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Investor Sentiment and Options Volume Trading around M&A Announcements

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Abstract

This study investigates the role of investor sentiment in options market trading activity prior to M&A announcements. Using options and stock data on M&A announcements made between 1997 and 2018, we find that the CBOE Put-Call ratio, a proxy of investor sentiment, is a significant determinant of the options-to-stock volume ratio (the ratio of total volume of trading on the listed options market to the corresponding volume of trading on the stock market). This finding suggests that higher sentiment leads to higher options trading volume during the pre-announcement period. This effect is more pronounced in short-term ATM call and put options. The results of this study extend previous research which report that the pre-M&A activities are purely driven by informed trading, hence ignoring the systematic impact of investor sentiment.

Keywords: Investor sentiment; Mergers and acquisitions; Options volume; Behavioural finance.

JEL Classifications: G34, G12, G14

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1. Introduction

One of the most substantial propositions in social sciences, the efficient market hypothesis theory (EMH), developed independently by Paul A. Samuelson and Eugene F. Fama in the 1960s, maintains that market prices reflect all available information. It further assumes that market participants try to maximize utility in a rational way. However, the most enduring critiques of the EMH, presented by behavioural studies, documents that investor's choices are influenced by sentiment (Brown and Cliff, 2005; Baker and Wurgler, 2006; Schmeling, 2009; Kaplanski and Levy, 2010; Chung et al., 2012).

While a large number of existing studies in the broader literature have examined the impact of investor sentiment on stock markets[2], few studies have examined the role of sentiment in the options market. Furthermore, no previous research has looked at the relationship between investor sentiment and options volume trading. Prior studies find that options trading increases prior to major corporate announcements (Jayaraman et al., 2001; Cao et al., 2005; Roll et al., 2010). However, these studies assume that the increase in options volume trading is driven by rational motives such as informed trading. Evidence from the equity market shows

[2] Clarke and Statman (1998), Brown (1999), Fisher and Statman (2000), Lee et al. (2002), Baker and Stein (2004), Brown and Cliff (2004), Wang et al. (2006), and Lemmon and Portniaguina (2006) use direct survey-based measures of investor sentiment such as the Investor's Intelligence survey, the American Association of Individual Investors survey, and the Michigan Consumer Sentiment Index. Pan and Poteshman (2006), Martikainen and Puttonen (1996) and Simon and Wiggins (2001) use derivatives data such as put-call ratio, open interest, volatility index (VIX), and options premium. Brown and Cliff (2004) and Wang et al. (2006) use the ARMS Index—the ratio of advancing issues to declining issues. Lee et al. (1991), Chen et al. (1993), Qiu and Welch (2004), Ritter (1991), Conrelli et al. (2006), Rober and Wheatley (1998), Brown et al. (2003), Frazzini and Lemont (2006), Baker and Wurgler (2004, 2007) use indirect measures such as the closed end fund discount (CEFD), initial public offering (IPO), net mutual fund redemption (NMFD) , dividend premium and insider trading. Baker and Wurgler (2006, 2007) construct a composite index of sentiment based on the first component of six variables: the closed-end fund discount (CEFD), New York Stock Exchange (NYSE) turnover, the number of average first-day returns on Initial Public Offering (IPO), the equity share in new issues, and the dividend premium (the NYSE turnover ratio was later dropped). Huang et al. (2015) use the same proxies of Baker and Wurgler (2006, 2007) and develop a new `aligned sentiment index` which eliminates the error or noise in these sentiment proxies.

that trading activity can also be driven by irrational motives. More specifically, these studies show that investor sentiment is positively related to stock trading volume, whereby optimism leads to higher stock trading (Baker and Stein, 2004; Kurov, 2008; Odean, 1998; Liu, 2015). Based on these findings, this study questions the implicit assumption made by previous studies that pre-M&A announcement activity is purely driven by informed trading, by investigating whether, and to what extent, the increase in options trading volume prior to mergers and acquisitions (M&A) announcements is driven by investor sentiment. To the best of our knowledge, this is the first study that bridges this gap by examining the role of sentiment on options trading activity prior to mergers and acquisitions (M&A) announcements.

