探討台灣股市新聞情緒與關注度對股票報酬、流動性與機構投資人交易行為的影響

Exploring the Impacts of News Sentiment and Attention Levels on Stock Return, Liquidity, and Institutional Investor Trading Behavior in the Taiwan Stock Market

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摘要

COVID-19 不僅改變了台灣人們的日常生活，還對國內股市產生了巨大的影響。2021 年 5 月，台灣爆發了疫情，由於負面媒體報導引發的恐慌在大多數投資者中蔓延，並且對台灣證券市場造成了巨大的衝擊。負面情緒導致許多表現優異的股票出現不合理地下跌，這表示投資者對相關事件的情緒和關注度對金融市場有顯著影響。本研究量化了新聞報導中的文本情緒，並將其與搜索量指數的變化率結合，然後使用迴歸模型來探討從 2019 年初到 2021 年底新聞情緒和關注度對台灣股市的影響。實證結果顯示，新聞情緒和關注度對股票報酬率、流動性以及外國機構投資者和投信的交易行為有顯著的正面影響。

關鍵字：文字探勘、新聞情緒、搜尋量指數、迴歸分析

JEL 分類：G11, G12, G41

政策與管理意涵

本研究整合新聞情緒與關注度，建構綜合情緒指標，探討其對台灣股市報酬、流動性與機構投資行為的影響。結果顯示，綜合情緒指標在解釋股票報酬方面優於僅分析新聞情緒的傳統研究，且在特殊時期 (如 COVID-19)表現出更強的解釋力。本研究首度結合新聞情緒與關注度，為投資決策與政策制定提供重要洞見，具有顯著的學術與實務貢獻。

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ABSTRACT

COVID-19 not only changed the daily lives of people in Taiwan, but also hugely impacted the domestic stock market. In May 2021 the epidemic broke out in Taiwan, and the panic caused by negative media reports spread among most investors and fired a tremendous shock throughout the Taiwan securities market. Negative sentiment caused many high-performing stocks to suffer irrational drops in their stock prices, demonstrating that investors' sentiment and attention to related events have a significant impact on financial markets. This research quantifies the textual sentiment in news reports, combines it with the rate of change in a search volume index, and then uses a regression model to explore the impacts of news and the level of concentration on the Taiwan stock market from early 2019 to the end of 2021. The empirical results show that news sentiment and attention have significantly positive effects on stock returns, liquidity, and the trading behavior of foreign institutional investors and investment trusts.

Keywords: Text mining, News sentiment, Search Volume Index, Regression analysis

***JEL* classifications**: G11, G12, G41

1. INTRODUCTION

The impact of media sentiment on stock market performance has been a research topic of great interest. As studies have usually divided media into news media (Tetlock, 2007, 2010, 2011, 2014; Tetlock et al., 2008; Bajo and Raimondo, 2017; Heston and Sinha, 2017; Jiao et al., 2020) and social media (Dong and Gil-Bazo, 2020; Ren et al., 2021; Long et al., 2023), our analysis focuses on the influence of news sentiment in the stock market, but we introduce two distinct aspects. First, we integrate news sentiment with the level of attention to individual stocks, which is relatively uncommon in the literature. Second, we analyze whether the impact of sentiment differs among more experienced investors.

We evaluate analyze the impact of news sentiment and attention level on the stock market and also investigate whether professional institutional investors are less influenced by sentiment. To analyze the trading behavior of professional institutional investors, this study targets the Taiwan stock market, which in 2011 ranked 12th globally in terms of trading volume. One notable characteristic of it is the composition of investors, which can be categorized into domestic individuals, domestic institutional investors (DIIs), and foreign institutional investors (FIIs). The respective proportions of these investor types from 2019 to 2022 were 62%, 11%, and 27%.[1] Taiwan thus provides a suitable research subject for analyzing institutional investors' trading behavior.

Why is it important to examine the level of attention in addition to the significant impact of news sentiment on a stock market? We illustrate this with a real case example. Figure 1 shows the trend of the Taiwan Weighted Index (TWII) and the Google Search Volume Index (SVI) from 2019 to 2022. The COVID-19 pandemic began at the end of 2019, and Taiwan's Centers for Disease Control reported its first confirmed case on January 21, 2020. February 2020 and May 2021 were the respective periods of the first and second outbreaks of COVID-19 in Taiwan. These outbreaks caused public panic and also led to a noticeable increase in Internet users' attention to the stock market. Concurrently, the weighted index experienced significant declines during these periods.

---Insert Figure 1 about here---

As time progressed and the level of attention weakened, the weighted index halted its decline and started to rebound. This suggests that the transmission of information not only affects investors' sentiment, but also impacts their level of

[1] The data on the trading proportions of different types of investors are obtained from the Taiwan Stock Exchange. (https://www.twse.com.tw/en/trading/statistics/list07-262.html)

attention to events, thus influencing the market. Moreover, the greater the magnitude of the change in attention is, the larger are the fluctuations in the stock price index. Additionally, the direction of the fluctuations is driven by investors' sentiment. When the level of attention to an event decreases, the affected subjects' trend will adjust in the opposite direction, indicating a loss of momentum.

News sentiment and investor attention both play pivotal roles in a stock market. News sentiment, particularly in financial news, directly or indirectly influences investors' decision-making and subsequently affects stock price fluctuations. Specifically, positive news sentiment can heighten investors' optimistic expectations towards a particular stock, driving up its price. Conversely, negative news sentiment can lead investors to hold a pessimistic outlook on the market's prospects, causing a drop in stock prices.

The level of attention towards specific stocks is also a significant factor influencing a stock market. Stocks that command high investor attention often see larger trading volumes, potentially resulting in more substantial price fluctuations. Bank et al. (2011) used the frequency of Internet keyword searches as a proxy variable for the degree of attention, finding a positive correlation between search volume and the liquidity of stocks. In an era where the speed of information dissemination is accelerating, the release of news can swiftly attract investor attention, creating immediate impacts on the stock market.

This study further investigates the aforementioned aspects during periods when special events occur, in order to provide references for similar situations in the future. The Taiwan stock market experienced the impacts of the COVID-19 pandemic via significantly increased volatility of many stocks' returns and abnormal changes in liquidity. The panic induced by the pandemic directly affected investors' sentiments, which in turn influenced their trading behaviors, leading to an impact on turnover and stock liquidity (Hsu et al., 2021). Several studies show that the stock market is more liquid when sentiment indices rise. Granger causality tests suggest that investor sentiment Granger-causes market liquidity (Liu, 2015; Kumari, 2019). The literature has documented that insufficient liquidity may lead to higher stock return rates, resulting in a negative association with stock returns (Amihud, 2002; Acharya and Pederson, 2005).

The study explores how the degree of attention to news sentiment affects individual stock returns. The positive coefficients for variables like composite news sentiment attention index (*ComposSent*) and news sentiment (*NewsSent*) across various models indicate that heightened attention to positive news sentiment is associated with higher stock returns. This suggests that investors react positively to favorable news, possibly due to improved market sentiment and optimism about

future performance. The findings also show that increased attention to news sentiment positively impacts the liquidity of individual stocks. This is demonstrated by the significant positive coefficients for *ComposSent* and *NewsSent* in the turnover regression models. The rationale behind this could be that positive news sentiment boosts investor confidence, leading to higher trading volumes as investors are more willing to buy and sell stocks. The study examines the influence of news sentiment on the trading behavior of institutional investors, including foreign institutional investors, investment trusts, and dealers. The results show that institutional investors are likely to buy more when there is positive news sentiment, as indicated by the positive coefficients for *ComposSent* and *NewsSent*. This behavior might be due to institutional investors' reliance on public news as a source of market information, guiding their trading decisions to capitalize on market trends.

The rest of this paper runs as follows. Section 2 explores the relevant literature and develops hypotheses. Section 3 outlines the data utilized in our study and introduces the empirical model. Section 4 analyzes the empirical findings and conducts robustness tests. Section 5 provides the conclusion of the paper.

2. LITERATURE

Many studies have explored whether investor sentiment affects stock market performance, but before examining this topic, a way to measure investor sentiment needs to be established. Brown and Cliff (2004) divide the measurement of investor sentiment into indirect and direct indicators. Indirect investor sentiment indicators cover initial public offering (IPO) day stock prices, derivative product trading, individual stock market performance, etc. Direct sentiment indicators involve directly surveying the public's views on the market through questionnaires.

Notable literature on indirect investor sentiment indicators includes Baker and Wurgler (2006), who synthesize a comprehensive sentiment variable based on the historical data of seven factors: closed-end fund discounts, stock exchange trading volume, number of stock issues, IPO day returns, initial public offerings, new share issues, and dividend premiums. Their research confirms that sentiment variables can affect stock prices, especially small-cap stocks, non-dividend-paying stocks, stocks with poor profitability, and highly volatile stocks, which are more susceptible to investor sentiment. As for direct investor sentiment indicators, Brown and Clif (2005) use a research platform (Investors Intelligence) to survey investor optimism about the market based on questionnaire data from newspapers and magazines. They examine whether sentiment affects asset pricing, finding that when investor sentiment is optimistic, stock prices tend to be overvalued, and stocks with highly positive sentiment will have significantly lower returns over the next two to three years.

There are many factors that can affect investor sentiment, and media news is a crucial one. Mindell (1961) points out that news affects market trends, but early research focused on specific and easily identifiable news events, such as macroeconomic announcements and earnings results. Mindell (1961) also notes that future research could study a wider range of news events through techniques of quantifying language.

Tetlock (2007) measures a popular Wall Street Journal column through quantitative techniques, further transforming complex news text into quantitative indicators and constructing media sentiment. Following Tetlock (2007), a large strand of academic research about quantifying news sentiment has appeared, such as Tetlock (2007, 2010, 2011, 2014), Tetlock et al. (2008), Heston and Sinha (2017), and Jiao et al. (2020) who have all done similar research. The above literature supports that news sentiment affects investor behavior.

Do different types of investors (individual investors, institutional investors, etc.) have different responses to news sentiment? The answer is yes. Lillo et al. (2015) analyze whether the total number of daily news and news semantics affected NOKIA's stock returns and volatility from 2003 to 2008 and find that governmental and non-profit organizations are weakly sensitive to news and returns or volatility, while households and companies are very sensitive. In addition to different investors having different responses, research has also analyzed different periods. Yahya et al. (2021) study the effect of COVID-19 cases on investor sentiments and stock returns of clean energy in the Asian-Pacific region, noting during the COVID-19 epidemic that positive news about the epidemic has a positive impact on individual stock returns; otherwise, it brings a negative impact. Based on the findings of the above two articles, this present study further analyzes whether different investors have varying responses to the influence of news sentiment attention.

The above literature focuses on analyzing news sentiment, but the amount of news and its textual presentation cannot truly represent its actual impact on investor sentiment, as investors do not always pay attention to companies' related news. The level of attention paid to stock prices and liquidity should not be ignored. Merton (1987) proposes the Investor Recognition Hypothesis, which posits that, under limited time and resources, general investors will only invest in a few stocks they prefer, and the stocks preferred by such investors are usually those that attract public attention. Therefore, the degree of attention will affect the price and liquidity of the stocks. We thus use turnover rate as a proxy variable for the liquidity in this study.

The early literature on measuring attention mostly has used indirect indicators. For example, Barber and Odean (2008) apply abnormal returns and trading volume as indirect indicators of attention, and Chemmanur and Yan (2009) utilize a company's

advertising expenditure. However, these indirect indicators, like abnormal returns and trading volume, can be affected by other factors. The early literature largely lacks a direct quantitative indicator to measure investors' attention to individual stocks.

Fang and Peress (2009) find that the returns of stocks not covered by the media are superior to those with more news coverage. When these two types of stocks are separately made into portfolios, they present that the return of a portfolio of stocks not covered by the media is significantly higher than that of a portfolio of covered stocks.

This present study focuses on the amount of news. Fortunately, with the rapid development of the modern Internet, we are able to apply the Google Search Volume Index (SVI) to measure the attention of Internet users to a specific keyword. Google Trend takes the number of keyword queries divided by the total number of Google searches. One can choose the date range for the query and index and standardize the results to generate a relative value ranging from 0 to 100. This allows to directly and effectively observe changes in investors' attention to individual stocks.

Da et al. (2011) observe changes in the Russell 3000 with the SVI index and note compared to other indirect indicators that SVI can more quickly reflect investors' attention, and when SVI rises, stock prices also rise in the short term and undergo price reversals within a year. Dergiades et al. (2015) believe that high attention from online media also represents high risk. Their research observes how factors like social media (Twitter, Facebook) and the Internet search indicator Google Trend affect the liquidity, spreads, and panic index of GIIPS sovereign bonds during the Eurozone crisis. They note that a rise in attention to negative news led to a simultaneous rise in Greek sovereign bond spreads and the panic index.

The literature has confirmed that investors' sentiments influence stock prices through trading activities. These sentiments may passively arise from media reports such as newspapers, magazines, and online resources or actively from news obtained through focused searches. The sentiments generated by these behaviors can lead to sentiment-driven trading activities in the market, causing stock price fluctuations (Duz Tan and Tas, 2021). When investors feel optimistic and greedy, they may buy more stocks, driving up stock prices. Conversely, when investors feel fearful and pessimistic, they may sell off stocks in large quantities, causing stock prices to drop (Da et al., 2015). This phenomenon of sentiments affecting stock prices is particularly pronounced in the short term, as short-term trading is often driven by sentiments.

