Net Buying Pressure and Informed Trading in the Options Market: Evidence from Earnings Announcements

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Abstract

Informed investors use options market to exploit their private information advantage to trade on the direction and volatility of underlying asset values. This paper tests whether informed trading occurs around quarterly earnings announcement events in the options market. We capture informed trading by using the net buying pressure measure of Bollen and Whaley (2004). Empirical tests show that informed trading tends to occur in at-the-money (ATM) options as this option is cheaper and more liquid relative to other categories of moneyness (leverage). Net buying pressure measure of ATM options prior to good earnings news is significantly related to announcement abnormal returns. Also, net buying pressures in the post event window is associated with the direction of post-event stock abnormal returns. We conclude from this evidence that option investors have superior skills in processing publicly disclosed information relative to other investors.

Keywords: earnings announcements, equity options, informed trading, option net buying pressure

JEL Classification: G10, G13, G14

1. Introduction

Numerous studies document that informed investors prefer trading in the option market to the stock market to take advantage of its unique properties, such as higher leverage, lower transaction costs, easier short selling access, and limited downside risk (Black, 1975; Amin and Lee, 1997; Cao, Chen and Griffins, 2005). Consistent with this conjecture, numerous studies show that option informed trading measures, such as option volumes, volatility spread and volatility skew, can predict underlying stock returns in the cross section (Easley, O'Hara, and Srinivas, 1998; Cao, Chen and Griffins, 2005; Pan and Poteshman, 2006; Cremers and Weinbaum, 2010; Roll, Schwartz, and Subrahmanyam, 2010; Xing, Zhang, and Zhao, 2010). Also, informed trading is reflected in options activity prior to major corporate events, such as earnings as well as merger and acquisition announcements (Jin, Livnat, and Zhang, 2012; Chan, Ge, and Lin, 2015).

A related branch of literature finds that option investors trade on the volatility of underlying stock returns also. Patell and Wolfson (1981) document that the average standard deviations to expiration implied by pre-earnings announcement option prices are positively correlated with the standard deviations of the underlying stock prices during the event. A recent study by Ghargori, Maberly and Nguyen (2016) reports that volatility spread and volatility skew, as measured prior to stock split announcements, do not predict the direction or volatility of stock returns of splitting firms. However, Ghargori, Maberly, and Nguyen (2016) observe that options' daily implied volatility prior to stock splits announcements is significantly correlated with stocks' realized volatility during the split announcement event window. Moreover, Chen and Wang (2016) find that the volatility of net buying pressure of OTM put options is positively correlated with changes in the corresponding option's implied volatility in the Taiwan's capitalization-weighted stock index market. Overall, this evidence suggests that option investors trade on the expected change in underlying stock return volatilities (see also Bollen and Whaley, 2004).

Chen and Wang (2016) conjecture that option investors betting on the direction of stock returns trade differently from those betting on the volatility of stock returns. When positive news is expected to increase both stock returns and volatility, directional (volatility) traders will sell (buy) put options. By contrast, when negative news is expected to decrease stock returns but increase volatility, directional (volatility) traders will sell (buy) call options. This exogenous shock can have simultaneous but offsetting effects on option informed trading measures. In this regard, option informed trading measures, such as volatility spread and volatility skew employed in prior studies, do not distinguish between these two types of option traders and instead focus solely on whether option investors have private information on the direction of future stock returns. Consequently, focusing only on one type of option trading does not provide a complete picture of informed option trading, as these option measures capture only the dominant effect of the two informed trades.

Given that the directional and volatility option investors may trade differently on the same impending news, it is important to distinguish between these two types of option trades. To fill this gap in the literature, this paper examines option investors' trading prior to quarterly earnings announcements with respect to both expected changes in stock returns and the volatility of stock returns during the event. We focus on earnings announcements due to the fact that informed trading is likely to occur at such times (Patell and Wolfson, 1982). To separate the two types of option informed trading, we employ trading measures initially developed by Bollen and Whaley (2004) and further refined by Chen and Wang (2016). Additionally, we split our sample based on the moneyness (leverage) of the options in an effort to better understand how moneyness affects informed trading. Kim and Verrecchia's (1991; 1994) information-based trading theory suggests that informed investors trade not only on private information prior to an event but due to superior ability in processing publicly disclosed

information. To test this conjecture, we examine the relation between net buying pressure and both stock returns and stock return volatility during the post-event window.

