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An analysis of prices, volumes, and bid-ask spreads surrounding the announcement of tender offers

Abstract

This study examines the daily and intraday prices, volumes, and bid-ask spreads of acquirers and targets in cash tender offers. This study finds that even considering trading costs, investors can make a profit by adopting the “tender offer game” strategy, which involves buying the target stocks and selling the acquirer stocks on the announcement day close and reversing the position on the effective day close. Before the announcement, abnormal trading volume of acquirers and targets indicates that the announcement news has leaked out prior to the formal announcement, implying that considerably informed trading exists before the tender offer announcement. After the announcement day, the overall increasing abnormal volume of acquirers and targets could result from diversity of opinion instead of private information. The increasing abnormal relative quoted spreads of acquirers and targets imply that the market makers increase the spread to resist the informed traders. Lagged returns (or lagged order imbalances) are all insignificant predictors of future returns before announcement; that is, these stocks achieve weak-form (or strong-form) efficiency after 1.5 minutes, indicating that before announcement, informed trading (even insider trading) improves the accuracy of stock prices and supports an efficient market.

Keywords: tender offer, market efficiency, acquirer, target, spread.

JEL Classification: G12, G14, G34.

Introduction

This paper examines the daily and intraday prices, volumes, and bid-ask spreads in acquiring and target firms surrounding the announcement of tender offers. Early literature has documented that acquisitions did not enhance bidding firm value, as measured by either short-term or long-term performance measures. Specifically, acquisitions often decrease acquiring firm value¹. Although most of the early studies focus on the performance of acquiring firms, some research also focuses on the returns of target firms. Because acquirers generally pay premiums to acquire targets, target shareholders often experience considerable positive returns². Aside from target performance³, scholars have also examined the effects of acquisitions on combined bidder and target returns. These studies have generally shown that acquisitions produce positive combined returns, and the decomposition of these combined returns has revealed that targets account for the majority of those gains, with acquiring firms contributing neutral or negative returns⁴.

After the merger bid is announced, the target stock usually trades at a discount to the price offered by the acquirer. Merger arbitrage is the strategy for capturing a discount, termed the arbitrage spread. Relevant studies have documented that merger arbi-

trage is highly profitable (Mitchell and Pulvino, 2001; Baker and Savasoglu, 2002; Jindra and Walkling, 2004; Branch and Wang, 2006). A traditional arbitrage strategy of cash merger involves buying the target stock and selling it to the bidder for the offer price when the bid is completed. Because there is uncertainty about the completeness of bid, we sell the target stock on the specific day after the announcement to ensure profit. Therefore, we explore whether or not the risk arbitrageurs could profit by buying the target stocks and selling the acquirer stocks on the announcement day close and reversing the position on the specific day close after the announcement (hereafter referred to as a tender offer game).

The aforementioned literature has mostly focused on the abnormal returns after the announcement; another subset of the literature focuses on the abnormal returns before the announcement. Related studies have usually documented a pre-announcement run-up in the target firm's shares. This price run-up is also associated with higher abnormal trading volume⁵. This price-volume pattern has been associated with illegal insider trading in prosecuted cases because tender offers provide an opportunity for corporate insiders to earn abnormal return⁶. Moreover, Cao et al. (2005) and Arnold et al. (2006) have found that the trading prior to a tender offer announcement could be mainly initiated by traders who hold private information. Relevant studies have concentrated on the trading activity of the target firms before announcement, whereas our paper also

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¹ See Chatterjee (1992), Datta et al. (1992), King et al. (2004), Moeller et al. (2003), Seth et al. (2002).

² See Asquith and Kim (1982), Datta et al. (1992), Hansen and Lott (1996).

³ In addition, Bertrand and Zitouna (2008) find that acquisitions do not increase the profit of French target firms. However, they clearly raise the productivity of target firms.

⁴ See Bradley et al. (1988), Houston et al. (2001), Leeth and Borg (2000).

⁵ See Jarrell and Poulsen (1989), Conrad and Niden (1992), Chae (2005), Graham et al. (2006).

⁶ See Cornell and Sirri (1992), Meulbroeck (1992), Chakravarty and McConnell (1997), Fische and Robe (2004), King (2009).

focuses on bidding firms prior to announcement to explore whether or not there is additional informed trading¹. In this paper, we examine the abnormal return, volume, and spread of acquirers and targets to detect the informed trading.

