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Do Option Markets Substitute for Stock Markets?

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Do option markets substitute for stock markets? Evidence from trading on anticipated tender offer announcements

Using a sample of cash tender offers occurring between 1993 and 2002, we find evidence that the options market has become the preferred venue for traders attempting to profit on anticipated announcements. Options offer advantages relative to stocks. Traders gain leverage by trading in options and multiple options contracts on an individual stock. The results of our study indicate that a substitution effect does exist. Abnormal volume in the option market replaces abnormal volume in the stock market prior to cash tender offer announcements, and this abnormal option volume precedes abnormal stock volume for targets with or without traded options.

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1. Introduction

Prior empirical studies have documented significant volume and price increases in the stocks of tender offer targets prior to the first public announcement of an offer. Our study examines whether the availability of options affects the demand for stock in these scenarios. More specifically, we test for a substitution effect in which options are purchased in lieu of the underlying stock. A number of reasons exist that might lead to this substitution effect.

A call option is a limited-life security with value derived from the price of an underlying stock and provides a larger potential return than investing in the underlying stocks. We test for such a substitution effect in this paper and find that the options market has indeed become the preferred venue for trading. For those targets with traded options, we find that the abnormal stock volume that exists for targets without traded options is replaced by abnormal options volume and that the abnormal option volume begins earlier (13 days prior to announcement) when compared to abnormal stock market volume for the case of options not being available (10 days prior to announcement).

Given the higher expected payoff to trading in options contracts, this finding of a substitution effect is not surprising as it validates prior empirical studies documenting abnormal levels of volume and implied volatility in the options of takeover targets preceding takeover announcements. Specifically, our results indicate that the average return on the call options of tender offer targets is over 12 times that of the return on

common stocks (417% vs. 34%) and the median return is over 6 times that of stocks (191% vs. 31%) over the tender offer event period.

The remainder of our study is organized as follows: Section 2 reviews the existing relevant literature, Section 3 describes our sample and methodology, Section 4 presents our empirical tests for a substitution effect of trading in options markets rather than stock markets, Section 5 concludes.

2. Prior research

Many studies have been conducted to test the informational efficiency of capital markets surrounding the event of a corporate takeover. Early research tends to support semistrong-form market efficiency, favoring the idea that significant abnormal returns preceding corporate acquisitions are associated with insider trading. Research by Mandelker (1974), Halpern (1976), and Keown and Pinkerton (1981) produce evidence of significant positive movements in target firm stock prices prior to a formal acquisition announcement. Using monthly data, both Mandelker and Halpern find a preponderance of positive price movements on the order of 58% beginning one month prior to the takeover announcement and this percentage increases to 62% in the month of the announcement. Refining these empirical findings with daily data, Keown and Pinkerton find that statistically significant positive abnormal returns begin 12 days in advance of a takeover announcement. Linking the findings of these three studies to those of Jaffe (1974) and Finnerty (1976), who find that registered insiders possess special information that allow them to earn abnormal returns, Keown and Pinkerton conclude that the stock price run-ups of target firms preceding takeover announcements are attributable to illegal

trading on inside information. The daily results reported by Keown and Pinkerton are later corroborated by Dennis and McConnell (1986) who find abnormal returns beginning twenty days before merger announcements.

Contrary to the insider trading theory, Jarrell and Poulsen (1989) suggest that the same pre-bid price run-ups are consistent with capital markets anticipating a takeover bid for a target firm. Controlling for media speculation about the potential takeover of the target in advance of a formal takeover announcement, Jarrell and Poulsen find that pre-bid price run-ups are significantly higher in media-speculated bids than in non-speculated bids. The authors conclude that these price run-ups are consistent with "a legitimate market for information" in the form of capital market anticipation of a takeover rather than trading on inside information.

Sanders and Zdanowicz (1992) redefine the event period to include an unpublicized initiation date that is taken as the first sign of a takeover bid rather than the initial date of media speculation. Similar to Jarrell and Poulsen, the authors conclude that the takeover announcement date is not the appropriate benchmark to use for the defining date of the event to determine if insider trading exists. Using an event date adjusted to account for unpublicized signals of impending takeovers, Sanders and Zdanowicz find no evidence of any volume or price run-up prior to this adjusted date.

