Article Title: Option Informativeness Before Earnings Announcements and Under Real Activity Manipulation

Author Details:

Author 1 Name: Xiang Gao
Author 1 Affiliation: Research Center of Finance; Shanghai Business School; 2271 West Zhong Shan Rd. Shanghai 200235, P.R. China
Author 1 Email: gaoxiang@sbs.edu.cn

Author 2 Name: Jiahao Gu
Author 2 Affiliation: John Chambers College of Business and Economics; West Virginia University; 1335 Stewrdstown Rd. M2, Morgantown, WV 26505, U.S.
Author 2 Email: jigu@mix.wvu.edu

Author 3 Name: Yingchao Zhang
Author 3 Affiliation: Business School; Durham University; Millhill Ln, Durham DH1 3LB, UK

Corresponding Author: Yingchao Zhang
Corresponding Author's Email: yingchao.zhang@durham.ac.uk

Option Informativeness Before Earnings Announcements and Under Real Activity Manipulation

Abstract

Purpose. This article investigates whether single-name options trading prior to earnings announcements is more informative when there exist real activity manipulations.

Design/methodology/approach. Using 5,419 earnings announcements during 2004-2018 made by 208 public U.S. companies with relatively high options volumes ranked by the CBOE, we uncover two regularities using predictive regressions for stock return.

Findings. First, the total options volume up to twenty days pre-announcement is significantly higher than that in other periods only for earnings management firms; moreover, after detailing options characteristics, we find these intensive pre-announcement trading to be concentrated in transactions of in-the-money call and long-term maturity put options. Second, an increase in the single-name call minus put options volume can positively predict the underlying stock's next-day excess return much better in real earnings management firms, with a larger magnitude of effect in periods right before regular earnings announcement dates.

Originality/value. This paper makes a marginal and novel contribution by showing that real earnings management can serve as a proxy for the potential profit from informed trading in options as the return predictability of options volume becomes stronger for firms that have the manipulation motive and indeed perform manipulative actions.

JEL Classification: G12, G13, G14, M41

Keywords: Options trading volume, near-term return predictability, earnings announcement, real earnings management

1. Introduction

There is a consensus in the literature that, in the presence of information frictions, the options market serves as a crucial venue to accommodate informed investors. Such investors seek to capitalize on their privately-held information there, hence facilitating price discovery across all markets (Black, 1975; Copeland, 1976; Easley *et al.*, 1998)[1]. This consensus has laid down a solid theoretical foundation for the return predictability of options trading volumes, especially before the release of important corporate-specific news, in the empirical world (Amin and Lee, 1997; Cao *et al.*, 2005). More recent studies have put more emphasis on trading microstructure, cross-market interaction, and modeling techniques to extract from options the exact and valuable messages related to the underlying stocks. However, studies about how the underlying firm characteristics affect the predictor power of options volume over future stock returns are sparse. This paper hence investigates whether single-name options trading prior to earnings announcements (EA) is more informative for firms that are suspected of conducting real earnings management activities (REM). The logic behind the investigation is that real activity manipulation should contain more private information and imply higher profit potential in options markets.

The importance of our approach is twofold. For one, arguably one of the most material items in financial reports, EAs provide a vast amount of data about a firm's fundamentals on a regular basis. Given earnings are commonly subject to manager strategically managing earnings in response to shocks (Cohen *et al.*, 2008; Farrell *et al.*, 2014), it is crucial for both academics and practitioners to fully understand whether an increased options trading before EAs is dominated by leakages of knowledge about true earnings or by speculative bets on historical trends of stock prices. For another, while a large body of literature is exploring the relations between stock trading activities, real earnings management, and stock performance (Benston and Hagerman, 1974; Gallant *et al.*, 1992; Hiemstra and Jones, 1994; Lo and Wang, 2000; Li, 2010; Peng *et al.*, 2016), the

[1] Black (1975), among others, emphasizes that informed traders are attracted to the options market by the market's high leverage achievable, and also by the downside risk protection provided by derivatives.

association between transactions in the options market and returns from the underlying stock for firms that have conducted real activities manipulations has not yet be been studied.