We find that informed directional trading does not occur in deep-out-of-the-money (DOTM) and out-of-the-money (OTM) options but is present in at-the-money (ATM) options prior to earnings announcements. This finding is likely attributable to the relatively higher liquidity and lower transactions costs of ATM options (Chakravarty, Gulen and Mayhew, 2004). We also find evidence that option investors trade on stock return volatility prior to earnings announcements, particularly in OTM options. In the post-event window, net buying pressures of deep-out-of-the-money (DOTM), and out-of-the-money (OTM) call & put options are associated with post-event cumulative stock returns.

Our study contributes to the literature in several ways. First, we provide empirical evidence concerning whether option investors trade on the expected changes in stock returns or volatility of stock returns. Second, we provide evidence that option investors have private information prior to an event and better ability to process publicly disclosed information. Third, empirical evidence is provided on option moneyness to gain insight into its effects on option informed trading.

The remainder of this paper proceeds as follows. The next section reviews the research design and option informed trading measures. Section 3 describes the sample selection process. Section 4 presents the empirical results. Section 5 concludes.

2. Research Design

To proxy demand in the underlying stock equivalent, Bollen and Whaley (2004) propose net buying pressure (NBP), as defined by the difference between the number of buyer-motivated contracts and number of seller-motivated contracts multiplied by the absolute value of option delta. Bollen and Whaley (2004) identify buyer-motivated options as trades executed at the price above the midpoint of prevailing bid and ask prices. While transaction prices of options are not available in Ivy DB (OptionMetrics), best quotes are reported. Thus, if the current midpoint price is higher/lower than the prevailing midpoint price, we identify that trade as buyer/seller-motivated price, respectively. This procedure is repeated for the entire universe of call/put options for U.S. equities. Hence, in this paper option net buying pressure (NBP) measure is calculated as the difference between the number of buyer-motivated contracts and seller-motivated contracts multiplied by the absolute value of the option's delta.

To separate directional-motivated option trading effects on stock prices from volatility-motivated effects, we use measures proposed by Chen and Wang (2016). These authors modify the NBP measure in Bollen and Whaley (2004) by distinguishing between informed trading on direction of the underlying stock price versus its volatility. The directional-motivated demand for the *k*th-moneyness category of call and put options, respectively, are measured as

$$NBPD_{C,t}^{k} = \frac{NBP_{C,t}^{k} - NBP_{P,t}^{k}}{2} \quad (1)$$

$$NBPD_{P,t}^{k} = \frac{NBP_{P,t}^{k} - NBP_{C,t}^{k}}{2}. \quad (2)$$

$NBPD_c$ ($NBPD_p$) is the difference between the NBPs of calls (puts) and puts (calls) options divided by 2 categorized by moneyness k over the time interval t, where $k \in$ {DOTM, OTM, ATM}. Similarly, the volatility-motivated demand for the *k*th-moneyness category option is measured as

$$NBPV_{t}^{k} = \frac{NBP_{C,t}^{k} + NBP_{P,t}^{k}}{2}. \quad (3)$$

Following Jin et al. (2012), option informed trading measures are computed during the base-, pre-, and post-event windows associated with days -50 to -11 prior to the event, days -10 to -1 prior to earnings announcements, and days +1 to +5 days after the event, respectively. Option net buying pressure directional (and option net buying pressure volatility) measures are computed for each sample stock in these different windows, which are denoted as *NBPD_CALL_BASE, NBPD_PUT_BASE, NBPD_CAL_PRE, NBPD_PUT_PRE, NBPD_CALl_POST, NBPD_PUT_POST, NBPV_BASE, NBPV_PRE, and NBPV_POST*. The event window is days +1 to -1.