Other studies have found a mix of insider and speculative trading leading up to the announcement of a takeover attempt. In her empirical study of prosecuted insider trades, Meulbroek (1992) finds that approximately half of the pre-bid run-up in stock prices preceding a takeover announcement is attributable to insider trading and this insider trading begins six days prior to takeover announcements, on average. In clinical studies

of the takeover attempts of Campbell Taggart and Carnation, Cornell and Sirri (1992) and Chakravarty and McConnell (1999) respectively find that known insider trades in stocks are hidden within liquidity and speculative ("noise") trades and the two types of trades are indistinguishable from each other without the knowledge of which trades were actually executed on behalf of insiders. These results support the empirical findings of Jarrell and Poulsen and Sanders and Zdanowicz that insider trading is not the sole driving force behind pre-bid stock price and volume run-ups, but they also contradict the conclusion that the run-ups are solely attributable to market anticipation. Taken together, these studies seem to suggest that the pre-bid run-ups in stock price and volume are driven by both types of informed trading – insiders and informed speculators anticipating a takeover attempt. However, these studies do not investigate pre-announcement trading if options are available.

Event studies suggest that informed trading exists in the option market (see Easley, O'Hara, and Srinivas (1998) for a formal model as to why this may be the case) and leads to more efficient price discovery in the underlying stock market. Amin and Lee (1997) show that the existence of traded options leads to more efficient price discovery in the event of surprise earnings announcements. Both Cao, Chen, and Griffin (2000) and Jayaraman, Frye, and Sabherwal (2001) find that informed trading in options markets leads to more efficient price discovery preceding takeover announcements. Chakravarty, Gulen, and Mayhew (2004) find that option markets contribute approximately 17% to price discovery. Levy and Yoder (1993) also show that implied option volatility reacts

further in advance of a merger announcement than the stock price.[1] Consequently, the options market does appear to be a possibly "preferred" venue for trading in advance of an informational event. However, as discussed in Skinner (1997) in regard to earnings announcements, it is difficult to separate astute speculators with insider traders. This same shortcoming also applies to merger announcements because such an event does not yield a perfect advantage to insiders as the actual takeover premium is not completely known upon announcement nor is there a guarantee of fruition.[2]

Although an investigation of insider trading is not goal of this paper, the selection of cash tender offers as the subject of our analysis is in direct response to this caveat of "speculators" versus "insiders" issue of Skinner. Cash tender offers give an "insider" a definite advantage in that the exact takeover premium can be known in advance, but there will still be the possibility of the acquisition failing. Because tender offers are used in this study, we expect the option market to become the preferred venue for trading due to the informational advantage of insider information. Astute speculators may still be present in both the stock and option markets, but such traders do not have the same advantage as an insider in this scenario. Our investigation indicates that the options market does become the preferred venue for trading prior to a tender offer and we suspect it is because of the informational advantage enjoyed by insiders. However, empirical evidence to indicate the latter statement conclusively does not exist in this paper.

[1] Interestingly, Geppert and Kamerschen (2006) find that post-merger implied stock option volatility is significantly greater than the amount predicted by a weighted portfolio combination of the target and acquirer.

[2] Consider the recent example of the announced merger of Hewlett-Packard (HP) and Compaq. The SEC is investigating abnormal volume in Compaq call options in the days before the merger announcement, but the

3. Data and methodology

3.1 Description of sample

An initial sample of 401 cash tender offer targets announced between January 1, 1994 and December 31, 2000 is taken from the Securities Data Corporation (SDC) database. We limit our sample to inter-party cash tender offers occurring between 1994 and 2000 as complete call option volume data is not available from the *Wall Street Journal* prior to 1994.[3] We then check *Value Line* for the existence of traded options for the target firms of these tender offers. The sample of tender offers is then dichotomized into subsamples on the basis of the existence of traded options. The subdivision of the data yields 71 targets with traded options and 356 targets without traded options.

Call option data is then collected from daily *Wall Street Journals* for the period beginning 50 days prior to the tender offer announcement date through the actual announcement date (day 0).[4] Of the 71 targets with traded options, 8 were excluded because they were not primary offers and 18 were excluded because they were not pure cash offers, resulting in a final subsample of 45 targets with traded options. Approximately 40% of these options are traded on the Chicago Board of Options Exchange (CBOE) with the remainder traded on the American, New York, Philadelphia, and Pacific exchanges.[5] A further description of our sample is provided in Table 1.

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options actually lost value since HP stock was offered in exchange for Compaq shares and HP's stock (and Compaq's) dropped at announcement due to a negative market reaction.

[3] Initially, we attempted to use the Berkeley options database for our analysis. However, the database ends in 1995 and contains only those options traded on the Chicago Board of Options Exchange (CBOE). Using this database would have limited our options sample size to 22 observations.