In addition, motivated by Chordia et al. (2005), we use intraday data to examine the convergence process as to how tender offer information is incorporated into the stock price of acquirers and targets during the announcement period. If tender offer information cannot be incorporated into the price immediately², traders are theoretically able to develop an intraday trading strategy, yielding a positive return during the announcement period. We examine the convergence process with five different time intervals (1.5, 5, 10, 15, and 30 min). To the best of our knowledge, there is no study that explores the convergence process of acquirer and target stock returns during the announcement period.

We have several marginal contributions to the literature. First, a traditional arbitrage strategy of a cash merger is finished when the bid is completed. Since there is uncertainty about the completeness of bid, we sell the target stock on the specific day after the announcement to ensure profit. We find that by reversing the position on the specific day, arbitrageurs can still make net profit by adopting the tender offer game strategy. Second, relevant studies have concentrated on the trading activity of target firms before announcements, whereas our paper also investigates acquirer firms prior to the announcement to explore whether or not there is additional informed trading. We find that before the announcement, the abnormal trading volume of acquirers indicates that the news has leaked out prior to the formal announcement. After the announcement, the overall increasing abnormal volume of acquirers could result from diversity of opinion. The permanent increase in the relative quoted spread of acquirers implies that market makers pay more attention to the acquirers' stocks because more informed traders exist. Third, we fill a gap to explore the convergence process of acquirers and targets during the announcement period. We find that acquirers' and

targets' stocks achieve weak-form (or strong-form) efficiency only after 1.5 minutes, indicating that before announcement, informed trading (even insider trading) improves the accuracy of stock prices and supports an efficient market. At and after the announcement, because the information is released, liquidity traders would dominate informed traders.

The remainder of the paper is organized as follows. In Section 1 which follows, we describe the data and methodology. The empirical results are presented in Section 2. In the last section we conclude.

1. Data and methodology

We include cash offer acquirers and targets from the Securities Data Company (SDC) Merger and Acquisition database. Our sample period is from January 1, 2000 through December 31, 2007³. Stocks are included in our samples according to the following criteria. First, all stocks whose transaction data are not available in both SDC and TAQ are excluded from our samples. Second, we delete assets from the following categories: certificates, American Depositary Receipts, shares of beneficial interest, units, companies incorporated outside the U.S., Americus Trust components, closed-end funds, preferred stocks and REITs, because of their different trading characteristics. Finally, 146 acquirers and targets are included in our sample.

We divide the daily data into two parts to distinguish whether the abnormal return on the day following the announcement is ascribed to the overnight price movement or price movement during the following day. The market return is usually proxied by the return on S&P 500 index. The return based on the strategy in the holding period is

$$Abnormal\ Return_i = \left(\prod_{t_i=1}^T (1 + R_{i,t_i}) - 1 \right) - \left(\prod_{t_i=1}^T (1 + R_{m,t_i}) - 1 \right), \quad (1)$$

where $R_{i,t}$ and $R_{m,t}$ are the return on stock i and the S&P 500 index in the day t , respectively, and T is the length of the trading interval.

In this paper, we also focus on trading volume, and the bid-ask spread as measures of trading activity around tender offers. The spread is defined as:

$$Relative\ Quoted\ Spread = \frac{(P_a - P_b)}{((P_a + P_b)/2)} \quad (2)$$

where P_a is the lowest ask price, P_b is the highest bid price.

¹ In this paper, we directly use the price pattern to infer informed trading instead of employing a variety of proxies of informed trading because in traditional microstructure literature, informed trading is defined as its direction foreshadows subsequently price changes. Moreover, Aktas et al. (2007) suggest that the probability of information-based trading (PIN), which has been increasingly used in empirical research in finance, is not suitable as an information-based trading indicator, at least around merger and acquisition announcements.

² From the perspective of market inefficiency, Chordia et al. (2005) showed that the market does not converge to efficiency immediately. Grossman (1975) and Grossman and Stiglitz (1980) have found that the market prices cannot fully incorporate all knowable information. They argue that someone must be able to generate returns by exploiting the deviation of prices from fundamental values.

³ We start our sample from 2000 to prevent our results from being contaminated by the acquisition wave of the late 1990s.

Moreover, we divide the intraday period into three parts: a period from announcement day -5 to the announcement day -1, announcement day, and a period from announcement day +1 to announcement day +5. We use Lee and Ready (1991) trade assignment algorithm to derive 1.5-minute, 5-minute, 10-minute, 15-minute, and 30-minute order imbalances. For each stock, we define the order imbalance (OI) as the number of buyer-initiated trades¹ minus that of seller-initiated trades.

