How Web Search Activity and Financial Media Coverage Affect Asset Prices?

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ABSTRACT

Internet and financial media are increasingly important sources of public information for investors to ensure proper decision-making. A growing body of literature has investigated the impacts of web search activities and media coverage on capital markets in terms of investor attention. So far, however, there has been little discussion about whether Internet and financial media capture attention from the same group of investors. Focusing on the attention effect on stock returns, this present study aims to fill up the gap by employing typical asset pricing models and a mediation analysis. We find that firms receiving more investor attention from Internet possess higher stock returns and Jensen's alpha. Larger firms are covered by more news stories than smaller firms. However, medium-sized firms are found most sensitive to Internet and financial media. Overall, both web search activity and media coverage significantly affect stock returns, but their impacts are weak and insignificant during financial crises. The mediation analysis indicates that Internet and financial media might capture investor attention from different groups.

Keywords: Web Search Behavior, Google Search Volume Index, Media Coverage, Asset Pricing, Trading Activity

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1 Introduction

Internet and financial media spread public information that might influence investors' decision-making in modern society. Both information services appear to be important sources of information for individual investors (Tetlock 2010; Bank *et al.* 2011; Da *et al.* 2011b), and a considerable amount of theoretical models have been proposed to investigate the impact of information on asset prices (Kihlstrom 1974; Grossman & Stiglitz 1980; Radner & Stiglitz 1984; Allen 1990). However, information alone cannot yield any economic effect on asset prices unless investors pay attention to and digest the information (Da *et al.* 2011b). Therefore, two essential elements of the information impact coming from Internet and financial media on asset prices are information content and investor attention.

Some financial economists argue that it is mainly information content that affects asset prices: good news would push asset prices up, while bad news would pull them down, no matter the news is reported on Internet or by financial media. They further suggest that the extent to which information contents affect asset prices depends on market efficiency as well as the information disclosure policy (Fama *et al.* 1969; French & Roll 1986). Since information asymmetry leads to higher trading costs, firms with less news stories reported on the financial media (*i.e.,* media coverage) need to offer higher stock returns to compensate investors for non-diversifiable risks due to insufficient information (Fang & Peress 2009). Merton (1987) provides a theoretical foundation for the media effect in terms of incomplete information and investor attention. In contrast, Barber and Odean (2008) argued that firms with more investor attention are likely to experience positive price pressure. These attention-based theories provide explanations about the effect of neutral information, which contains neither good nor bad news and is hardly explained by information content.

To date there has been little agreement on which role (information content or investor attention) do Internet and financial media play in capital markets. Studies focusing on information content tent to view the number of news stories reported by financial media (e.g. the Reuters NewsScope service, Broadtape, and Wall Street Journal) as a proxy for information supply (Sobel 1982; Mitchell & Mulherin 1994; Vlastakis & Markellos 2012). Similarly, search volume on Internet was employed as a measure of information demand because investors who demands relevant news may take advantage of search engines (Vlastakis & Markellos 2012). On the other hand, studies focusing on investor attention tend to use web search activities and media coverage to measures investor attention, assuming that both information services

have captured investor attention (Barber & Odean 2008; Fang & Peress 2009; Bank *et al.* 2011; Da *et al.* 2011b).

These above-mentioned studies generally confirm the influences of Internet and financial media on asset prices. So far, however, there has been little discussion about the intricacies between web search activities, media coverage, and asset pricing. In most cases, financial media probably offer interesting news stories that may drive investors to search for more information via internet. Therefore, media coverage, besides affecting price directly, might influence web search activities, which in turn affect numerous economic activities (Choi & Varian 2009; Bank *et al.* 2011; Mondria & Wu 2011; Da *et al.* 2011a; Da *et al.* 2011b). If web search activities are highly correlated with media coverage, search volume on Internet would be just a proxy for media coverage. Investigating these links shed light on whether Internet and financial media capture investor attention from the same group.

The present study endeavors to examine the role played by Internet and financial media in asset pricing from the perspective of attention theories. To measure web search activities, we use Google Search Volume Index (SVI), which also serves a direct proxy for investor attention (Da *et al.* 2011b). We focus on web search activities in Taiwan because it is a densely populated country with extremely high internet penetration rate[5]. Moreover, the Taiwan stock market has a high proportion of individual investors[6]. As individuals, being uninformed investors, are more likely to use Internet to search for financial information than institution investors, web search activities in Taiwan are expected to possess a certain degree of influence on Taiwan stock market. On the other hand, we follow previous studies and use the number of news stories to measure media coverage (Veldkamp 2006; Barber & Odean 2008; Fang & Peress 2009; Vlastakis & Markellos 2012). These news stories, reported on major newspapers and official websites of listed companies, are only associated with financial and company news, and exclude reports on price movement and trends. We collect these news stories from the Taiwan Economic Journal database (TEJ) and calculate the number of news each week as a measure of media coverage. Finally, to assess the influences of Internet and financial media on asset prices, we use traditional asset pricing models such as the market model (CAPM), the Fama and French three-factor model (Fama & French 1993), and the Carhart four-factor model

[5] According to Internet World Stats, there were 17,530,000 internet users in Taiwan, representing 75.4% of the population, at mid-year 2012. The Council for Economic Planning and Development (CEPD) also noted that Taiwan's Internet penetration rate is the fourth highest in Asia.

[6] Barber *et al.* (2005) document that individual investors, occupying about one-third of Taiwan's population and holding more than half of total stock ownership in 2000, dominate the Taiwan market.

(Carhart 1997).

Using a portfolio sorting exercise based on SVI, we find that firms in a portfolio with more investor attention from Internet possess higher stock returns and Jensen's alpha. Moreover, both stock returns and Jensen's alpha are found to increase monotonically with investor attention. Through a panel regression analysis with mainstream asset pricing models, we find that both investor attention and media coverage suitably acts as asset pricing factors with statistical significance. As for their predictive ability, we find that an abnormally high SVI relative to previous 8 weeks can predict a positive rise in the next week's stock returns. In accordance with prior findings, the result supports the attention theory of Barber and Odean (2008). However, media coverage fails to predict future stock returns. Since the influence of news stories in the event week hardly extends to the next week, the Taiwan stock market probably works as the weak-form efficient market theory predicts (Malkiel & Fama 1970).

We also consider the impacts of market capitalization and market states. Sorting the sample stocks by market capitalization into quintiles, we find media coverage increases monotonically with market capitalization across quintiles, indicating that larger firms tend to have more news articles than smaller firms. However, the magnitude of the media effect on asset prices appears to be lowest in the fifth quintile. This result indicates that prices of larger stocks are less sensitive to the influence of a news story than smaller stocks. This is not surprising because firms with large market capitalization tend to be robust against trivial news. Moreover, the attention effect predicted by Barber and Odean (2008) is notable in the medium-sized firms but absent both in the largest and smallest 20% of firms in our sample. The result is partly consistent with the finding of Da *et al.* (2011b), who documented that the attention effect is only present among the smaller half of the Russell 3000 stock sample. On the other hand, financial crises probably make investors reluctant to buy stocks and drive them to sell irrationally. Consequently, the number of buyers of attention-grabbing stocks might be far less than that of sellers of the same stocks, so the attention effect on stock returns would be limited in the financial crises. Consistent with institution, we find that the attention effect is found absent in the 2008 Financial Tsunami and in the 2011 European Sovereign Debt Crisis. In these years, the media effect on stock returns is relatively weak as well.

Finally, to find out whether Internet and financial media capture attention from the same group of investors, we conduct a mediation analysis to investigate the links between web search activities, media coverage, and asset pricing. We find that media coverage can explain a tiny part of variation in SVI, implying that only a part of web search activities are affected by financial media; there might be other possible

factors affecting web search activities of investors than financial media. The result further shows that the indirect effect of media coverage through SVI is incomparable to its direct effect. Accordingly, SVI is not an intervening variable between media coverage and asset prices. These findings suggest that Internet and financial media probably capture investor attention from different groups.