Following Roll et al. (2010), we run a cross-sectional regression with options-to-stock volume ratio(O/S), the ratio of total volume of trading on the listed options market to the corresponding volume of trading on the stock market, as the dependent variable and use a set of different independent variables commonly used in this branch of the literature. The independent variables are bid-ask spread, options delta, implied volatility, firm size, and macroeconomic announcement days. We further divide our options sample into different moneyness and maturity categories. We report the results for calls and puts separately. The results provide evidence of an increase in sentiment-driven options trading prior to M&A announcements.

The remainder of this study is organised as follows. Section 2 presents the methodology used to test the impact of sentiment on options trading prior to M&A announcements. Section 3 presents the data and provides summary statistics. Section 4 discusses the main empirical findings, and Section 5 concludes.

2. Literature Review

Broadly defined as the "belief about future cash flows and investment risks that is not justified by the facts at hand" (Baker and Wurgler, 2007, p. 129), investor sentiment has a predictive power to forecast stock market returns (Brown and Cliff, 2005; Baker and Wurgler, 2006; Schmeling, 2009; Kaplanski and Levy, 2010; Chung et al., 2012). Brown and Cliff (2005), for instance, find that investor sentiment is negatively related to future stock returns. They explain that excessive optimism leads to overvaluation, which is then followed by lower future returns. Baker and Wurgler (2006) show that sentiment varies with stock characteristics, whereby during periods of high (low) sentiment, small stocks, young stocks, high volatility stocks, unprofitable stocks, non-dividend paying stocks, extreme growth stocks, and distressed stocks earn relatively low (high) subsequent returns as prices revert to their fundamental values.

Further studies show that sentiment also affects trading volume (Baker and Stein, 2004; Liu, 2015). For instance, Baker and Stein (2004) argue that in a market with short sale constraints, irrational investors affected by sentiment are more likely to trade when they are optimistic, thereby increasing trading volume. Furthermore, Liu (2015) provides evidence of increased trading volume in the stock market during periods of high sentiment. This result is consistent with the theoretical links between investor sentiment and market liquidity, whereby higher sentiment generates increased noise trading or brings more irrational investors to the market. This can also be explained in a similar way to overconfident investors trading more (Odean, 1998), whereby optimistic investors, affected by sentiment, lead to increased trading in the market.

From a different angle, researchers have also found evidence of investor irrationality in the options market, whereby investor sentiment affects options prices (Han, 2008; Mahani and Poteshman, 2008; Bauer et al. (2009); Sung and Jun, 2015a, 2005b). For instance, Han (2008) finds that during periods of high market sentiment, S&P 500 index option volatility smile is flatter, and the risk-neutral skewness of monthly index return is less negative. Additionally, Seo and Kim (2015) find that investor sentiment affects the relationship between the implied volatility of options and the future stock return volatility. Therefore, in a similar way to the equity market, we would expect sentiment to have an impact on the options volume as well.

Previous studies show that rational investors with information about future events prefer to trade options rather than stocks because of the leverage opportunities that the options market provides (Cao, 1999; Cao and Wei, 2008; Easley et al., 1998; Pan and Poteshman, 2006). In this regard, various studies provide evidence of informed trading in the options market prior to major corporate announcements. For instance, Roll et al. (2010) find that the options-to-stock volume ratio (O/S) increases in the few days around an earnings announcement. Furthermore, they show that post-announcement absolute returns are positively related to pre-announcement O/S, suggesting that at least part of the increase in options volume is due to informed trading. Considering options trading activity, Amin and Lee (1997) show that options trading activity increases prior to earnings announcements, and report that option traders anticipate the direction of the price change induced by the earnings. Furthermore, in the context of takeovers, Cao et al. (2005) find an increase in call option imbalances (buyer- minus seller-initiated call volume, scaled by the volume during the benchmark period) prior to a takeover announcement, and that call volume imbalances prior to takeover announcements

are strongly related to next-day stock returns, suggesting that the options market contains a significant level of informed trading.

While the focus of most studies has been on informed trading prior to a corporate announcement, little evidence has been provided of the role of investor sentiment on the options trading activity prior to such announcements. Therefore, this paper fills the gap in the literature by providing new evidence of an increased sentiment-driven options trading prior to M&A announcements. To the best of our knowledge, this is the first study examining the impact of investor sentiment on options trading volume in the context of M&As.

