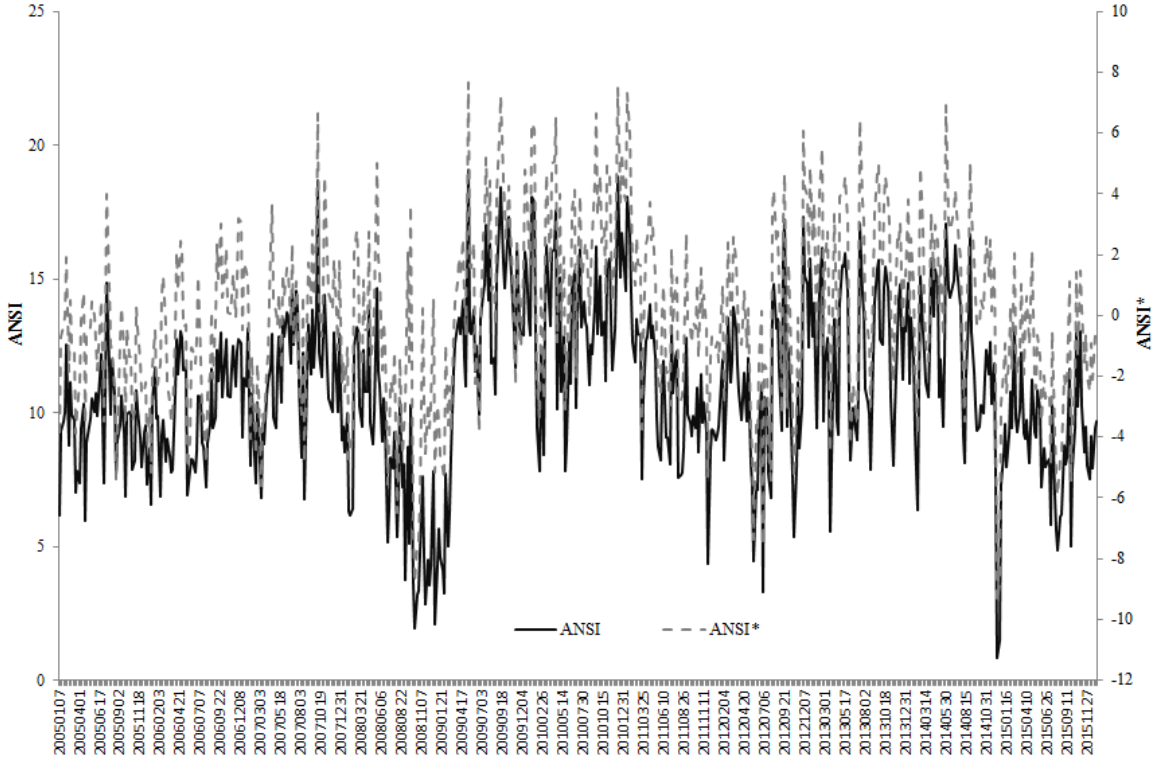
Panel A The evolution of the weekly market *ANSI* (*ANSI*)



Panel B The evolution of the Finance *ANSI* (*ANSIF*)

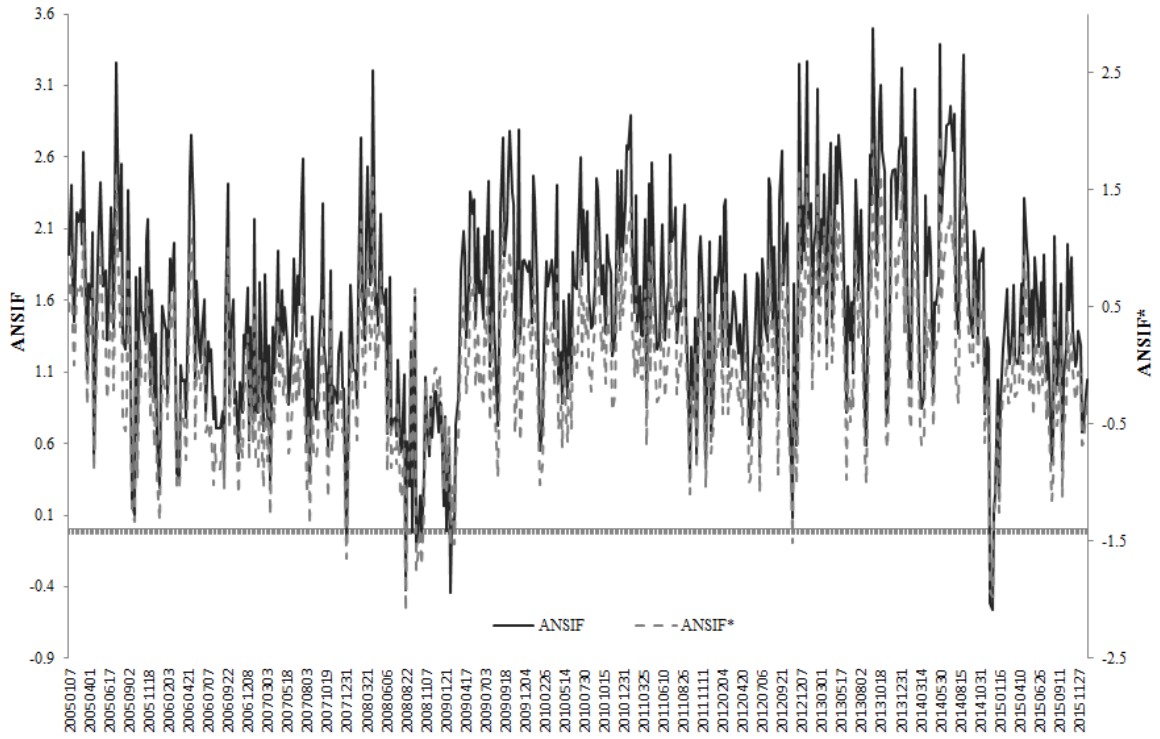
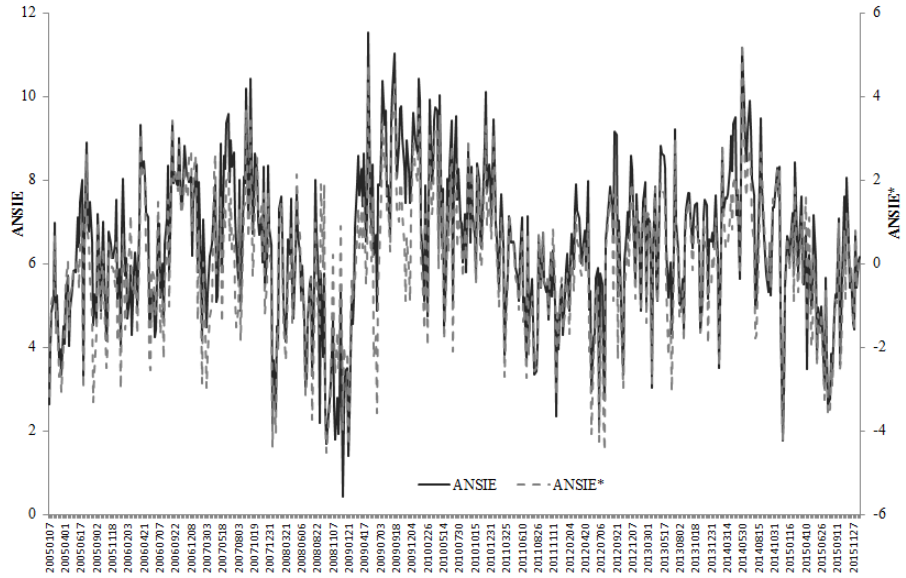


Figure 1 The evolution of the level and orthogonalized aggregate news sentiment index

(continued)

Panel C The evolution of the Electronics *ANSI* and the Electronics Sub-Indices



Panel C The evolution of the Non-finance/ Non-electronics *ANSI* (*ANSIN*)