Following previous research (e.g., Roychowdhury, 2006; Cohen et al.,2008; Zang, 2012; Farrell *et al.*, 2014), we estimate two REM estimates: the abnormal levels of production costs as our main variable and the abnormal levels of discretionary expenses as a robustness check. This paper demonstrates that the interaction between a REM dummy (equals to 1 if the firms just meet analysts forecast and there indeed exist abnormal expenditures; 0 otherwise) and an option informative proxy (the daily total call volume minus put volume) foreshadows next-day excess stock return up to twenty days prior to EAs. Moreover, we also find that this predictive power stays robust to regressing in various subsamples classified according to options characteristics. In particular, we uncover the following two key empirical regularities.

First, we discover that during the pre-announcement period, which is defined as twenty days before EAs, the average daily options volume of in-the-money calls for REM firms is significantly higher (143.8% for short-term maturity contracts, and 94.6% for long-term maturity contracts) than that for their counterparties in the benchmark period, which is defined as from twenty days after the previous EA date to twenty-one days before the latest EA date. Long-term puts for all moneyness categories also have significantly higher trading volume for REM firms during Pre-EA periods. Turning to non-REM firms, no such significance is found except for out-of-the-money calls (a 43.7% and 25.4% increase during pre-EA periods for short-term and long-term maturity, respectively). This regularity provides a crude indication that the options market is more informative before EAs and under real activities manipulation. However, since uninformed traders also like to bet firms with private information around prescheduled events, it is a challenging task to identify the extent to which the pre-EA volume for REM firms increase is based on information rather than speculation. We argue this should not be a concern by presenting our next regularity.

Second, we find that the pre-announcement can minus put volume can indeed predict the next-day contemporaneous excess returns of the underlying stocks, especially for firms suspected of managing earnings by discretionary expenditure manipulation. It is further shown that this predictability stays robust to options characteristics (e.g. moneyness and expiry date). In specific, by categorizing all sample options into moneyness- and maturity-based buckets, we find that options categories with the higher volume concentration and larger percentage rise normally display stronger predictive abilities irrespective of REM characteristics. But considering only REM firms our option informativeness proxy exhibits persistent predictability for all moneyness-maturity subsamples. This conclusion is consistent with that arrived at by Degeorge *et al.* (1999), in which firms who are under suspicion of boosting their earnings over specified behavioral thresholds have incentives to report a lower future performance. To the best of our knowledge, our article is among the first to demonstrate a meaningful connection between earnings manipulation and the information contained in options volume. In addition, it also justifies our previous finding, which suggests that the equity options market serves as an important venue of informed trading activities before prescheduled corporate events, not just before unexpected events such as mergers and acquisitions.

The rest of the article is organized as follows. Section 2 reviews the relevant literature. In Section 3 we develop testable hypotheses. Section 4 describes data and identification methods. Section 5 discusses empirical results, followed by a Section 6 that concludes.

2. Literature Review

Our article is related to two literature strands that attempt to discern the codes conveyed by options trading behaviors. One strand lays the theoretical foundations for our hypotheses proposed in the next section. Another strand empirically tests the options market's information content. We make a marginal contribution by studying whether the return predictability of pre-EA options trading volume is more prominent for underlying

firms that have manipulated their earnings in a real way.

Regarding the theoretical literature, despite the noise-trader argument (e.g., De Long *et al.*, 1990; Choy and Wei, 2012;), it is generally agreed upon that just being listed in the options market facilitates information processing in stock markets. Ho (1993) documents a higher degree of institutional holdings and wider coverage of news as two possible channels for enhanced price discovery of stocks with listed options. Kumar *et al.* (1998) document a decrease in bid-ask spreads but an increase in stock turnovers after corresponding option listings. Besides the binary variable of option listing, the options trading volume is considered to be a better proxy for information arrival rates (Amin and Lee, 1997; Easley *et al.*, 1998; Cao *et al.*, 2005; Pan and Poteshman, 2006) because options reveal equity prices actively (or limitedly) when their trading volume is thick (or thin) as argued by Roll *et al.* (2010).

The informativeness of the options market is also reflected in the evidence that stocks with listed options will adjust price faster upon EAs (Jennings and Starks, 1986). However, from this point on, the literature diverges in terms of the magnitude of this adjustment. Some find a smaller magnitude with stocks having listed options since information about earnings to be released has already been partially impounded in stock prices before the announcement day (Skinner, 1990; Atiase and Bamber, 1994; Ho, 1993; Ho *et al.* 1995). Others argue the opposite because they believe the response of stock prices upon EAs is a gradual process, not a jump. So, higher volumes of pre-EA options trading may help correct the initial under-reaction, and the options market will thus facilitate a more complete, larger magnitude of price adjustments (Mendenhall and Fehrs, 1999; Turong and Corrado, 2014). In the latter case, the options volume represents investors' attention (Lo and Wang, 2000; Chordia and Swaminathan, 2000; Barber and Odean, 2008). Our results support the former argument indirectly---a significant predictive power of options volume implies that rational informed actions overwhelm irrational investor attentions.