[4] We take the SDC announcement date as day 0 unless the announcement occurs after 4:00 P.M. Eastern time in which case we assign the following trading day as day 0.

[5] Options trading ceased on the New York Stock Exchange in 1997.

3.2 Methodology

For both the option and non-option tender offer samples, we measure abnormal stock price returns using standard event study methodology proposed by Brown and Warner (1985) where equity returns are based on the market model:

$$r_{jt} = \alpha + \beta_j r_{mt} + \varepsilon_{jt} \quad (1)$$

where r_{jt} is the rate of return on firm j's stock on day t, r_{mt} is the return on the CRSP value-weighted market portfolio on day t, and ε_{jt} is the error term. We estimate this equation over the period beginning 50 days before the announcement date and ending 21days before the announcement date. The estimates of the market model parameters are then used to calculate abnormal returns during the event period of relative day –20 through the announcement date.

Abnormal trading volume in the stock and options markets is measured for both the option and non-option samples, based on the methodology put forth by Ajinkya and Jain (1989) and used by Sanders and Zdanowicz (1992). Because raw trading volume data are highly non-normal, it is recommended that the volume variable be transformed when performing event studies:

$$v_{jt} = \log(1+\text{volume}_{jt}) \quad (2)$$

where volume_{jt} is firm j's day t trading volume in number of contracts. We then estimate the relation:

$$\Delta v_{jt} = \alpha + \beta_j \Delta v_{jt-1} + \varepsilon_{jt} \quad (3)$$

where $\Delta v_{jt} = v_{jt} - v_{jt-1}$, over the estimation interval –50 through –21. To calculate abnormal volume, we use standard event-study methodology and re-estimate this

equation during the event period –20 through the announcement date using the parameters estimated over the estimation interval where:

$$AV_{j,t} = \Delta V_{j,t} - \alpha_j + \beta_j * \Delta V_{j,t-1} \quad (4)$$

and $AV_{j,t}$ is the abnormal volume for the trading day and is summed to calculate a cumulative abnormal volume (CAV) through that trading day. This methodology is applied to stocks and aggregate option volume.

4. Empirical tests for a substitution effect

In order to determine if a substitution of option trading for stock trading occurs in our sample, we compare the volume run-ups in the stocks of both subsamples and the aggregate option volume of the subsample with traded options to determine if a significant difference exists in the abnormal volume patterns between the two subsamples. If we find significant abnormal aggregate option volume in the traded option subsample, along with a corresponding lower level of abnormal stock volume for the option subsample relative to the non-option subsample, then we may conclude that a substitution effect exists.

4.1 Volume and price run-ups in target stocks

We present our results for the abnormal stock price returns for the full, option, and non-option samples over the 21-day event period, beginning 20 days prior to the tender offer announcement date and ending on the announcement date, in Table 2. For the subsample of targets with listed options we find significant CARs of 33.97% over the 21-day event period with continuously significant CARs beginning on day –13. Targets

without listed options experience CARs of 27.23% over this 21-day interval and these CARs become continuously significant on day -5. Our abnormal volume results also reveal a difference in run-up patterns between the option and non-option subsamples. As can be seen in Table 3, the subsample of targets without traded options experiences significant CAV on day -10. In contrast, the CAV of targets with traded options does not become continuously significant until three days before announcement.[6] This seven day lag in cumulative abnormal stock volume demonstrates that abnormal stock volume is greater for tender offer targets without traded options – despite the fact that the CARs of tender offer targets with traded options become significant eight days in advance of those stocks without traded options. This result confirms the finding of Cao, Chen, and Griffin (2000) and Jayaraman, Frye, and Sabherwal (2001) that the existence of traded options leads to more efficient price discovery. To further determine if trading volume has migrated from the stock market to the options market for tender offer targets with traded options we examine abnormal trading volume in the options market.

4.2 Analysis of aggregate call option volume

To measure abnormal aggregate call option volume (AACOV) we employ the Sanders and Zdanowicz measure described in Section 3. Consistent with Jayaraman, Frye, and Saberwahl (2001), our results show that abnormal call option volume occurs well in advance of abnormal stock volume for targets with traded options. As can be seen in Table 4, significant cumulative abnormal volume begins 13 days prior to announcement – one day before stock CARs and 10 days before stock CAVs become

[6] After controlling for media speculation, stock CAV becomes significant on day –1 in the options sample

significant in the same subsample, and three days before CAVs become significant in the non-options subsample. Our nonparametric binomial test statistic reveals that significantly more than 50% of the targets with traded options experience aggregate call option volume in excess of their median control-period level beginning on day –6 and extending through the announcement day. These results are similar to those of Levy and Yoder who find the implied standard deviations of options contracts increase significantly three days prior to takeover announcements.

