

Investor Attention and Stock Market Under-reaction to Earnings Announcements: Evidence from the Options Market

Xuewu (Wesley) Wang*

Zhipeng Yan[†]

Qunzi Zhang[‡]

ABSTRACT

Using a broad sample of earnings announcements, we show that the initial stock market response more than triples in magnitude and the post-earnings announcement drift becomes much weaker in the presence of more active pre-earnings option trading. When interacting option trading with the number of competing announcements on the announcement date and announcement weekday, we find that the strongest initial stock market response originates from those announcements that have higher pre-earnings option trading, that have fewer competing announcements on the announcement date, and that are made on non-Fridays as compared to Fridays. Our interpretation for these findings is that heightened investor attention, as captured by higher pre-earnings option trading and less distraction to investors from fewer competing and non-Friday announcements, accelerates the stock market response and mitigates the stock market under-reaction.

JEL Classification: G11, G14, G15

Keyword: Investor Attention, Earnings Announcement, Option Trading, Stock Market Under-reaction

* Xuewu (Wesley) Wang is an assistant professor of finance at the Michael F. Price College of Business at the University of Oklahoma. Address: 307 West Brooks Street, Adams Hall 205A, Norman, OK 73019. Email: xuewu.wang@ou.edu. Tel: (405) 325- 9836.

[†] Zhipeng Yan is an associate professor of finance at the Martin Tuchman School of Management at the New Jersey Institute of Technology. Address: School of Management, New Jersey Institute of Technology, University Heights, Newark, NJ 07102-1982. Email: zyan@njit.edu. Tel: (973) 596-3260.

[‡] Qunzi Zhang is an assistant professor of finance at the School of Economics at Shandong University, China. Address: No. 27 South Shanda Road, Jinan City, Shandong Province, P. R. China, 250100. Email: qunzi.zhang@sdu.edu.cn. Tel: 0086-13031720710.

1. Introduction

Stock market response to earnings announcements has received enormous attention from both academia and industry practitioners for at least two reasons. First, routinely scheduled earnings announcements are significant information events where firms release material information about their performance in the most recent quarters and their outlook for future quarters. Second, the stock market listens and responds to the earnings conference calls. In particular, the literature has documented two twin stylized facts about the stock market response to earnings announcements: stock market under-reaction at announcement times and the post-earnings announcement drift (PEAD). That is, stock market tends to under-react to the information released via the earnings announcements. This under-reaction is accompanied by one of the most persistent anomalies in the asset pricing literature: the tendency of stock prices to continue to move in the direction of the earnings surprise after earnings are announced.

This paper examines the stock market reaction to earnings announcements in the presence of options trading. A number of existing studies have examined how the introduction of option listing shapes the stock market response to earnings announcements. Skinner (1990) and Ho (1993) document evidence that the stock market response is reduced when option is introduced. The intuition is that a lot of information has been preempted because of option listing, and hence, the stock market is less surprised when the actual announcement is made. However, Mendenhall and Fehrs (1999) challenge these findings. They point out that the decrease in the stock market response may be caused by changes in firm size and changing market conditions. Using 420 firms that initiated option trading during 1973-1993, they show that firms initiating option trading *after 1986* fail to exhibit a decline in the earnings response. In addition, they present evidence that option listing may actually *increase* the stock-price response to earnings.

Over recent years, option listing has become progressively widespread. Surprisingly, very few papers examine how option trading affects the stock price dynamics surrounding earnings announcements. Our paper tries to fill this gap. In particular, we take one step beyond the option listing status and examine how varying degrees of option trading affect initial and subsequent market reactions to earnings announcements.

One increasingly popular explanation for the stock market under-reaction is that investors have limited attention, and hence, either they ignore the earnings-relevant information, or they fail to incorporate the released information into stock prices in a timely fashion. As the new information finally gets incorporated, the stock price displays the documented drift pattern: stock price tends to go up (down) after good (bad) news many days *after* the announcement date.

The notion of limited attention has been widely applied in behavioral finance research. Using various

proxies for investor attention, researchers have shown that the initial stock market response is stronger and the post-earnings announcement drift is weaker when investors are more attentive. For instance, when there are *fewer* announcements made on the same day (Hirshleifer, Lim and Teoh 2009), or when the announcements are made on *non-Fridays* as compared to other weekdays (presumably, investors are more distracted and less attentive on *Fridays*) (Della Vigna and Pollet 2009), or when the announcements are made during *trading hours* as compared to *non-trading hours* (Francis, Pagach, and Stephan 1992; and Bagnoli, Clement, and Watts 2005), information released through such announcements gets incorporated into stock prices much faster and consequently, the stock market reacts more.

The novelty of this paper is that we relate pre-earnings option trading to investor attention and analyze the stock market reaction from investor attention perspective. Our main argument is that as more attentive investors choose to trade options immediately prior to earnings announcements, increased investor attention leads to more active option trading and at the same time mitigates the stock market under-reaction to earnings releases. In other words, higher pre-earnings option trading helps reduce the stock market under-reaction, thus making the initial stock market response closer to a complete one (i.e., the stock market response in the absence of stock market under-reaction). We provide strong supportive evidence using data from the options market.

Using a broad sample of earnings announcements, we show that the initial stock market response more than triples and the post-earnings announcement drift becomes much weaker in the presence of more active pre-earnings option trading. When interacting option trading with the number of competing announcements on the announcement date and the announcement weekday, we find that the strongest initial stock market response originates from those announcements that have higher pre-earnings option trading, that have fewer competing announcements on the announcement date, and that are made on non-Fridays as compared to Fridays. Our interpretation for these findings is that heightened investor attention, as captured by higher pre-earnings option trading and less distraction to investors from fewer competing and non-Friday announcements, accelerates the stock market response and mitigates the subsequent stock market under-reaction.

This paper is closely related to Mendenhall and Fehrs (1999) and Truong and Corrado (2014) in that we also provide evidence that higher pre-earnings option trading *increases* the stock price response. However, our paper expands the existing literature in two important aspects. First, we examine the varying degree of option trading rather than the option listing status. This is a meaningful extension given the fact that option listing has become more pervasive. Second, while Mendenhall and Fehrs (1999) document the increase in the stock market response, they simply hypothesize that the increase in stock price response can be attributed to informed traders without any further empirical tests. In comparison,

we shed light on the reason for the increased stock market reaction to earnings announcements by associating the pre-earnings option trading with investor attention. We provide strong evidence by examining the options market. We argue that increased investor attention, as proxied by higher pre-earnings option trading, drives the accelerated stock market response. To the extent that informed traders constitute a subset of attentive investors, the extension from informed traders to attentive investors is meaningful given that we often lack direct evidence of informed trading.