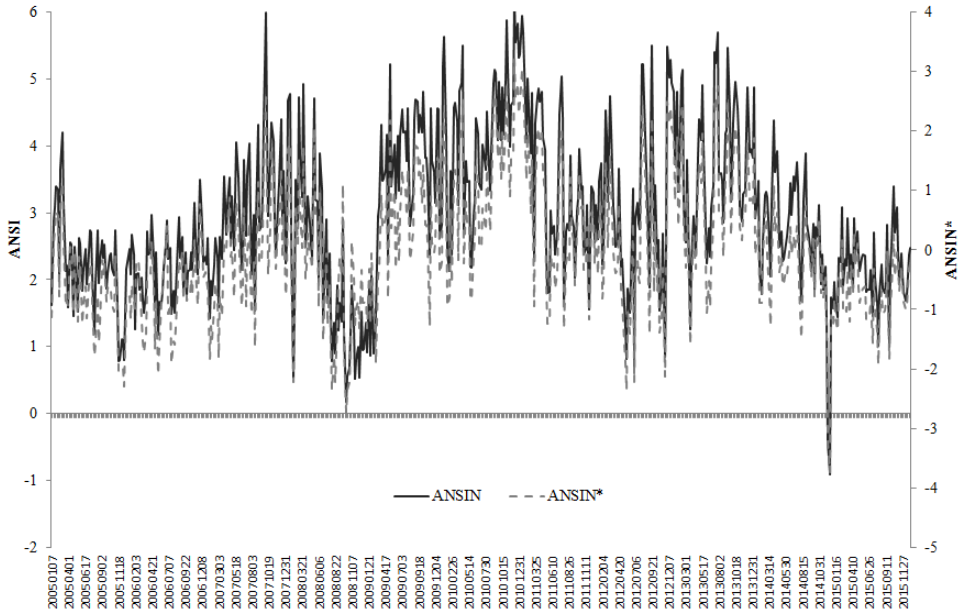


Figure 1 The evolution of the level and orthogonalized aggregate news sentiment index

Notes: This figure illustrates the historical pattern of the weekly market and industrial aggregate new sentiment index (*ANSIs*) between January 2005 and December 2015. Panel A presents the trend for the market *ANSI*, Panel B presents the trend for Finance *ANSI* (*ANSIF*) and the Finance Sub-Index, Panel C presents the trend for the weekly Electronics *ANSI* (*ANSIE*) and the Electronics Sub-Index, Panel D presents the trend for the weekly Nonfinance Nonelectronics *ANSI (ANSIN)* and the Nonfinance Nonelectronics Sub-Index. *ANSI, ANSIF, ANSIE* and *ANSIN* are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the residual of regressing *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators.

Table 1 Summary statistics of market and industry responses

Variables	Mean	Median	Std	Min	Max	Skewness	Kurtosis
Panel A Summary statistics of the TAIEX							
TAIEX	7694.5381	7840.0800	1184.4565	4171.1000	9913.28	-0.6403	3.1704
TValue	19.9467	19.9413	0.3377	18.2423	21.0431	-0.5754	5.5490
Ret	8.89%	35.14%	2.6328%	-10.6495%	9.8672%	-0.5184	4.7232
Turn	2.3482	2.1116	1.0012	0.3831	7.2376	1.3902	5.9641
PerC(%)	68.71%	64.89%	13.33%	28.25%	99.13%	0.6968	3.0597
*ANSI**	0.0000	-0.0501	2.9063	-9.3946	7.6725	-0.0907	2.9946
ANSI	10.9024	10.7617	3.1130	0.8564	19.0961	-0.1494	3.1188
MNews	4518.4268	4337	1106.419	633	8427	0.4522	1.3093
Panel B Summary statistics of the Finance industry							
Findex	932.8929	943.4300	139.9075	469.9500	1235.22	-0.7957	4.2736
TValueF	17.4014	17.3470	0.4780	15.3437	19.2039	0.4682	4.0466
RetF	5.15%	6.29%	3.5026%	-15.1258%	17.1653%	0.1199	6.4505
TurnF	1.4626	1.2355	0.8766	0.1734	6.7910	2.3469	11.0058
PerCF	88.18%	87.88%	7.75%	48.39%	100.00%	-0.7613	4.5524
*ANSIF**	0.0000	-0.0267	0.6814	-2.0972	1.9650	0.0097	2.9782
ANSIF	1.5356	1.5252	0.6967	-0.5614	3.4982	-0.0118	3.0066
FNews	352.4815	350	92.1669	53	657	0.0443	0.9600
Panel C Summary statistics of the Electronics industry							
Eindex	303.2667	303.7100	46.3328	156.0100	404.31	-0.4871	3.5558
TValueE	19.4982	19.5058	0.3330	17.8397	20.6307	-0.7315	5.8664
RetE	10.43%	43.61%	2.8790%	-10.5953%	9.6442%	-0.4898	4.2360
TurnE	3.1036	2.8584	1.1424	0.4880	8.6598	1.3593	5.9037
PerCE	65.68%	62.01%	15.00%	25.88%	99.34%	0.6016	2.6120
*ANSIE**	0.0000	0.1079	1.6924	-4.5263	5.2654	-0.1792	2.8737
ANSIE	6.4196	6.5184	1.8286	0.4428	11.5158	-0.2100	2.9460
ENews	1724.5661	1745	373.257	364	3368	0.0593	1.9730
Panel D Summary statistics of the Nonfinance Nonelectronics industry							
Nindex	9475.6822	10060.28	2012.716	5341.98	12607.03	-0.5539	1.9649
TValueN	18.4762	18.4668	0.4696	16.7113	19.7124	-0.1684	3.3617
RetN	11.36%	28.10%	2.5928%	-11.3319%	9.8881%	-0.4789	4.9270
TurnN	2.0995	1.7036	1.2192	0.2472	8.0570	1.4018	5.1960
PerCN	69.92%	66.04%	13.06%	21.91%	99.24%	0.6491	3.3146
*ANSIN**	0.0020	-0.1647	1.1428	-3.7427	3.2103	0.3263	2.9256
ANSIN	2.9495	2.7774	1.1844	-0.9141	6.2349	0.2696	2.7802
NNews	2441.3792	2218	752.5921	216	5613	0.7573	0.9775
Panel E The other variables							
VIX	20.6753	17.8740	8.3837	8.6900	56.8680	1.3019	4.5876
MI	22.5220	22.0000	7.1890	9.0000	39.0000	0.5010	-0.2433

Notes: This table presents the summary statistics on weekly market and industry-level responses between January 2005 and December 2015, with Panels A, B, C and D respectively reporting the data on the market, finance, electronics and non-finance/non-electronics industries. The *TAIEX* is the Taiwan Stock Exchange Capitalization Weighted Stock Index of the Taiwan Stock Exchange (*TWSE*); *Findex* is the finance sub-index; *EIindex* is the electronics sub-index; and *Nindex* is the non-finance/non-electronics sub-index. *Ret* (*TValue*, *Turn*, *PerC*, *MNews*), *RetF* (*TValueF*, *TurnF*, *PerCF*, *FNews*), *RetE* (*TValueE*, *TurnE*, *PerCE*, *ENews*) and *RetN* (*TValueN*, *TurnN*, *PerCN*, *NNews*) are the returns (trading value in natural logarithms, turnover ratio, the percentage coverage of the listed firms in media reports, the total numbers of weekly news) of the market, finance, electronics and non-finance/non-electronics industry, respectively. *ANSI*, *ANSIF*, *ANSIE* and *ANSIN* are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the orthogonalized *ANSI.* Panel E reports the *VIX* and the monitoring indicator of Taiwan; the *TVIX* is the Taiwan volatility index derived from the *TAIEX* options and *MI* is the monitoring indicator reported by National Development Council of Taiwan.

Table 2 Correlation analysis

Panel A Market response							
Variables	*TAIEX*	*TValue*	*Ret*	*Turn*	*VIX*	*PerC*	*WANSI**
TValue	0.3419***						
Ret	0.0654	0.1001**					
Turn	-0.1689***	0.7579***	0.1538***				
VIX	-0.499***	0.1293***	-0.0467	0.3822***			
PerC	-0.0263	0.2434***	-0.0544	0.1855***	-0.0113		
*WANSI**	0.3181***	0.2934***	0.3704***	0.2044***	-0.2157***	0.0992**	
WANSI	0.3729***	0.3855***	0.3814***	0.2809***	-0.2706***	0.1197***	0.9336***
Panel B Finance industrial responses							
Variables	*Findex*	*TValueF*	*RetF*	*TurnF*	*VIX*	*PerCF*	*WANSIF**
TValueF	0.1453***						
RetF	0.093**	0.1713***					
TurnF	-0.1663***	0.8684***	0.2522***				
VIX	-0.5684***	0.3394***	-0.0273	0.487***			
PerCF	-0.06	0.2747***	-0.0058	0.2135***	0.0927**		
*ANSIF**	0.2585***	0.2076***	0.3192***	0.1414***	-0.296***	0.1019**	
ANSIF	0.292***	0.2297***	0.3139***	0.1542***	-0.3261***	0.1065**	0.978***
Panel C Electronics industrial responses							
Variables	*Eindex*	*TValueE*	*RetE*	*TurnE*	*VIX*	*PerCE*	*ANSIE**
TValueE	0.3968***						
RetE	0.068	0.1077**					
TurnE	-0.015	0.7539***	0.1895***				
VIX	-0.4649***	0.0552	-0.0624	0.2039***			
PerCE	-0.0298	0.272***	-0.0579	0.2598***	0.0071		
*ANSIE**	0.3435***	0.298***	0.3657***	0.2366***	-0.1913***	0.1107***	
ANSIE	0.4041***	0.4048***	0.3806***	0.3414***	-0.2389***	0.1333***	0.9255***
Panel D Non-finance/ Non-electronics industrial responses							
Variables	*Nindex*	*TValueN*	*RetN*	*TurnN*	*VIX*	*PerCN*	*ANSIN**
TValueN	0.3701***						
RetN	0.039	0.1231***					
TurnN	-0.1801***	0.7759***	0.1723***				
VIX	-0.3874***	0.2164***	-0.014	0.3952***			
PerCN	0.0516	0.207***	-0.0017	0.1254***	-0.0413		
*ANSIN**	0.3805***	0.4276***	0.2743***	0.2427***	-0.0895**	0.0998**	
ANSIN	0.4102***	0.4767***	0.2915***	0.2867***	-0.1512***	0.1169***	0.9646***