The rest of the present paper is organized as follows. Section 2 presents literature review. Section 3 describes data and sample construction. Section 4 presents empirical results and robustness analyses. Section 5 concludes.

2 Literature Review

2.1 The Effect of Investor Attention

Two principal schools of thought have addressed the economic effects of investor attention on stock returns. Merton (1987) argued that firms which capture less investor attention have to offer higher stock returns so that investors can be compensated for imperfect diversification due to incomplete information. Fang and Peress (2009) provided evidence to support the argument of Merton (1987). To approximate attention attracted by companies, they used the number of published newspaper articles, referred to as media coverage, and found that stocks without media coverage earn a higher return than those with extensive media coverage. This is because investors of firms with less media coverage suffer a higher cost due to information asymmetry and require a higher stock return as a compensation for the risk. The other school of thought postulates an opposite effect resulting from investor attention. According to the attention theory of Barber and Odean (2008), individual investors are net buyers of attention-grabbing stocks; an increase in individual investor attention leads to net buying and thus results in positive price pressure.

In this context, search volume serves as a direct measure of investor attention[7] (Da *et al.* 2011b); therefore, a dramatic increase in search volume can be viewed as a boon in investor attention that pushes the stock prices up. A couple of empirical studies have confirmed the strong impacts of Google search volume on stock returns. Using a sample of Russell 3000 stocks, for example, Da *et al.* (2011b) find that an abnormal increase in SVI predicts higher stock prices in the next 2 weeks. Similarly,

[7] Da, Engelberg et al. (2011b) provide a comprehensive analysis to support it.

Bank *et al.* (2011) also find evidence that an increase in SVI is associated with temporarily higher future returns. Based on the reasoning, we expect a positive correlation between changes in SVI and stock performance. To test whether attention-grabbing stocks have higher stock returns, we form portfolio based on the level of SVI and expect that a portfolio with higher level of SVI possesses higher stock returns. To examine how stocks in the attention-based portfolios perform relative to the market, we also use Jensen's alpha as a measure of abnormal returns.

2.2 The Explanatory Power of SVI Based on Abbreviated Company Names

What kind of keywords is sent by the Google users determines no only the search results but also the explanatory power of SVI. Bank *et al.* (2011) employ SVI based on a company's name and confirm its explanatory power in economic activity. In contrast, Da *et al.* (2011b) argued that SVI for company name might be problematic because of at least two reasons. One is that investors may search the company name for reasons unrelated to investing. The other is that different investors may search the same firm using several variations of its name. Therefore, Da *et al.* (2011b) adopt SVI for stock ticker symbols to capture investor attention.

Unlike the United States Stock Market that frequently utilizes ticker symbols, Taiwan Stock Exchange Corporation (TWSE) uses numerical codes and abbreviated company names as an alternative way to indicate each traded stock. Since a numerical code is indistinguishable from other meaningless figures, and rarely works as a keyword in search engine, investors who search for relevant information tend to use abbreviations of company names. Moreover, company names in such abbreviated forms are also commonly seen in public information and frequently used in daily communication, so they are quite familiar to investors as well as to the public. Consequently, we employ the SVI for abbreviated company names and investigate its effect throughout the study.

It is worth exploring whether this type of SVI (i.e., the SVI for abbreviated firm names) exhibits similar explanatory power just like SVI for stock ticker symbols. As these abbreviated company names are generally and habitually used by brokers, analysts, officials, and mass media, an investor searching for such official abbreviations is likely to be interested in financial information about these stocks. Therefore, this kind of SVI can serve as an indicator of interest of the public, which induces investors to carry out a transaction.

2.3 The Effect of Media Coverage

Financial media can affect stock prices in various ways. One of the most essential elements is information contents reported by news article: positive news would push stock prices up, while negative news would exhibit an opposite effect. The effect exists because financial media provides public information that might influence investors' decision-making, and in turn affect their investment performance (Akerlof, 1970; Allen, 1990; Fama et al., 1969; French & Roll, 1986; Grossman & Stiglitz, 1980; Kihlstrom, 1974). On the other hand, financial media frequently reports news, resulting in the flow of information. The Mixture of Distributions Hypothesis (MDH) provides a theoretical foundation on the link between information flow and trading activity such as stock return, market volatility, and trading volume.

However, information reported by financial media cannot produce any economic effect unless investors pay attention to and digest the information (Da *et al.* 2011b). Accordingly, a condition for the realization of media effects is investor attention. As mentioned above, two principal schools of thought have addressed the economic effects of investor attention on stock returns. Investor attention probably affects stock prices even when the news is simply presented on financial media, neither positive nor negative. This maybe because the news makes investors aware of the existence of the stock that it reports. Since news articles might also arouse interests among investors and drive investors to search for relevant information from Internet, Google search volume is supposed to rise.

Moreover, when investors become interested in a certain company, they might pay more attention to the news relevant to this company. In this case, the media effect is supposed to be larger in firms with much investor attention. This implies that influences of investor attention and media coverage on stock returns might not be additive.

2.4 The Size Effect

The size effect, first documented by Banz (1981), suggests that smaller firms have higher risk-adjusted returns, on average, than larger firms. Subsequent studies found that smaller stocks are sensitive to price changes, while larger stocks are less likely to be affected by bid-ask bounce. These finding implies that market capitalization determines a wealth of stock characteristics. For example, larger firms are supposed to have a larger number of analysts and news articles than smaller firms. Accordingly, media coverage and investor attention should vary with market

capitalization.

Da *et al.* (2011b) found that the positive price pressure predicted by attention theory of Barber and Odean (2008) is only present among the smaller half of our Russell 3000 stock sample. Their finding suggests that market capitalization affects the influence of investor attention on stock returns. Moreover, Russell 3000 stocks, representing above 90% of market capitalization of total U.S. equity, are relatively large stocks. Whether the price pressure exists among the small stocks remains unclear.

2.5 The Effect of Financial Crises

Financial Crises significantly affect investor sentiment and drive investors to sell irrationally. Meanwhile, for fear of substantial systematic risks, investors tend to be reluctant to buy stocks. Therefore, more selling activities emerge during periods of crisis than buying activities. In this case, the number of buyers of attention-grabbing stocks might be far less than the number of sellers of the same stocks. Consequently, the attention effect on stock returns would be limited in financial crises. In other words, financial crises which lead to irrational sales probably invalidate the positive price pressure caused by investor attention. The attention effect would be weak and insignificant during periods of crisis.

3 Data and Sample Construction

To construct traditional asset pricing models, we collect all relevant data from the Taiwan Economic Journal database (TEJ), including market information, closing price, risk free rate, market capitalization, book values, and equity values. We follow conventional approaches to evaluating asset pricing factors. Specifically, we rank all stocks with a formation period of six months and then group them into three portfolios based on stock performance. The top 30% stocks constitute the winner portfolio, while the 30% worst ones form the loser portfolio. Return on the winner portfolio minus return on the loser portfolio yields the momentum factor. For the risk-free rate we use the one-month money market rate.

In addition, the TEJ database has been recording news stories of listed companies. These news stories, reported in major newspapers and official websites of Taiwan's securities market, are associated with financial and company news, and exclude technical reports on price movement and trends. We calculate the number

of news each week as a proxy for media coverage, which is also an alternative measure of attention. Since data on media coverage is not available prior to 2008 from TEJ, the sample is limited to the period from January 2008 to October 2012.

We focus on all listed common stocks ever traded on the Taiwan Stock Exchange (TWSE) during this period and thus obtain a sample of 834 common stocks. For each stock in our sample, we draw the corresponding time series of internet search activity from Google Insights for Search. To avoid arbitrariness and assure the reliability of the analysis, we employ for each firm its abbreviated name as given by Taiwan Stock Exchange Corporation (TWSE)[8]. These abbreviated company names are commonly seen on mass media and official websites and are quite recognizable to investors. Since Google Insights designates a certain threshold of traffic for search terms, we obtain SVI data only on 781 common stocks, of which 533 are at weekly frequency[9]. We remove stocks whose abbreviated firm names have a generic meaning or sound indistinguishable[10]. As a result, we collect a total of 119,712 firm-week observations. Moreover, we winsorize both stock returns and market returns by the highest and lowest 1%. Media coverage is winsorized by the highest 1% to remove outliers. Table 1 provides definitions for all variables used in this paper, and Table 2 presents the summary statistics.