Investors are divided into retail investors and professional institutional investors. In Taiwan, the three major institutional investors significantly influence market volatility due to their large holdings and trading volumes. Although institutional investors' trades rely more on professional knowledge and analysis, the trading

behaviors driven by sentimental changes triggered by special market events cannot be ignored. Nguyen and Song (2024) show that institutional investors tend to hold fewer stocks of firms that receive high media sentiment. The three major institutional investors have better information collection and interpretation capabilities, giving them a leading edge. This study explores the relationship between the composite news sentiment attention index, composed of sentiment indicators and attention levels, and the trading behaviors of the three major institutional investors, particularly whether there is a certain degree of correlation between their holding ratios and the composite news sentiment attention index. Based on the above literature, the following three hypotheses are proposed.

Hypothesis 1: The degree of attention to news sentiment has a positive effect on individual stock returns.

Hypothesis 2: The degree of attention to news sentiment has a positive effect on the liquidity of individual stocks.

Hypothesis 3: The degree of attention to news sentiment has a positive effect on the buying and selling behaviors of institutional investors.

3. METHODOLOGY

3.1 Data

This study focuses on the Taiwan stock market for two primary reasons. First, the investor structure in this market is quite unique with a significantly high proportion of domestic individuals. This allows for a comparison between the investment behaviors of individual and institutional investors. Second, the COVID-19 pandemic in 2020 severely impacted economic activities worldwide.[2] However, the Taiwan government managed to control the situation relatively well compared to other countries during this period. Thus, it is possible to compare between the pandemic and non-pandemic special periods.

To avoid issues arising from significant disparities in company sizes or liquidity risks, this study uses the Taiwan 50 Index constituents as the research sample. The Taiwan 50 Index comprises the 50 largest companies by market capitalization, accounting for approximately 70% of the total market value of the Taiwan Stock Exchange. This adequately represents the performance of the Taiwan stock market.

Among the selected 50 companies, this study excludes seven companies with insufficient news coverage and two companies with unique names, leaving 41 sample companies for investigation. The two uniquely named companies are Uni-President

[2] Reporting by Lowy Institute (https://www.lowyinstitute.org/the-interpreter/looking-keys-covid-success).

and Nan Ya Plastics. Uni-President is excluded due to its Chinese name being identical in meaning to the political terms "unification" or "reunification", resulting in a retrieval of a large amount of non-company-related news during searches. Nan Ya Plastics is omitted, because the first two characters of its Chinese name can also mean South Asia, causing it to be excluded. Appendix Table 1 presents the sample companies.

The data used in this study can be categorized into three major types: stock prices (including related variables mentioned later), sentiment indicators, and attention levels. The data on stock prices and related variables are sourced from the Taiwan Economic Journal (TEJ) Database. For the sentiment indicators, Python was used to scrape web financial news from Anue News and Economic Daily News.[3] The sentiment value, calculated from the text within the news articles, serves as a proxy variable for investor sentiment. Lastly, the Google Trend search index helps to gauge the level of attention each stock receives.

3.2 Constructing Composite News Sentiment Attention Index

The construction of the composite news sentiment attention index (hereinafter referred to as “composite sentiment”, *ComposSent*) in this study is divided into two major steps. The first collects news for text processing and sentiment analysis. The second one incorporates the level of attention to construct the composite sentiment.

First, in terms of news collection for text processing and sentiment analysis, this study utilizes daily news data over a span of 1095 days from 2019 to 2021. After completing the identification of news titles, timestamps, and content through the above-mentioned steps, we remove punctuation marks, English words, numbers, and stop words from the text content. We use the Jieba package developed by Baidu developers in China to segment the text into lists comprised of different words. These lists are then imported into the sentiment dictionary to calculate the proportion of positive and negative words. The sentiment dictionary used herein combines the National Taiwan University Semantic Dictionary (NTUSD) developed by National Taiwan University and the Chinese Financial Sentiment Dictionary (CFSD) developed by Du et al. (2022). We merge the two dictionaries and remove duplicate words. For accurate analysis, we manually add words commonly used in Taiwan’s financial field. After compiling, we have a total of 6036 positive words and 8890 negative words.

The sentiment indicator is calculated using Tetlock et al. (2008)'s method. It involves subtracting the number of negative words from the number of positive words in a single news article and then dividing it by the total number of words containing

[3] Anue (https://www.cnyes.com/) and Economic Daily News (https://money.udn.com/money/index?from=edn_header) are two important news information websites in Taiwan.

sentiment. If there are multiple related news articles on the same day, then the day's news sentiment value is calculated using the total number of positive and negative words from all the news articles. The calculation formula is:

$$NewsSent_{i,j,t} = \frac{\sum_{j=1}^{n}(Pos_{i,j,t} - Neg_{i,j,t})}{\sum_{j=1}^{n}(Pos_{i,j,t} + Neg_{i,j,t})}, \qquad (1)$$

where $NewsSent_{i,j,t}$ represents the sentiment value of the j^{th} news on day t for company i; and $Pos_{i,j,t}$ ($Neg_{i,j,t}$) represents the number of positive (negative) words in the j^{th} news on day t for company i.

Studies have proposed using Google Trends as an effective proxy for investor attention. Google Trends is now considered a valid measure of investor attention, indicating that the directional movement of stock returns, in response to changes in search volume, depends on the specific term being searched and the sentiment associated with that term (Swamy et al., 2019; Huang et al., 2020; Behrendt and Prange, 2021; Smales, 2021). The literature has primarily analyzed news sentiment, while this study includes attention levels, as they are expected to enhance explanatory power. Since news only impacts when it attracts attention, we use the relative change in the Google Search Volume Index (*CSVI*), provided by Google Trends, as an indicator to incorporate attention levels into the construction of the composite sentiment. The formula is:

$$CSVI_{i,w} = \frac{SVI_{i,w}}{SVI_{i,w-1}}, \qquad (2)$$

where $SVI_{i,w}$ represents the attention level for company i in week w; and $CSVI_{i,w}$ represents the relative change in the attention level for company i in week w.

The value of $CSVI$ is benchmarked at 1, where values greater than 1 indicate an increase in attention level, and values less than 1 indicate a decrease. The primary reason for not using the change of attention ratio is because the $NewsSent$ variable can have both positive and negative values. We then construct the composite sentiment ($ComposSent$) by multiplying $NewsSent$ by $CSVI$. Using the change of attention ratio could result in incorrect values due to the possibility of negative multiplied by negative yielding a positive. The composite sentiment constructed in this study combines the aforementioned news sentiment ($NewsSent$) and the relative change in attention level ($CSVI$). The formula for the composite sentiment ($ComposSent_{i,t}$) is:

$$ComposSent_{i,t} = NewsSent_{i,t} \times CSVI_{i,w-1}. \quad (3)$$

This study uses the relative change in the attention level ($CSVI$) as a multiplier that can further amplify or reduce news sentiment. If $CSVI$ of the previous week is greater than (less than) 1, then it will amplify (reduce) the daily news sentiment of the current week. The rationale for using the previous week's *CSVI* is based on the findings of Joseph et al. (2011), who developed a trading strategy using weekly search volumes for company tickers. They found that higher search intensity in the preceding week was associated with abnormal stock returns in the current week.

3.3 Regression Model

In accordance with the three hypotheses proposed in Section 2, this study mainly investigates whether the composite sentiment ($ComposSent_{i,t}$) affects individual stock returns, individual stock liquidity (turnover rate as a proxy), and institutional investor trading behavior. Therefore, our basic model is:

$$Ret_{i,t}, Turnover_{i,t} \ or \ Institutional_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \varepsilon_{i,t}, \quad (4)$$

where $Ret_{i,t}$ ($Turnover_{i,t}$) is stock *i*'s return (turnover rate) in day *t*. The dependent variables, in addition to returns and turnover, also include institutional investor variables $Institutional_{i,t}$, which respectively comprise three variables: *Foreign*, *InvestTrust*, and *Dealer* that respectively represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. $Main_{i,t-1}$ includes three independent variables mentioned in Equation 3: $ComposSent$, $NewsSent$, and $CSVI$. Additionally, we will compare the effects of the three main variables on the dependent variable. The above regression formula includes firm, industry, and year fixed control variables. Specifically, we incorporate firm fixed effects, industry fixed effects, and year fixed effects into the model using dummy variables to control for unobserved differences across firms, industries, and years (Tsao et al., 2021). The calculation formulae for the dependent variables are shown in equations (5), (6), and (7):

$$Ret_{i,t} = \frac{Adj\ Close_{i,t} - Adj\ Close_{i,t-1}}{Adj\ Close_{i,t-1}} \times 100\% \quad (5)$$

$$Turnover_{i,t} = \frac{Trading\ Volume_{i,t}}{Share\ Outstand_{i,t}} \times 100\% \quad (6)$$

$$Institutional_{i,t} = (Institutional\ Buy_{i,t} - Institutional\ Sell_{i,t})/100 \quad (7)$$

Here, $Adj\ Close_{i,t}$, $Trading\ Volume_{i,t}$, $Share\ Outstand_{i,t}$ are stock *i*'s adjusted closing stock price, trade volume, and number of shares outstanding in day t, respectively. $Institutional_{i,t}$ includes three types of institutional investor variables: foreign institutional investors, investment trusts, and dealers. For example, $Foreign_{i,t}$ is stock *i*'s difference between the total buying volume and the total selling volume of foreign institutional investors in day t, $Foreign\ Buy_{i,t}$ ($Foreign\ Sell_{i,t}$) is stock *i*'s foreign institutional investors total buying (selling) volume in day t. The concepts of the *InvestTrust* and *Dealer* variables are the same as those mentioned for the *Foreign* variable. They are calculated based on the total buying and selling volumes of investment trusts and dealers, respectively. In addition to discussing the three main independent variables ($ComposSent$, $NewsSent$, $CSVI$) mentioned above, we will further control for eight firm and stock characteristic variables and five macroeconomic variables.

For the eight firm and stock characteristic variables, we select the Short Sale/Margin Purchase Ratio, Volatility, Bias Ratio, Price-to-Earnings Ratio, Price-to-Book Ratio, Turnover Rate, Altman's Z Score, and Piotroski's F Score. Both Seneca (1967) and Brown and Cliff (2004) point out that the Short Sale/Margin Purchase Ratio can serve as a proxy variable for sentiment. The calculation of the Short Sale/Margin Purchase Ratio is:

$$S/M_{i,t} = \frac{ShortSelling_{i,t}}{MarginBuying_{i,t}}, \quad (8)$$

where $ShortSelling_{i,t}$ ($MarginBuying_{i,t}$) is stock *i*'s balance of short selling (margin long purchasing) in day t. The Taiwan securities market prohibits institutional investors from engaging in Short Sale and Margin Purchase transactions. Therefore, S/M represents the perspective of retail investors in Taiwan regarding the market outlook and is commonly known as the Retail Investor Indicator. According to Article 61 of the Securities and Exchange Act, "*The permissible amount, terms, financing ratio, and the margin percentage required for margin purchases and short sales for securities transactions shall be prescribed by the Competent Authority after consultation with and consent from the Central Bank of China.*" Therefore, the quantity of securities available for short selling must not exceed the quantity available for margin purchases. As a result, the S/M variable will range between 0 and 1. When more retail investors believe that the company's stock price will decline in the future, they will short sell the

company, causing the S/M number to be closer to 1; conversely, it will be closer to 0.

Brown and Cliff (2004) also indicate that volatility can serve as a proxy variable for sentiment. In this study we mainly use two types of volatility as control variables. The first is daily volatility ($Volatility_{i,t}$), which represents the daily sentiment performance of individual stocks; the second is short-term volatility, for which the chosen proxy variable is the Bias Ratio ($Bias_{i,t}$). This study refers to the Rogers and Satchell (1991) model to calculate daily volatility ($Volatility_{i,t}$), but because the Taiwan securities market has a price limit system, the calculation method for daily volatility ($Volatility_{i,t}$) is revised as shown in Equation (9), and the calculation method for Bias Ratio ($Bias_{i,t}$) is shown in Equation (10):

$$Volatility_{i,t} = \left(\left|\ln(H_{i,t}) - \ln(O_{i,t})\right| + \left|\ln(H_{i,t}) - \ln(C_{i,t})\right| + \left|\ln(L_{i,t}) - \ln(O_{i,t})\right| + \left|\ln(L_{i,t}) - \ln(C_{i,t})\right| + \left|\ln(O_{i,t}) - \ln(C_{i,t-1})\right| + \left|\ln(C_{i,t}) - \ln(C_{i,t-1})\right|\right)/2 \times 100 \quad (9)$$

$$Bias_{i,t} = \frac{C_{i,t} - MA14_{i,t}}{MA14_{i,t}}. \quad (10)$$

Here, $Volatility_{i,t}$ ($Bias_{i,t}$) is stock *i*'s daily volatility (Bias Ratio) in day *t*; $H_{i,t}$ is stock *i*'s daily highest price in day *t*; O, L, and C represent the opening price, the lowest price, and the closing price, respectively; and $MA14_{i,t}$ is stock *i*'s 14-day moving average price in day *t*. In Equation (9), the modified formula, by using absolute log differences and including the previous day's closing price, aims to measure the absolute magnitude of daily price changes, irrespective of their direction. The inclusion of the previous day's closing price may help to better capture the overall volatility experienced by the asset from one trading session to the next. This study prefers the modified formula for calculating volatility over the Rogers and Satchell (RS) estimator, as it provides a more comprehensive measure by incorporating absolute price changes and previous day's closing prices, thereby offering a clearer representation of overall price movement magnitude.