Cumulative abnormal returns (CAR) for the *i*th stock are computed as follows:

$$CAR_{it} = \sum(r_{i,t} - r_{m,t}), \tag{4}$$

where the CRSP value-weighted market return $r_{m,t}$ is obtained from Kenneth French's website. Abnormal stock returns during the event (post-event) window on days -1 to +1 (+6 to +90) are denoted *XRET* (*XRET_POST*).

Like Jin et al. (2012), to examine whether options traders have private information before the earnings announcement date on the expected change in stock prices or have better processing skills of publicly disclosed information, we employ the following regression specifications:

$$XRET(-1,+1)_i = Intercept + \alpha PRE\_NBPD^k_{C,i} + \beta PRE\_NBPD^k_{P,i} + \delta BASE\_NBPD^k_{C,i} + \gamma BASE\_NBPD^k_{P,i} + \mu PRE\_SVOL_i + \sum_{j=1}^{N} ControlVariables_{i,j} + \varepsilon_i \tag{5a}$$

$$XRETPOST(+6,+90)_i = Intercept + \alpha POST\_NBPD^k_{C,i} + \beta POST\_NBPD^k_{P,i} + \delta BASE\_NBPD^k_{C,i} + \gamma BASE\_NBPD^k_{P,i} + XRET_i + \mu POST\_SVOL_i + \sum_{j=1}^{N} ControlVariables_{i,j} + \varepsilon_i \tag{5b}$$

where PRE_SVOL (POST_SVOL) is the logarithm of the volume of stocks traded during the pre-(post-)event window. If option trading measures contain information relevant to expected changes in stock prices, the estimated coefficients on *PRE_NBPDc* and *POST_NBPDc* should be positively related to *XRET* and *XRETPOST*, respectively. Control variables are size (natural logarithm of market capitalization) and M/B (market to book ratio) of sample firms.

Following Chen and Wang (2016) and Gharghori et al. (2015), we also examine whether option trading measures of volatility-motivated informed trading are related to stock return volatility based on the following regression specifications:

$$STDEVSHORT(-1,+1)_i = Intercept + \alpha PRE\_NBPV_i^k + \beta BASE\_NBPV_i^k + \gamma PRE\_SVOL_i + \varepsilon_i \quad (6a)$$

$$STDEVLONG(+6,+90)_i = Intercept + \alpha POST\_NBPV_i^k + \beta BASE\_NBPV_i^k + \gamma POST\_SVOL_i + \varepsilon_i \quad (6b)$$

where *STDEVSHORT (STDEVLONG)* is the standard deviation of the daily market-adjusted returns in the event window period -1 to +1 (+6 to +90) days. If option volatility trading measures contain information relevant to expected volatility changes of stocks, the estimated coefficients on *PRE_NBPV* and *POST_NBPV* should be significantly related to *STDEVSHORT* and *STDEVLONG*, respectively.

3. Data

We obtain equity options and stock related information from the OptionMetrics database IvyDB US for the sample period January 1, 2005 to April 30, 2016. The database provides daily bid and ask quotes, open interest, volume, implied volatility, and Greeks such as delta, gamma, vega, and theta for call and put options listed on all option exchanges for underlying U.S. equities. Options on the individual stocks are American type. Moreover, we collect the underlying stock related data for daily stock bid and ask quotes, closing prices, total returns,

trading volume, and outstanding shares. The Research Insight database is used to collect quarterly earnings announcement dates from 2005 to 2016. CRSP market index data is downloaded from the Kenneth French website. These three datasets are merged based on whether the firms that announce quarterly earnings during our sample period are optionable. Thus, stocks should meet the following criteria to be included in the sample: information matched across all three data sources, and non-zero pre-options net buying pressure.

Following Cremers and Weinbaum (2010) and Jin et al. (2012), we select options (calls and puts) with maturity from 10 days to 60 days. To address thin trading issues, options with zero open interest and zero volume are removed. Based on option volume data, net buying pressure for both call and put options is computed.

Panel A of Table 1 shows the number of option contracts during the pre-, base-, and post-windows. The number of contracts shows that call options, except for DOTM call options in the pre-window period, are traded more often than put options in all window periods. The numbers of option contracts traded during the base window are the largest across option moneyness. Transactions volume drops in the pre-window period and drop further in the post-window period. The decrease in the number of contracts traded in the pre- and post-window periods suggests that only informed option investors trade during these periods. The numbers of net purchases displayed in Panel B of Table 1 are on average negative (except for ATM call and put options in the pre-window period and ATM put options in the post-event period), which suggests that these contracts are seller motivated.