[Insert Table 1]

[Insert Table 2]

[8] See http://www.twse.com.tw/en/ .

[9] Those with low volume might be inaccessible or might appear in the form of monthly frequency. Moreover, Google Insights does not return a valid SVI for some of our queries. If a term is rarely searched, Google Insights will return a zero value for that ticker's SVI.

[10] Due to ambiguity, SVIs for these stocks are likely to be higher than they should be. For example, the abbreviated firm name for stock code 9928 is "Greater Taipei", which exhibits a geographical meaning. Another example is "Elite" for stock code 2331, which also possesses multiple meanings.

4 Empirical Results

4.1 Stock Characteristics across SVI Quartiles

As mentioned previously, two principal schools of thought have addressed the economic effects of investor attention on stock returns. Merton (1987) argues that firms which capture less investor attention have to offer higher stock returns so that investors can be compensated for imperfect diversification due to incomplete information. In contrast, Barber and Odean (2008) postulate that firms with much investor attention are likely to experience positive price pressure because investors are net buyers of attention-grabbing stocks. Suppose SVI adequately proxies for investor attention. There should be a negative relation between SVI and stock returns if Merton (1987) argument holds. Otherwise, if the relation between SVI and stock returns turns out to be positive, the attention theory of Barber and Odean (2008) is supported.

To investigate the relation between SVI and stock returns, we sort all firms in the sample into four quartiles of equal size according to the level of SVI. The sorting procedure is based on weekly basis. Then, we use a t-test to examine whether the characteristics of firms which attract much investor attention, such as those firms in the fourth quartile, differ from those with little investor attention, such as those in the first quartile. Moreover, for each quartile, we regress the stock returns using the Carhart (1997) four-factor model, which employs well-known asset pricing factors, including system risk derived from market return ($MktRet_t$), size (SMB_t), book-to-market (HML_t), and momentum (MOM_t). This procedure enables us to observe whether and how typical asset pricing factors change across quartiles.

[Insert Table 3]

Table 3 shows the comparison results based on the t-test and the estimation results of the Carhart (1997) four-factor model in panel A and B, respectively. Panel A presents univariate comparisons of key descriptive variables by SVI quartile. Mean values of these variables for each quartile are listed at each row. The quartiles are constructed each week, which explains why the ranges of SVI overlap across quartiles. Moreover, the average value of SVI for each quartile is presented at the first row with distinguished gaps between these quartiles. Using a t-test, we examine whether the stock characteristics of the fourth-quartile firms differ significantly from those of the

first-quartile firms. Consistent with expectation, the results indicate that almost all essential characteristics of firms in the fourth-quartile are significantly different from those in the first-quartile.

The second row lists the characteristics of media coverage across quartiles. The t-test result shows that media coverage of the fourth-quartile firms is significantly higher than that of the first-quartile firms with a t-statistics value of -12.14. However, we can find that media coverage do not always change monotonically with SVI. Media coverage is relatively high in the second and third quartile. Consequently, the relationship between media coverage and SVI seems to be the inverted U-shaped across quartiles. The nonlinear relationship implies that investor attention would be influenced by factors other than media coverage.

As for stock return, past researches indicate that firms in portfolios with higher SVI possess abnormal stock returns (Bank *et al.* 2011; Da *et al.* 2011b). The t-test result provides consistent evidence by showing that the average stock return for the fourth-quartile firms significantly exceeds that for the first-quartile firms with a t-statistics value of -4.082. Moreover, moving from the first quartile to the fourth one, we can find that stock return increases monotonically with SVI. Accordingly, a positive relationship might exist between stock returns and investor attention, just as the attention theory of Barber and Odean (2008) predicts.

Risk in the fourth row is measured by the standard deviation of daily return within one week. We can observe that the magnitude of risk is similar across quartiles. With a t-statistics value of -1.309, the t-test also fails to identify out significant difference in risk between the first and fourth quartile. The result implies that the relation between risk and investor attention might be absent unless we control possible factors[11].

Market capitalization in million is measured in the form of natural logarithm. Similar to media coverage, the relationship between market capitalization and SVI appears to be reversed U-shaped. This result implies that the relationship of market capitalization with SVI might not be as explicit as that with media coverage.

Trading volume in dollars and stock turnover rate are essential measures for trading activity in the capital market in literature (Karpoff 1987; Lo & Wang 2000; Chordia *et al.* 2001; Chordia *et al.* 2007). Bank *et al.* (2011) documented a positive relationship between SVI and liquidity. They argue that using search engines helps reduce information asymmetry and thus results in increased individuals' willingness to invest. Similarly, Vlastakis and Markellos (2012) also documented a positive link

[11] Vlastakis and Markellos (2012), who documented that SVI is associated with the volatility of individual stocks, provides a detailed analysis.

between SVI and trading volume after studying 30 stocks traded on the NYSE. Our t-test results also indicate that the fourth-quartile firms differ significantly from the first-quartile firms in terms of trading volume and turnover. Therefore, the evidence is consistent with prior studies. However, except stock returns, the rest stock characteristics do not always change monotonically with SVI. As a result, comparing the stocks in the first and fourth quartiles of SVI is not sufficient to describe the relation between investor attention and other stock characteristics. The same result holds for trading volume and turnover.

One concern arises from reviewing the results shown in panel A: whether the monotonic relation between stock returns and investor attention changes after considering other asset pricing factors. To address the issue, panel B compares regression coefficients in the asset pricing model of Carhart (1997) across quartiles. We can see that the intercept increases monotonically with SVI, indicating that a higher Jensen's alpha tends to be accompanied with higher investor attention. Since the academic literature often interprets the Jensen's alpha as a type of abnormal returns, the result here implies that abnormal returns are more likely to occur in firms which attract much investor attention, consistent with prior findings (Bank *et al.* 2011; Da *et al.* 2011b). Moreover, the positive relation between SVI and Jensen's alpha confirms the attention theory of Barber and Odean (2008) that investor attention might produce positive price pressure**.**

The results presented in panel B also indicate that firms in the fourth quartile have the lowest loading on system risk ($MktRet_t$), size (SMB_t), and momentum (MOM_t) factors. However, these regression coefficients do not always change monotonically with SVI. Consequently, as in panel A, it is not sufficient to describe the relation between investor attention and these asset pricing factors simply by comparing regression coefficients in the Carhart (1997) four-factor model across quartiles. Overall, the finding presented on panel B is quite consistent with that on panel A. Accordingly, both portfolio sorting exercise and regression analysis provide supports for the attention theory of Barber and Odean (2008).