Notes: This table presents the correlation coefficients between the weekly ANSIs and various market responses from January 2005 to December 2015, with Panels A, B, C and D reporting the data on the market, finance, electronics and non-finance/non-electronics industries. The *TAIEX* is the Taiwan Stock Exchange Capitalization Weighted Stock Index of the Taiwan Stock Exchange (TWSE); *Findex* is the finance sub-index; *EIindex* is the electronics sub-index; and *Nindex* is the non-finance/non-electronics. *Ret* (*TValue*, *Turnover*, *PerC*), *RetF* (*TValueF*, *TurnoverF*, *PerCF*), *RetE* (*TValueE*, *TurnoverE*, *PerCE*) and *RetN* (*TValueN*, *TurnoverN*, *PerCN*) are the returns (trading value in natural logarithms, turnover ratio, the percentage coverage of the listed firms in media reports) of the market, finance, electronics and non-finance/non-electronics industry sub-indices, respectively. *ANSI*, *ANSIF*, *ANSIE* and *ANSIN* are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the residual of regressing *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 3 Relationship between the lagged term of the Market, industrial ANSIs and responses

Panel A Market response						
Variables	*Ret*	*TValue*	*Turn*	*VIX*	*ANSI**	*PerC*
C	15.7775	8.9141***	11.6037***	2.3463	-19.6048	1.2054**
	(1.5236)	(1.5237)	(1.5238)	(1.5239)	(1.5240)	(1.5241)
Ret_{t-1}	-0.0499***	0.0034	0.0229	-0.1937***	0.1229	0.002
	(-1.0877)	(0.7807)	(2.3412)	(-5.7589)	(3.0619)	(0.8775)
$TValue_{t-1}$	-0.7767***	0.5552	-0.5708***	-0.0871***	1.0535	-0.0221***
	(-1.4515)	(10.9785)	(-5.0071)	(-0.2223)	(2.252)	(-0.8258)
$Turn_{t-1}$	0.388	0.0447	0.9315	0.3224	-0.1323***	0.0213
	(2.0276)	(2.471)	(22.8478)	(2.3003)	(-0.7911)	(2.2182)
VIX_{t-1}	-0.0175***	0**	0.0053	0.9553	-0.0232***	-0.0015***
	(-1.133)	(0.0269)	(1.6044)	(84.3454)	(-1.7125)	(-1.8978)
$ANSI*_{t-1}$	-0.0076***	0.0105	0.017	0.0127	0.5192	-0.0006***
	(-0.1711)	(2.5044)	(1.803)	(0.3913)	(13.3994)	(-0.2761)
$PerC_{t-1}$	-1.0672***	-0.2144***	-0.2477***	-0.6127***	-0.9093***	-0.1398***
	(-1.2388)	(-2.6338)	(-1.3496)	(-0.9711)	(-1.2074)	(-3.2391)
Panel B Finance industrial responses						
Variables	*RetF*	*TValue*	*TurnF*	*VIX*	*ANSIF**	*PerCF*
C	23.5596	6.4588	0.7883	-3.0725***	-1.2334***	0.4955
	(2.167)	(6.253)	(0.4323)	(-0.5073)	(-0.6897)	(2.0754)
$RetF_{t-1}$	-0.0623***	0.0051	0.0113	-0.1009***	0.0287	0.0004
	(-1.346)	(1.1701)	(1.45)	(-3.9136)	(3.7746)	(0.3886)
$TValueF_{t-1}$	-1.4304***	0.6342	-0.035***	0.2226	0.0897	0.0164
	(-2.1794)	(10.1698)	(-0.3181)	(0.6087)	(0.8308)	(1.1363)
$TurnF_{t-1}$	0.8373	0.0254	0.6475	0.2729	0.034	-0.0034***
	(2.1628)	(0.6908)	(9.9723)	(1.2655)	(0.5344)	(-0.4054)
VIX_{t-1}	-0.0233***	0.0054	0.018	0.9465	-0.0165***	0.0004
	(-1.0361)	(2.5254)	(4.7908)	(75.6496)	(-4.4685)	(0.8055)
$ANSI*_{t-1}$	-0.1856***	0.047	0.0677	-0.2382***	0.3699	0.0027
	(-0.738)	(1.9664)	(1.6046)	(-1.6998)	(8.9397)	(0.4809)
$PerCF_{t-1}$	0.7352	-0.2758***	-0.0449***	-0.0984***	-0.0438***	0.1113
	(0.3697)	(-1.4601)	(-0.1346)	(-0.0888)	(-0.1339)	(2.5478)

(continued)

Table 3 Relationship between the lagged term of the Market, industrial ANSIs and responses

Panel C Electronics industrial responses						
Variables	*RetE*	*TValueE*	*TurnE*	*VIX*	*ANSIE**	*PerCE*
C	25.283	8.6824	15.7187	1.6431	-13.6387***	1.2615
	(2.343)	(8.9985)	(5.7428)	(0.224)	(-2.6182)	(2.2495)
$RetE_{t-1}$	-0.0737***	0.0011	0.0163	-0.1639***	0.0907	0.0027
	(-1.6075)	(0.2599)	(1.3985)	(-5.2577)	(4.0981)	(1.1314)
$TValueE_{t-1}$	-1.3293***	0.5556	-0.7897***	-0.0618***	0.7337	-0.031***
	(-2.3215)	(10.852)	(-5.4371)	(-0.1589)	(2.6544)	(-1.0423)
$TurnE_{t-1}$	0.5793	0.0227	0.9057	0.2388	-0.0348***	0.0265
	(3.4232)	(1.4979)	(21.1021)	(2.0762)	(-0.4263)	(3.0124)
VIX_{t-1}	-0.0235***	0.0002	0.0039	0.9638	-0.015***	-0.001***
	(-1.5411)	(0.1386)	(1.0196)	(93.1589)	(-2.0407)	(-1.219)
$ANSIE^*_{t-1}$	-0.0239***	0.0207	0.0487	0.0574	0.4436	-0.0012***
	(-0.2933)	(2.843)	(2.36)	(1.0364)	(11.2876)	(-0.2906)
$PerCE_{t-1}$	-0.8455***	-0.1396***	-0.1701***	-0.625***	-0.3871***	-0.0947***
	(-1.0036)	(-1.8537)	(-0.7958)	(-1.0914)	(-0.9519)	(-2.1639)
Panel D Nonfinance Nonelectronics industrial responses						
Variables	*RetN*	*TValueN*	*TurnN*	*VIX*	*ANSIN**	*PerCN*
C	5.9672	4.8145	3.8587	3.5605	-10.5615***	0.2051
	(0.8162)	(6.1236)	(2.1535)	(0.6611)	(-4.5239)	(0.5647)
$RetN_{t-1}$	0.0115	0.0117	0.0483	-0.2096***	0.0436	0.0016
	(0.2569)	(2.4426)	(4.4225)	(-6.3802)	(3.0648)	(0.7007)
$TValue_{t-1}$	-0.2856***	0.7464	-0.1886***	-0.1608***	0.6005	0.0346
	(-0.6952)	(16.8949)	(-1.8735)	(-0.5315)	(4.5776)	(1.6956)
$TurnN_{t-1}$	0.1255	0.0131	0.8625	0.293	-0.1445***	-0.0014***
	(0.8039)	(0.782)	(22.5495)	(2.5482)	(-2.8986)	(-0.1773)
VIX_{t-1}	0.0028	0.0017	0.0083	0.9555	-0.0003***	-0.0015***
	(0.1883)	(1.0819)	(2.3131)	(88.7085)	(-0.0662)	(-2.0244)
$ANSIN^*_{t-1}$	-0.0188***	0.0248	0.0135	0.0116	0.5806	-0.0036***
	(-0.1667)	(2.0491)	(0.4885)	(0.1398)	(16.157)	(-0.6512)
$PerCN_{t-1}$	-1.288***	-0.276***	-0.3793***	-0.3634***	-0.3261***	-0.1604***
	(-1.4969)	(-2.9832)	(-1.7987)	(-0.5733)	(-1.1868)	(-3.7509)