Our article is mostly complementary to the discussions on how single-name options trading activities can predict future underlying stock returns before the release of firm-specific information. Philbrick and Stephan (1993) and Amin and Lee (1997) discover a larger reaction of options trading volume to earnings announcements than stock, with more long positions initiated ahead of positive earnings news. These are clear evidence that the options market contains information for stock prices, but whether such information can foreshadow future stock returns is dependent on a range of factors. First of all, the type of information plays a role here. Cao *et al.* (2005) show that higher pre-takeover-announcement volume on call options is predictive of higher future stock prices, but higher pre-EA option volume is not so good as the corresponding stock volume. The second factor is market conditions or structure. Studies that follow Hasbrouk (1995) in computing the information share in option quotes generally suggest no price discovery function for the options market, unless when the stock price hits the option strike price (Chakravarty *et al.*, 2004) or if counterfactually option quotes make no adjustments for eliminating arbitrage (Muravyev *et al.*, 2013). Therefore, their findings imply that the stock and options market interact to generate return predictability. Other studies resort to higher moments of option variables as return predictors preceding EAs (Patell and Wolfson, 1981; Bollen and Whaley, 2004; Dubinsky and Johannes, 2006; Ni *et al.*, 2008; Diavatopoulos *et al.*, 2012; Chung and Louis, 2017; Gao *et al.*, 2018). The drawback of the higher-moment indicators is that they are weak concerning economic intuitions.

The importance of market microstructure leads to the third factor of cross-market linkages. Easley *et al.* (1998) document that directional option volume contains information for contemporaneous stock prices, but there exists less decisive evidence that it leads future stock prices. A group of scholars utilizes volume ratios to capture the interaction. For example, Pan and Poteshman (2006) and Kang *et al.* (2018) deem put-call volume ratios as good return predictors. Roll *et al.* (2010), Johnson and So (2012), and Ge *et al.* (2016) all trust option-to-stock trading volume ratios in prediction. However, after controlling for stock order flow, Chan *et al.* (2002) conclude unambiguously that options order flow does not possess pricing power compared to stocks. To unbundle the entangled effects, Hu

(2014) decomposes the total stock order imbalance into an option-induced imbalance and an imbalance independent of options. He then shows that, in the presence of the past stock and options returns, the option-induced imbalance significantly predicts future stock returns, but the imbalance independent of options has only a transitory price impact. Fourth, firm characteristics matter. Lee and Yi (2001) argue that options with greater financial leverage for the underlying firm are more attractive to informed investors. Based on transaction data on the German DAX index, Schlag and Stoll (2005) find that options volume fails to predict stock index changes. Their finding implies that the predictability of individual options from different firms is canceling out each other at the index level. Our article contributes to the literature about the fourth factor by emphasizing the role of REM activities as an important firm characteristic in affecting the return predictability of option volumes.

3. Hypothesis Development

In the options market, the level of trade volume for a single-name option immediately prior to EAs is significantly higher than the corresponding level in non-EA periods. Given this, the extant literature has shown that the information content or return predictability of options trading is prominent during earnings preannouncements, and even more prominent when the actual announced figures (i.e., high earnings surprise) or analyst dispersion (i.e., large standard deviation of the analysts' EPS forecasts) suggest a high-profit potential for informed options trading. While the earnings surprise and analyst dispersion proxy are event characteristics, one frequently-used proxy for profit potential high options trading profit is analyst coverage, which can be considered as a firm characteristic capturing the level of information asymmetry. In this paper, we hypothesize real earnings management activities to be another firm-specific information asymmetry measure. If we are correct, we should observe a stronger return predictive power of options volume for REM firms during the pre-EA periods.