3. Sample and Descriptive Statistics

The sample used in this research covers US M&A deal announcements extracted from Thomson One Database between 1 January 1997 and 31 December 2018[3]. The conditions for a deal to remain in the sample used are: (a) the acquirer is a US public firm listed on the NYSE, AMEX, or NASDAQ and has a market value of at least $1 million when the deal was completed; (b) the transaction value should be at least $1 million; (c) the acquirer holds less than 50% of the shares of the target firm before deal announcement; (d) the acquirer should aim to control 51% of the target firm's assets after the transaction; (e) M&As announced by the same acquirer during the 11-days event window are excluded[4]. Additionally, as this study is interested in examining the abnormal returns of the acquiring firms during the M&A

[3] OptionMetrics provides options data starting from 1996. Since we need data on options during the benchmark period (t-200) where t=0 is the M&A announcement date, we exclude M&A announcements made in 1996 for which we don't have historical options data.

[4] Similar conditions are used in Barbopoulos and Adra (2016) and Liu (2018).

announcement period, stock data is obtained from The Center for Research in Security Prices (CRSP) database, whereby the two datasets are matched together by CUSIP and Ticker.

To capture investor sentiment, this study uses the Chicago Board Options Exchange (CBOE) put-call ratio (PCR) as a proxy of sentiment[5][6]. Additionally, to fulfil the aims of this research, options data are extracted from OptionMetrics database for firms in the sample that have options traded on their common shares. These include the daily number of call and put option contracts traded for each US firm listed on NYSE, NYSE American, and NASDAQ stock exchanges along with the bid-ask prices and other options data such as delta and implied volatility. Hence, deals where the acquirer does not have options traded on its stocks are excluded from the sample. Lastly, there should be sufficient coverage for both stock and options data during the benchmark period (trading days -200 to -100) and the pre-announcement period (trading days -30 to -1) for a deal to remain in the sample. Further exclusions from the options data sample include those observations which have (a) a negative bid-ask spread, (b) zero-bids or zero-asks, (c) trading volume of less than 5 contracts on a given day, and (d) options with less than 1 week to maturity[7]. These leave us with a final sample of 2,643 M&A announcements.

We also divide our options sample into different moneyness and maturity categories. A call option is said to be at-the-money (ATM) if $S/K \in (0.95, 1.05)$; out-of-the-money (OTM) if $S/K \leq 0.95$; and in-the-money if $S/K \geq 1.05$, where S is the stock

[5] Obtained from www.cboe.com.
[6] Wang et al. (2006), Martikainen and Puttonen (1996), and Simon and Wiggins (2001) use PCR as a sentiment proxy to predict future returns and future volatility.
[7] Following Bakshi et al. (1997), Andreou et al. (2014) and Liu et al. (2020).

price and K is the strike price. On the other hand, a put option is said to be at-the-money if $S/K \in (0.95, 1.05)$; out-of-the-money (OTM) if $S/K \geq 1.05$; and in-the-money if $S/K \leq 0.95$. As for the maturity of the option contracts, those contracts which have less than two months (60 days) to expiration are said to be short term, whereas those with greater than two months to expiration are said to be long term. For each firm, the daily average of the variables are calculated over the benchmark and pre-announcement periods, and then the cross-sectional averages of the variables across the different firms are obtained.

Table 1 (Panel A) below shows the annual distribution of the M&A sample according to whether the deal is completed or withdrawn, the method of payment, the public status of the target company, whether the deal is a diversified deal, and whether the deal is a friendly deal. It is shown that 96.75% of the announced deals are completed, whereas only 3.25% are withdrawn. Additionally, 41.05% of the deals are paid in cash as compared to 37.91% paid in stock and 21.04% a mix of cash and stock. In almost half of the deals, the target is a public target (51.31%), and 99.70% of the deals are friendly deals. Lastly, most of the deals are diversified deals where the acquirer and target have different two-digit SIC codes (77.49%). Table 1 (Panel B) shows the distribution of the sample according to the target company's sector. The three sectors with the highest number of M&A deals are High Technology (32.16%), Financials (22.06%), and Healthcare (11.65%).