Notes: This table presents the results of the relationship between the lagged market, industrial *ANSIs* and responses ranges from January 2005 to December 2015, with Panels A, B, C and D respectively reporting the data on the market, finance, electronics and non-finance/non-electronics industries. *Ret* (*TValue*, *Turn*, *PerC*), *RetF* (*TValueF*, *TurnF*, *PerCF*), *RetE* (*TValueE*, *TurnE*, *PerCE*) and *RetN* (*TValueN*, *TurnN*, *PerCN*) are the respective returns (trading value in natural logarithms, turnover ratio, the percentage coverage of the listed firms in media reports) of the market, finance, electronics and non-finance/non-electronics industry. *ANSI**, *ANSIF**, *ANSIE** and *ANSIN** are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the residual of regressing *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4 News sentiment and classified market and industrial responses

	News sentiment					t-tests		
Panel A Market response								
	1	2	3	4	5	1-3	3-5	1-5
Ret	-1.5768	-0.1574	0.2258	0.7702	1.1791	-4.6893***	-3.3896***	-7.7876***
TValue	19.8203	19.8904	19.9271	20.0368	20.0585	-2.5532**	-3.3234***	-5.4793***
Turn	2.1272	2.1772	2.3156	2.562	2.5585	-1.6631*	-1.8298*	-3.4628***
VIX	23.6506	20.885	20.5519	20.06	18.2326	2.4442**	2.285**	4.5103***
PerC	0.6615	0.6774	0.7067	0.6948	0.6951	-2.6793***	0.6581	-1.9664*
*ANSI**	-4.09	-1.5276	-0.0196	1.6123	4.0241	-28.7142***	-32.0286***	-44.565***
Panel B Finance industrial responses								
	1	2	3	4	5	1-3	3-5	1-5
RetF	-1.8879	-0.2938	0.3971	0.766	1.2728	-4.8029***	-2.1169**	-6.9466***
TValueF	17.2719	17.2836	17.4188	17.4879	17.5453	-2.545**	-1.8556*	-4.1105***
TurnF	1.3161	1.2902	1.4378	1.5697	1.6998	-1.343	-1.9656*	-3.0795***
VIX	23.9191	21.8171	21.0689	19.2192	17.355	2.4369**	3.5431***	5.9408***
PerCF	0.8725	0.8713	0.8854	0.8894	0.8905	-1.1871	-0.5549	-1.6396
*ANSIF**	-0.9453	-0.3629	-0.0137	0.3581	0.9638	-28.6196***	-31.5663***	-44.8706***
Panel C Electronics industrial responses								
	1	2	3	4	5	1-3	3-5	1-5
RetE	-1.8371	0.2054	0.3966	0.3764	1.377	-5.2147***	-3.0509***	-8.7407***
TValueE	19.355	19.4788	19.4683	19.5529	19.6356	-2.4496**	-4.0227***	-6.446***
TurnE	2.7956	3.0189	3.0385	3.1331	3.5323	-1.7219*	-3.1884***	-5.0075***
VIX	24.0162	20.771	19.7342	19.6761	19.1871	3.4036***	0.5445	3.9092***
PerCE	0.6382	0.6456	0.6628	0.6515	0.686	-1.2524	-1.1357	-2.4933**
*ANSIE**	-2.4703	-0.8626	0.1159	0.9516	2.2645	-32.6187***	-29.2662***	-46.1172***
Panel D Nonfinance Nonelectronics industrial responses								
	1	2	3	4	5	1-3	3-5	1-5
RetN	-0.8811	-0.1703	0.2765	0.2079	1.1336	-3.3898***	-2.9503***	-6.0673***
TValueN	18.252	18.2875	18.4446	18.6092	18.7877	-3.2501***	-6.2274***	-9.6574***
TurnN	1.8006	1.8141	1.9936	2.3284	2.5617	-1.3573	-3.5875***	-5.209***
VIX	21.8915	19.6389	20.5683	21.4711	19.8277	1.1126	0.732	1.8425*
PerCN	0.6751	0.6943	0.7183	0.6897	0.7186	-2.4061**	-0.0196	-2.4967**
*ANSIN**	-1.4488	-0.666	-0.1455	0.5211	1.7506	-26.7535***	-36.6819***	-46.4671***
Panel E Market and industry level *ANSI*								
	*ANSI**	*ANSIF**	*ANSIE**	*ANSIN**	*ANSI*ttest*	*ANSIF* ttest*	*ANSIE* ttest*	*ANSIN* ttest*
Sluggish	-0.4775	-0.0676	-0.2604	-0.1495	-2.8286***	-1.6897*	-2.6926***	-2.3709**
Stable	-0.1430	0.0587	-0.0127	-0.1889	-0.7918	1.1691	-0.1076	-2.6552***
Boom	2.3249	0.1388	1.1104	1.0757	7.811***	2.1737**	6.7467***	8.403***

Notes: This table presents the summary average market and industrial responses in the classified region of *ANSIs*, further it show ttest of the difference between *ANSIs* regions. The study period extends from January 2005 to December 2015. Group 1 is the smallest *ANSIs* category, and Group 5 is the largest *ANSIs* category. Panels A, B, C and D respectively reporting the data on the market, finance, electronics and non-finance/non-electronics industries. *Ret* (*TValue*, *Turn*, *PerC*), *RetF* (*TValueF*, *TurnF*, *PerCF*), *RetE* (*TValueE*, *TurnE*, *PerCE*) and *RetN* (*TValueN*, *TurnN*, *PerCN*) are the respective returns (trading value in natural logarithms, turnover ratio, the percentage coverage of the listed firms in media reports) of the market, finance, electronics and non-finance/non-electronics industry. *ANSI**, *ANSIF**, *ANSIE** and *ANSIN** are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the orthogonalized *ANSI. ANSI** is the result of ttest which is significant form zero or not. *VIX* is the Taiwan volatility index derived from *TAIEX* options. Panel E reports the results of *ANSIs* among sluggish, stable and boom period which classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 5 Granger causality between the market, industrial ANSIs and responses incorporating the quintile effect of the ANSI

c		Panel A X1 equals *ANSI**					Panel B X1 equals *ANSIF**				
	X2	Ret	TValue	Turn	VIX	PerC	RetF	TValueF	TurnF	VIX	PerCF
Quintile 1	X1 does not G.C. X2	1.856	0.4279	0.0468	0.0944	1.6664	3.2378**	0.252	0.6752	0.0722	0.6298
	X2 does not G.C. X1	0.4375	0.1213	0.0829	1.9976	0.1203	2.9477**	0.1067	0.1092	0.3495	0.3075
Quintile 2	X1 does not G.C. X2	2.833**	0.8817	0.0286	0.2157	1.534	1.4206	0.5321	0.7575	1.1228	0.4685
	X2 does not G.C. X1	0.3662	0.8174	1.1865	0.068	0.493	0.934	1.3538	0.7507	0.6479	1.9967
Quintile 3	X1 does not G.C. X2	10.7159***	2.659*	0.4239	1.6599	1.1684	5.8064***	1.2333	1.0327	0.3443	0.2313
	X2 does not G.C. X1	0.5168	0.8461	0.2811	1.0698	0.1061	2.2019*	0.4446	0.367	0.0638	0.0892
Quintile 4	X1 does not G.C. X2	8.8966***	0.0687	0.2413	1.0421	0.5038	5.6015***	2.1504	2.0211	1.3838	2.878**
	X2 does not G.C. X1	1.7209	1.0913	0.0543	0.0896	0.2615	1.2608	0.1117	0.6033	0.1337	0.7497
Quintile 5	X1 does not G.C. X2	2.4561*	2.6768*	5.4314***	1.4096	0.1051	2.8369**	5.5107***	4.6093**	2.442*	1.7017
	X2 does not G.C. X1	1.1638	1.5778	2.6797*	1.4356	0.8527	0.5135	3.0704*	2.614*	2.9988*	1.4476
Full Sample	X1 does not G.C. X2	0.6919	4.1056**	0.9432	0.5227	1.1563	1.5004	2.2853	3.5009**	1.9335	1.4851
	X2 does not G.C. X1	5.5327***	2.3863*	1.2976	1.1182	1.5657	11.442***	2.373*	1.5451	4.3637**	0.1992