To carry out formal empirical analyses to test this hypothesis, we first divide all

companies into two groups: those suspected of earnings management and those unsuspected. According to Graham et al. (2005), the suspected ones are defined as firms whose disclosed EPS is 0-to-1-cent lower than the latest analyst forecast consensus before fiscal year-end for at least one year over our sample period. Then, we further divide the suspected group members into REM firms and non-REM firms. REM firms are those who have abnormal levels of discretionary expenses. Next, the options volume predictor is constructed by subtracting the daily put trading volume from the corresponding call trading volume. Finally, we interact the REM firm dummy with the call minus put volume and then regress daily returns above the risk-free rate on this interaction. A significant coefficient estimate would suggest the holding of our hypothesis. By completing the above procedures, we make a marginal and novel contribution: REM can serve as a proxy for the potential profit from informed trading in options. Or put it another way, the return predictability of options order imbalance becomes stronger for firms that have the motivation to manipulate their earnings and indeed perform REM actions.

4. Data and Methodology

4.1 Data Sources

The daily options market data is obtained from the OptionMetrics database, which is devoted to research areas such as analyzing market movement before corporate events and exploring serial relation between options variables and stock returns. As these historical options data fit the scope of our study, we combine them with other standard sources of data including CRSP, IBES, and COMPUSTAT. Hence, our raw sample includes all public firms listed in the NYSE, AMEX, and NASDAQ with options on their stocks traded in a range of exchanges, e.g., the CBOE, ISE, AMEX, PHLX, NYSE Arca, and BOX. Note that firms with missing values on major financial statement variables and firms classified into finance and utilities industries are excluded due to good reasons.

We choose a long fifteen-year sample period spanning from January 2004 to December 2018, since there exists great randomness in options speculators in various economic

cycles and at different stages of a business cycle (i.e., our sample period covers the 2002 dotcom bubble burst, the 2007 credit crisis onset, the 2012 European sovereign debt crisis and the 2016-2018 worldwide stock market downturns). The sample period starts right after top corporate executives were prohibited from wrongly exercising warrants (i.e., our sample period can just fully reflect the short-, medium- and long-run economic consequences of the 2002 Sarbanes-Oxley Act), and winds up to the most recent data available year. Due to issues of effects canceling out over a long period, we also construct three cross-sectional subsamples, 2004-2005, 2011, and 2017-2018, representing the onset, middle, and end of our original sample.

We repeat all exercises in these subsamples and find robust results, but earlier results are relatively more significant than later ones. Our conjecture for the reason behind this is that, with reforms post the 2007 credit crisis aiming at building more strictly regulated derivatives markets, informed investors confront more scrutiny and become less willing to trade in the options market.[2] As a result, the informative trades are less active. Furthermore, these subsamples can avoid extreme influences exerted by crisis periods as frequent earnings manipulations in turbulent months will defunct the price discovery function of pre-EA options trading volume. Nevertheless, it turns out that our findings based on the entire sample period are unchanged in selected sub-periods.

As for sample firms, given that both investors and speculators prefer liquid contracts (this is because better-informed investors stop exploiting their information due to illiquidity and ill-informed speculators profit from buying low and selling high as fast as possible), we restrict our dataset to publicly-listed U.S. companies that have at least appeared once in the top 100 traded equity options according to the CBOE at each of the fifteen sample years. By applying this rule to the raw sample, our base sample consists of 208 companies

[2] According to the Financial Industry Regulatory Authority (FINRA) 2008 Year in Review and Annual Financial Report, by executing a more rigorous examination system and rulebook enforcement, FINRA has issued 200 formal complaints and 1,007 decisions in formal disciplinary cases against regulation violators in equity trading places including the equity options markets.

with 5,419 EAs. Although the rank is by CBOE, the daily trading volume for each firm's options is computed as the average volume transacted across all options exchanges.

4.2 Methodology

To begin with, we compute call minus put volume as the daily difference between the total put volume generated by the optionable stock under concern and the total call volume. In light of the interaction between the options and the stock market, we also need to control for abnormal stock transactions. Let us denote the current earnings announcement date and the previous earning announcement date for the firm of interest by EA_DATE_t and $EA\_DATE_{t-\tau}$, respectively. We then define the pre-announcement period as one to twenty days before an announcement date and the benchmark period as the twenty days after the previous EA date to twenty-one days before the current EA date. The daily abnormal option trading volume is calculated by first subtracting the mean trading volume over the benchmark period from the daily trading volume, and then dividing this difference by the mean trading volume.