This paper presents itself among the voluminous investor attention literature. While existing studies have greatly enhanced our understanding of the stock market reaction from the perspective of limited investor attention, the extant literature on investor attention has primarily taken a one-dimensional approach by investigating the effects of various proxies of investor attention and the associated stock market response. Our paper adds to the literature in that we examine the joint effects of pre-earnings option trading and two popular proxies for investor attention: the announcement weekday and the information overload. Interacting the pre-earnings option trading with these two proxies provides a unique setting under which investors are most or least attentive, thus allowing us to thoroughly investigate how the stock market response differs with varying degree of investor attention.

Our paper contributes to the strand of the literature about the earnings response coefficient (ERC). We add to the literature by augmenting the commonly used ERC framework to accommodate for varying degree of option trading immediate before earnings announcements. Using the augmented ERC framework not only allows us to quantify the stock market reaction when there is active pre-announcement option trading but also enables us to examine the joint effect of pre-earnings option trading and the two widely used proxies of investor attention.

This paper is also related to the informed option trading literature. A big strand of literature examines the informational content of pre-earnings option trading using either signed option trading volume or option implied volatility spread. While we also examine pre-earnings option trading, we do not necessarily argue that such option trading originates entirely from informed traders. Even though investors may become attentive because they have private information about the upcoming announcements, heightened investor attention may be also driven by other considerations such as media coverage and investor speculation. Insofar as informed traders fall under the category of attentive investors, our notion of attentive investors subsumes informed traders and hence, our findings are more general. To our knowledge, this is the first paper in the literature that connects pre-earnings option trading to investor attention.

The rest of the paper is organized as follows. In Section 2 we survey the literature on investor attention as well as the stock market response to earnings announcements. Testable hypotheses are developed in

Section 3. We discuss the data and empirical methodology in Section 4. The main empirical results are presented in Section 5. Section 6 concludes.

2. Literature Review

Contrary to the standard economic assumption that investors utilize all available information to make rational decisions, the psychology and behavioral finance literature argue that investors are subject to cognitive constraints and psychological biases and that there is a limit to the central cognitive-processing capacity of the human brain. This is in sharp contrast to the enormous amount of information relevant to the firm valuation and the substantial cognitive resources required to process such information. Consequently, investors often fail to incorporate all relevant information. In other words, investors have limited attention. Abarbanell and Bushee (1998) show that analysts do not efficiently use information available in a set of financial ratios. Teoh and Wong (2002) find that analysts do not discount discretionary accruals of new issue firms adequately. Hirst and Hopkins (1998) provide experimental evidence that professional analysts often fail to recall, and to respond appropriately to, information in complex financial disclosures. Collectively, their findings suggest that investor (in)attention apply not only to individual investors but also to sophisticated investors such as security analysts and mutual fund managers.

Since the determinants of investor attention are not completely understood, measuring investor attention remains a challenge. To circumvent this measurement issue, researchers have proposed many empirical metrics for investor attention. Application of these empirical metrics has provided a lots of insights into the stock price dynamics surrounding significant corporate information events including earnings announcements, analyst recommendations, and attention-grabbing events, etc

Firm size seems to be a natural proxy for investor attention. Larger firms typically receive more attention from investors. For instance, large firms usually have more analyst coverage and following, which supposedly help increase investor attention. News media also has more coverage for larger firms as compared to smaller ones. However, the drawback of using firm size as a proxy for investor attention is that firm size may also proxy for a lot of other variables such as information asymmetry, and hence, it is a very noisy measure for investor attention. In addition, although firm size and analyst coverage may proxy for the amount of information available in the public domain, it is at best an indirect measure since to what extent investors utilize it remains unclear.

Not surprisingly, many alternative proxies for investor attention or investor distraction/inattention have been proposed in the literature, among which the trading hours, the announcement weekday, and the number of competing announcements stand out. Francis, Pagach, and Stephan (1992), and Bagnoli, Clement, and Watts (2005) find a greater under-reaction to earnings releases made during non-trading hours. Similarly, Della Vigna and Pollet (2009) argue that since investors are more distracted from the

task of stock valuation on Fridays, investors are less attentive to earnings announcements that are made on Fridays as compared to non-Fridays. Consistent with this notion, they document more muted initial stock market reactions to Friday earnings announcements followed by stronger stock price drifts as compared to non-Friday announcements. Hirshleifer, Lim and Teoh (2009) examine the amount of information overload by the number of earnings announcements on a given day. They find that the announcement day response is weaker and the post-earnings announcement drift is stronger when the earnings announcement is made on days with many competing announcements, and that same day earnings announcements from unrelated industries are more distracting than industry-related announcements.

Other proxies include the Google Search Volume Index (Google SVI). Da et al. (2011) proposes Google SVI as a more direct measure of investor attention. They contend that a large search volume for a stock in Google indicates that many investors are paying attention to and looking for information about that stock. Using the Google SVI for a sample of Russell 3000 stocks from 2004 to 2008, they document a strong positive relation between search volume changes and investor trading. Moreover, they document that increases in investor attention are associated with large first-day IPO stock returns.

Among the alternative empirical proxies, trading volume has evolved into one of the most popular and widely used ones, largely because it is intuitively appealing. When investors are inattentive to a stock, they are unlikely to trade it; and when they pay more attention to a stock, they are more likely to trade it. In other words, investor attention should be highly correlated with trading volume. In addition, investor attention may interact with other psychological biases and result in a divergence of opinions among investors about the stock, which presumably generates more trading (Odean (1998), and Scheinkman and Xiong (2003)).

Empirical evidence has strongly supported the connection between investor attention and trading volume. Lo and Wang (2000) show that since large stocks tend to attract more investor attention, trading volume tends to be higher among these stocks. Gervais, Kaniel and Mingelgrin (2001) argue that the trading volume spike raises a stock's visibility and attracts more investor attention. Chordia and Swaminathan (2002) show that returns of high volume stocks tend to respond faster to information in market returns than as compared to low volume stocks even after controlling for size. It seems that trading volume contains information about investor attention beyond firm size. Barber and Odean (2008) argue that volume is more closely tied to actual attention, since it is a direct outcome of investor attention. Using trading volume as a proxy for investor attention, Hou et al. (2009) find that higher earnings momentum profits among low volume stocks. They attribute this finding to reduced investor attention and stock market under-reaction to earnings announcements.