4.2 The Role of Investor Attention in Typical Asset Pricing Models

For information to be instantaneously incorporated into prices when it arrives, investors need to allocate sufficient attention to the asset, which is an implicit but critical assumption in asset pricing models, as suggested by Da *et al.* (2011b). To investigate whether SVI for abbreviated firm names exhibits explanatory power for stock returns, we take a panel regression controlling for other well-known asset pricing factors such as system risk derived from market return ($MktRet_t$), size

(SMB_t), book-to-market (HML_t), and momentum (MOM_t). Specifically, we regress the stock returns in the current week on their corresponding SVI by including the attention variable in three traditional asset pricing models: the market model (CAPM), the Fama and French (1993) three-factor model, and the Carhart (1997) four-factor model. We include firm fixed effects in all panel regressions and apply the following model:

$$FirmRet_{it} = b_0 + b_1 SVI_{it} + b_2 MktRet_t + b_3 SMB_t + b_4 HML_t + b_5 MOM_t + c_i + u_t + \varepsilon_{i,t}. \quad (1)$$

Media coverage, or the number of headlines presented in newspapers, is another popular measure of investor attention (Barber & Odean 2008). Da *et al.* (2011b) find that the time-series correlations between SVI and media coverage are positive but low. In the next step, we consider the media effect on stock returns by adding the media variable to these asset pricing models. Specifically, we estimate the following model:

$$FirmRet_{it} = b_0 + b_1 Media_{it} + b_2 MktRet_t + b_3 SMB_t + b_4 HML_t + b_5 MOM_t + c_i + u_t + \varepsilon_{i,t}. \quad (2)$$

Finally, to address the issue whether SVI is simply a proxy for media coverage, we include both variables in our regressions.

$$FirmRet_{it} = b_0 + b_1 \mathrm{SVI}_{\mathrm{it}} + b_2 Media_{it} + b_3 MktRet_{\mathrm{t}} + b_4 \mathrm{SMB}_{\mathrm{t}} + b_5 \mathrm{HML}_{\mathrm{t}} + b_6 \mathrm{MOM}_{\mathrm{t}} + c_i + u_t + \varepsilon_{i,t}. \quad (3)$$

The results are reported in Table 4. In each specification, the dependent variable $FirmRet_{it}$ is always return premium, calculated as the stock return minus the risk-free rate. In specifications (1) – (3), the explanatory variable of interest is SVI_{it}. Since the coefficients on these variables are statistically significant at the 1% level after controlling for the primary asset pricing factors, investor attention (or interest) is found to influence the current stock returns. Consequently, parts of the return premium that cannot be explained by other well-known risk factors are induced by investor attention, which seems to be an effective asset pricing factor. Moreover, as these coefficients are statistically significant and positive, stocks are found to experience positive price pressure subsequent to an increase in individual attention. The results support the attention theory of Barber and Odean (2008) and reinforces previous empirical findings (Da *et al.* (2011b), Bank *et al.* (2011)).

The results remain robust even after we include both attention variables in these asset pricing models, as shown in specifications (7) – (9). Since SVI_{it} does not lose its significance after we include $Media_{it}$ in these settings, it should not be a mediator variable between $\mathrm{R_{it}}$ and $Media_{it}$. Therefore, investor attention, as measured by SVI, is found to significantly affect stock returns, incremental to the influence of information contained in news articles. However, the inclusion of $Media_{it}$ slightly mitigates the influence of SVI_{it}. This is because: attention invoked by headlines in newspapers may translate into a higher SVI as people start to search the company stock (Da *et al.* 2011b). In other words, media coverage captures a certain degree of investor attention, so $Media_{it}$ partially subsumes the influence of SVI_{it}. Nevertheless, $Media_{it}$ can neither fully capture investor attention nor completely consume the explanatory power of SVI, because investors may start to pay attention to a stock in anticipation of a news event before it is mentioned or reported in newspapers. Using a vector autoregression (VAR) framework, Da *et al.* (2011b) confirm the possibility by finding that SVI actually leads news. Consequently, the effect of SVI on stock returns remains significant after we take media coverage into account.

In sum, the findings for attention as being an effective asset pricing factor are quite strong, since the stock prices reflect some degree of information gathered from web search activity. We therefore conclude that the effect of SVI on stock returns is economically and statistically significant even after accounting for well-established risk factors.

[Insert Table 4]

4.3 The Predictive Power of ASVI for Stock Returns

In the literature on adaptive expectations, unexpected changes or abnormal variations have long been considered to possess a greater influence on economic activities. We then follow Da *et al.* (2011b) and shift our focus on the influence caused by abnormal changes in Google search volume. The variable of interest, $ASVI_{it}$, is defined as the log SVI during the current week minus the log median SVI during the previous 8 weeks. It can be mathematically expressed as

$$ASVI_{it} = log(SVI_{it}) - log[Med(SVI_{it-1}, \cdots, SVI_{it-8})]. \quad (4)$$

Da *et al.* (2011b) argue the median value of SVI during the prior 8 weeks,

$Med(SVI_{it-1}, \cdots, SVI_{it-8})$, represents the regular level of attention during a period. As such, deviation from the median, or a jump, naturally captures a surge in public attention. $ASVI_{it}$ is robust to recent jumps and excludes the influence of time trends and other low-frequency seasonality. Within the framework of Barber and Odean (2008), a positive $ASVI_{it}$ should predict higher stock prices in the short term. Therefore, we employ $ASVI_{it}$ and examine its predictive power for future stock returns with the expectation that large $ASVI_{it}$ would result in increased buying pressure that pushes stock prices up temporarily.

The regression results are reported in Table 5. Specifications (1) – (3) in Table 5 are similar to those in Table 5 except the use of $ASVI_{it}$. We can see that the coefficients on $ASVI_{it}$ in these specifications are statistically significant and positive at the 1% level. Moreover, abnormal changes in Google search volume are found to be able to predict the next week's stock returns, as shown in specifications (4) – (6). These coefficients remain statistically significant even after we include $Media_{it}$ in the specifications (7) – (9). Consequently, we find a positive correlation between ASVI and the next week's stock returns. Specifically, a unit of increase in ASVI is associated with an outperformance of more than 8.62 basis points (bps). The finding highlights the incremental value of SVI, support the hypotheses of Barber and Odean (2008), and confirm evidence of Da *et al.* (2011b).

[Insert Table 5]

4.4 Revisiting the Size Effect

Market capitalization has been a fundamental factor in determining a wide range of stock characteristics. For example, smaller firms have higher risk adjusted returns, on average, than larger firms. Moreover, stocks of smaller firms are sensitive to price changes, while stocks of large firms are less likely to be affected by bid-ask bounce. The size effect, first documented by Banz (1981), was found to has been in existence for at least forty years in the U.S. stock markets. However, Banz (1981) himself also argued that whether size is just a proxy for other factors correlated with it remains unclear. Since larger firms are supposed to have a larger number of analysts and news articles than smaller firms, media coverage and investor attention should vary with market capitalization. Accordingly, size may be a mere proxy for media coverage and investor attention.

On the other hand, the size effect might affect the influence of investor attention on stock returns. For instance, Da *et al.* (2011b) found a larger price increase

following an increase in ASVI among smaller Russell 3000 stocks. Moreover, through both a portfolio sorting exercise and regression analysis, they found that the positive price pressure predicted by the attention theory of Barber and Odean (2008) is only present among the smaller half of our Russell 3000 stock sample. Their finding supports the hypothesis that market capitalization affects the influence of investor attention on stock returns. Moreover, Russell 3000 stocks, representing above 90% of market capitalization of total U.S. equity, are relatively large stocks. Whether the price pressure exists among the small stocks remains unclear.

When examining the response of small stocks to investor attention, however, empiricists who employ SVI as a proxy variable for investor attention face an unavoidable challenge: small stocks tend to have fewer searches (Da *et al.* 2011b). If a keyword is rarely searched, Google Trends will return a zero value for that keyword's SVI. Moreover, to alleviate market microstructure-related concerns, stocks with market price less than a specific threshold are often removed from the studied sample. In most cases, responses of the smallest stocks are not explored due to exclusion policies, which also limit the present study. Nevertheless, this study still endeavor to examine whether our results are robust to the size effect.

To address issues on the size effect, we also conduct a portfolio sorting exercise and regression analysis as in Table 3. Following Banz (1981)[12], we sort all firms in the sample into five quintile of equal size based on their log market capitalization. We are interested in whether the characteristics of large firms, such as those firms in the fifth quintile, differ from those with low market capitalization, such as those in the first quintile. We test the hypothesis that the fifth-quintile firms differ significantly from the first-quintile firms using a t-test. Moreover, for each quintile, we regress the stock returns on SVI, media coverage, controlling for four well-known asset pricing factors, including system risk derived from market return ($MktRet_t$), size (SMB_t), book-to-market (HML_t), and momentum (MOM_t) factors. Table 6 shows the comparison results based on the t-test in panel A and the estimation results for the regression analysis in panel B.