Next, we continue to construct REM measures in two steps. As for step 1, we identified suspected REM firms based on a strategy that exploits the pressure faced by public companies in meeting analysts' forecasts (e.g., Degeorge *et al.*, 1999; Cohen *et al.*, 2008). In particular, a suspected firm is defined as one whose actual EPS, evaluated before the fiscal-year-end, turns out to be lower than the last consensus of analyst forecasts by a wedge between 0 and 1 cent. The reason why this treatment is necessary goes as follows. If we directly inspect REM activity indicators in the full sample, then for firms with no motive to manipulate earnings, a large indicator value might just imply more economic activities other than conducting REM. Since beating earnings is addictive, as long as a firm's EPS was 0-to-1 cent below forecast in at least one year during our entire sample period, we will label it as suspected. By doing this, we form the largest possible treatment group of suspected firms.

As for step 2, we estimate a primary proxy, the abnormal part of production costs, for real

manipulative activities. The normal production cost can be expressed as a function of contemporaneous sales in absolute terms as well as both the contemporaneous change and the lagged change in sales using a cross-sectional regression for each firm *i* and year *y*:

$$\frac{Production\ Cost_{i.y}}{Asset_{i,y-1}} = \alpha_0 + \alpha_1 \frac{1}{Asset_{i,y-1}} + \alpha_2 \frac{Sales_{i,y}}{Asset_{i,y-1}} + \alpha_3 \frac{\Delta Sales_{i,y}}{Asset_{i,y-1}} + \alpha_4 \frac{\Delta Sales_{i,y-1}}{Asset_{i,y-1}} + \varepsilon_{i,y},$$

where the production cost is defined as the sum of costs of goods sold and changes in inventories. All the variables are scaled by total assets at the end of the year *y-1* and winsorized at the 1st and 99th percentile. Then, the abnormal production cost is computed as the gap between the actual cost incurred and the firm's normal level derived by estimated coefficients from the above equation. We also estimate an alternative proxy, abnormal levels of discretionary expenses, as a robustness check.

Similarly to production cost, the normal level of discretionary expense is estimated as a function of lagged sales based on a cross-sectional regression for the target firm's industry every year:

$$\frac{Discretionary\ Expense_{i.y}}{Asset_{i,y-1}} = \alpha_0 + \alpha_1 \frac{1}{Asset_{i,y-1}} + \alpha_2 \frac{Sales_{i,y-1}}{Asset_{i,y-1}} + \varepsilon_{i,y},$$

where the discretionary expense is defined as the sum of advertising expenses, R&D, and SG&A expenses. We scale all regression variables by total assets at the end of year *y-1* and winsorize them at the 1st and 99th percentile. The abnormal part of the discretionary expense is, therefore, measured by the difference between the target firm's actual expense and its normal level predicted by the above estimating equation. Now, it is ready to define a dummy of REM that equals 1 for firms using abnormal levels of production costs or discretionary expenses to manipulate earnings; and 0 otherwise.

At last, to investigate the information content of options volume, we test among REM

firms the options volume's implications on the underlying stock's price movements in the near future. The empirical equation is specified as follows:

$$r_{i,t} = \alpha + \beta_1 opt_{i,t-1} + \beta_2 stk_{i,t-1} + \beta_3 opt_{i,t} + \beta_4 stk_{i,t} + \beta_5 REM_{i,y} + \beta_6 REM_{i,y} \times opt_{i,t-1} + \boldsymbol{\gamma F} + \epsilon_{i,t}.$$

On the left-hand side, let $r_{i,t}$ be the CRSP return of firm *i* in excess of the risk-free rate (taken from Kenneth R. French's website) during trading day *t*. On the right-hand side, we use $opt_{i,t}$ and $opt_{i,t-1}$ to denote, respectively, the contemporaneous and the lagged one-day call minus put options volume of firm *i* in the trading day *t* and *t-1*. Similarly, we use $stk_{i,t}$ and $stk_{i,t-1}$ to represent, respectively, the contemporaneous and the lagged one-day abnormal volume of the underlying stocks. $REM_{i,y}$ is a dummy equaling to 1 for firm *i* using abnormal levels of production costs to manipulate earnings at year *t* (the corresponding results using abnormal levels of discretionary expenses are very similar and thus not reported); and 0 otherwise. $\boldsymbol{F}$ represents the conventional Fama-French five factors as controls (Fama and French, 2015). Our expectation is that, if the options volume proxy is indeed informative before EAs and under REM, then the lagged abnormal options volume should have significant predictability for the next-day stock returns, after controlling for other contemporaneous volume effects such as the one that is originated from abnormal stock volumes.