There are at least two mechanisms through which option trading can play a role in mitigating the stock market under-reaction. Firstly, there is a transaction cost perspective. Fedenia and Grammatikos (1992) document evidence that the average bid-ask spread of NYSE firms that have initiated option trading decreases by about 20 percent at the time of option listing. Bhushan (1994) argues that transaction costs, along with differential abilities among investors to process information, can lead to investor under-reaction and post-earnings announcement drift. Mendenhall and Fehrs (1999) points out that while the actions of uninformed traders tend to make the price deviate from the information contained in earnings, the informed traders move the prices in the proper direction because they can take larger and less expensive positions when option is introduced. It is thus plausible that higher option trading immediately before the announcement date reduces the equity transaction costs and relaxes the transaction cost-induced constraints, thus providing informed traders additional motives to continue trading. This will help reduce the stock market under-reaction. Consistent with this view, Govindarajet al. (2012) argue that option traders are less susceptible to the under-reaction bias as compared to equity traders. Secondly, there is a price discovery perspective. Option trading can reduce the market under-reaction by speeding up the price discovery process. Jennings and Starks (1986) document solid evidence that optioned firms adjust to the quarterly earnings releases much faster than non-optioned firms. Mendenhall and Fehrs (1999) also point out that informed traders can take larger and less expensive options for optioned firms to help speed up aligning the stock price with new information. It is worth noting that these two perspectives can complement each other in that the reduced transaction cost helps materialize the impact of increased investor attention on the stock market response.

3. Hypothesis Development

We start with a first look at how pre-earnings option trading affects the stock market response without implicating other proxies for investor attention. We believe this constitutes a clean and direct test of the effects of pre-earnings option trading. It has been well documented that at least some of the pre-earnings option trading originates from informed traders (Amin and Lee (1997)). If informed traders trade options to capitalize their private information, they are certainly attentive investors. On the other hand, pre-earnings option trading could also be driven by other considerations such as speculation. For instance, speculative investors can engage in straddle strategies right before earnings announcements in the hope of profiting from the anticipated price volatility. Xing and Zhang (2013) show that straddle strategies around earnings announcements generate significantly positive returns. While it is hard to disentangle these trading motives, the notion of investor attention subsumes both trading motives. Regardless of whether investors trade options because they are informed or because they want to speculate on the anticipated price movement, heightened investor attention before earnings announcements leads to more active pre-earnings option trading.

To the extent that pre-earnings option trading proxies for investor attention and that increased investor attention mitigates stock market under-reaction, we expect earnings announcements with higher pre-earnings option trading should have stronger stock market response at announcement times and weaker post-earnings announcement drifts. Our Hypothesis 1 formally summarizes the intuition as follows:

Hypothesis 1a: *Stock market response should be stronger at announcement times for those earnings announcements with higher pre-earnings option trading.*

Hypothesis 1b: *The post-earnings announcement drift should be weaker for those earnings announcements with higher pre-earnings option trading.*

Our next two hypotheses examine the confounding effects of pre-earnings option trading and other metrics of investor attention. More specifically, we focus on two widely used proxies of investor attention: 1) the number of announcements made on a single day; and 2) Friday vs. non-Friday announcements. Hirshleifer et al. (2009) propose the number of announcements made on a single day as a measure of *information overload* on investors. The intuition for this measure is simple: the more competing announcements made on the same day, the more distraction investors are exposed to, and hence, the less attentive investors are to each announcement. Consistent with this notion, they find that the announcement day response is weaker and the post-earnings announcement drift is stronger when the earnings announcement is made on days with many competing announcements.

Combining the information overload on investors with pre-earnings option trading enables us to derive a number of testable implications. Firstly, consider the number of announcements made on a single day. When all the announcements are sorted by both the number of announcements and the level of pre-earnings option trading, we have the following 2 by 2 matrix.

		Pre-earnings Option Trading	
		High	Low
No. of Announcements	Many	A	B
	Few	C	D

Denote the stock market response coefficients by A , B , C and D correspondingly for the four subsets of earnings announcements sorted by both the information overload and pre-earnings option trading. If increased investor attention mitigates the stock market under-reaction, then we expect to see the strongest reaction at announcement times and the weakest post-earnings announcement drift when there is high pre-earnings option trading *and* when the earnings announcements are made on days with few competing announcements, since investors are most attentive in this case. In other words, stock market response coefficient C should be the largest and B should be the smallest among the four subsets. This

relationship should reverse when we examine the post-earnings announcement drift. Our Hypothesis 2 summarizes this intuition:

Hypothesis 2a: *The stock market response should be the strongest (weakest) when there are few (many) competing announcements made on the announcement date **and** when there is high (low) pre-earnings option trading.*

Hypothesis 2b: *In addition, the post-earnings announcement drift should be the weakest (strongest) when there are few (many) competing announcements made on the announcement date **and** when there is high (low) pre-earnings option trading.*

Secondly, consider the announcements that are made on Fridays vs. non-Fridays. Della, Vigna and Pollet (2009) argue that since investors are more distracted from the task of stock valuation on Fridays, investors are less attentive to earnings announcements that are made on *Fridays* as compared to *non-Fridays*. Consistent with this notion, they document more muted initial stock market reactions to Friday earnings announcements followed by stronger stock price drift, compared to non-Friday announcements.

When all the announcements in the sample are sorted by both Friday/non-Friday announcements and the level of pre-earnings option trading, we have a similar 2 by 2 matrix.

		Pre-earnings Option Trading	
		High	Low
Fridays vs. Non-Fridays	Friday	A	B
	Non-Friday	C	D

Given that investors are more distracted on Fridays, increased investor attention for announcements that have higher pre-earnings option trading and that are made on non-Fridays should experience the strongest stock market reaction at announcement times and the weakest post-earnings announcement drift. In other words, we again expect the stock market response coefficient C (B) to be the largest (smallest). Our hypothesis 3 formally summarizes the intuition.

Hypothesis 3a: *The stock market response should be the strongest (weakest) for those announcements that are made on non-Fridays (Fridays) **and** that have high (low) pre-earnings option trading.*

Hypothesis 3b: *In addition, the post earnings announcement drift should be the strongest (weakest) for those announcements that are made on Fridays (non-Fridays) **and** that have low (high) pre-earnings option trading.*

It is worth pointing out that both Hypothesis 2 and 3 imply that the stock market response coefficient C is greater than both A and D whereas the response coefficient B is smaller than both A and D . It is also interesting to compare A and D . Whether A is greater than D depends on the relative dominance of the

pre-earnings option trading effect as compared to the information overload effect or Friday effect. Since we don't have a prior for the relative dominance, we leave it open to the empirical exercise.