The last five control variables we introduce in this study are the Price-to-Earnings Ratio ($P/E_{i,t}$), Price-to-Book Ratio ($P/B_{i,t}$), Turnover Rate ($Turnover$), Altman's Z Score ($Zscore$), and Piotroski's F Score ($Fscore$). The main reason for including these is that the Taiwan Stock Exchange provides three key pieces of information on its website at the end of each trading day: Dividend Yield, Price-to-Earnings Ratio, and Price-to-Book Ratio. The calculation of Dividend Yield is the annual dividend divided by the stock price. The announcements of dividends typically occur around May each

year, with the dividends distributed around July. However, following the dividend distribution, the dividend yield is still calculated based on the then-issued dividend, which may result in distortion. Therefore, we exclude Dividend Yield.

Trading volume is an important indicator in technical analysis. According to Chandrapala (2011), past trading volume change negatively relates to stock returns. Although Chen (2012) notes that the evidence for trade volume predicting returns is weaker, this paper prudently includes trading volume in the regression model by adding the turnover rate variable of individual stocks. The calculation method for turnover is shown in equation (6). However, when turnover is used as an independent variable, it refers to the turnover rate of the previous period.

Finally, the variables mentioned above are more focused on stock fundamentals or technical indicators, lacking related indicators of a company's financial condition. Therefore, this paper also includes the Z score proposed by Altman (1968) and Altman et al. (2017) and the F score proposed by Piotroski (2000). The Z score is an important indicator of financial risk, where a lower score indicates a higher likelihood of bankruptcy. The F score lists nine financial conditions, giving 1 point for each met condition and 0 points otherwise, with a total score of 9 points. A higher score indicates better financial health. Piotroski (2000) also states that companies with better financial health have better stock returns. Therefore, we include the Z score and F score in the regression analysis as part of the firm and stock characteristic variables. However, when using these two variables, financial companies are excluded due to differences in their financial statements compared to other industries.

For the five macroeconomic variables, we refer to Su et al. (2016) and select Real Gross Domestic Product ($RGDP$), Industrial Production Index (IPI), Real Index of Producer's Shipment for Manufacturing ($MANUF$), Real Customs-Cleared Exports ($REXP$), and Average Monthly Overtime Hours of Industry and Service (WHR). The complete regression model is:

$$\begin{aligned} Ret_{i,t}, Turnover_{i,t} \ or \ Institutional_{i,t} \\ &= \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} \\ &+ \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} \\ &+ \beta_8 Zscore_{i,t-1} + \beta_9 Fscore_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t \\ &+ \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t} \end{aligned} \quad (11)$$

To summarize this model, this study has 5 dependent variables, where *Ret* and *Turnover* respectively represent stock return and turnover rate. *Foreign*, *InvestTrust*, and *Dealer* respectively represent the net buy-and-sell quantity (a unit is 100 board

lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. The independent variables include 3 main variables. *ComposSent*, *NewsSent*, *CSVI* represent the composite sentiment, news sentiment, the relative change in the Google Search Volume Index, respectively, which are the main independent variables to be examined in this study. Additionally, there are eight other firm and stock characteristic variables: *S/M, Volatility, Bias, P/E, P/B, Turnover, Zscore, and Fscore*; they respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate, Altman's Z score and Piotroski's F score. Finally, there are 5 macroeconomics variables: *RGDP*, *IPI*, *MANUF*, *REXP*, and *WHR*; they respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service.

We lastly divide the regression into six models for verification, summarized in Appendix Table 2. Model 1 is the basic model considering only the effects of *ComposSent*, *NewsSent*, and *CSVI* on the dependent variables. Model 2 includes six firm and stock characteristic variables. Model 3 includes five macroeconomic variables. Model 4 includes both six firm and stock characteristic variables and five macroeconomic variables. Model 5 is based on Model 4 with the addition of the F score, which reduces the sample size by about 30%. Due to the collinearity issue between the Z score and P/B, Model 6 includes the Z score while removing the P/B ratio.

4. EMPIRICAL OUTCOMES

Panel A and Panel B of Table 1 show the descriptive statistics for the dependent and main independent variables of this study, respectively. The total sample size is 19,228. *ComposSent* is the main variable with an average value of 0.449. *NewsSent* is a variable ranging between -1 and 1. A median value of 0.455 indicates during the study period that there were more positive news sentiment than negative ones. *CSVI* is a variable benchmarked at 1. A median of 1 and a mean of 1.116 indicate a slight increase in attention levels during the study period. Panels C and D of Table 1 present the descriptive statistics for the firm and stock characteristic variables and the macroeconomic variables, respectively. We see that the sample sizes for *Zscore* and *Fscore* are smaller, primarily due to the exclusion of the financial industry. The study further categorizes *ComposSent* by three different industries, shown in Panel E of Table 1. The average values for these three industries are 0.451, 0.462, and 0.432, respectively. The differences are not substantial, but the electronics industry exhibits the greatest range and the highest standard deviation.

---Insert Table 1 about here---

The correlation coefficient is an indicator that measures the degree of closeness between variables. Table 2 presents the correlation coefficient matrix of the variables. The results show that the highest correlation coefficient is 0.875 between $Turnover_t$ and $Turnover_{t-1}$, followed by a correlation coefficient of 0.864 between *MANUF* and *REXP*. To avoid issues of multicollinearity, the Variance Inflation Factor (VIF) is used for testing. A smaller VIF value indicates less multicollinearity. We use *Ret* as the dependent variable for the VIF test. The results of the VIF test appear in Table 3. From the results in the first three columns, we find that the VIF values for the three main independent variables, *ComposSent*, *NewsSent*, and *CSVI*, when paired with other independent variables are only 1.0996, 1.1898, and 1.0533, respectively. However, for the other independent variables, the VIF value for *Zscore* exceeds 10. According to Cohen et al. (2003), a VIF greater than 10 indicates severe multicollinearity. From Table 2, we find that the correlation coefficient between *Zscore* and *P/B* is 0.512. Therefore, in the results of columns 4 and 5, where *Zscore* and *P/B* are respectively removed, all VIF values are below 10.

---Insert Tables 2 and 3 about here---

First, this study examines the impact of the composite sentiment on individual stock returns (Hypothesis 1). The study further presents the descriptive statistics of returns for samples in the top 25% and bottom 25% of the composite sentiment (*ComposSent*) in Panel A of Table 4. The results reveal that the stock returns for the group with a high composite sentiment are greater than those for the group with a low composite sentiment. This suggests that stocks tend to perform better when they are viewed more optimistically and receive more attention. The same pattern is also observed across three different industries.

Second, this study explores the impact of the composite sentiment on individual stock liquidity (Hypothesis 2). The study further presents the descriptive statistics of the daily turnover rate for stocks in the top 25% and bottom 25% of the composite sentiment (*ComposSent*) in Panel B of Table 4. The results reveal that the stocks in the high composite sentiment group have lower daily turnover rates compared to those in the low composite sentiment group. This indicates in more optimistic and high attention scenarios that individual stock liquidity tends to be weaker. However, observing three different industries shows that the electronics industry exhibits the opposite behavior. One possible reason could be that the study period includes the time of COVID-19, when the demand for electronic products surged, attracting

significant public attention. This increased the turnover rate, thereby overshadowing investor focus on the other two industries.

Finally, we also conduct a difference test for the top 25% and bottom 25% of returns (turnover). The results show that the returns (turnover) of the top 25% are significantly higher (lower) than those of the bottom 25%.

---Insert Table 4 about here---

Regarding the test of Hypothesis 1, we use the regression model of equation (11) to explore the relationship between the three main independent variables and individual stock returns. Models 1 and 2 are presented in Table 5. Models 3 and 4 are presented in Table 6. Models 5 and 6 are presented in Table 7. We discuss the impact of the three main independent variables on individual stock returns separately in Model 1. We find that *ComposSent* and *NewsSent* have a significantly positive impact on individual stock returns, while *CSVI* is not significant. This implies for a company receiving high levels of attention that the more positive the news sentiment on a given day is, the higher the stock's return will be. We also find that the *t*-value of *ComposSent* is greater than that of *NewsSent*, indicating that although *CSVI* is not significant, it can have an amplifying effect. Therefore, *ComposSent* has greater explanatory power compared to *NewsSent*. We cannot ignore the contribution of the *CSVI* variable.

In Model 2, where we include firm and stock characteristic variables, we find that *ComposSent* and *NewsSent* continue to have a significantly positive impact on individual stock returns. The *t*-value of the *ComposSent* is still greater than that of *NewsSent*. In the firm and stock characteristic variables of Model 2, *P/B* (Price-to-Book ratio) and *Turnover* reach significance levels of 1% (negative) and 1% (positive), respectively. This suggests during the period of this study that stocks of companies with lower price-to-book ratios (considered value stocks) and higher previous day's turnover rate tend to perform better in terms of returns.

We continue to examine Models 3 and 4 in Table 6. Model 3 controls for macroeconomic variables, while Model 4 controls for both firm and stock characteristic variables and macroeconomic variables. We still find that the explanatory power of the *ComposSent* variable is greater than that of *NewsSent* and *CSVI*. This indicates that considering the country's economic conditions does not diminish the impact of *ComposSent* on individual stock returns.

In the final two models, Model 5 and Model 6, for testing Hypothesis 1 (Table 7), we include the financial condition variables, *Zscore* and *Fscore*. *Fscore* has a significantly positive impact on individual stock returns. This indicates that companies with better financial health (higher F score) have higher returns. *Zscore* has a

significantly negative impact on individual stock returns, indicating that companies with a higher probability of bankruptcy (lower Z score) have higher returns during the study period. These companies tend to be value stocks (with lower P/B ratios). The explanatory power of *ComposSent* is significantly positive from Model 1 to Model 6, and it is superior to *NewsSent* and *CSVI*. The empirical results mentioned above support our Hypothesis 1.

---Insert Table 5, 6, and 7 about here---

Regarding the test of Hypothesis 2, we also use the 6 models mentioned in Appendix Table 2 to individually verify the relationship between the three main independent variables and individual stock turnover. Models 1 and 2 are presented in Table 8. Models 3 and 4 are presented in Table 9. Models 5 and 6 are presented in Table 10.

From Model 1 in Table 8, the findings show that the composite sentiment (*ComposSent*) has a significantly positive impact on the daily turnover rate of individual stocks (*Turnover*). This means that a high attention company, when exhibiting more positive news sentiment on a given day, will have a higher stock turnover rate. An interesting finding is that *NewsSent* is not significant, while *CSVI* has a significantly positive impact. This is different from the results where individual stock returns are used as the dependent variable. This result can be reasonably explained. Before trading a particular stock, investors are likely to search for relevant information about that stock online.

In Model 2, *ComposSent* still has a significantly positive impact on individual stock turnover. After controlling for firm and stock characteristic variables, *NewsSent* also shows a significantly positive effect, but its *t*-value is still slightly smaller than that of *ComposSent*. The explanatory power of *CSVI* significantly decreases in Model 2 (*t*-value drops from 6.49 to 1.73), indicating that the explanatory power of *CSVI* is affected by the control variables.

From Model 3 and Model 4 in Table 9, additional control variables for macroeconomic conditions are introduced, including *RGDP*, *IPI*, *MANUF*, *REXP*, and *WHR*. These macroeconomic variables help to capture the broader economic environment's impact on stock turnover. The results show that *ComposSent* continues to have a significantly positive impact on turnover (*t*-value of 2.02), demonstrating that news sentiment attention remains a strong predictor even after accounting for macroeconomic factors. However, *CSVI* in Model 3 seems to have a very high explanatory power. If we further examine Model 4, we can observe that when we also control for firm and stock characteristic variables, its explanatory power becomes

insignificant.

From Model 5 and Model 6 in Table 10, further controls for firm-specific risk characteristics are added, specifically the Zscore (Altman's Z-score) and Fscore (Piotroski's F-score), which assess the financial health and performance of firms. After adding these variables, the sample size significantly decreases to 13,631. We find that *ComposSent* consistently has a significantly positive impact on individual stock turnover, whereas *NewsSent* and *CSVI* do not always show significant effects. This further indicates that *ComposSent*, which combines *NewsSent* with *CSVI*, still has a significantly positive impact on both individual stock returns and turnover, even after controlling for various variables. The empirical results mentioned above support our Hypothesis 2.

---Insert Table 8, 9, and 10 about here---

Regarding the test of Hypothesis 3, this study first discusses whether there are differences in the net buy-and-sell quantity among three different types of institutional investors between the high *ComposSent* group and the low *ComposSent* group. The results are presented in Table 11. They reveal that the net buy-and-sell quantity in the high composite sentiment group is higher than that in the low composite sentiment group. This suggests that institutional investors tend to net buy stocks of a company that has high attention and has more positive news sentiment on a given day. We further conduct difference tests between the high group and the low group, finding that foreign institutional investors and investment trusts reach a 1% significance level.

We next use these 6 models (see Appendix Table 2) to test Hypothesis 3, exploring the relationship between the three main independent variables and the buy-and-sell quantity of institutional investors. The results are presented in Table 12. To simplify the tables, we only present the coefficients for *ComposSent*, *NewsSent*, and *CSVI*. For foreign investors and investment trusts, we find that both *ComposSent* and *NewsSent* significantly positively impact the buy-and-sell quantity, while *CSVI* is almost always insignificant. For dealers, none of the three variables (*ComposSent*, *NewsSent*, and *CSVI*) are significant. This phenomenon seems to indicate that the trading behavior of dealers differs from that of the other two types of institutional investors. According to Lu et al. (2008), empirical results demonstrate that share ownership changes by foreign investors and securities investment trusts in the Taiwan stock market trigger significant herding effects and are associated with positive feedback trading and cascading impacts. In contrast, adjustments by dealers do not lead to herding effects and are linked to negative feedback trading without cascading. The cascading behavior

from foreign investors and securities investment trusts notably influences market dynamics more than positive feedback trading.