5. Empirical Results

5.1 Preliminary Analysis

Table 1 reports the cross-sectional averages of daily trading volumes for option contracts and their underlying stocks in both benchmark and pre-announcement periods and for both REM and non-REM firms. As can be seen, considering only REM firms, the average daily volume of transacted option contracts increases by 43 in absolute values and by 7.65% in percentage terms, from 562 contracts in the benchmark period to 605 contracts in the pre-announcement period; the average daily volume of transacted option contracts

for non-REM companies decrease by 5 and 0.71%, respectively, from 699 to 694. However, there is no significant difference between the rise in shares of underlying stocks transacted for the REM and non-REM firms. Consistent with the conventional wisdom, when comparing the trading activities during the benchmark periods to those during the pre-announcement periods, options will experience an increase in trading volume. What is new to previous findings, we find that this increase is mainly driven by firms with real activity manipulations. Therefore, even at first glance of the raw data, the findings in Table 1 support our hypothesis.

[INSERT TABLE 1 HERE]

We present in Table 2 changes of call and put volumes across subcategories of both moneyness and maturity characteristics, and observe significant differences when comparing the volume variables in benchmark and pre-EA periods for REM firms. Insignificance occurs mainly for non-REM underlying firms and REM firms over the short run with at-the-money and out-of-the-money option contracts. In specific, we observe three patterns by focusing on firms with detected real activity manipulation. First, short-term in-the-money call options with less than 2 months to expiry undergo significantly larger increases in terms of trading activities than their long-term counterparties. To get a sense of magnitude, the trading volumes of short- and long-term in-of-the-money call options rise by 143.8% and by 94.6%. Second, the percentage increases in short-term put options trading volume from benchmark to pre-EA periods, irrespective of moneyness, remain steady and significant over the range from 17.3% to 38.3%. In contrast, non-REM firms may experience a decrease in options volume, suggesting less valuable private information to trade against before regular events. Since options are considered to be the riskiest hedging derivative, their high trading levels and volatilities prior to EAs for REM firms indicate that the spillovers of material and nonpublic information indeed emerge during the time of our interest.

[INSERT TABLE 2 HERE]

5.2 Forecasting Analysis

This subsection runs predictive regressions of how stocks' excess returns depend on call minus put volumes in two steps. We apply the empirical specification as described in subsection 4.2 to a panel dataset, in which inter-individual differences are used to reduce the collinearity between current and lag variables so that unrestricted time-adjustment patterns can be estimated (e.g., see Pakes and Griliches, 1984). This function of panel data can be attained in our paper since the Hausman test reveals a significant fixed effect. Conditional on option characteristics, Table 3 reports the results of regressing the next-day excess stock returns on the interaction between the volume and REM variables during the benchmark and pre-announcement periods. By looking at these comparable results, we discover that the lagged call minus put options volume alone can significantly predict the next-day excess stock returns only for subcategories of long-term in-the-money and all-term out-of-the-money options. However, the magnitude of this predictive effect is much smaller when compared to the interaction term between the REM variable and the options volume variable. Although the interaction possesses predictive power for both the benchmark and pre-EA periods, the size of its estimated coefficients turns out to be slightly larger during the sample of pre-announcement periods. At last, the results in Table 3 stay robust to changing the REM proxy based on the abnormal level of production costs to that of discretionary expenses. This result is evident for our proposed hypothesis that the return predictability of options volume becomes stronger for REM firms due to enhanced information asymmetry in such underlying issuers. It merits a note that our study suffers from the drawback of not incorporating trade direction and market microstructure (such as private vs. public information, options leverage, the concentration of informed traders, etc.) due to data limitation. We argue that our focus is on REM as a valid proxy of the amount of return information contained in options trading volume.