Overall, our results indicate that abnormal volume begins earlier in the options market than in the stock market and that the abnormal stock volume that exists for the subsample without traded options is largely replaced by abnormal option volume for those stocks with traded options. These results support the assertion of Easley, O'Hara, and Srinivas that informed traders will substitute trading in options for trading in stocks when possible.

5. Summary and conclusions

In this study, we present evidence that a substitution effect exists that favors the purchase of option contracts over the underlying securities preceding tender offer announcements. Comparing the run-up patterns in stock price and volume between tender offer targets with and without traded options, we find that significant abnormal stock volumes preceding the announcement occur much sooner for those targets without traded options. For those targets with traded options, we find that the abnormal stock volume that exists for stocks without traded options is replaced by abnormal options

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and day –8 in the nonoptions sample.

volume. Further, the abnormal volume begins earlier in the options market for target stocks with options than in the stock market for targets with or without traded options.

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Table 1
Description of sample

Description of sample data including number of tender offer target and option contract observations, and breakdown of exchanges on which options were traded in Panel A. Descriptive statistics of stock and option returns and number of contracts per tender offer target with traded options over the event period are reported in Panel B.

Panel A: General description of sample

Sample characteristics		Options exchanges of tender offer targets	
Tender offer targets with traded options	45	Chicago Board of Options Exchange	19
Tender offer targets without traded options	352	Philadelphia	11
Number of options contracts analyzed	545	American	7
		Pacific	5
		New York	3

Panel B: Descriptive statistics of securities and their returns in sample

	Mean	Median	Standard deviation	Minimum	Maximum
Event period tender offer target common stock return	34%	31%	26%	1%	140%
Average event period tender offer target call option return for all traded options of target	417%	191%	731%	5%	4,348%
Event period tender offer target insider contract return	1,233%	371%	3,127%	7%	20,800%
Number of call option contracts per tender offer target	12.1	10.0	6.1	3	24

Table 2
Abnormal stock returns

Summary of abnormal stock returns (ARs) and cumulative abnormal returns (CARs) from 20 days prior to announcement day through the announcement of tender offer during sample period of 1994-2000. The results are reported for firms with traded options (n=45) and a control sample of firms without traded options (n=356).

	Option Sample				Non-Option Sample			
Day	AR	z-stat	CAR	t-stat	AR	z-stat	CAR	t-stat
-20	0.22	0.45	0.22	0.45	0.24	0.85	0.24	0.85
-19	-0.10	-0.22	0.11	0.15	-0.06	-0.30	0.18	0.55
-18	0.94 a	2.74	1.06	1.30	-0.25	-1.09	-0.05	-0.13
-17	0.48	1.21	1.54 b	2.01	-0.14	-0.58	-0.19	-0.41
-16	0.16	0.38	1.69 b	1.87	-0.11	-0.49	-0.30	-0.58
-15	-0.59	-1.57	1.11	1.13	0.34	1.33	0.05	0.08
-14	0.04	0.07	1.15	1.02	0.15	0.64	0.20	0.32
-13	1.00 b	1.74	2.14	1.52	0.17	0.83	0.36	0.55
-12	0.93	1.10	3.07 a	2.09	-0.29	-1.31	0.08	0.11
-11	0.28	0.52	3.34 a	2.18	0.00	-0.01	0.08	0.12
-10	0.67	1.42	4.01 a	2.38	0.16	0.69	0.24	0.33
-9	0.42	0.94	4.44 a	2.61	0.01	0.03	0.24	0.33
-8	0.47	1.01	4.91 a	2.74	0.02	0.08	0.27	0.35
-7	-0.41	-0.87	4.50 a	2.48	0.19	0.85	0.46	0.58
-6	1.62 b	2.34	6.12 a	3.17	0.53 a	2.25	0.99 b	1.22
-5	0.47	0.96	6.60 a	3.31	0.43 b	1.73	1.42 b	1.69
-4	0.15	0.38	6.75 a	3.31	0.45 b	1.77	1.87 b	2.12
-3	1.43	1.56	8.18 a	3.72	1.32 a	4.13	3.20 a	3.38
-2	0.34	0.60	8.52 a	4.14	0.98 a	3.57	4.18 a	4.21
-1	4.88 a	3.03	13.40 a	5.27	1.96 a	5.52	6.13 a	5.99
0	20.57 a	6.26	33.97 a	10.35	21.09 a	16.92	27.23 a	17.99

a Significant at the 1% level.
b Significant at the 10% level.