[Insert Table 6]

Univariate comparisons of key descriptive variables by market capitalization quintile are presented in panel A of Table 6. The first two rows, Min and Max, represent the minimum and maximum values of the log market capitalization for

[12] Banz (1981) divided the stocks on the NYSE into quintiles based on market capitalization and found that small firms tend to outperform large firms.

each quintile. The average log market capitalization is presented at the third row. Since the quintiles are constructed each week, the ranges of lnmv (Min - Max) overlap across quintiles. The t-test results indicate that all firm characteristics that we consider in the fifth-quintile are significantly different from those in the first-quintile.

One point worth mentioning is that media coverage increases monotonically with market capitalization. This result indicates that large firms tend to have more news articles relative to small firms, consistent with expectation. This also explains the inverted U-shaped pattern of media coverage, as found in table 3. However, we should be cautious in interpreting the influence of media coverage. As shown in panel B, the same result does not hold for the media effect on stock returns because the coefficients on media do not necessary increase monotonically with market capitalization. Moreover, both magnitude and significance appear to be lowest in the fifth quintile. The result is not surprising because it is harder to influence the price on a firm with enormous market capitalization.

As for investor attention, the t-test indicates that SVI for firms in the fifth-quintile are significantly different from those in the first-quintile. Accordingly, the largest 20% of firms in our sample statistically attract more investor attention than the smallest 20% of firms. However, as shown in panel B, the coefficients on SVI are not statistically significant for the first and fifth quintiles. Therefore, the positive price pressure predicted by attention theory of Barber and Odean (2008) is absent both in the largest and smallest stocks of our sample. The inference is robust if we sort all firms into four quartiles rather than into five quintiles of equal size. The result is partly consistent with the finding of Da *et al.* (2011b), who documented that the attention effect is only present among the smaller half of our Russell 3000 stock sample. Our evidence shows that the attention effect tends to be present in the medium-sized stocks. The result implies that investors in Taiwan may prefer the firms with medium market capitalization. To conclude, stock performances of large firms are hardly affected by media coverage and investor attention.

4.5 The Effect of Market States

Market states have been an issue when exploring economic activities. Vlastakis and Markellos (2012) found that investors significantly demand more information during periods of higher returns. Because investors who demand information are likely to utilize the Google search engine, the finding of Vlastakis and Markellos (2012) implies that SVI might be affected by market states. Moreover, they found the impact

of market information becomes stronger during periods of crisis. In this case, system risk in typical asset pricing models, which is derived from market return, might be influenced by market states as well.

Market states also affect investor sentiment, driving investors to sell irrationally in bearish markets. Accordingly, there should be more selling activities than buying ones during periods of crisis. One assumption of the attention theory of Barber and Odean (2008) is that investors are net buyers of attention-grabbing stocks. Financial crises which lead to irrational sales probably invalidate the positive price pressure caused by investor attention. In other words, since the number of buyers of attention-grabbing stocks might be far less than the number of sellers of the same stocks, the attention effect on stock returns would be limited in financial crises. On the other hand, investors during periods of crisis might show similar interests to some attention-grabbing stocks but are reluctant to buy for fear of substantial risks. Their reluctance might also drop the predictive power of SVI.

In this section, we examine the stability of our results across market states. We repeat the regression analyses year by year. This analytic procedure enables us to observe the influences of the 2008 Financial Tsunami and the 2011 European Sovereign Debt Crisis on our estimation results.

Table 7 presents the regression results for each year of the sample period. The results indicate that SVI loses its statistical significance both in 2008 and in 2011. Nevertheless, coefficients on SVI are still statistically significant at 1% level in the rest years. In other words, the predictive power of SVI is absent during the 2008 Financial Tsunami and the 2011 European Sovereign Debt Crisis. The results are quite consistent with our expectation that the attention effect tends to be insignificant during periods of crisis. Furthermore, the coefficients on SVI are larger in bullish markets (as those in 2009 and 2010) than in bearish markets (as those in 2008 and 2011). The results are in line with the finding of Vlastakis and Markellos (2012).

[Insert Table 7]

In comparison, the media effect is robust across these years but the magnitude of its influence varies with time. The results also indicate that the media effect is strongest in 2009, slightly weaker in 2010, and relatively weak in 2008 and 2011. The pattern is similar to that of SVI. To test the robustness of the predictive power of SVI and media coverage, we also use dummy variables for year to control variations exhibited through years. Presented in the next section, the results are quite robust.

On the other hand, Vlastakis and Markellos (2012) documented that market information is crucial during periods of crisis. Consistent with their finding, Table 7

shows that the greatest coefficient on market return ($MktRet_t$) appears in the 2008 Financial Tsunami. The second greatest coefficient on $MktRet_t$ happens in 2011, which are also consistent with Vlastakis and Markellos (2012). However, the value of the coefficient on $MktRet_t$ in 2010 is close to that in 2011. The result of 2010 might also be affected the influences of European Sovereign Debt Crisis.

4.6 Robust Analysis

Table 8 presents regressions predicting stock returns under different model speciation. Specifications (1) and (2) use a pooled regression analysis; specifications (3), (4), and (5) compare the between, random, and fixed effects models, respectively; the two-way fixed-effects model are presented in specification (6); the interaction effect of investor attention and media coverage is considered in specifications (7), (8), and (9). As in typical asset pricing models, we use risk premium as the dependent variable. Since it is essentially a kind of excess asset returns, we refer to risk premium as stock returns hereafter for brevity. The variables predicting stock returns are observed in the same week as the stock returns. In most, but not all, regressions, firms are allowed to enter and leave the panel.

[Insert Table 8]

The first column of Table 8 (i.e., specification (1)) reports estimates using pooled panel regression (i.e., the ordinary least squares method, OLS). We find that stock returns significantly with investor attention (SVI_{it}), media coverage ($media_{it}$), system risk ($MktRet_t$), size (SMB_t), but decrease with momentum (MOM_t) factors. All coefficients in specification (1) are statistically significant at 1% level. A unit increase in the level of SVI contribute, on average, 0.55 basis points (bps) to the stock returns, while each additional news article reported on media results in an increase of 7.1 bps in the stock returns. Since SVI scales from 0 to 100, the influence of SVI is economically significant particularly when it approaches the peak value.

Based on the OLS method, Table 8 further considers time effect using dummy variables for year (i.e., pooled panel regression with time fixed effects). The coefficient estimates are presented in the second column (specification (2)). Overall, the estimation results are almost identical in both model specifications and the influences of investor attention (SVI_{it}) and media coverage ($media_{it}$) are quite robust.

Next, we estimate the regression using the average of the variables over the

sample period. The coefficient estimates in this regression are different from the estimates of the other regressions. For example, the coefficients for media coverage ($media_{it}$) and momentum (MOM_t) turn negative and are no longer significant at 5% level in specification (3). The R-squared value also dramatically drops to 0.0195, suggesting this model specification, between-effects model, cannot explain much variation in stock returns.

We then use both random-effects and fixed-effects panel regressions and present their estimates in the fourth and fifth columns, respectively. Overall, both sign and significance do not change across these specifications. One notable difference among these model specifications is that the coefficients on SVI_{it} and $media_{it}$ are larger in the fixed-effects regressions than in the random-effects regression. Moreover, taking the time effect into account, we again add dummy variables for year to the fixed-effects panel regression in the sixth column. The influences of investor attention (SVI_{it}) and media coverage ($media_{it}$) are again found robust to time effect.

Finally, to address the interaction between investor attention and media coverage, we present three additional regression estimates in Table 8. The simultaneous influence of investor attention and media coverage on stock returns might not be additive. When investors are interested in a certain company, they probably pay more attention to news relevant to this company. In this case, the media effect is supposed to be larger in firms with much investor attention. On the other hand, a news article might also arouse interests among investors and direct their attention toward a certain company. In this case, the price pressure caused by investor attention would be greater on the focal company. We add the product of the SVI_{it} and $media_{it}$ variables to typical asset pricing models to estimate the interaction between investor attention and media coverage. However, the results using fixed-effects panel regressions indicate that the interaction term is not statistically significant across these model specifications.