[INSERT TABLE 3 HERE]

6. Conclusion

This article examines the information content of options volume prior to scheduled corporate events and under the constraint that the underlying firms highly likely have manipulated their earnings figures. We document a high degree of options trading activities before EAs for those REM firms, but not non-REM firms. Moreover, our daily call minus put volume in the options market contains private information on determinants of the underlying stock's earnings, which is consistent with findings by Easley *et al.* (1998) that the options market is a venue for information-based trading. Our paper adds to the literature by showing the information is more useful when there exist real activity manipulation by the underlying companies. Hence, informed traders do trade options to capitalize on their private information prior to well-scheduled events, and their private information will be getting revealed through such options trading. Put it the other way around, options trading volume should be able to predict the underlying stock price movements. After pooling a panel dataset together, we indeed find that the above-mentioned information revelation is mainly attained through short-term in-the-money call options and long-term put options, and the forecasting capability of options volumes becomes stronger for REM firms, implying behavioral aspects would affect the options volume's informativeness. All these findings together suggest that the options market may be a venue for information-based trading even before prescheduled events and under earnings management by real manipulative activities.

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Table 1: Average Trading Volume for Options and Underlying Stocks

This table reports the cross-sectional averages of daily-adjusted trading volumes for options and their underlying stocks. Results are reported for (i) the benchmark period, which is defined as the period from the 21st day after the previous EA date to 21 days before the current earnings announcement, [$EA\_DATE_{t-\tau}+21$, $EA\_DATE_{t}-21$]; and (ii) the pre-announcement period, which is defined as the period of 20 trading days before the EA date, [$EA\_DATE_{t}-20$, $EA\_DATE_{t-\tau}$]. REM firms are those both being the suspect of earnings manipulation and showing abnormal levels of production costs. We test the null hypothesis of no difference in means between the benchmark and pre-announcement period group by computing standard t-test statistics based on % changes. ***, ** and * represent 1%, 5% and 10% significant levels, respectively.

	Benchmark Period	**Pre-Announcement Period**	**Change in Absolute Level**	**% Change**
Ave. No. of Call and Put Options Traded				
REM Firms	562	605	43	7.65%
Non-REM Firms	699	694	-5	-0.71%
Ave. Vol. of Underlying Stocks Traded (in 10,000 Shares)				
REM Firms	1,230	1,334	104	8.47%
Non-REM Firms	1,453	1,540	86	5.94%
No. of Daily Obs.				
REM Firms	10,093	3,343		
Non-REM Firms	27,948	9,119		

Table 2: Average Trading Volume for Call and Put Contracts across Moneyness-Maturity Categories

For each moneyness-maturity category, this table presents the cross-sectional averages of options trading volumes for calls and puts in the benchmark and pre-announcement period. REM firms are those both being the suspect of earnings manipulation and showing abnormal levels of production costs. Options with maturities less (greater) than 60 days are classified as short-term (long-term) options. Option moneyness is defined as follows: call options are in-the-money if the strike price is less than 90% of the underlying stock price; at the money if the strike price is greater than 90% of the stock price and less than 110% of the stock price; out-of-the-money if the strike price is greater than 110% of the underlying stock price. We test the null hypothesis of no difference in group means between the benchmark and pre-announcement period group by computing standard t-test statistics based on % changes. ***, ** and * represent 1%, 5% and 10% significant levels, respectively.

		Benchmark Period	Pre-Announcement Period	% Change	Benchmark Period	Pre-Announcement Period	% Change
	Call Options	**Short Term (ST) With Maturity Less Than 60 Days**			**Long Term (LT) With Maturity Greater Than 60 Days**		
REM Firms	Out-of-the-Money	1,954	2,414	23.5%	2,401	2,787	16.1%
	At-the-Money	11,725	12,527	6.8%	2,860	3,047	6.5%
	In-the-Money	1,181	2,880	143.8%**	707	1,377	94.6%**
Non-REM Firms	Out-of-the-Money	2,341	3,363	43.7%**	2,816	3,532	25.4%**
	At-the-Money	23,874	23,766	-0.4%	4,633	5,096	10.0%
	In-the-Money	4,872	2,476	-49.2%	1,135	981	-13.6%
	Put Options	**Short Term (ST) With Maturity Less Than 60 Days**			**Long Term (LT) With Maturity Greater Than 60 Days**		
REM Firms	Out-of-the-Money	2,133	2,623	23.0%	2,041	2,394	17.3%*
	At-the-Money	12,872	14,653	13.8%	2,293	2,965	29.3%***
	In-the-Money	654	807	23.4%	356	492	38.3%***
Non-REM Firms	Out-of-the-Money	2,337	2,020	-13.6%	1,784	1,825	2.3%
	At-the-Money	7,405	8,086	9.2%	1,782	1,910	7.2%
	In-the-Money	1,089	923	-15.2%	474	581	22.6%