4. Data and Methodology

Our sample period covers 1996 – 2014. We obtain daily returns and trading volumes from the Center for Research in Securities Prices (CRSP). Financial data are retrieved from the Compustat databases. Common firm identifiers such as CUSIP numbers and ticker symbols are used to match observations from different databases. In the rest of this section we focus on the details of constructing the final sample of earnings announcements for optioned firms.

The options trading data come from the Ivy DB OptionMetrics database, which has evolved into the industry standard database for options-related research. OptionMetrics provides the end-of-the-day summary data of option volumes as well as the best bid and best offer prices for each optioned stock and for each option contract classified by the option type (call or put), the strike price, and maturity starting from January 1996.

It has been reported that OptionMetrics contains a number of data errors. We apply a number of filters to deal with the reported data errors contained in OptionMetrics. These data errors are mainly related to identical observations, zero best bid prices, and missing implied volatility estimates.

Data on earnings announcements are from the Institutional Brokers' Estimate System (I/B/E/S) database. The actuals file from the I/B/E/S database provides earnings announcements data, including firm names, firm identifiers and earnings announcement dates. Following Livnat and Mendenhall (2006), we require: 1) the earnings announcement date reported in Compustat and I/B/E/S should not differ by more than one calendar day; 2) the price per share is available from Compustat at each fiscal quarter end; 3) the price is greater than \$1; 4) the market and book values of equity at fiscal quarter end are available and are larger than \$ 5 million.

Our core variable standardized unexpected earnings (*SUE*) is calculated as the actual reported earnings per share minus the median analyst forecast within 90 days prior to the earnings announcement date, scaled by the closing price in the previous quarter. To capture the stock market response, we construct the announcement return (*AnnRet*) for each announcement in the sample. The announcement return is defined as the abnormal returns cumulated over the event window $[t-1, t+1]$, where t is the earnings announcement date (EAD). The standard alpha and beta estimates are estimated over the estimation window $[t-210, t-31]$ via a market model. The daily abnormal return is then obtained by subtracting the predicted daily return from the daily stock return over the event window.

In addition to our core variables *SUE* and *AnnRet*, we also construct a number of control variables to capture firm- and event-specific characteristics. We follow the standard practice in the literature when

constructing such variables. We compute *Size* as the natural log of shares outstanding multiplied by the closing price at date $t-31$. The pre-announcement stock price run-up (*Runup*) is defined as the abnormal stock returns cumulated over $[t-30, t-2]$. The estimates from the market model are again used to calculate daily abnormal returns. *Runup* is a proxy for information leakage in the days immediately before corporate announcements. Past stock returns (*PastRet*) are defined as the buy-and-hold stock return cumulated over $[t-210, t-31]$. Table 1 provides the summary statistics of the core variables along with the control variables.

5. Empirical analysis

5.1 Testing Hypothesis 1

To test Hypothesis 1a, we adapt the widely used earnings response coefficient (ERC) framework to incorporate option trading into the analysis of stock market response. Using *AnnRet* as a proxy for the stock market response and *SUE* as a proxy for the information released via the announcements, the ERC framework regresses *AnnRet* on *SUE*. The baseline ERC regression is as follows:

$$AnnRet = \alpha_0 + \alpha_1 \cdot SUE + \sum_{k=2}^K \alpha_k \cdot Control\ Variables + \varepsilon$$

By regressing *AnnRet* on *SUE*, researchers are able to quantify the initial stock market response by examining the slope coefficient estimate before *SUE*. To invoke option trading into this framework, we augment this regression specification by adding an interaction term between *SUE* and an option trading variable. The augmented regression equation is as follows:

$$AnnRet = \alpha_0 + \alpha_1 \cdot SUE + \alpha_2 \cdot SUE \cdot Opt\ Trading\ Variable + \sum_{k=3}^K \alpha_k \cdot Control\ Variables + \varepsilon$$

In the regression specification, the option trading variable we use is the average option turnover, defined as the option trading volume scaled by the open interest, averaged over $[t-30, t-1]$, where t is the earnings announcement date. Our intention is to capture the differentiated degree of option trading activity over

the 30 day window before the earnings announcement date. We further sort all the announcements into two groups based on the median option turnover. We then create a dummy variable *IsHigh* that takes the value of zero if the option turnover falls into the bottom group and one otherwise.

Our predictions for the three control variables, *Size*, *PastRet*, and *Runup*, are as follows: larger firms typically receive more attention from investors and hence, are generally associated with larger stock market response; daily stock returns are negatively auto-correlated; hence, we expect a negative slope coefficient estimate before *PastRet*; *Runup* is a proxy for informational leakage; hence, we expect a negative relationship between *Runup* and *AnnRet*. Our focal variable is the interaction term between *SUE* and the dummy variable *IsHigh*. Positive and significant slope coefficient estimate before the interaction term lends support to increased stock market reaction due to higher pre-earnings option trading.

Table 2 presents the estimation results. Given the fact that in many cases, the same firm makes multiple announcements in the sample period, we calculate the standard errors clustered by firms. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

As we can see clearly from Table 2, the control variables all carry the expected signs and are statistically significant. Larger firms are associated with greater stock market responses; whereas higher past stock returns and the stock price run-up immediately before the EAD reduce the stock market response to the earnings announcements.

Not surprisingly, the *SUE* variable carries a positive and significant parameter estimate of 0.0448. Thus, the greater the information shock, the greater the stock market reaction. More importantly, we notice that the slope coefficient estimate before *SUE*IsHigh* is positive and reliably different from 0 at 1% significance level. As a matter of fact, the interaction term carries a slope coefficient estimate of 0.0876. In other words, the stock market response coefficient almost triples as we move from low pre-earnings option trading group to high pre-earnings option trading group. This constitutes strong evidence that high pre-earnings option trading is associated with increased initial stock market response. This is consistent with the notion that increased investor attention is reflected in the higher pre-earnings option trading, which further alleviates the stock market under-reaction. Overall we think the result in Table 2 lends strong support to Hypothesis 1a.

To test for the post-earnings announcement drift effect, we construct the *PEAD* variable, defined as the buy-and-hold abnormal return cumulated over $[t+2, t+61]$, where t is the earnings announcement date. The following regression equation is then estimated.

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot Size + \alpha_3 \cdot PastRet + \alpha_4 \cdot Runup + \varepsilon$$

Our focal variable is the option trading dummy variable *IsHgh*. Table 3 reports the results. The standard errors are clustered by firms. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

The results show that larger firms and stocks that have already run up a lot more tend to have weaker post-earnings announcement drift. Our focal variable *IsHgh* carries a negative and significant slope coefficient estimate. Announcements that have higher pre-earnings option trading are associated with weaker post-earnings announcement drift, thus lending to Hypothesis 1b.