4. Results

4.1. Directional-motivated options trading

Panels A and B of Table 2 report the results for equation (5a) regressing short-term CARs on the informed option trading measures NBPD_CALL_PRE and NBPD_PUT_PRE for DOTM

and OTM options, respectively. Each panel reports directional informed trading tests for all news, bad news and good news. As can be seen these options shows that net buying pressures of DOTM and OTM options are not associated with short-term CARs.

Panel C of Table 2 examines the relation between announcement period returns and net buying pressures for ATM options. Unlike DOTM and OTM options, for good news events, we now find that announcement period returns are significantly related to net buying pressures of call options. Hence, we infer that informed trading occurs in ATM options during the pre-announcement period before the impending good news events. Also Atilgan (2014) finds that informed option trading is stronger for more liquid options.

4.2. Volatility-motivated options trading

Figlewski and Frommherz (2015) and Gharghori et al. (2015) argue that transactions in the options market may be related to expected changes in the volatility of underlying asset values. To test this conjecture, following Chan and Wang (2016), we employ a measure of inform option trading based on the options transactions – namely, net buying pressure volatility (NBPV). This measure reflects option trading information related to the volatility (rather than the direction) of underlying asset values. Table 3 reports net buying pressures of volatility trading prior to announcement dates. There is strong evidence of volatility-based trading prior to earnings announcements in OTM. However, the estimated coefficients for NBPV_BASE are negative and significant for OTM options, which suggests that these trades are probably hedging motivated.

4.3. Informed options trading

Lastly, we test the conjecture that option investors have better ability to process publicly disclosed information than other investors. If so, we expect that net buying pressure in the

post-event window will be significantly associated with post-event stock returns. Even after controlling for the underlying stock volume, size and market to book ratio, Panels A and B of Table 4 show that in the case of good news events, net buying pressures of DOTM and OTM call and put options are significantly related to post-event stock returns. For ATM options, this relation is found to be insignificant. We infer from these results that option investors have superior information processing skills with respect to earnings announcements and directionally trade on this information.

Table 5 contains the regression results for equation (6b) relating stock return volatility to post-event option net buying pressure. The coefficient estimate for NBPV_POST is statistically insignificant for each category of options i.e. DOTM, OTM and ATM. These results indicate that after earnings announcements informed options investors do not trade on stock volatility information.

5. Conclusion

This study attempted to contribute to the informed trading literature by employing an option transaction based measure (viz., option net buying pressure) to test whether informed traders trade on the direction and volatility of futures stock prices before and after major corporate events. Previous literature documents that informed investors trade in the options market to exploit private information about future stock prices. Recent studies utilizing a price-based measure (viz., implied volatility spread) as a proxy for informed trading have found evidence consistent with informed trading in the options market.

To investigate informed trading in the options market, we focused on quarterly earnings announcements events. Our empirical tests indicated that: (1) option investors trade ATM options on expected changes in stock prices around these announcements; and (2) net buying pressure was significantly related to realized stock return volatility before the event. These

results suggest that option investors have private information prior to the event. Further tests revealed that option investors have superior processing ability of publicly disclosed information in terms of predicting the direction of stock returns in the post-event window period.

Based on this evidence, we conclude that informed traders benefit from private information related to both the direction and volatility of underlying asset values. Also, informed trading tends to be more prevalent in the ATM options prior to earnings announcements. It appears that these options provide high liquidity and lower transaction costs compared to other categories of moneyness.