Table 2 below reports the distribution of the options sample across to the moneyness of the options contract. It reports the percentage change in the cross-sectional averages of daily volume from the benchmark period [-200,-100] to the pre-announcement period [-30,-1]. It can be shown that OTM put options have the highest

percentage increase (an increase of 50%) in their cross-sectional averages of daily volumes from the benchmark period to the pre-announcement period. On the other hand, the percentage increase is lower for OTM Call options (13.49%). An explanation for this could be that investors, affected by negative sentiment, trade OTM puts because of the insurance-type properties and the high leverage of such contracts. There is no substantial difference between the percentage increase in average daily volume for ATM call and put options, where the increase is 32.49% for ATM calls options and 33.52% for ATM put options. As for ITM options, there is a 2.19% decrease in ITM call options volume from the benchmark to the pre-announcement period as compared to an increase of 8.11% for ITM Put options. This may be due to the high cost of trading ITM options.

Table 1: Annual distribution of the M&A sample

Panel A											
Year	All	Completed	Withdrawn	Full Cash	Full Stock	Mixed	Public	Private	Subsidiary	Diversified	Friendly
1997	193	182	11	25	154	14	116	71	6	159	191
1998	218	216	2	48	153	17	105	100	13	161	217
1999	257	247	10	62	174	21	155	98	4	200	256
2000	201	192	9	40	138	23	90	102	9	154	200
2001	134	127	7	38	72	24	86	42	6	104	134
2002	105	103	2	46	37	22	59	38	8	86	105
2003	114	112	2	56	30	28	57	46	11	90	114
2004	106	104	2	64	15	27	53	43	10	87	106
2005	128	125	3	75	20	33	55	61	12	100	128
2006	103	101	2	62	17	24	47	41	15	79	102
2007	107	104	3	67	13	27	58	39	10	82	107
2008	84	78	6	55	11	18	46	29	9	59	84
2009	62	60	2	25	13	24	27	27	8	51	62
2010	84	79	5	57	13	14	54	24	6	67	83
2011	80	76	4	55	17	8	29	38	13	64	79
2012	104	101	3	66	15	23	41	41	22	79	104
2013	89	87	2	47	16	26	35	41	13	65	89
2014	122	121	1	59	21	42	50	56	16	95	122
2015	114	113	1	46	17	51	50	48	16	77	114
2016	80	78	2	37	14	29	48	23	9	61	80
2017	70	65	5	26	18	26	43	18	9	62	70
2018	88	86	2	29	24	35	52	26	10	66	88
N	2643	2557	86	1085	1002	556	1356	1052	235	2048	2635
%	100.00%	96.75%	3.25%	41.05%	37.91%	21.04%	51.31%	39.80%	8.89%	77.49%	99.70%

Panel B												
Year	TLC	CST	RE	EGP	CPS	IND	RET	MED	HEA	MTL	FIN	HTECH
1997	13	5	0	6	18	11	7	3	26	9	46	49
1998	11	3	1	9	19	8	8	11	15	7	55	71
1999	19	5	1	12	17	17	8	6	24	7	55	86
2000	12	2	1	7	12	15	9	5	16	1	33	88
2001	5	2	0	2	15	7	1	1	10	2	22	67
2002	6	3	1	7	6	3	2	4	14	3	14	42
2003	6	1	2	4	8	6	4	1	19	0	21	42
2004	2	5	0	1	10	4	2	2	11	1	21	47
2005	2	3	2	5	6	8	6	4	12	2	22	56
2006	4	2	2	5	5	9	2	4	8	3	21	38
2007	5	3	0	2	7	11	1	0	16	4	23	35
2008	3	3	2	3	2	6	2	3	13	3	10	34
2009	1	4	1	7	5	5	1	1	7	2	5	23
2010	3	1	0	7	5	6	1	1	12	3	9	36
2011	3	3	3	5	2	8	2	4	17	6	13	14
2012	7	0	1	7	7	9	3	7	16	6	19	22
2013	2	5	1	6	4	4	1	5	13	4	24	20
2014	1	6	4	6	8	10	4	3	18	4	39	19
2015	2	0	1	3	5	11	2	3	14	6	38	29
2016	1	0	3	8	4	5	0	4	12	5	26	12
2017	1	2	3	3	3	7	2	2	6	2	30	9
2018	0	2	1	8	2	7	1	4	9	6	37	11
N	109	60	30	123	170	177	69	78	308	86	583	850
%	4.12%	2.27%	1.14%	4.65%	6.43%	6.70%	2.61%	2.95%	11.65%	3.25%	22.06%	32.16%