5.2 Testing Hypothesis 2

Hypothesis 2 relates to the joint effect of pre-earnings option trading and information overload. To examine the initial stock market response in the presence of both option trading and the number of competing announcements, we construct another dummy variable *IsMul* using the following procedure. For each announcement day in the sample, we count the number of earnings announcements. The median number of announcements is then used to sort all announcements into two groups. Any announcement that is made on a day with the number of announcements less than the median number of announcements is placed into the bottom group. Otherwise, it is sorted into the top group. *IsMul* takes the value of zero if the announcement falls into the bottom group and one otherwise.

Since we have a 2 by 2 sorting scheme, we have multiple ways to examine the combined effects. We start with estimating the following regression equations for both the high and the low pre-earnings option trading groups.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsMul_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{ \text{High Opt. Trading Group, Low Opt. Trading Group} \}$

By sorting all the announcements by the pre-earnings option trading, we can examine how the initial stock market response differs in the presence of information overload for both the high and low pre-earnings option trading group through the interaction term between *SUE* and *IsMul*. In other words, we estimate the stock market response coefficients *A* and *C* versus *B* and *D*.

Panel A and Panel B in Table 4 present the estimation results for the high and low option trading group respectively.

A few observations are noticed. Firstly, *Size*, *Runup*, and *PastRet* still carry expected signs and are all statistically significant at 5% level. Secondly, we notice that the interaction term *Sue*IsMul* carries a negative sign and is significant at 1% level only for the high pre-earnings option trading group. Interestingly enough, the sign for the interaction term flips for the low pre-earnings option trading group. Thus, it appears that in the presence of high pre-earnings option trading, announcements that are made on days with fewer competing announcements experience much stronger initial stock market reaction at announcement times. When pre-earnings option trading is low, the stock market actually responds more when there are more competing announcements made on the announcement date. While this is certainly puzzling, we also notice that the magnitude of the earnings response coefficient is largest for the combination of high pre-earnings option trading group and few competing announcements on the announcement days. The ERC decreases from 0.522 to 0.131 when more competing announcements are made for the high pre-earnings option trading group. Thus, our findings are consistent with Hirshleifer et al. (2009). Thirdly, we notice that the ERC estimates are generally larger for the high pre-earnings option trading group as compared to the low pre-earnings option trading group (0.522 vs. 0.015). This is certainly consistent with the results in Table 2 and lends additional support to Hypothesis 1.

Table 4 estimates the response coefficients *A* and *C* versus *B* and *D* separately. We now turn to the estimation of *A* and *B* versus *C* and *D* separately. We sort all the announcements on the basis of the information overload and focus on the interaction term between *SUE* and *IsHgh*. The following two regression equations for both many and few earnings announcement groups are estimated.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsHgh_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{\text{Many Announcements Group, Few Announcements Group}\}$

Panel A and Panel B in Table 5 presents the results for the many and few announcements groups respectively. An interesting observation emerges when the announcements are sorted this way. In Panel A, we notice that the ERC more than doubles as we move from low pre-earnings option trading to high pre-earnings option trading. In sharp contrast, in Panel B where investors are less distracted and more attentive, the ERC increases from 0.014 to 0.5134 (more than 30 times!) as the pre-earnings option trading becomes more active. As a matter of fact, the presence of the interaction term between *SUE* and *IsHgh* deprives *SUE* of the statistical significance in this case. This is certainly consistent with our expectation that as investors are most attentive as captured by high pre-earnings option trading and a light information overload, the stock market is most responsive to the earnings announcements.

Overall, the results in Table 4 and 5 show that the strongest (weakest) initial stock market reaction

takes place when there is high (low) option trading preceding the earnings announcements and when the announcements are made on days with few (many) competing announcements. We now turn to the post-earnings announcement drift effect.

To examine the impact of the pre-earnings option trading and the information overload on the post earnings announcement drift, we estimate the following regression equations:

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot IsHgh \cdot IsMul + \alpha_3 \cdot Size + \alpha_4 \cdot PastRet + \alpha_5 \cdot Runup + \varepsilon$$

Our focal interest is on the dummy variable *IsHgh* and the interaction term between *IsHgh* and *IsMul*. If stock market under-reaction has been reduced due to increased investor attention as reflected by high pre-earnings option trading and few competing announcements made on the same day, we expect weaker post earnings announcement drift. As a result, we expect negative slope coefficient estimates before *IsHgh* and the interaction term.

Table 6 presents our findings. Consistent with what we expect, both *IsHgh* and the interaction term carry negative signs, thus lending support to Hypothesis 2b. However, only *IsHgh* shows up as statistically significant at 10% level whereas the coefficient on *IsHgh*IsMul* is not significant at all. Mendenhall and Fehrs (1999) points that in general, the PEAD test is not powerful enough to obtain statistical significance. While the lack of statistical significance is consistent this notion, the contrast between the significance of *IsHgh* and *IsHgh*IsMul* speaks to the relative dominance of the option trading effect as compared to the information overload effect.

5.3 Testing Hypothesis 3

Hypothesis 3 examines the joint effect of option trading and the weekday effect of announcement times. If high pre-earnings option trading and non-Friday weekdays reflect increased investor attention, then we expect to see stronger (weaker) initial (subsequent) stock market response. To test this Hypothesis, we create a dummy variable, *IsFri*, that takes the value of one if the announcement is made on Fridays and zero otherwise.

Similar to testing Hypothesis 2, we start with the following regression analysis:

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsFri_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{ \text{High Opt. Trading Group, Low Opt. Trading Group} \}$

Panel A and Panel B in Table 7 present the results for the high and low option trading group respectively. A few observations are immediately noticed. Firstly, *Size*, *Runup*, and *PastRet* still carry expected signs and are all statistically significant at 5% level. Secondly, we notice that the interaction term *Sue*IsFri* carries a negative sign and not statistically significant. This pattern is robust across both the high and low pre-earnings option trading groups. Thus, while Friday announcements appear to have more muted stock market response, the data only provide very weak support. Thirdly, we notice that the ERC estimates are generally larger for the high pre-earnings option trading group as compared to the low pre-earnings option trading group. (0.135 vs. 0.049). This is certainly consistent with the results in Table 2 and lends additional support to Hypothesis 1.