(continued)

Table 5 Granger causality between the market, industrial ANSIs and responses incorporating the quintile effect of the ANSI

c		Panel C X1 equals *ANSIE**					Panel D X1 equals *ANSIN**				
	X2	RetE	TValueE	TurnE	VIX	PerCE	RetN	TValueN	TurnN	VIX	PerCN
Quintile 1	X1 does not G.C. X2	2.0846	0.6403	0.0264	1.4585	0.1833	4.4828***	0.5204	0.6629	1.0457	2.2837*
	X2 does not G.C. X1	0.1162	0.4097	0.6162	1.4682	1.7241	0.811	0.2789	0.1946	1.3829	0.5624
Quintile 2	X1 does not G.C. X2	5.202***	0.08	1.3928	0.6811	0.1437	1.4267	1.1875	1.8274	0.706	3.0142**
	X2 does not G.C. X1	0.4143	2.7147*	1.8398	0.791	1.3239	0.222	0.6732	0.8642	0.1341	1.5726
Quintile 3	X1 does not G.C. X2	3.6616**	2.1288	0.4403	2.4034*	0.2122	8.3865***	1.3754	0.2191	1.5292	0.6984
	X2 does not G.C. X1	0.232	0.6515	0.8678	1.8404	0.3135	1.2997	0.0822	0.1348	1.5185	0.7175
Quintile 4	X1 does not G.C. X2	4.8859***	0.2963	0.2781	1.8902	0.4477	2.2745*	1.1878	5.5232***	0.946	0.2275
	X2 does not G.C. X1	0.4972	0.4963	1.0795	1.5991	1.1007	0.6931	1.2797	1.4218	0.1385	2.6705*
Quintile 5	X1 does not G.C. X2	0.7469	0.3543	1.0773	0.4935	0.2528	3.9621**	3.4134**	2.8673*	0.7049	0.6641
	X2 does not G.C. X1	1.0443	2.6322*	3.0128*	1.9771	1.5307	0.5062	0.0789	0.0477	1.8861	1.2783
Full Sample	X1 does not G.C. X2	0.726	5.2548***	1.2998	0.5701	0.8149	1.2118	3.377**	0.0498	0.8301	3.3455**
	X2 does not G.C. X1	8.6841***	4.1845**	2.6795*	1.2555	1.3583	5.9389***	5.1476***	1.6551	0.0839	0.5832

Notes: This table presents the summary pairwise Granger causality tests of *ANSIs* and responses including returns trading value, turnover ratio and the volatility index for quintiles of *ANSIs*. The study period extends from January 2005 to December 2012. *Ret* (*TValue*, *Turn*, *PerC*), *RetF* (*TValueF*, *TurnF*, *PerCF*), *RetE* (*TValueE*, *TurnE*, *PerCE*) and *RetN* (*TValueN*, *TurnN*, *PerCN*) are the respective returns (trading value in natural logarithms, turnover ratio, the percentage coverage of the listed firms in media reports) of the market, finance, electronics and non-finance/non-electronics industry. *ANSI**, *ANSIF**, *ANSIE** and *ANSIN** are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics sub-indices, respectively. The *ANSI* labeled with a superscript * is the residual of regressing *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. The quintiles range from 1 (lowest) to 5 (highest). *WANSI* refers to the weekly aggregate news sentiment index. Figures report the pairwise Granger causality probabilities from a vector auto-regressive (*VAR*) model. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6 News sentiment spillover across industries and market state

Panel A Full sample period				
variables	*VIX*	*ANSIF**	*ANSIE**	*ANSIN**
C	0.7111***	0.2678***	0.383**	0.0183
	(3.0443)	(3.9513)	(2.3216)	(0.1833)
VIX_{t-1}	0.9658***	-0.013***	-0.0182**	-0.0008
	(91.5334)	(-4.2475)	(-2.4476)	(-0.1773)
$ANSIF^*_{t-1}$	-0.2955*	0.3421***	-0.2879***	-0.0269
	(-1.8869)	(7.5267)	(-2.6031)	(-0.4016)
$ANSIE^*_{t-1}$	0.0314	-0.0117	0.5283***	0.0003
	(0.5341)	(-0.6847)	(12.7239)	(0.01)
$ANSIN^*_{t-1}$	0.0104	0.1255***	0.1464**	0.6792***
	(0.1084)	(4.5081)	(2.1613)	(16.5405)

Panel B Sluggish period				
variables	VIX	ANSIF*	ANSIE*	ANSIN*
C	0.7144**	0.2381***	0.2745	-0.0134
	(2.1136)	(2.6647)	(1.2653)	(-0.1022)
VIX_{t-1}	0.9657***	-0.0122***	-0.0173*	-0.0021
	(67.0295)	(-3.197)	(-1.8723)	(-0.3679)
$ANSIF^*_{t-1}$	-0.2326	0.2597***	-0.3827**	-0.0152
	(-0.9279)	(3.9172)	(-2.3784)	(-0.156)
$ANSIE^*_{t-1}$	-0.0132	-0.0192	0.5102***	0.0051
	(-0.1463)	(-0.8055)	(8.8368)	(0.147)
$ANSIN^*_{t-1}$	-0.0425	0.1973***	0.1948*	0.6298***
	(-0.2557)	(4.49)	(1.8262)	(9.7515)

Panel C Stable period				
variables	*VIX*	*ANSIF**	*ANSIE**	*ANSIN**
C	0.5874	0.264**	0.3442	-0.2356
	(1.5573)	(2.0366)	(1.2366)	(-1.4358)
VIX_{t-1}	0.977***	-0.0117*	-0.0188	0.0092
	(52.8244)	(-1.8462)	(-1.3782)	(1.1478)
$ANSIF^*_{t-1}$	-0.4363**	0.4169***	-0.1282	0.0485
	(-2.0047)	(5.5753)	(-0.7987)	(0.5119)
$ANSIE^*_{t-1}$	0.1812**	-0.0012	0.5932***	-0.0178
	(2.0094)	(-0.0375)	(8.9138)	(-0.4544)
$ANSIN^*_{t-1}$	0.1941	0.0676	0.0656	0.6097***
	(1.2715)	(1.2885)	(0.5828)	(9.1824)

Panel D Boom state				
variables	*VIX*	*ANSIF**	*ANSIE**	*ANSIN**
C	2.9797***	0.8517**	1.6765	2.417***
	(2.6781)	(2.2125)	(1.4058)	(3.2919)
VIX_{t-1}	0.8521***	-0.038**	-0.0321	-0.0843***
	(17.2125)	(-2.2159)	(-0.6046)	(-2.5816)
$ANSIF^*_{t-1}$	-0.6303	0.255*	-0.0096	-0.0178
	(-1.4615)	(1.7084)	(-0.0207)	(-0.0625)
$ANSIE^*_{t-1}$	0.0969	-0.0248	0.2042	0.0104
	(0.7011)	(-0.5192)	(1.3786)	(0.1139)
$ANSIN^*_{t-1}$	-0.1234	0.0625	-0.119	0.3666***
	(-0.5758)	(0.8424)	(-0.5179)	(2.5923)

Notes: This table shows the results of the relationship between the industrial *ANSIs* and *TVIX*. Panel A, B, C and D present the results of full study period, sluggish state, stable period and boom period, respectively. *VIX* is the Taiwan volatility index derived from *TAIEX* options. The study period is from January 2005 to December 2012. *ANSI**, *ANSIF**, *ANSIE** and *ANSIN** are the aggregate news sentiment index for the market, finance, electronics and non-finance/non-electronics, respectively. The *ANSI* labeled with a superscript * is the orthogonalized *ANSI. VIX* is the Taiwan volatility index derived from *TAIEX* options. The research period are classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). The monitoring indicator is an aggregate indicator in Taiwan constructed using nine individual components, comprising of monetary aggregates M1B, direct and indirect finance, the stock price index, the industry-level production index, non-agricultural Employment, customs-cleared exports, imports of machinery and electrical equipment, manufacturing sales and wholesale retail and food service sales. Figures in parentheses are t-statistics. Figures in parentheses are t-statistics. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 7 The effect of market state to the relationship between the ANSI and market responses*