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Table 1. Number of option contracts and net buying pressure

Panel A. Number of contracts

	BASE		PRE		POST	
	CALL	PUT	CALL	PUT	CALL	PUT
DOTM	206,100,502	191,910,923	43,862,560	45,022,239	43,086,004	37,393,102
OTM	566,149,774	423,431,641	147,694,857	114,807,792	103,187,035	76,128,531
ATM	250,210,089	142,503,844	74,725,804	40,319,820	43,921,866	26,498,580

Panel B. Net purchases of contracts

	BASE		PRE		POST	
	CALL	PUT	CALL	PUT	CALL	PUT
DOTM	-76,644,054	-70,265,931	-12,014,524	-14,646,151	-23,128,010	-16,746,954
OTM	-80,358,912	-61,911,573	-12,146,457	-16,331,222	-26,954,413	-13,570,123
ATM	20,270,881	6,718,124	8,077,372	365,206	-1,868,556	1,750,040

Panel C. Net Buying Pressure

	BASE		PRE		POST	
	CALL	PUT	CALL	PUT	CALL	PUT
DOTM	-575,502	-100,884	-78,774	-22,402	-107,061	-40,610
OTM	815,111	674,119	169,969	193,602	-79,857	-122,302
ATM	248,581	-214,564	326,434	22,932	-73,120	-128,460

Table 2. Relationship between option NBPDs of calls (puts) and event returns

This table reports results for the effect of net buying pressure of call and put options on the event excess returns in different moneyness categories. The independent variable is the short-run CAR for the *i*th stock denoted $XRET(-1,+1)_i$. The dependent variables denoted *PRE_NBPD* and *BASE_NBPD* are the option net buying pressure directional measures for days -10 to -2, and -50 to -11, respectively, and PRE_SVOL is the natural logarithm of volume of stock traded during the pre-event window. SIZE is the natural logarithm of market value of equity and MB is market to book ratio. Bad News is for negative announcement returns. Good News is for positive announcement returns. Estimated *p*-values are shown in parentheses.

Panel A. DOTM	All	Bad News	Good News
NBPD_CALL_PRE	0.014	0.016	-0.019
	(0.39)	(0.36)	(0.25)
NBPD_PUT_PRE	0.008	-0.003	0.001
	(0.64)	(0.89)	(0.95)
NBPD_CALL_BASE	0.015*	0.031***	-0.012
	(0.06)	(0.00)	(0.12)
NBPD_PUT_BASE	-0.003	-0.006	0.005
	(0.73)	(0.52)	(0.51)
PRE_SVOL($x10^7$)	0.000**	0.000***	0.000***
	(0.01)	(0.00)	(0.00)
SIZE	0.004***	0.014***	-0.013***
	(0.00)	(0.00)	(0.00)
MB	0.000	0.000	0.000
	(0.45)	(0.29)	(0.22)
Intercept	-0.037***	-0.193***	0.180***
	(0.00)	(0.00)	(0.00)
Obs	6,962	3,484	3,478
Adj. R^2	0.004	0.105	0.084
Panel B. OTM			
NBPD_CALL_PRE	-0.003	-0.005	-0.007*
	(0.42)	(0.23)	(0.07)
NBPD_PUT_PRE	0.005	-0.001	0.005
	(0.30)	(0.87)	(0.32)
NBPD_CALL_BASE	-0.004	0.002	-0.007***
	(0.15)	(0.53)	(0.00)
NBPD_PUT_BASE	-0.003	0.001	-0.005**
	(0.37)	(0.79)	(0.04)
PRE_SVOL($x10^7$)	0.000**	0.000***	0.000***
	(0.02)	(0.00)	(0.00)
SIZE	0.003***	0.013***	-0.014***
	(0.00)	(0.00)	(0.00)
MB	0.000*	0.000	0.000
	(0.08)	(0.85)	(0.54)
Intercept	-0.024***	-0.177***	0.178***

	(0.00)	(0.00)	(0.00)
Obs	11,175	5,623	5,552
Adj. R^2	0.002	0.086	0.097
Panel C. ATM			
NBPD_CALL_PRE	0.002	-0.001	0.008**
	(0.54)	(0.76)	(0.01)
NBPD_PUT_PRE	0.005	0.002	0.001
	(0.17)	(0.64)	(0.77)
NBPD_CALL_BASE	0.001	0.000	0.001
	(0.58)	(0.90)	(0.73)
NBPD_PUT_BASE	-0.001	-0.003	-0.001
	(0.67)	(0.21)	(0.72)
PRE_SVOL($x10^7$)	0.000***	0.000***	0.000**
	(0.00)	(0.00)	(0.01)
SIZE	0.004***	0.013***	-0.012***
	(0.00)	(0.00)	(0.00)
MB	0.000	0.000	0.000
	(0.87)	(0.49)	(0.79)
Intercept	-0.036***	-0.175***	0.162***
	(0.00)	(0.00)	(0.00)
Obs	4,864	2,494	2,370
Adj. R^2	0.005	0.084	0.083