To further compare the effects of pre-earnings option trading and Friday effect, we also estimate the following regression equations for both many and few earnings announcement groups.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsHgh_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{ \text{Friday Announcements Group, Non-Friday Announcements Group} \}$

Panel A and Panel B in Table 8 present the estimation results for the many and few announcements group respectively. An interesting observation emerges when the announcements are sorted this way. In Panel A, we notice that the ERC more than triples as we move from low pre-earnings option trading to high pre-earnings option trading. In sharp contrast, in Panel B, the ERC increases from 0.048 to 0.089 as the pre-earnings option trading becomes more active. In addition, the non-Friday announcement group enjoys stronger statistical significance for the interaction term. This clearly speaks to the cumulative effect of active pre-earnings option trading and non-Friday announcements on the stock market response.

Overall, the results in Table 7 and 8 show that the strongest (weakest) initial stock market reaction occurs when there is high (low) option trading on non-Friday (Friday) announcements. We now turn to the post-earnings announcement drift effect.

To examine the impact of the pre-earnings option trading and announcement weekday on the post earnings announcement drift, we estimate the following regression equations:

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot IsHgh \cdot IsFri + \alpha_3 \cdot Size + \alpha_4 \cdot PastRet + \alpha_5 \cdot Runup + \varepsilon$$

If stock market under-reaction has been reduced due to increased investor attention as reflected by high pre-earnings option trading and not-so-much-distracted non-Friday weekdays, we expect weaker post earnings announcement drift. In other words, we expect negative slope coefficient estimates before *IsHgh* and the interaction term.

Table 9 presents the estimate results. We notice that consistent with what we expect, both *IsHgh* and the interaction term carry negative signs, thus lending support to Hypothesis 3b. However, only *IsHgh* shows up as statistically significant at 1% level whereas *IsHgh*IsFri* is not significant at all. This again might be due to the fact that the PEAD test usually lacks the statistical power. While the lack of statistical significance is consistent this notion, the contrast between the significance of *IsHgh* and *IsHgh*IsFri* speaks to the relative dominance of the option trading effect as compared to the weekday effect.

6. Conclusions

Whether the stock market responds efficiently to corporate earnings announcements is of substantial importance to the long-lasting theme of market efficiency. This paper explores the role of investor attention to earnings announcements in the presence of the stock market under-reaction. Using the pre-announcement option trading as a proxy for investor attention, we show that heightened investor attention helps faster incorporation of new information in the presence of more active option trading, which further reduces stock market under-reaction and leads to stronger initial stock market response. In addition, we invoke two alternative proxies for investor attention and find strong evidence that when investors are most (least) attentive, the initial stock market reaction is the strongest (weakest).

Our findings show the relevance of investor attention for the stock market reaction. The existence of the options market provides the necessary venue for investors to materialize their increased attention. However, it is not entirely clear how such enhanced investor attention works its way to more timely response to earnings releases through active option trading. While we hypothesize there are two possible channels, we are still quite agnostic about the exact mechanism of such channels. A thorough investigation

into the relationship between investor attention and option trading helps us achieve a complete understanding of stock market response. We leave this issue to our future research.

Table 1: Summary Statistics of Main Variables

This table presents the summary statistics of main variables used in this paper. *SUE* is the standardized unexpected earnings, calculated as the actual reported earnings per share minus the median analyst forecast within 90 days prior to the earnings announcement date, scaled by the closing price in the previous quarter. *AnnRet* is the announcement return, defined as the abnormal returns cumulated over the event window $[t-1, t+1]$, where t is the earnings announcement date. A market model is estimated over the estimation window $[t-210, t-31]$ to obtain the alpha and beta parameter estimates. The daily abnormal return series is then obtained by subtracting the predicted daily return using the parameter estimates from the estimated market model from the daily stock return over the event window. *Size* is the natural log of shares outstanding multiplied by the closing price. *Size* is measured at date $t-31$; *Runup* is the pre-announcement stock price run-up, defined as the abnormal stock returns cumulated over $[t-30, t-2]$. *PastRet* is the past stock returns, defined as the buy-and-hold stock return cumulated over $[t-210, t-31]$.

Variable	N	Mean	Std. Dev.	Min.	Max.
<i>SUE</i>	158,580	-0.0016	0.0825	-14.4711	5.1131
<i>AnnRet</i>	158,580	0.0003	0.0891	-0.8593	2.4249
<i>Size</i>	158,580	14.2493	1.5711	8.2005	20.3021
<i>Runup</i>	158,580	-0.0044	0.1440	-0.8947	3.6570
<i>PastRet</i>	158,580	0.0862	0.4609	-0.9636	21.2353

Table 2: Pre-Earnings Option Trading and ERC

This table examines the earnings response coefficient (ERC) using the following augmented ERC equation:

$$AnnRet = \alpha_0 + \alpha_1 \cdot SUE + \alpha_2 \cdot SUE \cdot IsHgh + \alpha_3 \cdot Size + \alpha_4 \cdot PastRet + \alpha_5 \cdot Runup + \varepsilon$$

AnnRet, *SUE*, *Size*, *PastRet*, and *Runup* are as defined in Table 1. For each announcement in the sample, we first calculate the average option turnover (option volume scaled by open interest) over the time period $[t-30, t-1]$, where t is the earnings announcement date. All announcements are then sorted into two groups based on the median option turnover. *IsHgh* takes the value of zero if the earnings announcement falls into the bottom group and one otherwise. The standard errors are calculated by firm clustering to accommodate for the fact that many firms make multiple announcements in the sample period. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0066***	0.0023	-2.89	0.0039
<i>Sue</i>	0.0448***	0.0131	3.43	0.0006
<i>Sue*IsHgh</i>	0.0876***	0.0249	3.52	0.0004
<i>Size</i>	0.0006***	0.0002	3.72	0.0002
<i>PastRet</i>	-0.0124***	0.0009	-13.97	<.0001
<i>Runup</i>	-0.0128***	0.0027	-4.67	<.0001

Table 3: Pre-Earnings Option Trading and PEAD

This table examines the post-earnings announcement drift (PEAD) in the presence of pre-earnings option trading. The following regression equation is estimated.