Although the empirical results for Hypothesis 3 are not significant for dealers, they are still significantly positive for foreign investors and investment trusts. This implies that foreign investors and investment trusts all tend to buy stocks that are more closely watched and have more positive news coverage. The empirical results provide partial support for Hypothesis 3.

---Insert Tables 11 and 12 about here---

Finally, we conduct robustness tests to further substantiate our three hypotheses. The period of our study spans from January 2019 to December 2021. During this period, Taiwan experienced two significant events that could potentially affect the empirical results: the 2020 presidential election and COVID-19. Shen et al. (2017) confirm during the 2008 Taiwan presidential election that political factors such as government policies and political connections affected stock returns. We also reasonably suspect that the period during this presidential election up to the president's inauguration could have an impact on the stock market. The voting day for Taiwan's 2020 presidential election was January 11, 2020, and the president's inauguration date was May 20, 2020. To avoid the impact of pre-election polls on the stock market as well as any influence around the president's inauguration, we separately conduct empirical analysis for the data from January 2020 to May 2020 (2020 Presidential Election Period).

The COVID-19 pandemic in 2020 shook the global economy. There is already ample literature confirming the impact of COVID-19 on stock markets. In the early stages of the pandemic, the Taiwan government was relatively successful in controlling the outbreak compared to other countries worldwide. However, by early May 2021, a large-scale infection occurred in Taipei (capital city). To strengthen pandemic control measures, the government declared a Level 3 alert on May 15, 2021, shocking the entire population. The alert remained in effect until July 26, 2021. Therefore, we conduct separate empirical analyses for the data from May 2021 to July 2021 (COVID-19 Level 3 Alert).

We use Model 2 for robustness testing by dividing the study period into three distinct phases: Normal Period (excluding the 2020 Presidential Election and COVID-19 Level 3 Alert periods), 2020 Presidential Election Period, and the COVID-19 Level 3 Alert period. The main reason for this is that the 2020 Presidential Election Period and the COVID-19 Level 3 Alert period are relatively short, during which macroeconomic variables remained largely unchanged.

Tables 13 and 14 present the robustness test results for Hypothesis 1 and Hypothesis 2. From Table 13, we observe the coefficients for composite sentiment (*ComposSent*) are positive across all periods, with increasing magnitude during more uncertain times like the Presidential Election and the COVID-19 alert. This suggests that the effect of *ComposSent* on returns becomes more pronounced in periods of uncertainty or crisis. The higher coefficient during the COVID-19 Level 3 Alert (0.3138) compared to the normal period (0.0872) indicates that positive *ComposSent* has a stronger impact on stock returns during times of crisis. This could be because, in uncertain times, positive news or sentiment provides much-needed reassurance to investors, thereby driving up stock prices more substantially.

The impact of news sentiment (*NewsSent*) on returns is more variable. During the normal period, a positive coefficient (0.1206) suggests that favorable news sentiment can positively influence returns, albeit to a modest extent. However, during the 2020 Presidential Election, the effect diminishes (0.0183, not significant), and during the COVID-19 alert, it even turns slightly negative (-0.0622, not significant). This variability indicates that the direct influence of news sentiment on returns can diminish or even reverse in periods of high uncertainty, possibly because investors prioritize fundamental economic concerns over sentiment-based signals. This supports our Hypothesis 1, suggesting that *ComposSent* is a robust and effective indicator for predicting individual stock returns.

The magnitude of the coefficients for the main independent variables, particularly composite sentiment, suggests a stronger influence on stock returns during periods of heightened uncertainty. This reflects the heightened importance of sentiment in such times, where market participants may rely more on positive sentiment as a buffer against negative news or economic instability. Conversely, the less consistent impact of news sentiment, especially its diminishing or negative effect during crises, suggests that simple news sentiment metrics might be insufficient in capturing investor reactions under stress, where fundamental factors might overshadow sentiment signals.

From Table 14, the results show that during both the Normal Period and the COVID-19 Level 3 Alert period, *ComposSent* and *NewsSent* significantly positively impact individual stock turnover. During the COVID-19 Level 3 Alert period, the positive and significant coefficients of *ComposSent* (composite sentiment), especially during crises, indicate that higher composite sentiment improves liquidity, likely due to increased trading activity driven by positive investor sentiment. The effect of *NewsSent* (news sentiment) on liquidity is generally positive but less consistent than composite sentiment. During both normal periods and crises, positive sentiment seems to enhance liquidity, suggesting that news sentiment can drive market participation and

trading volumes. However, during the 2020 Presidential Election Period, neither variable is significant. This period included major events such as the presidential election day, the Lunar New Year holiday, the outbreak of COVID-19, and the presidential inauguration, which contributed to considerable uncertainty in the stock market. Although *ComposSent* does not achieve a significantly positive effect in all periods, it significantly positively impacts individual stock turnover in most periods, and its explanatory power is consistently higher than that of *NewsSent*. These results confirm that Hypothesis 2, as proposed, is supported in most periods.

The robustness test results for the net buy-and-sell quantities of institutional investors are presented in Table 15. We find that both *ComposSent* and *NewsSent* significantly positively impact the net buy-and-sell quantities of foreign institutional investors and investment trusts during the normal period and the 2020 presidential election period. For dealers, the results show a significantly negative impact during the 2020 presidential election period, while there is no significant impact in the other two periods. These results are similar to those in Table 12, which aligns with the concept pointed out by Lu et al. (2008) that the trading behavior of dealers differs from that of foreign institutional investors and investment trusts. The empirical results from the robustness test further confirm that our Hypothesis 3 is partially supported.

---Insert Tables 13, 14, and 15 about here---

5. Conclusion

News sentiment and attention levels have garnered significant attention in academic research within the field of finance. However, the literature has rarely discussed the combination of these two elements. Unlike other studies, we construct a comprehensive indicator that combines both news sentiment and attention levels, referred to as the composite sentiment. The aim of this study is to assess the impact of the composite sentiment on individual stock returns, stock liquidity, and institutional investors' trading behavior from 2019 to 2021. To increase the rigor of the study, we also identify specific periods during the research timeframe (such as presidential election periods and COVID-19 level 3 alert) for further discussion.

Our results show that the composite sentiment has a highly significantly positive impact on both individual stock returns and stock turnover rates. This suggests that when a company receives more positive news sentiment and high levels of attention, its stock returns and turnover rates are likely to be higher. Additionally, the net buy-and-sell quantity across foreign institutional investors and investment trusts is significantly positively influenced by the composite sentiment. This indicates that both foreign institutional investors and investment trusts tend to buy stocks that receive

high attention and positive news coverage. Among these three types of institutional investors, foreign institutional investors are even more inclined to buy stocks with high levels of attention and positive news coverage.

We also compared the explanatory power of the composite sentiment (*ComposSent*), news sentiment (*NewsSent*), and attention level (*CSVI*), and found that in most cases, the composite sentiment (*ComposSent*) has higher explanatory power. Notably, when comparing normal periods with special periods, the explanatory power of news sentiment significantly decreases. The overall findings suggest that news sentiment plays a significant role in influencing both stock returns and liquidity, with positive sentiment generally boosting both metrics. However, the impact varies across different market conditions, indicating that investors' reactions to sentiment can change depending on the broader economic environment. In normal periods, positive sentiment tends to improve both returns and liquidity, aligning with the idea that good news drives optimism and market activity. During periods of uncertainty or crisis (such as COVID-19 Level 3 Alert period), the relationship becomes more complex, reflecting the heightened sensitivity of investors to economic fundamentals and risk factors. These results highlight the importance of considering sentiment as a factor in financial decision-making, especially in understanding short-term market movements and investor behavior under varying market conditions.

The findings of this paper offer several insights for investors. 1) Monitoring news sentiment impact on stock performance: Investors should closely monitor the impact of news and media on the market. According to the study, positive news sentiment can lead to stock price increases, enabling investors to make more informed investment decisions.

2) Be wary of negative sentiment effects: Similarly, negative news sentiment can have a detrimental impact on stock prices. Investors should be cautious of these sentiment effects and avoid making overly reactive investment decisions based on sentimental responses.

3) Pay attention to individual stock focus: The study reveals that stocks receiving higher attention may perform better the following day. Therefore, investors might consider incorporating this factor into their investment strategy by monitoring market hotspots, stocks with high attention, and emerging industries garnering media focus. Overall, investors should be aware of the influence of news and sentiment on the market and integrate it into their investment analysis and decision-making processes.

The findings have practical implications for investors, traders, and policymakers. Understanding the impact of news sentiment can help investors make informed decisions, improve market efficiency, and potentially stabilize markets by anticipating and reacting to sentiment-driven volatility. In summary, the study provides a

comprehensive analysis of the role of news sentiment in financial markets, offering both theoretical and practical contributions. It enhances the understanding of how sentiment interacts with traditional financial metrics to influence market behavior.

Appendix Table 1
Sample Companies

Company Name	ID	Removed	MV% 2020	Industry Electronics (N=21)	Industry Finance (N=12)	Industry Non-Elec. & Fin. (N=17)	Turnover % 2019	Turnover % 2020	Turnover % 2021
Taiwan Semiconductor Manufacturing Co.,	2330		30.809	✓			30.7708	46.8662	35.1637
Hon Hai Precision Ind. Co., Ltd.	2317		2.859	✓			66.2338	73.1824	87.7723
Mediatek Inc.	2454		2.663	✓			122.0435	171.6590	122.0152
Formosa Petrochemical Corp.	6505		2.131			✓	6.8026	10.8013	10.7579
Chunghwa Telecom Co., Ltd.	2412		1.896	✓			21.6450	25.4658	25.8300
Delta Electronics, Inc.	2308		1.531	✓			66.0138	74.0676	79.9064
Formosa Plastics Corporation	1301		1.376			✓	23.6014	33.4702	39.8574
United Microelectronics Corp.	2303		1.313	✓			90.5537	296.0226	401.0463
Nan Ya Plastics Corporation	1303	✓	1.278			✓	18.5736	19.8416	28.7335
Cathay Financial Holding Co., Ltd.	2882		1.247		✓		32.2869	34.2209	64.2542
Formosa Chemicals & Fibre Corporation	1326		1.113			✓	22.3350	28.6962	22.6203
Fubon Financial Holding Co., Ltd.	2881		1.073		✓		29.8277	38.5518	58.2443
Largan Precision Co., Ltd.	3008		0.961	✓			129.1434	146.4589	126.4075
Mega Financial Holding Company Ltd.	2886		0.909		✓		33.1471	43.1979	34.2468
China Steel Corporation	2002		0.873			✓	19.6652	31.4991	203.7987
CTBC Financial Holding Co., Ltd.	2891		0.861		✓		37.6024	50.4189	46.6621
Uni-President Enterprises Corp.	1216	✓	0.860			✓	36.0889	42.8275	33.2243
Hotai Motor Co., Ltd.	2207	✓	0.787			✓	23.7497	22.6277	12.7711
Taiwan Mobile Co., Ltd.	3045		0.779	✓			23.5465	31.2223	23.0779
E.SUN Financial Holding Company, Ltd.	2884		0.720		✓		42.6331	64.9356	42.2280
Quanta Computer Inc.	2382		0.701	✓			48.5937	65.7181	58.9582
President Chain Store Corporation	2912	✓	0.621			✓	29.5757	38.3654	33.5292
First Financial Holding Co., Ltd.	2892		0.614		✓		25.3670	40.3194	27.9638
Taiwan Cooperative Financial Holding Co.	5880		0.608		✓		18.6912	28.5612	22.3959
Advantech Co., Ltd.	2395	✓	0.606	✓			26.2729	28.6409	34.0426
Nanya Technology Corporation	2408		0.602	✓			137.1070	142.7323	139.6775
Yageo Corporation	2327		0.577	✓			528.1502	744.4117	332.0556
Taiwan Cement Corp.	1101		0.563			✓	74.5050	71.6576	94.4961

Company Name	ID	Removed	MV% 2020	Industry			Turnover %		
				Electronics (N=21)	Finance (N=12)	Non-Elec. & Fin. (N=17)	2019	2020	2021
Yuanta Financial Holding Co., Ltd.	2885		0.559		✓		34.6338	57.9400	52.2453
Hua Nan Financial Holdings Co., Ltd.	2880		0.526		✓		19.8045	25.4344	22.5942
Chailease Holding Company Limited	5871		0.520			✓	55.3680	83.5682	59.0432
Novatek Microelectronics Corp.	3034		0.503	✓			287.5457	247.9673	365.7420
Silergy Corp.	6415		0.502	✓			141.6353	176.1822	109.0918
Evergreen Marine Corp. (Taiwan) Ltd.	2603		0.455			✓	55.5810	417.5541	1401.8060
Realtek Semiconductor Corporation	2379		0.447	✓			213.1670	204.9859	134.7097
Far EasTone Telecommunications Co., Ltd.	4904		0.447	✓			18.6056	26.9478	27.2101
Chang Hwa Commercial Bank, Ltd.	2801		0.418		✓		23.6382	19.0205	22.8672
Asustek Computer Inc.	2357		0.417	✓			41.5215	91.3485	129.3416
The Shanghai Commercial & Savings Bank,	5876		0.413		✓		49.1248	27.9725	22.8903
Pegatron Corporation	4938		0.402	✓			70.8569	92.7460	116.3215
Feng Tay Enterprises Co., Ltd	9910	✓	0.394			✓	44.3170	46.2947	29.8659
Airtac International Group	1590	✓	0.381			✓	229.4767	182.7175	104.2990
Far Eastern New Century Corporation	1402		0.347			✓	36.6499	47.7927	41.0886
Taishin Financial Holding Co., Ltd.	2887		0.324		✓		37.2686	42.6432	54.1983
AUO Corporation	2409		0.302	✓			130.2831	327.9887	562.3635
Unimicron Technology Corp.	3037		0.295	✓			678.8989	875.0727	659.1997
Nan Ya Printed Circuit Board Corporation	8046		0.264	✓			381.7933	722.1710	399.7169
Wan Hai Lines Ltd.	2615	✓	0.263			✓	22.6980	142.3327	725.8722
Yang Ming Marine Transport Corp.	2609		0.208			✓	15.8019	200.8608	1484.0800
momo.com Inc.	8454	✓	0.200			✓	11.5167	58.3087	70.3926