In summary, except the between-effects model in specification (3), the regression analysis here leads to the same results as in previous sections. The coefficients of investor attention (SVI_{it}) are supportive of the attention theory of Barber and Odean (2008). Moreover, the influences of investor attention are robust to individual and time effect. The same result holds for media coverage. However, we fail to find out the interaction effect of investor attention and media coverage in the panel regressions.

4.7 Mediation Analysis

In addition to affecting stock returns, media coverage is supposed to influence investor attention. Therefore, the media variable might affect SVI, which in turn affects stock returns. Statistically speaking, SVI works as the mediator that mediates the relationship between media coverage and stock returns. In addition to the direct effects of investor attention and media coverage, news media might exhibits indirect effect, or the mediational effect, through SVI on stock returns. The indirect effect represents the portion of the relationship between media coverage and stock returns that is mediated by SVI.

In order to further explore the interaction of investor attention and media coverage as well as their roles in asset pricing, we employ a mediation analysis using seemingly unrelated regression. To calculate the indirect effect, we follow the Product of Coefficients Approach proposed by Sobel (1982). Specifically, the indirect effect is calculated by multiplying two regression coefficients from two separate equations.

$$FirmRet_{it} = b_0 + b_1 SVI_{it} + b_2 Media_{it} + b_3 MktRet_t + b_4 SMB_t + b_5 HML_t + b_6 MOM_t + \varepsilon_{i,t}. \quad \textit{(5-A)}$$

$$SVI_{it} = c_0 + c_1 Media_{it} + e_{i,t} \quad \textit{(5-B)}$$

In the Sobel approach, equation *(5-B)* involves the relationship between media coverage ($Media_{it}$) and investor attention (SVI_{it}). A product is formed by multiplying two coefficients together, the partial regression effect for SVI predicting stock returns (b_1) and the simple coefficient for media predicting SVI (c_1). The indirect effect can be mathematically expressed as $b_1 \times c_1$. We use seemingly unrelated regression to estimate the above equations. The results are shown in Table 9.

[Insert Table 9]

The regression results for media coverage ($Media_{it}$) on investor attention (SVI_{it}) are identical across these model specifications, where the coefficients on media coverage are all statistically significant at 5% level. However, the R-squared value of 0.0015 indicates that only a tiny part of variation in SVI can be explained by media coverage. The results imply that news article could not fully capture attention and that there might be other possible factors affecting investor attention in addition to

the media effect. The evidence is not surprising as Da *et al.* (2011b) argued, "*a news article in the Wall Street Journal does not guarantee attention unless investors actually read it* (p. 1462)."

The bottom three rows of Table 9 list the direct effect, indirect effect, and the ratio of the direct effect to total effect. We can see that the direct effect is far greater than the indirect effect. Specifically, about 97% of the media effect is directly from media coverage, as indicated by the ratio. The result suggests that SVI might not be a mediator in the relationship between media coverage and stock returns.

5 Conclusions

To conclude, the present study has investigated the relationship between investor attention, media coverage, and asset pricing, but its relevance to web search behavior of individual investors can also be seen. Our findings as to the role of investor attention in asset pricing are consistent with prior studies (Choi & Varian 2009; Bank *et al.* 2011; Mondria & Wu 2011; Da *et al.* 2011a; Da *et al.* 2011b). Specifically, the portfolio sorting exercise based on SVI shows that firms in portfolios with more investor attention possess higher stock returns and Jensen's alpha. Moreover, both stock returns and Jensen's alpha are found to increase monotonically with investor attention. Using mainstream asset pricing models such as the market model (CAPM), the Fama and French (1993) three-factor model, and the Carhart (1997) four-factor model, we discover that both investor attention and media coverage significantly affect stock returns. Furthermore, consistent with prior literature on adaptive expectations, we find that abnormal increase in Google search volume can predict future stock returns. Overall, these findings support the attention theory of Barber and Odean (2008).

Moreover, we find that both market capitalization and market states affect the impact of investor attention on stock returns. The attention effect is present in the medium-sized firms but seems to be absent in the larger and smaller firms of our sample. The finding highlights the role of market capitalization in capital markets. In addition, both the attention and media effect on stock returns are found relatively weak in the 2008 Financial Tsunami and in the 2011 European Sovereign Debt Crisis. This might be because irrational sales caused by financial crises invalidate the positive price pressure resulting from investor attention.

Finally, the mediation analysis indicates that media coverage explains only a tiny part of variation in SVI, implying there might be other possible factors affecting web search activities of investors in addition to the financial media. Moreover, the effect

of media coverage on stock returns is mainly direct for its direct effect dominates its indirect effect through SVI. This study also fails to identify any interaction effect of media coverage and investor attention. Accordingly, the influences of Internet and financial media on asset prices are quite distinct, implying they might capture investor attention from separate groups.

This study has explored main issues concerning the influences of investor attention and media coverage on stock returns. However, SVI and media coverage may reflect parts of the aggregate investor attention because investors have other sources of information in addition to Internet and financial media. Therefore, the influences of Internet and media coverage on asset prices might be related to their popularity among investors. A future study allowing for the popularity of Internet and financial media would be very interesting.

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Tables

Table 1: Variable Definitions

Variable	Definition
Variables related to Investor Attention	
SVI	Aggregate search frequency from Google Trends based on official abbreviation of company name
ASVI	The log of SVI during the week minus the log of median SVI during the previous 8 weeks
Media	The proxy for media coverage, measured as the number of news for a company in a week.
Variables related to Stock Characteristics	
FirmRet	The return of the stock during week t
Risk	The standard deviation of the daily stock returns of the current week t
LnMV	The natural logarithm of the market capitalization in million
LnVolNTD	Trading volume in NT Dollars; the natural logarithm of the number of shares traded volume multiplied by the respective price
Turnover	The fraction of shares traded relative to the number shares outstanding

Table 2: Descriptive Statistics

Variable	mean	sd	min	p50	max	skewness	kurtosis
Variables related to stock characteristics							
FirmRet	-0.051	6.201	-40.550	0.000	103.200	0.2010	8.3820
MarketRet	-0.091	3.225	-11.260	0.226	9.410	-0.4790	3.7920
RiskFreeRate	0.019	0.011	0.008	0.017	0.044	1.2760	3.2890
SMB	0.151	2.146	-7.552	-0.049	6.061	-0.0200	3.6310
HML	-0.051	2.442	-12.800	-0.113	12.220	0.7050	9.5350
MOM	0.178	2.321	-6.423	0.281	8.664	-0.0008	3.8670
Variables related to Investor Attention							
SVI	26.470	16	0	25	100	0.8040	4.0950
ASVI	0.018	1	-4	0	5	1.4380	34.7800
Media	1.225	2	0	1	140	7.8810	233.7000
Winsonized Variables							
FirmRet	-0.061	5.811	-17.520	0.000	17.380	-0.0063	4.2960
MarketRet	-0.096	3.145	-9.597	0.226	6.781	-0.4900	3.3000
Media	1.183	1.767	0.000	1.000	10.000	2.5150	10.7300

Table 3 Stock characteristics by SVI quartiles

This table examines the stock characteristics using portfolio analysis. All stocks are sorted into four groups based on SVI_{it}, a direct proxy for attention. Media coverage is calculated as the number of news per week. Stock return is measured weekly. Risk is calculated as the standard deviation of daily returns in a week. Market value is natural logarithm of the market capitalization in million. Trading volume in NT dollars and turnover are basic measures of trading activities. $MktRet_t$, SMB_t, HML_t, MOM_t are common asset pricing factors of the Carhart (1997) four-factor model.