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot Size + \alpha_3 \cdot PastRet + \alpha_4 \cdot Runup + \varepsilon$$

PEAD is the post-earnings announcement drift, defined as the buy-and-hold abnormal return cumulated over $[t+2, t+61]$, where t is the earnings announcement date. *Size*, *PastRet*, and *Runup* are as defined in Table 1. *IsHgh* is as defined in Table 2. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	0.0334***	0.0054	6.20	<.0001
<i>IsHgh</i>	-0.0062***	0.0010	-6.43	<.0001
<i>Size</i>	-0.0017***	0.0004	-4.87	<.0001
<i>Runup</i>	-0.0365***	0.0062	-5.93	<.0001
<i>PastRet</i>	0.0049***	0.0020	2.49	0.0128

Table 4: ERC and Sorting by Pre-Earnings Option Trading

This table presents the estimation results of the augmented ERC regression framework for two subsamples sorted by pre-earnings option trading. The following regression equation is estimated for both the high and low pre-earnings option trading group.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsMul_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{ \text{High Opt. Trading Group, Low Opt. Trading Group} \}$

For each announcement in the sample, we first count the number of earnings announcements. All announcements in each subsample are further sorted by the median number of announcements. Any announcement that is made on a day with the number of announcements less than the median number of announcements is placed into the bottom group. Otherwise, it is sorted into the top group. *IsMul* takes the value of zero if the announcement falls into the bottom group and one otherwise. Panel A and Panel B provide the estimation results for the high and low option trading group respectively. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: High Pre-Earnings Option Trading				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0084***	0.0032	-2.63	0.0085
<i>Sue</i>	0.5219***	0.0934	5.59	<.0001
<i>Sue*IsMul</i>	-0.3909***	0.0965	-4.05	<.0001
<i>Size</i>	0.0007***	0.0002	3.14	0.0017
<i>Runup</i>	-0.0065**	0.0032	-2.02	0.0432
<i>PastRet</i>	-0.0110***	0.0011	-10.12	<.0001
Panel B: Low Pre-Earnings Option Trading				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0066**	0.0030	-2.18	0.029
<i>Sue</i>	0.0150	0.0104	1.45	0.1474
<i>Sue*IsMul</i>	0.0499**	0.0194	2.57	0.0101
<i>Size</i>	0.0006***	0.0002	2.91	0.0037
<i>Runup</i>	-0.0235***	0.0050	-4.73	<.0001
<i>PastRet</i>	-0.0156***	0.0014	-11.12	<.0001

Table 5: ERC and Sorting by Information Overload

This table presents the estimation results of the augmented ERC regression framework for two subsamples sorted by the information overload. The information overload is defined as the median number of announcements across all the announcement dates in the sample. All announcements are first sorted into two groups by the information overload. The following regression equation is estimated for both the high and low information overload group.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsHgh_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{\text{Many Announcements Group, Few Announcements Group}\}$

All variables are as defined in previous tables. We focus on the interaction term between *SUE* and *IsHgh*. Panel A and Panel B present the estimation results for the many and few announcements group respectively. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Many Announcements				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0071***	0.0024	-2.98	0.0029
<i>Sue</i>	0.0640***	0.0166	3.85	0.0001
<i>Sue*IsHgh</i>	0.0675**	0.0286	2.36	0.0183
<i>Size</i>	0.0006***	0.0002	3.78	0.0002
<i>Runup</i>	-0.0138***	0.0029	-4.84	<.0001
<i>PastRet</i>	-0.0130***	0.0009	-13.75	<.0001
Panel B: Few Announcements				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	0.0027	0.0071	0.38	0.7003
<i>Sue</i>	0.0140	0.0102	1.38	0.167
<i>Sue*IsHgh</i>	0.5134***	0.0931	5.52	<.0001
<i>Size</i>	0.0000	0.0005	-0.06	0.9506
<i>Runup</i>	-0.0021	0.0100	-0.21	0.8333
<i>PastRet</i>	-0.0070***	0.0024	-2.91	0.0036

Table 6: Pre-Earnings Option Trading, Information Overload and PEAD

This table investigates the post-earnings announcement drift in the presence of option trading and information overload on investors prior to each announcement. The following regression equation is estimated.

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot IsHgh \cdot IsMul + \alpha_3 \cdot Size + \alpha_4 \cdot PastRet + \alpha_5 \cdot Runup + \varepsilon$$

All variables are as defined in previous tables. Our focal interest is on the dummy variable *IsHgh* and the interaction term between *IsHgh* and *IsMul*. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	0.0334***	0.0054	6.21	<.0001
<i>IsHgh</i>	-0.0055*	0.0028	-1.93	0.0541
<i>IsHgh*IsMul</i>	-0.0008	0.0028	-0.27	0.7835
<i>Size</i>	-0.0017***	0.0004	-4.87	<.0001
<i>Runup</i>	-0.0365***	0.0062	-5.93	<.0001
<i>PastRet</i>	0.0049**	0.0020	2.49	0.0129

Table 7: ERC and Sorting by Pre-Earnings Option Trading

This table presents the estimation results of the augmented ERC regression framework for two subsamples sorted by pre-earnings option trading. The following regression equation is estimated for both the high and low pre-earnings option trading group.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsFri_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{ \text{High Opt. Trading Group, Low Opt. Trading Group} \}$

All announcements are first sorted into two groups by the median average option turnover. *IsFri* is a dummy variable that takes the value of one if the announcement is made on Friday and zero otherwise. All other variables are as defined in previous tables. Panel A and Panel B provide the estimation results for the high and low option trading group respectively. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: High Pre-Earnings Option Trading				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0064**	0.0032	-1.98	0.0476
<i>Sue</i>	0.1354***	0.0236	5.73	<.0001
<i>Sue*IsFri</i>	-0.0290	0.0464	-0.62	0.5323
<i>Size</i>	0.0005**	0.0002	2.54	0.011
<i>Runup</i>	-0.0093***	0.0032	-2.95	0.0032
<i>PastRet</i>	-0.0112***	0.0011	-10.24	<.0001
Panel B: Low Pre-Earnings Option Trading				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0088***	0.0031	-2.87	0.0041
<i>Sue</i>	0.0487***	0.0160	3.05	0.0023
<i>Sue*IsFri</i>	-0.0185	0.0214	-0.87	0.3859
<i>Size</i>	0.0007***	0.0002	3.52	0.0004
<i>Runup</i>	-0.0199***	0.0052	-3.86	0.0001
<i>PastRet</i>	-0.0155***	0.0014	-11.09	<.0001

Table 8: ERC and Sorting by Announcement Weekdays

This table presents the estimation results of the augmented ERC regression framework for two subsamples sorted by the announcement weekdays. All announcements are first sorted into two groups by whether the announcement date is a Friday or not. The following regression equation is estimated for both Fridays and non-Fridays group.

$$AnnRet_i = \alpha_0 + \alpha_1 \cdot SUE_i + \alpha_2 \cdot SUE_i \cdot IsHgh_i + \alpha_3 \cdot Size_i + \alpha_4 \cdot Runup_i + \alpha_5 \cdot PastRet_i + \varepsilon$$

where $i \in \{\text{Friday Announcements Group, Non-Friday Announcements Group}\}$