Appendix Table 2

Model Configuration of this Study

This study has 5 dependent variables, where *Ret* and *Turnover* respectively represent stock return and turnover rate. The *Institutional* variable includes the following three variables: *Foreign*, *InvestTrust*, and *Dealer* respectively represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. The model configuration of this study is as follows with a total of 6 models. The complete regression model is as follows:

$$Ret_{i,t}, Turnover_{i,t} \ or \ Institutional_{i,t}$$
$$= \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Zscore_{i,t-1}$$
$$+ \beta_9 Fscore_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

where $Ret_{i,t}$ is stock *i*'s return in day *t*. The independent variables include 3 main variables. *ComposSent*, *NewsSent*, and *CSVI* represent the composite sentiment, news sentiment, the relative change in the Google Search Volume Index, respectively, which are the main independent variables to be examined in this study. Additionally, there are eight other firm and stock characteristic variables: *S/M, Volatility, Bias, P/E, P/B, Turnover, Zscore, and Fscore,* which respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate, Altman's Z score and Piotroski's F score. Final, there are 5 macroeconomics variables: *RGDP*, *IPI*, *MANUF*, *REXP*, and *WHR*, which respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Panel A. Main Independent Variables						
ComposSent, NewsSent, CSVI	✓ (Select one of three)	✓ (Select one of three)	✓ (Select one of three)	✓ (Select one of three)	✓ (Select one of three)	✓ (Select one of three)
Panel B. Firm and Stock Characteristic Variables						
S/M		✓		✓	✓	✓
Volatility		✓		✓	✓	✓
Bias		✓		✓	✓	✓
P/E		✓		✓	✓	✓
P/B		✓		✓	✓	
Turnover		✓		✓	✓	✓
Zscore						✓
Fscore					✓	✓
Panel C. Macroeconomics Variables						
RGDP			✓	✓	✓	✓
IPI			✓	✓	✓	✓
MANUF			✓	✓	✓	✓
REXP			✓	✓	✓	✓

WHR			✓	✓	✓	✓
Year, Ind., Firm Fixed Effects	✓	✓	✓	✓	✓	✓

References

Acharya, V. V. and L. H. Pedersen (2005), "Asset Pricing with Liquidity Risk," *Journal of Financial Economics,* Vol. 77, No. 2, 375-410.

Altman, E. I. (1968), "Financial Ratios, Discriminant Analysis and The Prediction of Corporate Bankruptcy," *The Journal of Finance,* Vol. 23, No. 4, 589-609.

Altman, E. I., M. Iwanicz-Drozdowska, E. K. Laitinen and A. Suvas (2017), "Financial Distress Prediction in An International Context: A Review and Empirical Analysis of Altman's Z-Score Model," *Journal of International Financial Management and Accounting,* Vol. 28, No. 2, 131-171.

Amihud, Y. (2002), "Illiquidity and Stock Returns: Cross-Section and Time-Series Effects," *Journal of Financial Markets,* Vol. 5, No. 1, 31-56.

Bajo, E., and C. Raimondo (2017), "Media Sentiment and IPO Underpricing," *Journal of Corporate Finance*, Vol. 46, 139-153.

Baker, M. and J. Wurgler (2006), "Investor Sentiment and the Cross-Section of Stock Returns," *The Journal of Finance*, Vol. 61, No. 4, 1645-1680.

Bank, M., M. Larch and G. Peter (2011), "Google Search Volume and Its Influence on Liquidity and Returns of German Stocks," *Financial Markets and Portfolio Management*, Vol. 25, 239-264.

Barber, B. M. and T. Odean (2008), "All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors," *Review of Financial Studies*, Vol. 21, No. 2, 785-818.

Behrendt, S. and P. Prange (2021), "What Are You Searching For? On the Equivalence of Proxies for Online Investor Attention," *Finance Research Letters,* Vol. 38, 101401.

Brown, G. W. and M. T. Cliff (2004), "Investor Sentiment and the Near-Term Stock Market," *Journal of Empirical Finance*, Vol. 11, No. 1, 1-27.

Brown, G. W. and M. T. Cliff (2005), "Investor Sentiment and Asset Valuation," *Journal of Business*, Vol. 78, No. 2, 405-440.

Chandrapala, P. (2011), "The Relationship between Trading Volume and Stock Returns," *Journal of Competitiveness*, Vol. 3, No. 3, 41-49.

Chemmanur, T. and A. Yan (2009), "Product Market Advertising and New Equity Issues," *Journal of Financial Economics*, Vol. 92, No. 1, 40-65.

Chen, S. S. (2012), “Revisiting the Empirical Linkages between Stock Returns and Trading Volume,” *Journal of Banking and Finance,* Vol. 36, No. 6, 1781-1788.

Cohen, J, P. Cohen, S. G. West and L. S. Aiken (2003), *Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences* 3rd edition, Hillsdale, NJ: Lawrence Erlbaum.

Da, Z., J. Engelberg and P. Gao (2011), “In Search of Attention,” *The Journal of Finance*, Vol. 66, No. 5, 1461-1499.

Da, Z., J. Engelberg and P. Gao (2015), “The Sum of All FEARS Investor Sentiment and Asset Prices,” *Review of Financial Studies*, Vol. 28, No. 1, 1-32.

Dergiades, T., C. Milas and T. Panagiotidis (2015), “Tweets, Google Trends, and Sovereign Spreads in the GIIPS,” *Oxford Economic Papers*, Vol. 67, No. 2, 406-432.

Dong, H. and J. Gil-Bazo (2020), “Sentiment Stocks,” *International Review of Financial Analysis*, Vol. 72, 101573.

Du, Z., A. G. Huang, R. Wermers and W. Wu (2022), “Language and Domain Specificity: A Chinese Financial Sentiment Dictionary,” *Review of Finance*, Vol. 26, No. 3, 673-719.

Duz Tan, S. and Q. Tas (2021), “Social Media Sentiment in International Stock Returns and Trading Activity,” *Journal of Behavioral Finance*, Vol. 22, No. 2, 221-234.

Fang, L. and J. Peress (2009), “Media Coverage and the Cross-Section of Stock Returns,” *The Journal of Finance*, Vol. 64, No. 5, 2023-2052.

Heston, S. L. and N. R. Sinha (2017), “News Vs. Sentiment: Predicting Stock Returns from News Stories,” *Financial Analysts Journal*, Vol. 73, No. 3, 67-83.

Hsu, J., W. Young and Y. W. Huang (2021), “Investors' Reactions and Firms' Actions in the Covid-19 Period: The Case of Taiwan,” *International Review of Financial Analysis,* Vol. 78, 101905.

Huang, M. Y., R. R. Rojas and P. D. Convery (2020), “Forecasting Stock Market Movements Using Google Trend Searches,” *Empirical Economics,* Vol. 59, 2821-2839.

Jiao, P., A. Veiga and A. Walther (2020), “Social Media, News Media and the Stock Market,” *Journal of Economic Behavior and Organization*, Vol. 176, 63-90.

Joseph, K., M. B. Wintoki and Z. Zhang (2011), “Forecasting Abnormal Stock Returns

and Trading Volume Using Investor Sentiment: Evidence from Online Search," *International Journal of Forecasting*, Vol. 27, No. 4, 1116-1127.

Kumari, J. (2019), "Investor Sentiment and Stock Market Liquidity: Evidence from an Emerging Economy," *Journal of Behavioral and Experimental Finance,* Vol. 23, 166-180.

Lillo, F., S. Miccichè, M. Tumminello, J. Piilo and R. N. Mantegna (2015), "How News Affects the Trading Behaviour of Different Categories of Investors in a Financial Market," *Quantitative Finance*, Vol. 15, No. 2, 213-229.

Liu, S. (2015), "Investor Sentiment and Stock Market Liquidity," *Journal of Behavioral Finance*, Vol. 16, No. 1, 51-67.

Long, S., B. Lucey, Y. Xie and L. Yarovaya (2023), ""I Just like the Stock": The Role of Reddit Sentiment in the GameStop Share Rally," *Financial Review*, Vol. 58, No. 1, 19-37.

Lu, Y. C., J. Y. Wong and H. Fang (2008), "Herding Effect, Feedback Trading, Cascading, and Momentum by Share Ownership Adjustments of Three Major Institutional Investors in Taiwan Stock Market," *Journal of Management and Systems*, Vol. 15, No. 4, 523-543.

Merton, R. C. (1987), "A Simple Model of Capital Market Equilibrium with Incomplete Information," *The Journal of Finance*, Vol. 42, No. 3, 483-510.

Mindell, J. (1961), "How News Affects Market Trends," *Financial Analysts Journal*, Vol. 17, No. 1, 31-34.

Nguyen, L. T. M. and J. M. Song (2024), "Media Sentiment and Institutional Ownership," *Journal of Behavioral Finance*, Vol. 25, No. 2, 134–150.

Piotroski, J. D. (2000), "Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers," *Journal of Accounting Research,* Vol. 38, 1-41.

Ren, J., H. Dong, B. Padmanabhan and J. V. Nickerson (2021), "How Does Social Media Sentiment Impact Mass Media Sentiment? A Study of News in the Financial Markets," *Journal of the Association for Information Science and Technology*, Vol. 72, No. 9, 1183-1197.

Rogers, L. C. G. and S. E. Satchell (1991), "Estimating Variance from High, Low and Closing Prices," *The Annals of Applied Probability*, Vol. 1, No. 4, 504-512.

Seneca, J. J. (1967), “Short Interest: Bearish or Bullish?” *The Journal of Finance*, Vol. 22, No. 1, 67-70.

Shen, C. H., D. G. Bui and C. Y. Lin (2017), “Do Political Factors Affect Stock Returns during Presidential Elections?” *Journal of International Money and Finance*, Vol. 77, 180-198.

Smales, L. A. (2021), “Investor Attention and Global Market Returns during the COVID-19 Crisis,” *International Review of Financial Analysis,* Vol. 73, 101616.

Su X. Q., A. Lowe, C. D. Yuan and J. B. Yang (2016), “Stock Market Liquidity and the Business Cycle,” *Journal of Management and Systems,* Vol. 23, No. 1, 65-106.

Swamy, V., M. Dharani and F. Takeda (2019), “Investor Attention and Google Search Volume Index: Evidence from an Emerging Market Using Quantile Regression Analysis,” *Research in International Business and Finance,* Vol. 50, 1-17.

Tetlock, P. C. (2007), “Giving Content to Investor Sentiment: The Role of Media in the Stock Market,” *The Journal of Finance,* Vol. 62, No. 3, 1139-1168.

Tetlock, P. C. (2010), “Does Public Financial News Resolve Asymmetric Information?” *Review of Financial Studies*, Vol. 23, No. 9, 3520-3557.

Tetlock, P. C. (2011), “All the News That's Fit to Reprint: Do Investors React to Stale Information?” *Review of Financial Studies*, Vol. 24, No. 5, 1481-1512.

Tetlock, P. C. (2014), “Information Transmission in Finance,” *Annual Review of Financial Economics*, Vol. 6, No. 1, 365–384.

Tetlock, P. C., M. Saar-Tsechansky and S. Macskassy (2008), “More than Words: Quantifying Language to Measure Firms' Fundamentals,” *The Journal of Finance*, Vol. *63*, No. 3, 1437-1467.

Tsao,S. M., C. C. Lee and H. T. Lu (2021), “Internal Control and the Pricing of Discretionary Accruals,” *Journal of Accounting Review*, Vol. 73, 61-100.

Yahya, F., Z. Shaohua, M. Waqas and Z. Xiong (2021), “COVID-Induced Investor Sentiments and Market Reaction under Extreme Meteorological Conditions: Evidence from Clean Energy Sector of Asia-Pacific,” *Problemy Ekorozwoju*, Vol. 16, No. 1., 7-15.

Table 1

Descriptive Statistics.

This study has 5 dependent variables, where *Ret* and *Turnover* respectively represent stock return and turnover rate. *Foreign*, *InvestTrust*, and *Dealer* respectively represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. The independent variables include 11 stock characteristics. *ComposSent* is the composite sentiment, which is the main independent variable to be examined in this study and is constructed through news sentiment (*NewsSent*) and the relative change in the Google Search Volume Index (*CSVI*). Additionally, there are eight other firm stock characteristic variables: *S/M*, *Volatility*, *Bias*, *P/E*, *P/B*, *Turnover, Zscore,* and *Fscore,* which respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate, Altman's Z score, and Piotroski's F score. Finally, there are 5 macroeconomics variables: *RGDP*, *IPI*, *MANUF*, *REXP*, and *WHR*, which respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service.