Panel A Boom state						
variables	*Ret*	*TValue*	*Turn*	*VIX*	*ANSI**	*PerC*
C	-24.7671	6.4932	4.2335	-26.9113	-97.8108*	0.9804
	(-0.4265)	(1.6145)	(0.3586)	(-0.8129)	(-1.7706)	(0.3163)
Ret_{t-1}	-0.158	0.0291***	0.082***	-0.1125	0.4273***	0.0091
	(-1.1526)	(3.0682)	(2.9438)	(-1.4391)	(3.2767)	(1.2394)
$TValue_{t-1}$	1.3164	0.691***	-0.1319	1.4765	5.3231*	-0.0146
	(0.4374)	(3.3151)	(-0.2156)	(0.8606)	(1.8592)	(-0.0911)
$Turn_{t-1}$	-1.1371	-0.0363	0.6282***	-0.0577	-1.1233	0.0379
	(-1.0937)	(-0.5045)	(2.972)	(-0.0974)	(-1.1356)	(0.6822)
VIX_{t-1}	0.045	-0.0046	-0.0159	0.9215***	-0.2259***	0.0015
	(0.6307)	(-0.9392)	(-1.0977)	(22.6771)	(-3.3321)	(0.3923)
$ANSI^*_{t-1}$	-0.0069	-0.0025	-0.0158	-0.021	-0.0631	-0.003
	(-0.0453)	(-0.234)	(-0.5083)	(-0.2409)	(-0.435)	(-0.3677)
$PerC_{t-1}$	1.3225	-0.088	-0.2576	-1.6942	0.8687	-0.1775
	(0.5654)	(-0.543)	(-0.5417)	(-1.2705)	(0.3904)	(-1.4218)
Panel B Stable period						
variables	*Ret*	*TValue*	*Turn*	*VIX*	*ANSI**	*PerC*
C	-25.6873	11.9222***	12.5747***	18.8051*	-36.9021***	0.1713
	(-1.6365)	(6.415)	(3.25)	(1.6896)	(-2.9318)	(0.1944)
Ret_{t-1}	0.103	0.0041	0.0583***	-0.1845***	0.1908***	0.0034
	(1.283)	(0.4293)	(2.9436)	(-3.2402)	(2.9635)	(0.7545)
$TValue_{t-1}$	1.3708*	0.3942***	-0.6488***	-1.0249*	1.9999***	0.0312
	(1.6648)	(4.0428)	(-3.1966)	(-1.7553)	(3.0287)	(0.6761)
$Turn_{t-1}$	-0.4608	0.0788**	0.9384***	0.6367***	-0.8415***	0.012
	(-1.5244)	(2.2017)	(12.5933)	(2.9705)	(-3.4714)	(0.7091)
VIX_{t-1}	-0.005	0.0058*	0.015**	0.9587***	0.0026	-0.0022
	(-0.1791)	(1.7546)	(2.1732)	(48.3477)	(0.1144)	(-1.4254)
$ANSI^*_{t-1}$	-0.1527*	0.0086	-0.0015	0.1412**	0.4809***	-0.0015
	(-1.9049)	(0.9094)	(-0.0756)	(2.4855)	(7.483)	(-0.3244)
$PerC_{t-1}$	-0.545	-0.1319	0.3993	1.5787	-1.7921	-0.141*
	(-0.3983)	(-0.8141)	(1.1838)	(1.6271)	(-1.6333)	(-1.8367)

(continued)

Table 7 The effect of market state to the relationship between the ANSI and market responses*

Panel C Sluggish period						
variables	*Ret*	*TValue*	*Turn*	*VIX*	*ANSI**	*PerC*
C	45.1472***	8.9803***	15.3264***	-3.5107	-2.2963	2.1134***
	(2.9268)	(6.7445)	(5.0386)	(-0.2954)	(-0.1725)	(2.8366)
Ret_{t-1}	-0.1073*	0.0008	0.0029	-0.2106***	0.0879	0.0006
	(-1.7293)	(0.151)	(0.2407)	(-4.4054)	(1.6424)	(0.1877)
$TValue_{t-1}$	-2.2593***	0.5513***	-0.7546***	0.2499	0.1189	-0.0683*
	(-2.8491)	(8.0544)	(-4.8257)	(0.409)	(0.1737)	(-1.7839)
$Turn_{t-1}$	0.9529***	0.0343	0.959***	0.2812	0.2492	0.0297**
	(3.5531)	(1.4813)	(18.1323)	(1.3609)	(1.0765)	(2.2908)
VIX_{t-1}	-0.0425**	-0.0003	0.0034	0.9554***	-0.0364**	-0.0019*
	(-1.9967)	(-0.1774)	(0.8182)	(58.2104)	(-1.9775)	(-1.8378)
$ANSI^*_{t-1}$	0.0128	0.0098*	0.0212*	-0.01	0.4928***	-0.0005
	(0.2046)	(1.8108)	(1.7135)	(-0.206)	(9.094)	(-0.156)
$PerC_{t-1}$	-2.0975*	-0.2043*	-0.4689*	-1.6241*	-0.0719	-0.1384**
	(-1.6939)	(-1.9117)	(-1.9204)	(-1.7024)	(-0.0673)	(-2.3148)

Notes: This table presents the results of the relationship between the lagged *ANSIs* and the market responses. Panels A, B and C reporting the results of the sluggish period, stable period and boom period, respectively. The study period extends from January 2005 to December 2015. The research period are classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). The monitoring indicator is an aggregate indicator in Taiwan constructed using nine individual components, comprising of monetary aggregates M1B, direct and indirect finance, the stock price index, the industry-level production index, non-agricultural Employment, customs-cleared exports, imports of machinery and electrical equipment, manufacturing sales and wholesale retail and food service sales. *Ret* is the market return, *TValue* is the trading value in natural logarithms, *Turn* is the turnover ratio, *PerC* is the percentage coverage of the listed firms in media reports of the market level. *ANSI** is the orthogonalized market aggregate news sentiment index. The *ANSI* labeled with a superscript * is the residual of regressing *ANSI* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 8 The effect of market state to the relationship between the ANSIF and market responses*

Panel A Boom state						
variables	*RetF*	*TValueF*	*TurnF*	*VIX*	*ANSIF**	*PerCF*
C	57.1727	11.4571***	7.1052	-23.3901	-1.521	2.4738***
	(1.2706)	(2.6529)	(0.8481)	(-1.2834)	(-0.2602)	(3.0375)
$RetF_{t-1}$	-0.1701	0.0181	0.0389	-0.0236	0.0578***	0.0044*
	(-1.3007)	(1.4405)	(1.5972)	(-0.4449)	(3.4012)	(1.8466)
$TvalueF_{t-1}$	-3.6533	0.3603	-0.3001	1.5987	0.1553	-0.0936*
	(-1.3525)	(1.39)	(-0.5968)	(1.4612)	(0.4425)	(-1.914)
$TurnF_{t-1}$	1.6715	0.1355	0.7544***	-0.6557	0.0219	0.052**
	(1.1899)	(1.0052)	(2.8845)	(-1.1524)	(0.1202)	(2.0468)
VIX_{t-1}	0.0783	0.0001	-0.0222	0.8521***	-0.0522***	0.002
	(0.6332)	(0.0048)	(-0.9643)	(17.0209)	(-3.254)	(0.8922)
$ANSIF*_{t-1}$	0.3457	0.1085	0.0812	-0.6974	0.0445	0.0262
	(0.328)	(1.0725)	(0.4139)	(-1.6335)	(0.3253)	(1.373)
$PerCF_{t-1}$	3.0616	-0.5425	-1.0954	-0.6447	-0.0515	-0.0965
	(0.4747)	(-0.8763)	(-0.9122)	(-0.2468)	(-0.0615)	(-0.8269)
Panel B Stable period						
variables	*RetF*	*TValueF*	*TurnF*	*VIX*	*ANSIF**	*PerCF*
C	-39.8651**	8.1029***	-5.9756	4.1833	-10.6368***	-1.175**
	(-2.0906)	(3.4173)	(-1.5464)	(0.3738)	(-2.8848)	(-2.193)
$RetF_{t-1}$	0.0735	0.0181*	0.0487***	-0.1156**	0.054***	-0.0021
	(0.9096)	(1.8064)	(2.9723)	(-2.4371)	(3.4575)	(-0.9148)
$TvalueF_{t-1}$	2.3571*	0.5036***	0.3397	-0.323	0.6884***	0.1177***
	(1.9347)	(3.3244)	(1.3758)	(-0.4518)	(2.9221)	(3.4377)
$TurnF_{t-1}$	-2.0431***	-0.0013	0.2015	0.3125	-0.3889***	-0.0493**
	(-2.8629)	(-0.0149)	(1.3931)	(0.7462)	(-2.8179)	(-2.4593)
VIX_{t-1}	0.0526	0.0185***	0.0367***	0.9711***	-0.0153*	-0.0022**
	(1.3027)	(3.6903)	(4.4875)	(40.9473)	(-1.955)	(-1.9794)
$ANSIF*_{t-1}$	-0.2666	0.0152	0.0097	-0.1221	0.3593***	-0.0129
	(-0.7148)	(0.3281)	(0.1288)	(-0.5576)	(4.9816)	(-1.2269)
$PerCF_{t-1}$	1.08	0.2399	0.5718	1.9333	-0.5711	0.1214
	(0.3669)	(0.6554)	(0.9586)	(1.1191)	(-1.0034)	(1.4676)