Note: Panel A represents the annual distribution of target M&A bids announced by US public acquirers between January 1st, 1997 and December 31st, 2018. The distribution of the sample is presented according to the annual number of M&A transactions. Completed is a dummy variable assigned the value of 1 if the deal was completed, 0 otherwise. Withdrawn is a dummy variable assigned a value of 1 if the deal was unsuccessful, 0 otherwise. Full Cash is a dummy variable assigned the value of 1 if the deal is fully settled in cash, and 0 otherwise. Full Stock is a dummy variable assigned the value of 1 if the deal was fully settled in stock, 0 otherwise. Mixed is a dummy variable assigned the value of 1 if the deal is settled with a mix of stock and cash, 0 otherwise. Private is a dummy variable assigned the value of 1 if the target is a private firm, 0 otherwise. Public is a dummy variable assigned the value of 1 if the target is a public firm, 0 otherwise. Subsidiary is a dummy variable assigned the value of 1 if the target is a subsidiary, 0 otherwise. Diversifying is a dummy variable assigned the value of 1 if the acquirer and target do not share the same two-digit SIC code, 0 otherwise. Friendly is a dummy variable assigned the value of 1 if the deal is classified as friendly, 0 otherwise [Hostile]. Panel B represents the yearly distribution of M&A bids with respect to the target's sector. The sectors, as reported by SDC, are: Telecommunications (TLC), Consumer Staples (CST), Real Estate (RE), Energy and Power (EGP), Consumer Products (CPS), Industrials (IND), Retail (RET), Media and Entertainment (MED), Healthcare (HEA), Materials (MTL), Financials (FIN), and High Technology (HTECH).

Table 2: Distribution of options contract across moneyness

	Call Options			Put Options		
	[-200, -100]	[-30, -1]	%Change	[-200, -100]	[-30, -1]	%Change
OTM	52	59	13.49%	46	68	47.83%
ATM	66	87	32.49%	48	64	33.52%
ITM	51	50	-2.19%	39	42	8.11%

Note: This Table presents the cross-sectional averages of daily volume of options traded according to their moneyness categories. These are reported for both calls and put options during the benchmark period [-200, -100] and pre-announcement period [-30,-1]. OTM, ATM, and ITM denote out-of-the money, at-the money, and in-the money options respectively.

Table 3 (Panel A) below reports the descriptive statistics of the call options sample divided according to the moneyness of the options contract. It can be

Table 3: Descriptive Statistics

Panel A- Call Options

	Call Options [-30,-1]					
	OTM		ATM		ITM	
	Mean	Median	Mean	Median	Mean	Median
PCR	0.80	0.81	0.82	0.82	0.76	0.76
Delta	0.29	0.29	0.53	0.55	0.82	0.82
Implied Volatility	0.52	0.46	0.42	0.37	0.57	0.51
Bid-ask spread	0.22	0.15	0.27	0.20	0.43	0.30
Log(firm size)	16.24	16.23	16.32	16.34	16.43	16.48

Panel B- Put Options

	Put Options [-30,-1]					
	OTM		ATM		ITM	
	Mean	Median	Mean	Median	Mean	Median
PCR	0.81	0.82	0.84	0.85	0.83	0.83
Delta	0.18	0.18	0.45	0.44	0.72	0.72
Implied Volatility	0.55	0.49	0.42	0.36	0.57	0.49
Bid-ask spread	0.19	0.13	0.24	0.15	0.37	0.25
Log(firm size	16.71	16.72	16.53	16.55	16.40	16.38

Note: This table presents the summary statistics of the independent variables used in this study during the pre-announcement [-30, -1] period. PCR is the CBOE put-call ratio. Delta, implied volatility, and bid-ask spread are obtained from OptionMetrics. Firm size is the acquirer's firm market value of equity obtained from CRSP. Panel A and Panel B report these variables for call options and put options respectively according to the different moneyness categories.

seen that delta is highest for ITM call options (0.82) as compared to ATM (0.53) and OTM(0.29) call options. Firms whose options have higher deltas will require lower hedge ratios, therefore, we expect to have a negative relation between delta and option volume. In a similar way, implied volatility is highest for ITM call options (0.57) compared to ATM (0.42) and OTM (0.52) call options. As implied volatility increases, the underlying asset becomes more volatile. In order to benefit from such large increases/decreases in the price of the underlying, options trading activity increases since options are much cheaper to purchase as compared to the underlying, thereby allowing an investor to exploit the leverage benefit of options contracts. Hence, we expect a positive relationship between implied volatility and options volume. Bid-ask spread is also highest for ITM call options (0.43) as compared to ATM(0.27) and OTM