	N. of Samples	Mean	S.D.	Min.	Med.	Max.
Panel A. Dependent Variables (Period t)						
Ret	19228	0.121	1.949	-10.000	0.000	10.000
Turnover	19228	0.550	1.154	0.004	0.193	19.282
Foreign	19228	-4.861	81.825	-1060.670	-1.160	1656.380
InvestTrust	19228	0.519	14.253	-494.880	0.010	346.350
Dealer	19228	0.044	12.847	-356.770	-0.010	192.520
Panel B. Main Independent Variables (Period t-1)						
ComposSent	19228	0.449	0.513	-6.333	0.440	9.188
NewsSent	19228	0.405	0.353	-1.000	0.455	1.000
CSVI	19228	1.116	0.651	0.000	1.000	13.500
Panel C. Firm and Stock Characteristic Variables (Period t-1)						
S/M	19228	0.069	0.094	0.000	0.034	0.947
Volatility	19228	0.030	0.025	0.002	0.021	0.213
Bias	19228	0.043	1.024	-21.751	0.005	29.893
P/E	19228	23.929	41.398	3.319	17.107	941.202
P/B	19228	2.330	1.812	0.339	1.576	11.912
Turnover	19228	0.551	1.154	0.004	0.193	19.282
Zscore	13631	4.765	3.577	0.611	3.444	17.935
Fscore	13631	6.131	1.388	3.000	6.000	9.000
Panel D. Macroeconomics Variables (Period t)						
RGDP	19228	4.467	2.417	0.230	3.900	9.390
IPI	19228	9.031	7.482	-7.560	8.500	23.480
MANUF	19228	1.816	8.762	-26.090	1.090	26.935
REXP	19228	2.445	10.308	-25.070	2.429	40.025
WHR	19228	0.463	4.594	-8.140	0.000	11.594
Panel E. Composite Sentiment (*ComposSent*) by Industry						
Electronics	7810	0.451	0.544	-6.333	0.425	9.188
Finance	6022	0.462	0.521	-2.533	0.446	8.226
Non-Elec. & Fin.	5396	0.432	0.456	-3.071	0.457	8.750

Table 2

Correlation Matrix of Dependent Variables (DV) and Independent Variables (IV).

This study has 5 dependent variables, where *Ret* and *Turnover* respectively represent stock return and turnover rate. *Foreign*, *InvestTrust*, and *Dealer* respectively represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. The independent variables include 11 stock characteristics. *ComposSent* is the composite sentiment, which is the main independent variable to be examined in this study and is constructed through news sentiment (*NewsSent*) and the relative change in the Google Search Volume Index (*CSVI*). Additionally, there are eight other firm and stock characteristic variables: *S/M, Volatility, Bias, P/E, P/B, Turnover, Zscore,* and *Fscore,* which respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate, Altman's Z score, and Piotroski's F score. Finally, there are 5 macroeconomics variables: *RGDP*, *IPI, MANUF, REXP,* and *WHR*, which respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service.

		Variables	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	*(18)*	*(19)*	*(20)*	*(21)*
Frequency	**Variables**	**Period**	t-1	t-1	t-1	t-1	t-1	t-1	t-1	t-1	t-1	t-1	t	t	t	t	t	t
Daily	*(1) Ret*	t	0.032	0.020	0.008	0.016	0.037	0.000	0.003	0.001	0.052	-0.018	0.042	0.016	-0.005	-0.013	-0.016	-0.002
Daily	*(2) Turnover*	t	-0.009	-0.041	0.035	0.339	0.574	-0.003	0.075	0.171	0.875	-0.022	0.379	0.122	0.109	-0.003	0.016	0.004
Daily	*(3) Foreign*	t	0.052	0.064	-0.010	-0.003	-0.072	0.005	0.005	0.003	-0.041	0.012	0.007	0.010	-0.012	-0.017	-0.022	0.023
Daily	*(4) InvestTrust*	t	0.017	0.011	0.010	0.004	0.030	0.005	0.001	-0.010	0.005	-0.011	0.034	0.007	0.004	0.011	0.001	-0.001
Daily	*(5) Dealer*	t	0.002	0.003	0.001	-0.005	-0.040	-0.001	-0.001	-0.008	-0.018	-0.010	0.001	0.010	0.014	0.002	-0.002	-0.015
Daily	*(6) ComposSent*	t-1	1.000	0.746	0.463	0.018	-0.109	0.036	0.007	0.011	-0.017	-0.059	0.002	0.039	-0.075	-0.090	-0.090	0.032
Daily	*(7) NewsSent*	t-1		1.000	-0.018	-0.031	-0.186	0.042	0.008	0.027	-0.054	-0.106	-0.026	0.061	-0.052	-0.033	-0.050	0.076
Daily	*(8) CSVI*	t-1			1.000	0.069	0.074	0.004	0.002	-0.013	0.039	0.049	0.021	-0.018	-0.063	-0.118	-0.094	-0.049
Daily	*(9) S/M*	t-1				1.000	0.316	0.025	0.115	0.134	0.345	0.232	0.199	-0.076	-0.105	-0.018	-0.006	0.023
Daily	*(10) Volatility*	t-1					1.000	-0.002	0.093	0.225	0.650	0.131	0.377	0.082	0.156	0.029	0.047	-0.103
Daily	*(11) Bias*	t-1						1.000	-0.003	0.025	-0.003	-0.045	0.005	0.007	-0.008	-0.015	-0.004	0.014
Daily	*(12) P/E*	t-1							1.000	0.111	0.075	0.072	0.024	0.071	0.039	-0.004	-0.002	0.006
Daily	*(13) P/B*	t-1								1.000	0.173	0.512	0.203	0.203	0.183	0.000	0.013	0.037
Daily	*(14) Turnover*	t-1									1.000	-0.020	0.381	0.124	0.111	0.000	0.017	0.005
Daily	*(15) Zscore*	t-1										1.000	0.110	0.089	0.054	0.024	0.022	0.042
Quarterly	*(16) Fscore*	t-1											1.000	0.191	0.217	-0.005	0.010	0.036
Quarterly	*(17) RGDP*	t												1.000	0.573	0.077	0.099	0.242
Quarterly	*(18) IPI*	t													1.000	0.113	0.061	-0.068
Monthly	*(19) MANUF*	t														1.000	0.864	0.275
Monthly	*(20) REXP*	t															1.000	0.406
Monthly	*(21) WHR*	t																1.000

Table 3
Variance Inflation Factor (VIF) of Hypotheses.

	VIF	VIF	VIF	VIF	VIF
Main Independent Variables					
ComposSent	1.0996			1.0992	1.0995
NewsSent		1.1898			
CSVI			1.0533		
Firm and Stock Characteristic Variables					
S/M	1.9857	1.9816	1.9907	1.9309	1.9676
Volatility	2.2446	2.2839	2.2364	2.2424	2.2442
Bias	1.0663	1.0669	1.0651	1.0656	1.0652
P/E	1.2527	1.2531	1.2512	1.2407	1.2518
P/B	8.4777	8.4786	8.4816	4.4570	
Turnover	2.8772	2.8796	2.8707	2.8468	2.8427
Zscore	13.7430	13.7387	13.7401		7.2252
Fscore	1.9155	1.9155	1.9151	1.8494	1.8858
Macroeconomics Variables					
RGDP	2.2169	2.2158	2.2107	2.2139	2.2150
IPI	2.8971	2.8984	2.8857	2.8964	2.8962
MANUF	4.4861	4.4990	4.5075	4.4745	4.4844
REXP	4.8276	4.8473	4.8184	4.8221	4.8275
WHR	1.4454	1.4476	1.4454	1.4418	1.4453

Table 4

Descriptive Statistics of the Relationship between Composite Sentiment, Stock Returns and Turnover.

The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	High Composite Sentiment (Top 25%)				Low Composite Sentiment (Bottom 25%)			
	Total	Elec.	Fin.	Non- E&F	Total	Elec.	Fin.	Non- E&F
Panel A. Stock Returns								
N. of Samples	4807	1825	1583	1399	4807	1951	1475	1381
Mean (%)	**0.208**	0.374	0.139	0.068	**0.031**	0.055	0.057	-0.032
S.D. (%)	1.800	2.453	1.256	1.199	2.222	2.585	1.746	2.119
Min. (%)	-9.940	-9.940	-6.885	-9.623	-10.000	-9.960	-9.968	-10.000
Med. (%)	0.000	0.212	0.000	0.000	0.000	0.000	0.000	0.000
Max. (%)	10.000	10.000	8.192	9.897	10.000	10.000	10.000	10.000
Top 25% (0.208) minus Bottom 25% (0.031)= 0.177 (4.2965)* **								
Panel B. Stock Turnover								
N. of Samples	4807	1825	1583	1399	4807	1951	1475	1381
Mean (%)	**0.508**	0.974	0.169	0.283	**0.575**	0.879	0.190	0.557
S.D. (%)	1.089	1.382	0.144	1.047	1.136	1.120	0.172	1.549
Min. (%)	0.010	0.051	0.026	0.010	0.004	0.039	0.019	0.004
Med. (%)	0.171	0.450	0.131	0.098	0.223	0.489	0.140	0.133
Max. (%)	18.307	12.246	2.481	18.307	15.701	15.701	1.895	12.722
Top 25% (0.508) minus Bottom 25% (0.575)= -0.067 (-2.9741)* **								

Table 5

Regression Model 1 and Model 2 Results of Hypothesis 1.

Hypothesis 1: The degree of attention to news sentiment has a positive effect on individual stock returns. The complete regression model is as follows:

$$Ret_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \varepsilon_{i,t}$$

where $Ret_{i,t}$ is stock *i*'s return in day *t*. The independent variables include 3 main variables. *ComposSent*, *NewsSent*, and *CSVI* represent the composite sentiment, news sentiment, the relative change in the Google Search Volume Index, respectively, which are the main independent variables to be examined in this study. Additionally, there are 6 other firm and stock characteristic variables: *S/M, Volatility, Bias, P/E, P/B,* and *Turnover,* which respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 1	Model 1	Model 1	Model 2	Model 2	Model 2
Intercept	0.3498 (4.36)***	0.3567 (4.40)***	0.3800 (4.58)***	0.4185 (3.60)***	0.4104 (3.50)***	0.4569 (3.90)***
Main Independent Variables						
ComposSent	0.1258 (4.49)***			0.1308 (4.64)***		
NewsSent		0.1270 (3.05)***			0.1409 (3.32)***	
CSVI			0.0247 (1.13)			0.0218 (1.00)
Firm and Stock Characteristic Variables						
S/M				-0.3339 (-1.65)*	-0.3076 (-1.52)	-0.3065 (-1.51)
Volatility				0.4389 (0.54)	0.4884 (0.60)	-0.0324 (-0.04)
Bias				-0.0076 (-0.53)	-0.0072 (-0.51)	-0.0056 (-0.40)
P/E				-0.0001 (-0.32)	-0.0001 (-0.29)	-0.0001 (-0.18)
P/B				-0.0707 (-4.08)***	-0.0712 (-4.11)***	-0.0694 (-4.01)***
Turnover				0.0574 (2.84)***	0.0586 (2.90)***	0.0624 (3.10)***
Year, Ind., Firm Fixed Effects	✓	✓	✓	✓	✓	✓
R^2	0.0053	0.0047	0.0043	0.0068	0.0062	0.0057
Adj R^2	0.0032	0.0026	0.0022	0.0044	0.0038	0.0033
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	19228	19228	19228	19228	19228	19228

Table 6

Regression Model 3 and Model 4 Results of Hypothesis 1.

Hypothesis 1: The degree of attention to news sentiment has a positive effect on individual stock returns. The complete regression model is as follows:

$$Ret_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

In addition to the six firm and stock characteristic variables controlled in Model 2 of Table 5, Model 3 and Model 4 also control for 5 macroeconomics variables. *RGDP*, *IPI, MANUF, REXP,* and *WHR* respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 3	Model 3	Model 3	Model 4	Model 4	Model 4
Intercept	0.3481 (3.49)***	0.3551 (3.53)***	0.3805 (3.73)***	0.4375 (3.45)***	0.4322 (3.38)***	0.4779 (3.74)***
Main Independent Variables						
ComposSent	0.1126 (3.98)***			0.1177 (4.14)***		
NewsSent		0.1088 (2.58)***			0.1227 (2.88)***	
CSVI			0.0183 (0.83)			0.0151 (0.68)
Firm and Stock Characteristic Variables						
S/M				-0.3568 (-1.75)*	-0.3353 (-1.65)*	-0.3339 (-1.64)
Volatility				0.6866 (0.84)	0.7244 (0.88)	0.3181 (0.39)
Bias				-0.0079 (-0.56)	-0.0076 (-0.53)	-0.0062 (-0.44)
P/E				-0.0002 (-0.51)	-0.0002 (-0.49)	-0.0002 (-0.40)
P/B				-0.0739 (-4.26)***	-0.0743 (-4.28)***	-0.0731 (-4.21)***
Turnover				0.0526 (2.60)***	0.0537 (2.65)**	0.0567 (2.80)***
Macroeconomics Variables						
RGDP	0.0241 (2.84)***	0.0251 (2.95)***	0.0260 (3.06)***	0.0243 (2.83)***	0.0251 (2.92)***	0.0262 (3.05)***
IPI	-0.0092 (-2.9)***	-0.0095 (-2.99)***	-0.0100 (-3.16)***	-0.0096 (-3.02)***	-0.0099 (-3.10)***	-0.0104 (-3.27)***
MANUF	0.0034 (1.02)***	0.0029 (0.87)	0.0036 (1.08)	0.0039 (1.15)	0.0034 (1.00)	0.0040 (1.19)
REXP	-0.0047 (-1.59)	-0.0046 (-1.57)	-0.0054 (-1.83)*	-0.0054 (-1.84)*	-0.0054 (-1.81)*	-0.0060 (-2.04)**
WHR	-0.0024 (-0.66)	-0.0026 (-0.71)	-0.0018 (-0.49)	-0.0008 (-0.22)	-0.001 (-0.28)	-0.0005 (-0.13)
Year, Ind., Firm Fixed	✓	✓	✓	✓	✓	✓
R^2	0.0061	0.0056	0.0053	0.0077	0.0072	0.0068
Adj R^2	0.0037	0.0033	0.0030	0.0050	0.0046	0.0042
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	19228	19228	19228	19228	19228	19228

Table 7

Regression Model 5 and Model 6 Results of Hypothesis 1.