Table 3: **Predicting Next-Day Excess Stock Returns by Call Minus Put Options Volume for REM Firms**

This table reports the regression results of the following specification:

$$r_{i,t} = \alpha + \beta_1 opt_{i,t-1} + \beta_2 stk_{i,t-1} + \beta_3 opt_{i,t} + \beta_4 stk_{i,t} + \beta_5 REM_{i,y} + \beta_6 REM_{i,y} \times opt_{i,t-1} + \boldsymbol{\gamma F} + \epsilon_{i,t},$$

where $r_{i,t}$ is firm i stock return over day t in excess of risk-free rate, $opt_{i,t-1}$ and $opt_{i,t}$ are, respectively, the lagged one-day and contemporaneous daily difference between the total call volume and the total put volume traded for underlying stock i, abnormal option volume, $stk_{i,t-1}$ and $stk_{i,t}$ are, respectively, the lagged one-day and contemporaneous stock trading volumes. $REM_{i,y}$ is a dummy equaling to 1 for firm i using abnormal levels of production costs to manipulate earnings at year t (the corresponding results using abnormal levels of dicretionay expenses are very similar and thus not reported), and 0 otherwise. $\boldsymbol{F}$ represents the Fama-French five factors. All coefficient s are in unit of 10^{-5}. T-values are presented in parentheses. ***, ** and * represent 1%, 5% and 10% significant levels, respectively.

	Benchmark Period						**Pre-Annoucement Period**					
	At-the-Money		In-the-Money		Out-of-the-Money		At-the-Money		In-the-Money		Out-of-the-Money	
	ST	LT	ST	LT	ST	SL	ST	LT	ST	LT	ST	LT
$opt_{i,t-1}$	0.00	0.15*	-0.02	-0.13***	0.19***	0.11***	-0.01	-0.01	-0.03	-0.13***	0.37***	0.17***
	(0.01)	(1.71)	(-0.70)	(-2.98)	(4.45)	(2.70)	(-1.69)	(-0.01)	(-1.73)	(-3.26)	(4.04)	(2.78)
$stk_{i,t-1}$	-0.06	-0.05	0.20	0.23	-0.14	-0.17	0.11	0.18	1.21	1.16	-0.07	-0.08
	(-0.05)	(-0.05)	(0.19)	(0.23)	(-0.14)	(-0.17)	(0.09)	(0.15)	(0.99)	(0.96)	(-0.06)	(-0.07)
$opt_{i,t}$	0.02	0.02	0.04	0.19***	-0.29	-0.10***	0.01*	0.02	0.05***	0.21***	-0.44***	-0.20***
	(0.74)	(0.58)	(1.06)	(4.26)	(-5.02)	(-2.86)	(1.81)	(0.03)	(2.54)	(6.24)	(-4.09)	(-3.63)
$stk_{i,t}$	-0.03	-0.02	-0.37	-0.47	0.07	0.11	2.95	2.84	1.76	1.78	3.47	3.25
	(-0.01)	(-0.01)	(-0.16)	(-0.21)	(0.03)	(0.05)	(1.14)	(1.10)	(0.67)	(0.67)	(1.37)	(1.28)
REM	-0.16	-0.19	-0.10	-0.11	-0.18	-0.16	-0.01	0.00	0.00	0.01	-0.05	0.01
	(-0.87)	(-1.11)	(-0.52)	(-0.60)	(-1.02)	(-0.92)	(-0.07)	(0.01)	(-0.02)	(0.07)	(-0.30)	(0.06)
$REM \times opt_{i,t-1}$	6.82***	6.75***	6.69***	6.69***	6.58***	6.72***	7.29***	7.31***	7.05***	7.13***	6.97***	7.22***
	(23.53)	(23.68)	(23.10)	(23.45)	(23.21)	(23.79)	(24.20)	(23.60)	(24.60)	(25.17)	(23.17)	(24.37)
R^2	0.1011	0.1006	0.1042	0.1042	0.1110	0.1007	0.1074	0.1067	0.1111	0.1100	0.1320	0.1099
F-Stat	129	132	137	136	146	133	120	122	127	125	153	127
No. of Obs.	12,636	13,018	12,926	12,918	12,843	13,099	10,969	11,288	11,175	11,171	11,074	11,357