(continued)

Table 8 The effect of market state to the relationship between the ANSIF and market responses*

Panel C Sluggish period						
variables	*RetF*	*TValueF*	*TurnF*	*VIX*	*ANSIF**	*PerCF*
C	64.8957***	6.761***	3.9777*	-2.7	1.7452	0.8489***
	(4.0688)	(5.1241)	(1.6995)	(-0.2888)	(0.6768)	(2.7129)
$RetF_{t-1}$	-0.1254**	-0.0032	-0.0071	-0.1136***	0.0167*	0.0005
	(-2.0112)	(-0.6115)	(-0.7805)	(-3.109)	(1.6581)	(0.3757)
$TvalueF_{t-1}$	-3.6905***	0.6209***	-0.2007	0.2706	-0.0859	0.0015
	(-3.929)	(7.9902)	(-1.4562)	(0.4915)	(-0.5655)	(0.0798)
$TurnF_{t-1}$	2.535***	0.0609	0.8096***	0.4967	0.1559*	0.0052
	(4.4628)	(1.2955)	(9.712)	(1.4919)	(1.6976)	(0.4657)
VIX_{t-1}	-0.0963***	0.0028	0.0127***	0.9343***	-0.0188***	0.0005
	(-2.9555)	(1.0285)	(2.6565)	(48.9138)	(-3.5753)	(0.8469)
$ANSIF^*_{t-1}$	-0.307	0.0574**	0.0645	-0.2883	0.3808***	0.0054
	(-0.8898)	(2.0097)	(1.2748)	(-1.4257)	(6.828)	(0.7954)
$PerCF_{t-1}$	-2.7551	-0.377	-0.5634	-1.4667	-0.1203	-0.0033
	(-0.903)	(-1.4938)	(-1.2585)	(-0.8202)	(-0.2439)	(-0.0558)

Notes: This table presents the results of the relationship between the lagged *ANSIF* and the market responses. Panels A, B and C reporting the results of the boom period, stable period and sluggish period, respectively. The study period extends from January 2005 to December 2015. The research period are classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). The monitoring indicator is an aggregate indicator in Taiwan constructed using nine individual components, comprising of monetary aggregates M1B, direct and indirect finance, the stock price index, the industry-level production index, non-agricultural Employment, customs-cleared exports, imports of machinery and electrical equipment, manufacturing sales and wholesale retail and food service sales. *RetF* is the market return, *TValueF* is the trading value in natural logarithms, *TurnF* is the turnover ratio, *PerCF* is the percentage coverage of the listed firms in media reports of the finance industry level. *ANSIF** is the orthogonalized market aggregate news sentiment index. The *ANSIF* labeled with a superscript * is the residual of regressing *ANSIF* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 9 The effect of market state to the relationship between the ANSIE and market responses*

Panel A Boom state						
variables	*RetE*	*TValueE*	*TurnE*	*VIX*	*ANSIE**	*PerC*
C	8.5994	10.9508***	15.3372	-19.2874	-45.9271	-2.691
	(0.1579)	(2.959)	(1.2878)	(-0.641)	(-1.5468)	(-0.8844)
$RetE_{t-1}$	-0.1093	0.0313***	0.0975***	-0.0969	0.2443***	0.0047
	(-0.8668)	(3.6469)	(3.5338)	(-1.3903)	(3.5516)	(0.6645)
$TvalueE_{t-1}$	-0.5342	0.4325**	-0.776	1.0901	2.4365	0.1768
	(-0.1848)	(2.2015)	(-1.2273)	(0.6824)	(1.5458)	(1.0943)
$TurnE_{t-1}$	-0.0389	0.0586	0.9222***	0.0963	-0.1627	-0.0252
	(-0.0506)	(1.1201)	(5.4818)	(0.2266)	(-0.3879)	(-0.5862)
VIX_{t-1}	0.0471	0.0001	0.0003	0.9183***	-0.0359	0.0037
	(0.7223)	(0.0266)	(0.0194)	(25.5023)	(-1.011)	(1.0045)
$ANSIE^*_{t-1}$	-0.3418	-0.0196	-0.0563	-0.0021	-0.1191	0.0003
	(-1.4199)	(-1.1963)	(-1.0691)	(-0.0159)	(-0.9071)	(0.023)
$PerCE_{t-1}$	2.6033	0.0593	0.3553	-1.4399	0.6451	-0.1776
	(1.1666)	(0.3908)	(0.7279)	(-1.1675)	(0.5301)	(-1.4237)
Panel B Stable period						
variables	*RetE*	*TValueE*	*TurnE*	*VIX*	*ANSIE**	*PerC*
C	-10.1541	12.3238***	16.0596***	11.9063	-17.1002**	0.8373
	(-0.5688)	(6.6677)	(3.1959)	(1.0801)	(-2.0955)	(0.8654)
$RetE_{t-1}$	0.1207	-0.0065	0.0281	-0.1645***	0.1144***	0.0072
	(1.4576)	(-0.7572)	(1.204)	(-3.2151)	(3.0215)	(1.5974)
$TvalueE_{t-1}$	0.5821	0.3592***	-0.8211***	-0.6944	0.9594**	-0.0101
	(0.6044)	(3.6019)	(-3.0288)	(-1.1677)	(2.1792)	(-0.1938)
$TurnE_{t-1}$	0.0233	0.0778***	0.9557***	0.4182**	-0.1971	0.0257
	(0.0803)	(2.5929)	(11.7157)	(2.3369)	(-1.4878)	(1.6338)
VIX_{t-1}	-0.0396	0.0048	0.0069	0.9773***	-0.0206	-0.0007
	(-1.3526)	(1.5916)	(0.8378)	(54.086)	(-1.5412)	(-0.4389)
$ANSIE^*_{t-1}$	-0.2058	0.0244	0.012	0.2561***	0.4934***	-0.0054
	(-1.4281)	(1.6323)	(0.2948)	(2.8775)	(7.4882)	(-0.6912)
$PerCE_{t-1}$	-0.6437	-0.1639	0.0497	1.3019	-1.0431	-0.0672
	(-0.4501)	(-1.1071)	(0.1234)	(1.4742)	(-1.5955)	(-0.8666)

(continued)

Table 9 The effect of market state to the relationship between the ANSIE and market responses*

Panel C Sluggish period						
variables	*RetE*	*TValueE*	*TurnE*	*VIX*	*ANSIE**	*PerC*
C	50.3382***	9.3315***	22.2849***	-2.8549	-7.6023	2.3672***
	(3.1151)	(6.9191)	(5.6486)	(-0.2427)	(-0.9938)	(2.8563)
$RetE_{t-1}$	-0.1575**	0.002	0.0046	-0.1741***	0.0646**	0.0005
	(-2.5632)	(0.386)	(0.3074)	(-3.893)	(2.2208)	(0.1721)
$TvalueE_{t-1}$	-2.6391***	0.5208***	-1.13***	0.2055	0.3869	-0.0887**
	(-3.0957)	(7.3194)	(-5.4294)	(0.3312)	(0.9587)	(-2.0286)
$TurnE_{t-1}$	0.9796***	0.0123	0.9143***	0.1817	0.1083	0.0336***
	(4.2014)	(0.6304)	(16.0613)	(1.0707)	(0.9815)	(2.8093)
VIX_{t-1}	-0.0357*	0.0002	0.0047	0.9643***	-0.0172*	-0.0015
	(-1.7595)	(0.1299)	(0.9437)	(65.264)	(-1.7949)	(-1.4005)
$ANSIE^*_{t-1}$	0.0506	0.0213**	0.0762***	0.0112	0.4237***	0.0006
	(0.4399)	(2.2156)	(2.7133)	(0.1344)	(7.7835)	(0.1097)
$PerCE_{t-1}$	-1.7668	-0.1122	-0.2837	-1.3666	0.0169	-0.0959
	(-1.5041)	(-1.1441)	(-0.9892)	(-1.5983)	(0.0303)	(-1.5919)