Hypothesis 1: The degree of attention to news sentiment has a positive effect on individual stock returns. The complete regression model is as follows:

$$Ret_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Zscore_{i,t-1} + \beta_9 Fscore_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

In addition to the 6 firm and stock characteristic variables and 5 macroeconomics variables controlled in Model 4 of Table 6, Model 5 and Model 6 also include control for 2 Firm Characteristic Variables. *Zscore* and *Fscore*, which respectively stand for Altman's Z score and Piotroski's F score. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 5	Model 5	Model 5	Model 6	Model 6	Model 6
Intercept	0.1019 (0.52)	0.0887 (0.45)	0.1204 (0.61)	-0.0611 (-0.32)	-0.0747 (-0.39)	-0.0409 (-0.21)
Main Independent Variables						
ComposSent	0.1449 (3.81)***			0.1458 (3.84)***		
NewsSent		0.1528 (2.65)***			0.1513 (2.62)***	
CSVI			0.0398 (1.34)			0.0414 (1.40)
Firm and Stock Characteristic Variables						
S/M	-0.3905 (-1.56)	-0.3518 (-1.40)	-0.3658 (-1.46)	-0.3174 (-1.25)	-0.2792 (-1.10)	-0.2960 (-1.17)
Volatility	0.6050 (0.59)	0.6862 (0.67)	0.1605 (0.16)	0.5901 (0.58)	0.6626 (0.64)	0.1381 (0.14)
Bias	-0.0080 (-0.51)	-0.0077 (-0.49)	-0.0061 (-0.39)	-0.0092 (-0.59)	-0.0089 (-0.57)	-0.0073 (-0.47)
P/E	-0.0002 (-0.55)	-0.0002 (-0.53)	-0.0002 (-0.43)	-0.0003 (-0.66)	-0.0003 (-0.63)	-0.0002 (-0.53)
P/B	-0.0696 (-3.48)***	-0.0702 (-3.50)***	-0.0684 (-3.42)***			
Turnover	0.0462 (1.97)**	0.0468 (2.00)**	0.0501 (2.15)**	0.0394 (1.68)*	0.0401 (1.71)*	0.0435 (1.86)*
Zscore				-0.0380 (-2.73)***	-0.0377 (-2.71)***	-0.0368 (-2.65)***
Fscore	0.0331 (1.82)*	0.0335 (1.85)*	0.0343 (1.89)*	0.0397 (2.17)**	0.0401 (2.19)**	0.0407 (2.22)**
Macroeconomics Variables						
RGDP	0.0400 (3.50)***	0.0409 (3.59)***	0.0422 (3.70)***	0.0394 (3.46)***	0.0404 (3.54)***	0.0416 (3.65)***
IPI	-0.0104 (-2.47)**	-0.0107 (-2.54)**	-0.0113 (-2.70)***	-0.0102 (-2.42)**	-0.0105 (-2.50)**	-0.0111 (-2.65)***
MANUF	0.0062 (1.40)	0.0056 (1.25)	0.0066 (1.48)	0.0065 (1.46)	0.0059 (1.31)	0.0069 (1.55)
REXP	-0.0067 (-1.72)*	-0.0066 (-1.68)*	-0.0075 (-1.91)*	-0.0068 (-1.74)*	-0.0067 (-1.71)*	-0.0076 (-1.93)*
WHR	-0.0027 (-0.55)	-0.0029 (-0.59)	-0.0022 (-0.45)	-0.0025 (-0.51)	-0.0026 (-0.55)	-0.0020 (-0.41)
Year, Ind., Firm Fixed	✓	✓	✓	✓	✓	✓
R^2	0.0088	0.0083	0.0079	0.0085	0.0079	0.0076
Adj R^2	0.0059	0.0054	0.0050	0.0056	0.0050	0.0046
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	13631	13631	13631	13631	13631	13631

Table 8

Regression Model 1 and 2 Results of Hypothesis 2.

Hypothesis 2: The degree of attention to news sentiment has a positive effect on the liquidity of individual stocks. The complete regression model is as follows:

$$Turnover_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \varepsilon_{i,t}$$

where $Turnover_{i,t}$ is stock *i*'s turnover rate in day *t*. The independent variables include 3 main variables. *ComposSent*, *NewsSent*, *CSVI* represent the composite sentiment, news sentiment, the relative change in the Google Search Volume Index, respectively, which are the main independent variables to be examined in this study. Additionally, there are 6 other firm and stock characteristic variables: *S/M, Volatility, Bias, P/E, P/B,* and *Turnover* which respectively stand for Short Sale/Margin Purchase Ratio, Daily Volatility, Bias Ratio, Price-to-Earning Ratio, Price-to-Book Ratio, Turnover Rate. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 1	Model 1	Model 1	Model 2	Model 2	Model 2
Intercept	3.2279 (96.15)***	3.2494 (95.94)***	3.1736 (91.62)***	0.7279 (22.61)***	0.7244 (22.30)***	0.7265 (22.38)***
Main Independent Variables						
ComposSent	0.0258 (2.20)**			0.0181 (2.31)**		
NewsSent		-0.0240 (-1.38)			0.0246 (2.09)**	
CSVI			0.0590 (6.49)***			0.0105 (1.73)*
Firm and Stock Characteristic Variables						
S/M				0.1916 (3.40)***	0.1948 (3.46)***	0.1918 (3.41)***
Volatility				-0.4817 (-2.16)**	-0.4576 (-2.03)**	-0.5633 (-2.53)**
Bias				-0.0014 (-0.36)	-0.0014 (-0.36)	-0.0012 (-0.30)
P/E				-0.0003 (-2.65)***	-0.0003 (-2.66)***	-0.0003 (-2.59)***
P/B				0.0256 (5.34)***	0.0255 (5.31)***	0.0259 (5.40)***
Turnover				0.7483 (133.76)***	0.7484 (133.74)***	0.7490 (134.07)***
Year, Ind., Firm Fixed Effects	✓	✓	✓	✓	✓	✓
R^2	0.5034	0.5033	0.5044	0.7819	0.7819	0.7819
Adj R^2	0.5024	0.5023	0.5033	0.7814	0.7814	0.7814
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	19228	19228	19228	19228	19228	19228

Table 9

Regression Model 3 and 4 Results of Hypothesis 2.

Hypothesis 2: The degree of attention to news sentiment has a positive effect on the liquidity of individual stocks. The complete regression model is as follows:

$$Turnover_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

In addition to the 6 firm and stock characteristic variables controlled in Model 2 of Table 8, Model 3 and Model 4 also include control for 5 macroeconomics variables. *RGDP*, *IPI, MANUF, REXP,* and *WHR*, which respectively stand for Real Gross Domestic Product, Industrial Production Index, Real Index of Producer's Shipment for Manufacturing, Real Customs-Cleared Exports, and Average Monthly Overtime Hours of Industry and Service. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 3	Model 3	Model 3	Model 4	Model 4	Model 4
Intercept	2.9193 (70.33)***	2.9397 (70.34)***	2.8692 (67.80)***	0.6696 (19.05)***	0.6654 (18.78)***	0.6693 (18.91)***
Main Independent Variables						
ComposSent	0.0238 (2.02)**			0.0177 (2.24)**		
NewsSent		-0.0222 (-1.27)			0.0256 (2.17)**	
CSVI			0.0555 (6.09)***			0.0095 (1.55)
Firm and Stock Characteristic Variables						
S/M				0.1846 (3.27)***	0.1874 (3.33)***	0.1850 (3.28)***
Volatility				-0.5849 (-2.58)**	-0.5574 (-2.44)**	-0.6570 (-2.90)***
Bias				-0.0011 (-0.29)	-0.0012 (-0.30)	-0.0009 (-0.23)
P/E				-0.0003 (-3.22)***	-0.0003 (-3.23)***	-0.0003 (-3.16)***
P/B				0.0248 (5.16)***	0.0247 (5.14)***	0.0250 (5.21)***
Turnover				0.7464 (132.78)***	0.7464 (132.76)***	0.7470 (133.03)***
Macroeconomics Variables						
RGDP	0.0474 (13.41)***	0.0481 (13.61)***	0.0470 (13.34)***	0.0118 (4.94)***	0.0118 (4.97)***	0.0120 (5.03)***
IPI	-0.0004 (-0.29)	-0.0007 (-0.52)	-0.0004 (-0.27)	-0.0001 (-0.09)	-0.0001 (-0.09)	-0.0002 (-0.19)
MANUF	-0.008 (-5.75)***	-0.0079 (-5.67)***	-0.0074 (-5.27)***	-0.0026 (-2.79)***	-0.0027 (-2.90)***	-0.0025 (-2.68)***
REXP	0.0089 (7.26)***	0.0086 (7.01)***	0.0086 (7.00)***	0.0028 (3.42)***	0.0029 (3.47)***	0.0027 (3.30)***
WHR	-0.0096 (-6.41)***	-0.0094 (-6.23)***	-0.0092 (-6.12)***	-0.0032 (-3.13)***	-0.0032 (-3.19)***	-0.0031 (-3.05)***
Year, Ind., Firm Fixed	✓	✓	✓	✓	✓	✓
R^2	0.5095	0.5094	0.5103	0.7824	0.7824	0.7823
Adj R^2	0.5084	0.5083	0.5092	0.7818	0.7818	0.7818
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	19228	19228	19228	19228	19228	19228

Table 10

Regression Model 5 and 6 Results of Hypothesis 2.

Hypothesis 2: The degree of attention to news sentiment has a positive effect on the liquidity of individual stocks. The complete regression model is as follows:

$$Turnover_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Zscore_{i,t-1} + \beta_9 Fscore_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

In addition to the 6 firm and stock characteristic variables and 5 macroeconomics variables controlled in Model 4 of Table 9, Model 5 and Model 6 also include control for 2 Firm Characteristic Variables. *Zscore* and *Fscore*, which respectively stand for Altman's Z score and Piotroski's F score. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 5	Model 5	Model 5	Model 6	Model 6	Model 6
Intercept	0.3163 (5.50)***	0.3088 (5.34)***	0.3145 (5.43)***	0.3704 (6.65)	0.3619 (6.45)***	0.3700 (6.60)***
Main Independent Variables						
ComposSent	0.0242 (2.17)**			0.0248 (2.22)**		
NewsSent		0.0377 (2.22)**			0.0395 (2.33)**	
CSVI			0.0123 (1.41)			0.0116 (1.33)
Firm and Stock Characteristic Variables						
S/M	0.2304 (3.13)***	0.2360 (3.21)***	0.2311 (3.13)***	0.2475 (3.33)***	0.2532 (3.41)***	0.2484 (3.34)***
Volatility	-0.6211 (-2.08)**	-0.5729 (-1.90)*	-0.7084 (-2.37)**	-0.5513 (-1.84)*	-0.4999 (-1.65)*	-0.6387 (-2.14)**
Bias	-0.0021 (-0.46)	-0.0022 (-0.48)	-0.0018 (-0.40)	-0.0018 (-0.39)	-0.0019 (-0.42)	-0.0015 (-0.33)
P/E	-0.0003 (-2.78)***	-0.0003 (-2.79)***	-0.0003 (-2.71)***	-0.0004 (-3.07)***	-0.0004 (-3.09)***	-0.0004 (-3.00)***
P/B	0.0215 (3.66)***	0.0213 (3.63)***	0.0218 (3.71)***			
Turnover	0.7357 (107.21)***	0.7356 (107.14)***	0.7364 (107.41)***	0.7368 (107.4)***	0.7366 (107.32)***	0.7375 (107.61)***
Zscore				-0.0039 (-0.96)	-0.0040 (-0.97)	-0.0037 (-0.91)
Fscore	0.0472 (8.87)***	0.0472 (8.87)****	0.0474 (8.90)***	0.0480 (8.93)***	0.0480 (8.93)***	0.0482 (8.96)***
Macroeconomics Variables						
RGDP	0.0178 (5.31)***	0.0178 (5.32)***	0.0181 (5.41)***	0.0190 (5.66)***	0.0190 (5.66)***	0.0193 (5.76)***
IPI	0.0001 (0.04)	0.0001 (0.05)	-0.0001 (-0.07)	0.0000 (0.01)	0.0000 (0.03)	-0.0001 (-0.10)
MANUF	-0.0038 (-2.88)***	-0.0039 (-2.99)***	-0.0036 (-2.78)***	-0.0036 (-2.74)***	-0.0038 (-2.87)***	-0.0035 (-2.65)***
REXP	0.0040 (3.48)***	0.0041 (3.55)***	0.0039 (3.37)***	0.0039 (3.35)***	0.0040 (3.42)***	0.0037 (3.23)***
WHR	-0.0042 (-2.99)***	-0.0043 (-3.04)***	-0.0042 (-2.92)***	-0.0040 (-2.81)***	-0.0041 (-2.86)***	-0.0039 (-2.74)***
Year, Ind., Firm Fixed	✓	✓	✓	✓	✓	✓
R^2	0.7752	0.7752	0.7751	0.7750	0.7750	0.7749
Adj R^2	0.7745	0.7745	0.7745	0.7743	0.7743	0.7743
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	13631	13631	13631	13631	13631	13631

Table 11

Descriptive Statistics of the Relationship between Composite Sentiment (*ComposSent*) and Net Buy/Sell.