Asterisks *,**,*** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 3. Relationship between option NBPVs and event returns volatility

This table reports results for the effect of net buying pressure of call and put options on the event excess returns volatility in different moneyness categories. The independent variable is the short-run CAR volatility for the *i*th stock denoted STDEVSHORT $(-1,+1)_i$. The dependent variables *PRE_NBPV* and *BASE_NBPV* are the option net buying pressure volatility measures for days -10 to -2, and -50 to -11, respectively. Estimated *p*-values are shown in parentheses.

Panel A. DOTM	All	Bad News	Good News
NBPV_PRE	-0.007	-0.007	-0.006
	(0.19)	(0.37)	(0.39)
NBPV_BASE	-0.006***	-0.009**	-0.004
	(0.00)	(0.01)	(0.25)
Intercept	0.027***	0.029***	0.026***
	(0.00)	(0.00)	(0.00)
Obs	7,097	3,549	3,548
Adj R2	0.0012	0.0021	0.0001
Panel B. OTM			
NBPV_PRE	-0.003**	0.000	-0.006***
	(0.04)	(0.95)	(0.00)
NBPV_BASE	-0.006***	-0.005***	-0.006***
	(0.00)	(0.00)	(0.00)
Intercept	0.032***	0.032***	0.032***
	(0.00)	(0.00)	(0.00)
Obs	11,342	5,711	5,631
Adj. R^2	0.0056	0.0039	0.0079
Panel C. ATM			
NBPV_PRE	0.001	-0.001	0.003*
	(0.45)	(0.61)	(0.09)
NBPV_BASE	-0.001*	-0.001	-0.002
	(0.07)	(0.29)	(0.12)
Intercept	0.032***	0.033***	0.032***
	(0.00)	(0.00)	(0.00)
Obs	4,963	2,541	2,422
Adj. R^2	0.0004	-0.0002	0.0012

Astericks *,**,*** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 4. Relationship between option NBPDs of calls (puts) and post-event returns

This table reports results for the effect of net buying pressure of call and put options on the event excess returns in different moneyness categories. The independent variable is the post-event CAR for the *i*th stock denoted $XRETPOST(+6,+90)_i$. The dependent variables *POST_NBPD* and *BASE_NBPD* are the option net buying pressure directional measures for days +1 to +5, and -50 to -11, respectively, and POST_SVOL is the natural logarithm of volume of stock traded during the post-event window. XRET is the CAR during the event window (-1,+1). SIZE is the natural logarithm of market value of equity and MB is market to book ratio. Estimated *p*-values are shown in parentheses.

Panel A. DOTM	All	Bad News	Good News
NBPD_CALL_POST	0.096	0.150	0.160***
	(0.77)	(0.80)	(0.00)
NBPD_PUT_POST	-0.176	-0.296	-0.143***
	(0.59)	(0.66)	(0.00)
XRET	0.579***	-0.394	0.683***
	(0.00)	(0.38)	(0.00)
NBPD_CALL_BASE	-0.223**	-0.441**	0.001
	(0.04)	(0.04)	(0.90)
NBPD_PUT_BASE	-0.190	-0.365	-0.021**
	(0.10)	(0.12)	(0.01)
POST_SVOL	0.000	0.000	0.000***
	(0.19)	(0.13)	(0.00)
SIZE	0.041***	0.091***	-0.001
	(0.00)	(0.00)	(0.32)
MB	0.000	0.000	0.000
	(0.94)	(0.93)	(0.75)
Intercept	-0.411***	-0.961***	-0.004
	(0.00)	(0.00)	(0.57)
Obs	6,977	3,491	3,486
Adj. R^2	0.0042	0.0051	0.3649
Panel B. OTM			
NBPD_CALL_POST	0.008	-0.008	0.019**
	(0.93)	(0.97)	(0.01)
NBPD_PUT_POST	-0.069	-0.117	-0.026***
	(0.52)	(0.58)	(0.00)
XRET	0.538***	-0.326	0.588***
	(0.00)	(0.38)	(0.00)
NBPD_CALL_BASE	-0.145***	-0.287***	0.000
	(0.00)	(0.00)	(0.94)
NBPD_PUT_BASE	0.006	0.012	-0.001
	(0.88)	(0.88)	(0.72)
POST_SVOL	0.000	0.000	0.000***