(0.22) call options. A higher bid-ask spread signifies lower market liquidity, therefore, we expect to have a negative relationship between bid-ask spread and options volume. Firm size also captures market liquidity, since larger firms will have higher options traded on their underlying. Hence, we expect to see a positive relationship between firm size and options volume. The average firm size is highest for ITM call options (16.43), although, this number does not differ significantly for ATM (16.32) and OTM (16.24) call options. Lastly, the average put call ratio is highest for ATM call options (0.82) whereas the average volatiltiy index is highest for OTM (22.42) call options.

Table 3 (Panel B) reports the summary statitsics of the put options contracts according to their moneyness categories. Similar to the call options, ITM put options have the highest delta (0.72) implied volatility (0.57), and bid-ask spread (0.37). However, the average firm size is higher for OTM put options (16.71), although, this result is not significantly different for ATM (16.53) and ITM (16.40) put options. Similar to the call options, ATM put options have the highest PCR (0.84), suggesting that sentiment may have a higher and more significant impact on ATM call and ATM put options as compared to ITM and OTM call and put options.

4. Methodology and Results

Following Roll et al. (2010), we run cross-sectional regressions with the logarithm of options-to-stock volume ratio as the dependent variable for each trading day in the sample, where the trading volume for each firm is calculated as its average volume during the pre-announcement period [-30, -1]. The explanatory variables used are the firm size, delta, implied volatility, and bid-ask spreads. For the purpose of this study, we add the put-call ratio as an additional explanatory variable to Roll et al.'s model, thereby examining whether investor sentiment influences options trading

volume during the pre-announcement period. Accordingly, the regression model is given by:

$$Ln(O/S)_{i,t} = \beta_0 + \beta_1 PCR_t + \beta_2 Ln(Size)_{i,t} + \beta_3 Bid.ask.spread_{i,t} + \beta_4 Implited\ volatility_{i,t} + \beta_5\ Delta_{i,t} + \varepsilon_{i,t} \quad (1)$$

where O/S is the options-to-stock volume ratio, PCR is the CBOE put-call ratio used as a proxy of sentiment, size is the acquiring company's size (in million dollars), bid-ask spread is the difference between the bid and ask prices of an asset, implied volatility is an estimate of the future volatility of a stock based on its options prices, and delta is the rate of change in the price of the option with respect to changes in the price of the underlying.

Table 4 (Panel A) below presents the results of the cross-sectional regression for call options across diferrent moneyness categories. Chakravarty et al. (2004) and Chen et al. (2005) argue that it is important to divide options into different moneyness categories because each category will have different levels of liquidity and different degrees of leverage. Whereas, OTM options provide investors with higher leverage, they also have higher bid-ask spreads and higher trading costs. ATM options have lower bid-ask spreads which attracts investors trading on volatility. On the other hand, ITM options have lower trading costs. Roll et al. (2010) argue that traders who believe they possess important information would prefer to trade OTM options since they are cheaper and represent a higher degree of leverage. Hence, we would expect the effect of sentiment to be less pronounced in OTM options.

From Table 4 below, it can be shown that the put-call ratio, a measure of investor sentiment, has a significant and negative impact on the options-to-stock volume ratio

among the three moneyness categories. As high values of PCR imply a negative market sentiment, a negative relation between these two implies that sentiment has a positive impact on options volume in our sample. The impact of PCR on the options-to-stock volume ratio (log O/S) is highest for ITM call and OTM put options.

Table 5 below reports the results of the cross-sectional regression with log(O/S) as dependent variable for ATM Call and ATM Put options with different maturities (<60 days and >60days). It can be shown that the coefficient of sentiment is highest for both call and put options with less than 60 days to maturity.

5. Conclusion

Previous studies show that the options trading activity increases prior to major corporate announcements. However, these studies assume that this increase is mainly driven by informed trading, leaving no room for examining whether it could also be driven due to irrational motives such as investor sentiment. Extending the findings of Roll et al. (2010), we show that investor sentiment is a significant determinant of options volume. Using the CBOE Put-Call ratio as a proxy of sentiment, we show that sentiment is positively related to options trading volume, whereby optimism leads to increased trading activity in the options market prior to M&A announcements. This effect is more pronounced in short-term ATM call and put options.