Foreign Institutional Investors, Investment Trusts, and Dealers respectively represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Foreign Institutional Investors		**Investment Trusts**		**Dealers**	
	High *ComposSent* (Top 25%)	Low *ComposSent* (Bottom 25%)	High *ComposSent* (Top 25%)	Low *ComposSent* (Bottom 25%)	High *ComposSent* (Top 25%)	Low *ComposSent* (Bottom 25%)
N. of Sample	4807	4807	4807	4807	4807	4807
Mean (%)	-0.762	-12.073	0.706	0.010	0.129	0.001
S.D. (%)	65.977	85.051	10.382	14.120	10.763	12.149
Min. (%)	-901.260	-911.500	-246.280	-188.080	-229.590	-181.590
Med. (%)	-0.330	-2.390	0.010	0.020	0.000	-0.010
Max. (%)	668.330	1006.910	159.890	346.350	180.710	192.520
High minus Low	**11.310 (7.2851)*** **		**0.696 (2.7522)*** **		**0.128 (0.5482)**	

Table 12

Regression Model 1~6 Results of Hypothesis 3.

Hypothesis 3: The degree of attention to news sentiment has a positive effect on the buying and selling behavior of institutional investors. The complete regression model is as follows:

$$Institutional_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Zscore_{i,t-1} + \beta_9 Fscore_{i,t-1} + \beta_{10} RGDP_t + \beta_{11} IPI_t + \beta_{12} MANUF_t + \beta_{13} REXP_t + \beta_{14} WHR_t + \varepsilon_{i,t}$$

The dependent variables $Institutional_{i,t}$ include $Foreign_{i,t}$, $InvestTrust_{i,t}$, and $Dealer_{i,t}$ represent the net buy-and-sell quantity (a unit is 100 board lots, which is 100,000 shares) of foreign institutional investors, investment trusts, and dealers, respectively, for stock *i* on day *t*. For the introduction of Models 1 to 6, please refer to Appendix Table 2. To save space, only the coefficients of the variables *ComposSent*, *NewsSent*, and *CSVI* are presented. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Foreign Institutional Investors						
ComposSent	7.2862 (6.24) ***	6.1604 (5.26) ***	6.6989 (5.68) ***	5.7658 (4.88) ***	3.3452 (2.27) **	3.3472 (2.27) **
NewsSent	13.3977 (7.71) ***	10.4026 (5.91) ***	12.3223 (7.02) ***	9.7394 (5.50) ***	6.1425 (2.74) ***	6.0038 (2.68) ***
CSVI	-1.4746 (-1.62)	-0.5636 (-0.62)	-1.5828 (-1.73) *	-0.7274 (-0.79)	-0.5198 (-0.45)	-0.4308 (-0.37)
Investment Trusts						
ComposSent	0.5861 (2.87) ***	0.7173 (3.48) ***	0.5633 (2.73) ***	0.6795 (3.27) ***	0.7984 (2.83) ***	0.7982 (2.82) ***
NewsSent	0.6828 (2.24) **	0.9655 (3.12) ***	0.5895 (1.92) *	0.8472 (2.72) ***	1.0908 (2.54) **	1.0725 (2.50) **
CSVI	0.2445 (1.54)	0.2149 (1.35)	0.2775 (1.73) *	0.2408 (1.50)	0.2610 (1.18)	0.2722 (1.23)
Dealers						
ComposSent	0.0495 (0.27)	-0.0667 (-0.36)	0.0892 (0.48)	-0.0263 (-0.14)	0.0506 (0.22)	0.0522 (0.22)
NewsSent	0.1028 (0.37)	-0.2245 (-0.80)	0.1751 (0.63)	-0.1513 (-0.54)	0.0105 (0.03)	0.0032 (0.01)
CSVI	0.0224 (0.16)	0.1138 (0.79)	0.0273 (0.19)	0.1239 (0.85)	0.1708 (0.94)	0.1765 (0.97)
6 Firm & Stock		✓		✓	✓	✓ (Excluding *P/B*)
Zscore						✓
Fscore					✓	✓
5 Macroeconomics			✓	✓	✓	✓
Year, Ind, Firm Fixed	✓	✓	✓	✓	✓	✓

Table 13

Robustness Test of Hypothesis 1.

Hypothesis 1: The degree of attention to news sentiment has a positive effect on individual stock returns. The complete regression model is as follows:

$$Ret_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \varepsilon_{i,t}$$

For the introduction of Models 2, please refer to Appendix Table 2. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Normal Period		2020 Presidential Election Period		COVID-19 Level 3 Alert	
Intercept	0.5316 (4.06)***	0.5116 (3.87)***	2.0464 (3.94)***	2.0421 (3.92)***	1.2226 (1.78)*	1.2269 (1.78)*
Main Independent Variables						
ComposSent	0.0872 (2.79)***		0.2043 (2.56)**		0.3138 (2.75)***	
NewsSent		0.1206 (2.44)**		0.0183 (0.17)		-0.0622 (-0.41)
Firm and Stock Characteristic Variables						
S/M	-0.2087 (-0.92)	-0.1880 (-0.93)	-0.3578 (-0.51)	0.1358 (1.29)	-0.8496 (-0.82)	-1.0453 (-1.01)
Volatility	0.6691 (0.69)	0.8038 (0.82)	-2.831 (-1.35)	-0.3681 (-0.52)	1.0820 (0.31)	0.5831 (0.16)
Bias	-0.0216 (-1.38)	-0.0215 (-1.37)	0.0499 (1.21)	-3.2732 (-1.56)	-0.1509 (-1.07)	-0.1354 (-0.96)
P/E	-0.0001 (-0.38)	-0.0001 (-0.38)	-0.0309 (-2.02)**	0.0511 (1.24)	-0.0059 (-1.02)	-0.0069 (-1.19)
P/B	-0.0807 (-4.23)***	-0.0810 (-4.25)***	-1.366 (-5.02)***	-0.0311 (-2.04)**	-0.1011 (-0.31)	-0.0097 (-0.03)
Turnover	0.0318 (1.44)	0.0317 (1.44)	0.2591 (1.97)**	-1.3426 (-4.93)***	-0.0684 (-0.64)	-0.0351 (-0.33)
Year, Ind., Firm Fixed	✓	✓	✓ (no control *Year*)	✓ (no control *Year*)	✓ (no control *Year*)	✓ (no control *Year*)
R^2	0.0074	0.0072	0.0273	0.0257	0.0516	0.0455
Adj R^2	0.0043	0.0042	0.0136	0.0120	0.0178	0.0114
p value of F test	<0.0001	<0.0001	0.0002	0.0006	0.0191	0.0789
Observations	15012	15012	3026	3026	1190	1190

Table 14

Robustness Test of Hypothesis 2.

Hypothesis 2: The degree of attention to news sentiment has a positive effect on the liquidity of individual stocks. The complete regression model is as follows:

$$Turnover_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \varepsilon_{i,t}$$

For the introduction of Models 2, please refer to Appendix Table 2. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Normal Period		2020 Presidential Election Period		COVID-19 Level 3 Alert	
Intercept	0.7519 (19.16)***	0.7472 (18.87)***	1.4924 (19.9)***	1.4914 (19.84)***	2.3566 (11.29)***	2.3399 (11.15)***
Main Independent Variables						
ComposSent	0.0177 (1.89)*		-0.0003 (-0.02)		0.1303 (3.77)***	
NewsSent		0.0260 (1.76)*		0.0024 (0.16)		0.0901 (1.94)*
Firm and Stock Characteristic Variables						
S/M	0.2490 (3.66)***	0.2529 (3.73)***	-0.1242 (-1.22)	-0.1239 (-1.21)	0.3798 (1.21)	0.3465 (1.10)
Volatility	-0.4273 (-1.47)	-0.3960 (-1.35)	0.9839 (3.25)***	0.9945 (3.28)***	4.5614 (4.25)***	4.6065 (4.25)***
Bias	0.0007 (0.14)	0.0007 (0.14)	-0.0049 (-0.83)	-0.0050 (-0.84)	0.0069 (0.16)	0.0086 (0.20)
P/E	-0.0002 (-1.93)*	-0.0002 (-1.93)*	0.0066 (3.00)***	0.0066 (3.00)***	0.0016 (0.91)	0.0014 (0.81)
P/B	0.0220 (3.85)***	0.0219 (3.84)***	-0.0919 (-2.34)**	-0.0919 (-2.34)**	-0.0840 (-0.84)	-0.0698 (-0.70)
Turnover	0.7413 (112.45)***	0.7412 (112.42)***	0.3967 (20.89)***	0.3965 (20.91)***	0.2432 (7.53)***	0.2511 (7.76)***
Year, Ind., Firm Fixed	✓	✓	✓ (no control *Year*)	✓ (no control *Year*)	✓ (no control *Year*)	✓ (no control *Year*)
R^2	0.7945	0.7945	0.7353	0.7353	0.7278	0.7253
Adj R^2	0.7939	0.7939	0.7315	0.7315	0.7181	0.7155
p value of F test	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	15012	15012	3026	3026	1190	1190

Table 15

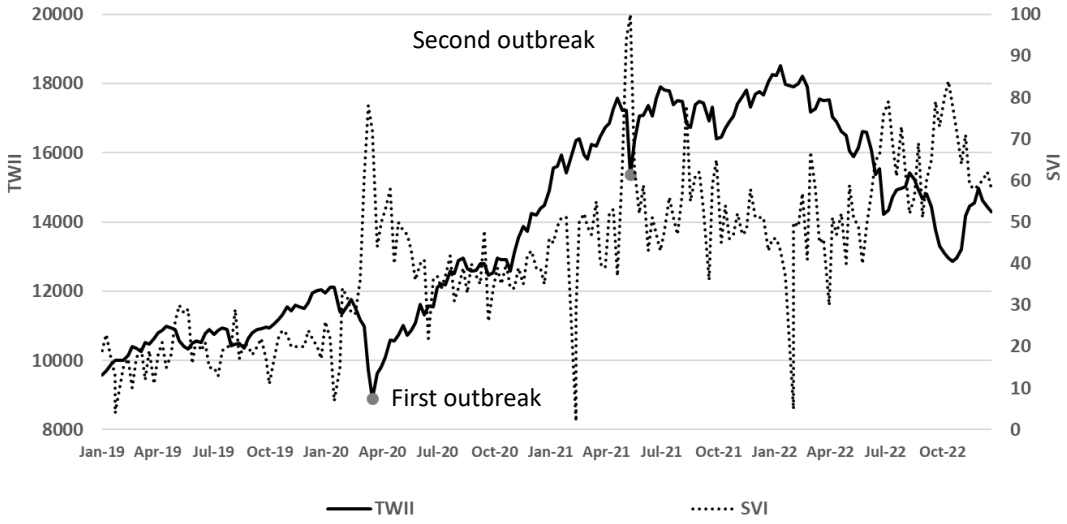
Robustness Test of Hypothesis 3.

Hypothesis 3: The degree of attention to news sentiment has a positive effect on the buying and selling behavior of institutional investors. The complete regression model is as follows:

$$Institutional_{i,t} = \alpha_{i,t} + \beta_1 Main_{i,t-1} + \beta_2 S/M_{i,t-1} + \beta_3 Volatility_{i,t-1} + \beta_4 Bias_{i,t-1} + \beta_5 P/E_{i,t-1} + \beta_6 P/B_{i,t-1} + \beta_7 Turnover_{i,t-1} + \varepsilon_{i,t}$$

For the introduction of Models 2, please refer to Appendix Table 2. The *t*–values are in parentheses. Significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Normal Period	2020 Presidential Election Period	COVID-19 Level 3 Alert
Observation	15012	3026	1190
Foreign Institutional Investors			
ComposSent	4.1226 (2.94)***	11.6713 (5.00)***	4.3575 (1.11)
NewsSent	8.5394 (3.87)***	14.1117 (4.58)***	-2.7935 (-0.53)
Investment Trusts			
ComposSent	0.4567 (1.83)*	1.3798 (3.82)***	0.5192 (0.71)
NewsSent	0.7741 (1.96)**	1.3492 (2.83)***	0.0141 (0.01)
Dealers			
ComposSent	0.0955 (0.43)	-0.9513 (-2.80)***	-0.3018 (-0.21)
NewsSent	0.1584 (0.45)	-0.6722 (-2.61)***	-0.5338 (-0.37)
S/M	✓	✓	✓
Volatility	✓	✓	✓
Bias	✓	✓	✓
P/E	✓	✓	✓
P/B	✓	✓	✓
Turnover	✓	✓	✓
Year, Ind., Firm Fixed	✓	✓ (no control *Year*)	✓ (no control *Year*)



[Figure 1] Taiwan Weighted Index (TWII) and Google Search Volume Index (SVI) during the COVID-19 period.