Panel A: Average stock characteristics of portfolios sorted by SVI						
Portfolio	Q1th	Q2th	Q3th	Q4th	t-value	p-value
Variable	[0, 9]	[9, 29]	[18, 41]	[29, 100]		
SVI	7.813	19.99	29.70	48.35	-528.8	0
Media Coverage	1.025	1.334	1.318	1.221	-12.14	0
Stock Return	-0.141	-0.0950	-0.0360	0.0700	-4.082	0
Risk	1.982	1.967	1.967	1.996	-1.309	0.190
Market Value	8.720	8.961	8.941	8.902	-14.60	0
Trading Volume	11.63	11.99	12.00	11.95	-17.57	0
Turnover	3.523	3.513	3.816	3.997	-10.89	0

Panel B: Asset pricing model for each portfolio				
Portfolio	Q1th	Q2th	Q3th	Q4th
	[0, 9]	[9, 29]	[18, 41]	[29, 100]
Variable	FirmRet			
Intercept	-0.1204***	-0.0566***	-0.0116**	0.1065***
	(0.0064)	(0.0055)	(0.0048)	(0.0058)
$MktRet_t$	1.0591***	1.0957***	1.0697***	1.0346***
	(0.0238)	(0.0194)	(0.0203)	(0.0223)
SMB_t	0.5762***	0.5073***	0.5147***	0.4942***
	(0.0319)	(0.0296)	(0.0263)	(0.0314)
HML_t	0.0649**	0.0307	0.0868***	0.0791**
	(0.0290)	(0.0262)	(0.0252)	(0.0308)
MOM_t	-0.0375*	-0.0708***	-0.0345**	-0.0207
	(0.0198)	(0.0184)	(0.0161)	(0.0167)
Observations	29,828	29,962	30,021	29,901
R-squared	0.3428	0.3730	0.3608	0.3064
Number of firms	375	445	478	463

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 4: Regression results of weekly returns on typical asset pricing factors

This table depicts the role of attention in typical asset pricing models such as CAPM, the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviated company names. $Media_{it}$ represents media coverage, calculated as the number of news per week. The market risk premium, $MktRet_t$, is the return on a value-weighted Taiwan market index less the return on the risk free asset. SMB_t is the return on a value-weighted portfolio of small stocks minus the return on a value-weighted portfolio of big stocks, HML_t is the return on a value-weighted portfolio of high book-to-market stocks minus that of low book-to-market stocks, and MOM_t is the return on a value-weighted portfolio of stocks with high recent six-month returns minus the return on a value-weighted portfolio of stocks with low recent six-month returns.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES					$FirmRet_t$				
Intercept	-0.218***	-0.282***	-0.276***	-0.113***	-0.213***	-0.206***	-0.351***	-0.436***	-0.430***
	(0.0459)	(0.0445)	(0.0444)	(0.0193)	(0.0210)	(0.0210)	(0.0520)	(0.0517)	(0.0516)
SVI_{it}	0.0100***	0.00959***	0.00964***				0.00916***	0.00859***	0.00864***
	(0.00174)	(0.00166)	(0.00166)				(0.00170)	(0.00163)	(0.00163)
$Media_{it}$				0.136***	0.156***	0.156***	0.132***	0.153***	0.153***
				(0.0163)	(0.0168)	(0.0168)	(0.0161)	(0.0166)	(0.0166)
$MktRet_t$	1.065***	1.068***	1.065***	1.064***	1.066***	1.063***	1.064***	1.066***	1.063***
	(0.0137)	(0.0140)	(0.0136)	(0.0137)	(0.0140)	(0.0137)	(0.0137)	(0.0140)	(0.0136)
SMB_t		0.527***	0.523***		0.530***	0.525***		0.529***	0.525***
		(0.0192)	(0.0190)		(0.0193)	(0.0191)		(0.0193)	(0.0190)
HML_t		0.0724***	0.0651***		0.0720***	0.0648***		0.0723***	0.0650***
		(0.0165)	(0.0171)		(0.0165)	(0.0171)		(0.0165)	(0.0171)
MOM_t			-0.0397***			-0.0393***			-0.0396***
			(0.00968)			(0.00966)			(0.00967)
Observations	119,712	119,712	119,712	119,712	119,712	119,712	119,712	119,712	119,712
Number of firms	523	523	523	523	523	523	523	523	523
R-squared	0.308	0.344	0.345	0.309	0.343	0.3432	0.309	0.3432	0.346

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 5: Regression results using abnormal rises in Search Volume Index (ASVI)

This table illustrates the effect of surge in attention on stock returns. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviation of company name. $ASVI_{it-1}$ represents the log of SVI_{it} during the week minus the log of median SVI_{it} during the previous 8 weeks. $Media_{it}$ represents media coverage, calculated as the number of news per week. The market risk premium, $MktRet_t$, is the return on a value-weighted Taiwan market index less the return on the risk free asset. SMB_t is the return on a value-weighted portfolio of small stocks minus the return on a value-weighted portfolio of big stocks, HML_t is the return on a value-weighted portfolio of high book-to-market stocks minus the return on a value weighted portfolio of low book-to-market stocks, and MOM_t is the return on a value-weighted portfolio of stocks with high recent six-month returns minus the return on a value-weighted portfolio of stocks with low recent six-month returns.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES					$FirmRet_t$				
Intercept	0.0430***	-0.0317***	-0.0247***	0.0254***	-0.0409***	-0.0338***	-0.110***	-0.200***	-0.193***
	(0.00163)	(0.00310)	(0.00347)	(0.00149)	(0.00293)	(0.00330)	(0.0176)	(0.0190)	(0.0191)
$ASVI_{it}$	0.275***	0.232***	0.233***						
	(0.0401)	(0.0395)	(0.0396)						
$ASVI_{it-1}$				0.106***	0.0862**	0.0869***	0.101***	0.0804**	0.0810**
				(0.0340)	(0.0334)	(0.0335)	(0.0340)	(0.0333)	(0.0334)
$Media_{it}$							0.115***	0.134***	0.134***
							(0.0148)	(0.0152)	(0.0152)
$MktRet_t$	1.065***	1.067***	1.064***	1.067***	1.067***	1.064***	1.066***	1.066***	1.063***
	(0.0137)	(0.0140)	(0.0136)	(0.0137)	(0.0139)	(0.0135)	(0.0137)	(0.0139)	(0.0136)
SMB_t		0.526***	0.522***		0.525***	0.521***		0.527***	0.523***
		(0.0192)	(0.0190)		(0.0192)	(0.0190)		(0.0193)	(0.0190)
HML_t		0.0729***	0.0656***		0.0703***	0.0636***		0.0701***	0.0634***
		(0.0165)	(0.0171)		(0.0163)	(0.0168)		(0.0163)	(0.0168)
MOM_t			-0.0396***			-0.0382***			-0.0381***
			(0.00967)			(0.00970)			(0.00968)
Observations	119,712	119,712	119,712	119,189	119,189	119,189	119,189	119,189	119,189
Number of firms	523	523	523	523	523	523	523	523	523
R-squared	0.3078	0.345	0.3438	0.314	0.3482	0.349	0.3124	0.350	0.3483

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 6: Stock characteristics by size quintiles

This table examines the size effect using portfolio analysis. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviated company names. $Media_{it}$ represents media coverage, calculated as the number of news per week. $MktRet_t$, SMB_t, HML_t, MOM_t are common asset pricing factors of the Carhart (1997) four-factor model.