This paper contributes to the financial literature by providing evidence of irrational investor behaviour, emphasizing on the role of sentiment in investor trading behavior. Further research is needed to explore the role of sentiment using different sentiment proxies and a different theoretical model which could provide additional insights on the relationship between investor sentiment and options market trading activity.

Table 4: Cross-sectional regression of options/stock volume ratios

Panel A: Call Options			
	ATM	ITM	OTM
Variable			
Constant	9.6067***	12.4616***	9.4694***
	(0.056704)	(0.0487)	(0.0410)
PCR	-1.2491***	-1.3961***	-0.8932***
	(0.022320)	(0.0185)	(0.0162)
Delta	-2.2315***	-1.3972***	-0.4439***
	(0.038077)	(0.0363)	(0.0230)
Implied	-0.0011	-0.5158***	-0.1670***
Volatility	(0.022940)	(0.0149)	(0.0136)
Bid-ask spread	-0.3543***	0.1341***	-0.0503***
	(0.014249)	(0.0088)	(0.0125)
Log(firm_size)	-0.2559***	-0.4790***	-0.3655***
	(0.0026)	(0.0022)	(0.0019)
N	139,854	154,266	245,417
Adjusted R-squared	0.1132	0.2799	0.1561

Panel B: Put Options			
	ATM	ITM	OTM
Variable			
Constant	7.9244***	9.5198***	8.6369***
	(0.0720)	(0.0644)	(0.0487)
PCR	-0.3688***	-0.3396***	-0.5122***
	(0.0269)	(0.0259)	(0.0178)
Delta	-0.3021***	0.0074	0.7946***
	(0.0470)	(0.0340)	(0.0381)
Implied	-0.2654***	-0.3367***	-0.0747***
Volatility	(0.0279)	(0.0188)	(0.0157)
Bid-ask spread	-0.1219***	0.3727***	-0.0161
	(0.0191)	(0.0130)	(0.0143)
Log(firm_size)	-0.2753***	-0.4471***	-0.3602***
	(0.0033)	(0.0031)	(0.0023)
N	97,728	82,614	188,660
Adjusted R-squared	0.0716	0.2232	0.1511

Note: This table presents the results of the regression with log(O/S) as the dependent variable across the different moneyness categories of call and put options. PCR is the CBOE put-call ratio. Delta, implied volatility, and bid-ask spread are obtained from OptionMetrics. Firm size is the acquirer's firm market value of equity obtained from CRSP. Panel A and Panel B report these variables for call options and put options respectively. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Cross-sectional regression of options/stock volume ratios

	ATM Calls		ATM Puts	
	<60 days	>60 days	<60 days	>60 days
Constant	6.8759***	11.4323***	5.7854***	10.4022***
	(0.0770)	(0.0793)	(0.0926)	(0.1093)
PCR	-1.4570***	-1.1822***	-0.3597***	-0.2802***
	(0.0303)	(0.0295)	(0.0346)	(0.0377)
Delta	-0.7708***	-2.9387***	-1.0256***	-0.8426***
	(0.0438)	(0.0762)	(0.0511)	(0.1081)
Implied Volatility	0.3169***	-1.0560***	0.1163***	-1.6917***
	(0.0290)	(0.0351)	(0.0334)	(0.0471)
Bid-ask spread	-0.3005***	0.0702***	-0.0031	0.2439***
	(0.0224)	(0.0169)	(0.0275)	(0.0241)
Log(firm_size)	-0.1075***	-0.3534***	-0.1139***	-0.4145***
	(0.0038)	(0.0035)	(0.0045)	(0.0045)
N	73,905	65,949	56,120	41,608
Adjusted R-squared	0.0581	0.1696	0.0261	0.1688

Note: This table presents the results of the regression with log(O/S) as the dependent variable across ATM Call options with different maturities. PCR is the the CBOE put-call ratio. Delta, implied volatility, and bid-ask spread are obtained from OptionMetrics. Firm size is the acquirer's firm market value of equity obtained from CRSP. Panel A and Panel B report these variables for call options and put options respectively. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively.

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