Table 3
Abnormal stock volume

Summary of abnormal stock volume (AV) and cumulative abnormal volume (CAV) from 20 days prior to announcement day through the announcement of tender offer during sample period of 1994-2000. The results are reported for firms with traded options (n=45) and a control sample of firms without traded options (n=356).

	Option Sample				Non-Option Sample			
Day	AV	z-stat	CAV	t-stat	AV	z-stat	CAV	t-stat
-20	0.15	1.34	0.15	1.34	-0.02	-0.28	-0.02	-0.28
-19	-0.10	-0.76	0.05	0.25	0.05	0.85	0.04	0.54
-18	-0.14	-0.94	-0.09	-0.50	0.01	0.21	0.05	0.73
-17	0.24	1.42	0.15	0.65	0.01	0.10	0.06	0.81
-16	-0.21	-1.45	-0.06	-0.28	-0.15 b	-2.31	-0.08	-1.16
-15	0.01	0.02	-0.05	-0.24	0.21 a	3.59	0.13 b	1.98
-14	0.02	0.17	-0.03	-0.13	-0.02	-0.31	0.11	1.62
-13	0.30 b	1.91	0.28	1.04	0.03	0.46	0.14 b	2.04
-12	0.03	0.14	0.31	0.92	0.01	0.17	0.15 b	2.09
-11	0.04	0.26	0.35	1.05	-0.06	-1.06	0.09	1.37
-10	0.08	0.53	0.43	1.30	0.13 b	2.30	0.22 a	3.18
-9	-0.21	-1.15	0.22	0.68	-0.06	-0.95	0.16 b	2.33
-8	-0.09	-0.78	0.13	0.36	0.00	-0.07	0.15 b	2.11
-7	0.13	0.66	0.26	0.68	0.01	0.22	0.18 b	2.41
-6	0.19	0.90	0.45	1.24	0.13 b	2.20	0.31 a	4.36
-5	0.20	1.36	0.66 b	1.75	0.02	0.30	0.33 s	4.48
-4	-0.11	-0.90	0.55	1.48	0.09	1.55	0.42 a	5.49
-3	0.42 b	2.57	0.97 b	2.51	0.11 b	1.91	0.53 a	7.29
-2	-0.18	-1.17	0.79 b	2.14	0.09	1.59	0.62 a	8.05
-1	0.40 b	1.95	1.18 a	3.17	0.23 a	3.83	0.85 a	10.29
0	2.73 a	10.73	3.89 a	10.11	2.16 a	23.62	3.01 a	29.82

a Significant at the 1% level.
b Significant at the 10% level.

Table 4
Aggregate call option volume surrounding tender offer announcement

Summary of call option volume over the event period of relative day –20 through the announcement day (day 0) for our sample of 45 tender offer targets with traded options. Relative day information shown in this table includes aggregate call option abnormal volume, percent of tender offer targets with aggregate volume above control period median values, binomial test statistic for proportions, and aggregate call option cumulative abnormal volume.

Day	Abnormal aggregate call option volume	% at or above control period median volume	Binomial test statistic	Cumulative abnormal aggregate call option volume
-20	0.00	40	-1.26	0.00
-19	0.16	40	-1.26	0.16
-18	-0.05	43	-0.94	0.11
-17	0.37	40	-1.26	0.47
-16	0.72 b	48	-0.31	1.19
-15	-0.30	43	-0.94	0.89
-14	0.01	43	-0.94	0.90
-13	0.31	50	0.00	1.21 b
-12	0.25	50	0.00	1.46 a
-11	0.45	55	0.62	1.91 a
-10	0.37	52	0.31	2.28 a
-9	0.15	52	0.31	2.43 a
-8	0.12	52	0.31	2.53 a
-7	0.09	55	0.62	2.62 a
-6	0.89 a	71	3.07 a	3.50 a
-5	0.04	71	3.07 a	3.55 a
-4	0.89 b	71	3.07 a	4.44 a
-3	0.74 b	79	4.51 a	5.18 a
-2	0.20	74	3.51 a	5.38 a
-1	0.86 a	93	10.78 a	6.25 a
0	1.65 a	95	13.77 a	7.89 a

a Significant at the 1% level
b Significant at the 10% level