Panel A							
VARIABLES	Q1th	Q2th	Q3th	Q4th	Q5th	t-value	p-value
Min	4.328	6.893	7.647	8.353	9.288	.	.
Max	7.936	8.651	9.358	10.27	14.670	.	.
lnmv	6.961	8.011	8.717	9.499	11.220	-586.9	0
lnret	-0.214	-0.078	0.001	0.039	-0.002	-3.686	0
SVI	24.830	26.830	27.000	26.360	27.340	-16.82	0
Media	0.455	0.658	0.845	1.224	2.946	-105.1	0

Panel B					
	Q1th	Q2th	Q3th	Q4th	Q5th
VARIABLES	FirmRet				
Intercept	-0.4897***	-0.5056***	-0.5768***	-0.3948***	0.0006
	(0.1052)	(0.0944)	(0.1574)	(0.1050)	(0.1236)
SVI_{it}	0.0044	0.0089***	0.0127**	0.0095***	0.0009
	(0.0040)	(0.0034)	(0.0051)	(0.0034)	(0.0038)
$Media_{it}$	0.2979***	0.2862***	0.3006***	0.1962***	0.0280*
	(0.0751)	(0.0449)	(0.0505)	(0.0337)	(0.0166)
$MktRet_t$	1.0012***	1.0537***	1.1020***	1.0866***	1.0629***
	(0.0252)	(0.0288)	(0.0253)	(0.0268)	(0.0278)
SMB_t	0.8616***	0.7018***	0.6223***	0.3934***	0.0521*
	(0.0326)	(0.0266)	(0.0268)	(0.0254)	(0.0296)
HML_t	-0.0234	0.0379	0.0898***	0.1355***	0.0917*
	(0.0234)	(0.0253)	(0.0329)	(0.0351)	(0.0500)
MOM_t	-0.0453**	-0.0315	-0.0294	-0.0387*	-0.0538**
	(0.0211)	(0.0216)	(0.0192)	(0.0214)	(0.0257)
Observations	23,839	24,001	23,991	24,001	23,880
R-squared	0.2955	0.3757	0.3703	0.3794	0.3711
Number of firms	168	249	264	210	153

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 7: Sub-period analysis

This table examines model performance in each year of the sample period. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviated company names. $Media_{it}$ represents media coverage, calculated as the number of news per week. $MktRet_t$, SMB_t, HML_t, MOM_t are common asset pricing factors of the Carhart (1997) four-factor model.

Year	2008	2009	2010	2011	2012
VARIABLES			FirmRet		
Intercept	-0.2355**	-1.1130***	-0.7211***	-0.2904**	-0.4122***
	(0.1179)	(0.1982)	(0.1189)	(0.1425)	(0.1243)
SVI_{it}	0.0007	0.0257***	0.0200***	0.0071	0.0125***
	(0.0040)	(0.0061)	(0.0042)	(0.0052)	(0.0044)
$Media_{it}$	0.1460***	0.2972***	0.1638***	0.0995***	0.0697**
	(0.0352)	(0.0428)	(0.0254)	(0.0289)	(0.0316)
$MktRet_t$	1.1123***	0.9965***	1.0544***	1.0567***	1.0250***
	(0.0175)	(0.0201)	(0.0182)	(0.0179)	(0.0219)
SMB_t	0.5572***	0.5242***	0.4324***	0.5780***	0.5991***
	(0.0242)	(0.0270)	(0.0222)	(0.0291)	(0.0300)
HML_t	0.0539***	0.0914***	0.1080***	-0.0109	0.0324
	(0.0204)	(0.0258)	(0.0280)	(0.0240)	(0.0243)
MOM_t	-0.0705***	0.0049	0.0003	-0.0229	-0.1020***
	(0.0181)	(0.0150)	(0.0165)	(0.0216)	(0.0204)
Observations	23,516	23,706	24,313	25,796	22,381
R-squared	0.4111	0.2646	0.3116	0.2993	0.3172
Number of firms	468	482	497	518	523

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 8: Regression Results under Various Model Specification

This table examines the robustness through different model specification. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviated company names. $Media_{it}$ represents media coverage, calculated as the number of news per week. The market risk premium, $MktRet_t$, is the return on a value-weighted Taiwan market index less the return on the risk free asset. SMB_t is the return on a value-weighted portfolio of small stocks minus the return on a value-weighted portfolio of big stocks, HML_t is the return on a value-weighted portfolio of high book-to-market stocks minus that of low book-to-market stocks, and MOM_t is the return on a value-weighted portfolio of stocks with high recent six-month returns minus the return on a value-weighted portfolio of stocks with low recent six-month returns.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES					FirmRet				
Intercept	-0.2499***	-0.3237***	-0.5650***	-0.2665***	-0.4305***	-0.5241***	-0.3341***	-0.4259***	-0.4200***
	(0.0290)	(0.0421)	(0.1291)	(0.0351)	(0.0516)	(0.0617)	(0.0489)	(0.0485)	(0.0485)
SVI_{it}	0.0055***	0.0055***	0.0039***	0.0058***	0.0086***	0.0087***	0.0086***	0.0082***	0.0083***
	(0.0009)	(0.0009)	(0.0013)	(0.0010)	(0.0016)	(0.0016)	(0.0018)	(0.0017)	(0.0017)
$Media_{it}$	0.0705***	0.0734***	-0.0248*	0.0788***	0.1525***	0.1584***	0.1173***	0.1437***	0.1434***
	(0.0082)	(0.0083)	(0.0147)	(0.0136)	(0.0166)	(0.0168)	(0.0303)	(0.0297)	(0.0296)
SVI_{it} x $Media_{it}$							0.0005	0.0003	0.0003
							(0.0011)	(0.0011)	(0.0011)
$MktRet_t$	1.0643***	1.0646***	1.3088***	1.0642***	1.0633***	1.0637***	1.0637***	1.0660***	1.0633***
	(0.0050)	(0.0052)	(0.3105)	(0.0136)	(0.0136)	(0.0136)	(0.0137)	(0.0140)	(0.0136)
SMB_t	0.5241***	0.5284***	2.7367***	0.5242***	0.5250***	0.5301***		0.5293***	0.5250***
	(0.0070)	(0.0071)	(0.5598)	(0.0190)	(0.0190)	(0.0191)		(0.0193)	(0.0190)
HML_t	0.0649***	0.0660***	-2.9578***	0.0649***	0.0650***	0.0665***		0.0723***	0.0650***
	(0.0068)	(0.0069)	(0.8078)	(0.0171)	(0.0171)	(0.0169)		(0.0165)	(0.0171)
MOM_t	-0.0396***	-0.0411***	0.0341	-0.0396***	-0.0396***	-0.0412***			-0.0396***
	(0.0065)	(0.0065)	(0.3395)	(0.0097)	(0.0097)	(0.0097)			(0.0097)
Observations	119,712	119,712	119,712	119,712	119,712	119,712	119,712	119,712	119,712
R-squared	0.3440	0.3441	0.0195	0.3440	0.3434	0.3458	0.3092	0.3432	0.3434
Estimator	OLS	OLS	BE	RE	FE	FE	FE	FE	FE
Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Year Effect	No	Yes	No	No	No	Yes	No	No	No
Number of firms	-	-	523	523	523	523	523	523	523

Robust standard errors are given in parentheses. *, **, *** denote 10%, 5% and 1% significance levels.

Table 9: Mediating Effect

This table examines model performance in each year of the sample period. SVI_{it}, a direct proxy for attention, is aggregate search frequency from Google Trends based on official abbreviated company names. $Media_{it}$ represents media coverage, calculated as the number of news per week. $MktRet_t$, SMB_t, HML_t, MOM_t are common asset pricing factors of CAPM, the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model.

	(1)		(2)		(3)	
VARIABLES	SVI	FirmRet	SVI	FirmRet	SVI	FirmRet
Intercept	26.0485***	-0.1747***	26.0485***	-0.2565***	26.0485***	-0.2499***
	(0.0571)	(0.0297)	(0.0571)	(0.0290)	(0.0571)	(0.0290)
SVI_{it}		0.0057***		0.0055***		0.0055***
		(0.0009)		(0.0009)		(0.0009)
$Media_{it}$	0.3600***	0.0600***	0.3600***	0.0706***	0.3600***	0.0705***
	(0.0269)	(0.0085)	(0.0269)	(0.0082)	(0.0269)	(0.0082)
$MktRet_t$		1.0646***		1.0670***		1.0643***
		(0.0046)		(0.0050)		(0.0050)
SMB_t				0.5284***		0.5241***
				(0.0070)		(0.0070)
HML_t				0.0721***		0.0649***
				(0.0067)		(0.0068)
MOM_t						-0.0396***
						(0.0065)
Observations	119,712	119,712	119,712	119,712	119,712	119,712
R-squared	0.0015	0.3078	0.0015	0.3438	0.0015	0.3440
Direct effect		0.0600		0.0706		0.0705
Indirect effect		0.0021		0.0020		0.0020
Ratio		96.68%		97.28%		97.27%