	(0.53)	(0.37)	(0.00)
SIZE	0.036***	0.079***	0.001
	(0.00)	(0.00)	(0.17)
MB	0.000	0.000	0.000
	(0.85)	(0.81)	(0.23)
Intercept	-0.328***	-0.773***	-0.014**
	(0.00)	(0.00)	(0.02)
Obs	11,151	5,610	5,541
Adj. R^2	0.0039	0.0052	0.2414
Panel C. ATM			
NBPD_CALL_POST	-0.003	-0.004	0.006
	(0.98)	(0.99)	(0.37)
NBPD_PUT_POST	-0.016	-0.036	-0.014
	(0.88)	(0.87)	(0.10)
XRET	0.551**	-0.452	0.558***
	(0.02)	(0.48)	(0.00)
NBPD_CALL_BASE	0.005	0.010	0.000
	(0.88)	(0.88)	(0.93)
NBPD_PUT_BASE	-0.028	-0.053	-0.004
	(0.48)	(0.50)	(0.11)
POST_SVOL	0.000	0.000	0.000**
	(0.76)	(0.57)	(0.03)
SIZE	0.029**	0.066**	0.000
	(0.02)	(0.01)	(0.81)
MB	0.000	0.000	0.000
	(0.96)	(0.93)	(0.52)
Intercept	-0.275**	-0.668**	-0.001
	(0.01)	(0.01)	(0.95)
Obs	4,759	2,445	2,314
Adj. R^2	0.0009	-0.0004	0.1977

Asterisks *,**,*** denote statistical significance at 10%, 5% and 1% levels, respectively.

Table 5. Relationship between option NBPVs and post-event returns volatility

This table reports the test results of the effect of net buying pressure of call and put options on the event excess returns volatility in different moneyness categories. The independent variable is STDEVLONG $(+6,+90)_i$ which is the CAR volatility for the *i*th stock, *POST_NBPV*, and *BASE_NBPV* are the option net buying pressure volatility measures for days +1 to +5, and -50 to -11 respectively. *p*-values are in parentheses.

Panel A. DOTM	All	Bad News	Good News
NBPV_POST	0.013	0.034	-0.003
	(0.91)	(0.88)	(0.71)
NBPV_BASE	0.038	0.080	-0.005**
	(0.31)	(0.28)	(0.04)
Intercept	0.031***	0.045**	0.018***
	(0.00)	(0.01)	(0.00)
Obs	7,050	3,527	3,523
Adj R2	-0.0001	-0.0002	0.0008
Panel B. OTM			
NBPV_POST	0.012	0.017	0.003
	(0.75)	(0.82)	(0.16)
NBPV_BASE	0.025*	0.056**	-0.005***
	(0.05)	(0.03)	(0.00)
Intercept	0.032***	0.043***	0.021***
	(0.00)	(0.00)	(0.00)
Obs	11,263	5,668	5,595
Adj. R^2	0.0002	0.0005	0.0075
Panel C. ATM			
NBPV_POST	0.006	0.011	0.002
	(0.87)	(0.88)	(0.21)
NBPV_BASE	0.005	0.010	0.000
	(0.73)	(0.70)	(0.46))
Intercept	0.034***	0.045**	0.022***
	(0.00)	(0.03)	(0.00
Obs	4,810	2,468	2,342
Adj. R^2	-0.0004	-0.0007	0.0001

Asterisks *,**,*** denote statistical significance at 10%, 5% and 1% levels, respectively.