Notes: This table presents the results of the relationship between the lagged *ANSIE* and the market responses. Panels A, B and C reporting the results of the boom period, stable period and sluggish period, respectively. The study period extends from January 2005 to December 2015. The research period are classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). The monitoring indicator is an aggregate indicator in Taiwan constructed using nine individual components, comprising of monetary aggregates M1B, direct and indirect finance, the stock price index, the industry-level production index, non-agricultural Employment, customs-cleared exports, imports of machinery and electrical equipment, manufacturing sales and wholesale retail and food service sales. *RetE* is the market return, *TValueE* is the trading value in natural logarithms, *TurnE* is the turnover ratio, *PerCE* is the percentage coverage of the listed firms in media reports of the electric industry level. *ANSIE** is the orthogonalized market aggregate news sentiment index. The *ANSIE* labeled with a superscript * is the residual of regressing *ANSIE* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Tab*le 10 The effect of market state to the relationship between the ANSIN* and market responses*

Panel A Boom state						
Variables	*RetN*	*TValueN*	*TurnN*	*VIX*	*WANSIN**	*PerCN*
C	-14.3895	1.8199	-10.4952	-17.5574	-44.2658***	2.2637
	(-0.3101)	(0.4155)	(-0.798)	(-0.6963)	(-2.7883)	(0.9445)
$RetN_{t-1}$	-0.0502	0.0385***	0.1204***	-0.1454**	0.1207***	0.0092
	(-0.3835)	(3.1144)	(3.2448)	(-2.0438)	(2.6946)	(1.363)
$TValueN_{t-1}$	0.7618	0.9387***	0.7257	1.0954	2.5979***	-0.0791
	(0.2957)	(3.8595)	(0.9938)	(0.7824)	(2.9472)	(-0.5942)
$TurnN_{t-1}$	-0.6993	-0.131	0.2926	-0.0867	-0.6948**	0.0517
	(-0.7786)	(-1.5454)	(1.1494)	(-0.1776)	(-2.2611)	(1.1154)
VIX_{t-1}	0.0723	-0.0101	-0.0345	0.9205***	-0.1033***	-0.003
	(0.8807)	(-1.2969)	(-1.4839)	(20.6227)	(-3.6756)	(-0.7146)
$ANSIN^*_{t-1}$	-0.0482	-0.0225	-0.1595	-0.08	0.0437	-0.0115
	(-0.1166)	(-0.5759)	(-1.3628)	(-0.3564)	(0.3096)	(-0.5409)
$PerCN_{t-1}$	1.6462	-0.0931	-0.4256	-1.7204	0.5665	-0.203*
	(0.6952)	(-0.4166)	(-0.6341)	(-1.3368)	(0.6992)	(-1.6597)
Panel B Stable period						
Variables	*RetN*	*TValueN*	*TurnN*	*VIX*	*ANSIN**	*PerCN*
C	-20.5135**	3.8635***	1.0404	16.0141**	-13.056***	-0.4605
	(-2.0989)	(2.9099)	(0.3562)	(2.2952)	(-4.5015)	(-0.8565)
$RetN_{t-1}$	0.0431	0.0204*	0.094***	-0.1644***	0.0775***	0.0004
	(0.5586)	(1.9411)	(4.0742)	(-2.983)	(3.3833)	(0.091)
$TValueN_{t-1}$	1.1651**	0.7982***	-0.0614	-0.9329**	0.7475***	0.0735**
	(2.1005)	(10.5933)	(-0.3706)	(-2.3558)	(4.5411)	(2.4094)
$TurnN_{t-1}$	-0.5033**	-0.01	0.7712***	0.6079***	-0.3218***	-0.0025
	(-2.1789)	(-0.3197)	(11.1705)	(3.6859)	(-4.6949)	(-0.1946)
VIX_{t-1}	0.0457	0.0065	0.0248***	0.9444***	0.0187**	-0.0037**
	(1.5449)	(1.6135)	(2.8052)	(44.7102)	(2.1254)	(-2.2698)
$ANSIN^*_{t-1}$	-0.592***	0.002	-0.0456	0.2925*	0.4805***	-0.0128
	(-2.8062)	(0.0714)	(-0.7236)	(1.9419)	(7.6743)	(-1.1058)
$PerCN_{t-1}$	-0.9509	-0.3313*	0.1598	1.6933*	-0.7401*	-0.19***
	(-0.7156)	(-1.835)	(0.4025)	(1.785)	(-1.8768)	(-2.5991)

(continued)

Table 10 The effect of market state to the relationship between the WANSIN* and market responses

Panel C Sluggish period						
Variables	*RetN*	*TValueN*	*TurnN*	*VIX*	*ANSIN**	*PerCN*
C	27.5353**	5.9918***	7.9272***	-3.8873	-6.7239*	0.7912
	(2.4129)	(5.4395)	(3.4095)	(-0.4369)	(-1.8818)	(1.4438)
$RetN_{t-1}$	-0.001	0.0047	0.0208*	-0.2357***	0.0332*	0.0007
	(-0.0173)	(0.8039)	(1.6915)	(-5.0053)	(1.7561)	(0.2421)
$TValueN_{t-1}$	-1.4637**	0.6786***	-0.4109***	0.2937	0.3662*	0.0019
	(-2.2959)	(11.0274)	(-3.163)	(0.5909)	(1.8346)	(0.0623)
$TurnN_{t-1}$	0.5063**	0.0274	0.9361***	0.1556	-0.0787	0.0027
	(2.2036)	(1.2367)	(19.9983)	(0.8684)	(-1.0938)	(0.2482)
VIX_{t-1}	-0.013	0.0008	0.0047	0.9599***	-0.0009	-0.0013
	(-0.6792)	(0.4399)	(1.199)	(64.3836)	(-0.1485)	(-1.3673)
$ANSIN^*_{t-1}$	0.1288	0.0249	0.0214	-0.0227	0.5766***	0.0002
	(0.8185)	(1.6408)	(0.6682)	(-0.1851)	(11.7066)	(0.0213)
$PerCN_{t-1}$	-1.8603	-0.2207*	-0.5126**	-1.3744	0.1224	-0.1473**
	(-1.4862)	(-1.8265)	(-2.0098)	(-1.4082)	(0.3122)	(-2.4512)

Notes: This table presents the results of the relationship between the lagged *ANSIN* and the market responses. Panels A, B and C reporting the results of the boom period, stable period and sluggish period, respectively. The study period extends from January 2005 to December 2015. The research period are classified by the monitoring indicator. A sluggish (stable and boom) state means that the monitoring indicator is categorized at the lowest level from 9-22 (23-31 and 32-45). The monitoring indicator is an aggregate indicator in Taiwan constructed using nine individual components, comprising of monetary aggregates M1B, direct and indirect finance, the stock price index, the industry-level production index, non-agricultural Employment, customs-cleared exports, imports of machinery and electrical equipment, manufacturing sales and wholesale retail and food service sales. *RetN* is the market return, *TValueN* is the trading value in natural logarithms, *TurnN* is the turnover ratio, *PerCN* is the percentage coverage of the listed firms in media reports of the non-finance/non-electronics industry level. *ANSIE** is the orthogonalized market aggregate news sentiment index. The *ANSIE* labeled with a superscript * is the residual of regressing *ANSIE* on growth rates in industrial production, durable consumption, non-durable consumption, services consumption, employment, and monitoring indicators. *VIX* is the Taiwan volatility index derived from *TAIEX* options. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Appendix Table: Characteristic terms for optimism and pessimism

Characteristic Terms			
Panel A: Optimism			
Upturn	Upper Price Limit	Profit	Victory
(好轉)	(漲停)	(獲利)	(捷報)
Benefit	Fluency	Rebound	outstanding
(受惠)	(暢旺)	(反彈)	(卓越)
inspire	powerful	active	Lead
(激勵)	(強勁)	(活躍)	(领先)
endorse	boom	excellent	recover
(贊同)	(旺季)	(出色)	(勝訴)
Optimistic	Success	focus	Explode
(樂觀)	(成功)	(焦點)	(激增)
Panel B: Pessimism			
Embroil	Fail	Frustrated	Crisis
(拖累)	(告吹)	(受挫)	(危機)
lay off employees	Over-Fall	Lower Price Limit	Bankruptcy
(裁員)	(跌破)	(跌停)	(破產)
Frustrated	Negative	Dispirit	Down
(受挫)	(負面)	(不振)	(下滑)
Lower Price Limit	secret worry	Panic	Plunge
(跌停)	(隱憂)	(恐慌)	(重挫)
Pessimistic	Dispirit	Thump	Weak
(悲觀)	(不振)	(重擊)	(疲弱)

Note: The characteristic terms describe the characteristics of the optimism and pessimism groups; the details provided in parentheses are the specific terms in Chinese. The total number of optimism (pessimism) characteristic terms in the database used in this study is 963 (501). A complete list of specific terms within each group is available from the authors upon request.