All variables are as defined in previous tables. We focus on the interaction term between SUE and $IsHgh$. Panel A and Panel B present the estimation results for Friday and non-Friday group respectively. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Friday Announcements				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	0.0078	0.0083	0.94	0.3491
<i>Sue</i>	0.0298**	0.0145	2.05	0.0404
<i>Sue*IsHgh</i>	0.0775*	0.0428	1.81	0.0706
<i>Size</i>	-0.0005	0.0005	-0.84	0.4004
<i>Runup</i>	-0.0145	0.0105	-1.38	0.1688
<i>PastRet</i>	-0.0092**	0.0038	-2.44	0.0148
Panel B: Non-Friday Announcements				
Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	-0.0076***	0.0024	-3.2	0.0014
<i>Sue</i>	0.0480***	0.0159	3.03	0.0025
<i>Sue*IsHgh</i>	0.0878***	0.0285	3.08	0.0021
<i>Size</i>	0.0006***	0.0002	4.04	<.0001
<i>Runup</i>	-0.0128***	0.0028	-4.49	<.0001
<i>PastRet</i>	-0.0126***	0.0009	-13.77	<.0001

Table 9: Pre-Earnings Option Trading, Announcement Weekday and PEAD

This table investigates the post-earnings announcement drift in the presence of option trading and announcement weekday effect for each announcement. The following regression equation is estimated.

$$PEAD = \alpha_0 + \alpha_1 \cdot IsHgh + \alpha_2 \cdot IsHgh \cdot IsFri + \alpha_3 \cdot Size + \alpha_4 \cdot PastRet + \alpha_5 \cdot Runup + \varepsilon$$

All variables are as defined in previous tables. Our focal interest is on the dummy variable *IsHgh* and the interaction term between *IsHgh* and *IsFri*. The standard errors are calculated by firm clustering. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Variable	Estimate	Std. Err.	t Value	Pr > t
<i>Intercept</i>	0.0334***	0.0054	6.20	<.0001
<i>IsHgh</i>	-0.0061***	0.0010	-6.27	<.0001
<i>IsHgh*IsFri</i>	-0.0008	0.0028	-0.29	0.7754
<i>Size</i>	-0.0017***	0.0004	-4.86	<.0001
<i>Runup</i>	-0.0365***	0.0062	-5.93	<.0001
<i>PastRet</i>	0.0049**	0.0020	2.49	0.0129

REFERENCES

- Abarbanell Jeffery and Brian Bushee, 1998, Abnormal returns to a fundamental analysis strategy, *The Accounting Review*, Vol. 73, No.1, 19-45
- Amin Kaushik and Charles Lee, 1997, Option trading, price discovery, and earnings news dissemination, *Contemporary Accounting Research*, Vol. 14, Issue 2, 153-192
- Bagnoli, M., Kross, W. and Watts, S. G., The information in management's expected earnings report date: a day late, a penny short, *Journal of Accounting Research*, Vol. 40 no. 5, December, 2002, pp. 1275-96
- Barber Brad and Terrance 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
- Bhushan R., 1994, An informational efficiency perspective on the post-earnings-announcement drift, *Journal of Accounting and Economics*, Vol. 18, No.1, 45-65
- Chordia Tarun and Bhaskaran Swaminathan, 2002, Trading volume and cross-autocorrelations in stock returns, *Journal of Finance*, Vol. 55, No. 2, 913-935
- Da Zhi, Joseph Engelberg, and Pengjie Gao, 2011, In search of attention, *Journal of Finance*, Vol. LXVI, No.5, 1461-1499
- Della Vigna Stefano and Joshua Pollet, 2009, Investor inattention and Friday earnings announcements, *Journal of Finance*, Vol. 64, No. 2, 709-749
- Fedenia Mark, and Theoharry Grammatikos, 1992, Option trading and the bid-ask spread of the underlying stock, *Journal of Business* Vol. 65, No. 3, 335-351
- Francis, Jennifer, Donald Pagach and Jens Stephan, 1992. The Stock Market Response to Earnings Announcements Made During Trading and Non-Trading Periods, *Journal of Accounting Research*, Vol. 30, No. 2, 165-184
- Gervais Simon, Ron Kaniel, and Dan Mingelgrin, 2001, The high-volume return premium, *Journal of Finance*, Vol. 56, No.3, 877-919
- Govindaraj Suresh, Sangsang Liu and Joshua Livnat, 2012, The post earnings announcement drift and option traders, working paper, Rutgers University
- Hirshleifer David, Sonya Seongyeon Lim, and Siewhong, Teoh, 2009, Driven to distraction: extraneous events and under-reaction to earnings news, *Journal of Finance*, Vol. 64, Issue 5, 2289-2325

- Hirst, D. E. and P. E. Hopkins (1998), Comprehensive Income Reporting and Analysts' Valuation Judgments, *Journal of Accounting Research*, Supplement, 47-75.
- Ho Li-Chin, 1993, Option trading and the relation between price and earnings: a cross-sectional analysis, *Accounting Review*, Vol. 68, No. 2, 368-384
- Hou Kewei, Lin Peng, and Wei Xiong, 2009, A tale of two anomalies: the implication of investor attention for price and earnings momentum, working paper, Ohio State University
- Jennings Robert and Laura Starks, 1986, Earnings announcements, stock price adjustment, and the existence of option markets, *Journal of Finance*, 41(1), 107-125
- Livnat Joshua and Mendenhall Richard, 2006, Comparing the post-earnings announcement drift for surprised calculated from analyst and time series forecasts, *Journal of Accounting Research*, 44 (1), 177-205
- Lo Andrew and Jiang Wang, 2000, Trading volume: definitions, data analysis, and implications of portfolio theory, *Review of Financial Studies*, Vol. 13, No.2, 257-300
- Mendenhall Richard and Donald Fehrs, 1999, Option listing and the stock-price response to earnings announcements, *Journal of Accounting and Economics*, Vol. 27, Issue 1, 57-87
- Odean Terrance, 1998, Are investors reluctant to realize their losses? *Journal of Finance*, Vol. LIII, No. 5, 1775-1798
- Scheinkman Jose and Wei Xiong, 2003, Overconfidence and speculative bubbles, *Journal of Political Economy* Vol. 111, No. 6, 1183-1219
- Skinner Douglas, 1990, Options markets and the information content of accounting earnings releases, *Journal of Accounting and Economics*, Vol. 13, Issue 3, 191-211
- Turong Cameron, and Charles Corrado, 2014, Options trading volume and stock price response to earnings announcements, *Review of Accounting Studies*, Vol. 19, Issue 1, 161-209
- Xing, Yuhang and Xiaoyan Zhang, 2013, Anticipating uncertainty: straddles around earnings announcements, working paper, Rice University