Chordia et al. (2005) explore whether lagged returns are significant predictors of future returns over short intervals to check the weak-form efficiency.

$$R_{it} = \alpha_0 + \alpha_1 \cdot R_{it-1}, \quad (3)$$

where R_{it} is the return on stock i in period t , defined as $\ln(P_{it}/P_{it-1})$, P_{it} is the transaction price.

If α_1 is significantly different from zero, we could conclude that the stock does not achieve weak-form efficiency.

Moreover, Chordia et al. (2005) explore whether lagged order imbalances are significant predictors of future returns over short intervals to check the strong-form efficiency.

$$R_{it} = \beta_0 + \beta_1 \cdot OI_{it-1}, \quad (4)$$

where R_{it} is the return on stock i in period t , defined as $\ln(P_{it}/P_{it-1})$, P_{it} is the transaction price, and OI_{it-1} is the order imbalance of stock i in period $t-1$.

If β_1 is significantly different from zero, we could conclude that the stock does not achieve strong-form efficiency.

2. Empirical results

2.1. Abnormal return. The close-to-close returns of acquirers are reported in Panel A of Table 1. The cumulative abnormal return from the announcement day -1 close until the announcement day close is -1.1 percent with a t -ratio of -3.285, implying that during the announcement day, uninformed traders hear the tender offer announcement and they sell stocks of acquiring firms because acquiring firms usually contribute neutral or negative returns in tender offers.

The cumulative abnormal return from the announcement day close until the effective day close is 2.8 percent with a t -ratio of 2.107. Over the whole period, average cumulative abnormal returns are increasing. It indicates that return of acquirers re-

verse after the announcement day since investors think that the prices of acquirers are undervalued and buy them to make profit.

Table 1. Average cumulative abnormal return of acquirer stocks in the days surrounding the announcement and effective days

Interval			
From	Until	Mean	T-value
Panel A. Close-to-close return			
Ann. day -1 close	Ann. day close	-0.011***	-3.285
Ann. day close	Eff. day close	0.028***	2.107
Ann. day close	Eff. day +1 close	0.027**	2.079
Ann. day close	Eff. day +10 close	0.025**	1.838
Ann. day close	Eff. day +20 close	0.023**	1.492
Ann. day close	Eff. day +40 close	0.020	1.249
Ann. day close	Eff. day +60 close	0.035**	1.725
Panel B. Returns between ann. and eff. days			
Ann. day close	Ann. day +1 open	-0.009***	-2.918
Ann. day +1 open	Ann. day +1 close	0.001	0.306
Ann. day +1 close	Eff. day close	0.041***	2.915
Eff. day -1 close	Eff. day open	0.000	0.136
Eff. day open	Eff. day close	0.001	0.769
Eff. day close	Eff. day +1 open	0.001	0.446
Eff. day +1 open	Eff. day +1 close	-0.001	-0.473
Panel C. Open-to-close returns			
Ann. day open	Eff. day close	0.055**	3.219
Ann. day open	Eff. day +10 close	0.061***	3.003
Ann. day open	Eff. day +20 close	0.060***	3.171
Ann. day open	Eff. day +40 close	0.075***	3.430
Ann. day open	Eff. day +60 close	0.096***	3.401

Note: ***, **, and * denote significant at 1%, 5%, and 10% level. Ann. day and Eff. day represent announcement day and effective day, respectively.

Average abnormal returns for different overnight and intraday intervals are reported in Panel B of Table 1. The average abnormal return from the announcement day close until the announcement day +1 open is -0.9 percent with a t -ratio of -2.918, while the average abnormal return from the open of the announcement day +1 to the close of the announcement day is 0.1 percent with a t -ratio of 0.306. Therefore, we can conclude that acquirers' stocks are efficient since the close-to-close return is driven by the overnight return².

Moreover, we focus on the profitability of risk arbitrage. Buying the acquirers' stocks at the close on the announcement day and selling them at the close on the effective day is referred to as the "acquirers' game" strategy. The average abnormal return of acquirers' game strategy is 4.10 percent (with a t -ratio of 2.915).

¹ We then sign trades using Lee and Ready (1991) rule: if a transaction occurs above (under) the prevailing quote midpoint, it is regarded as a buy (sell) order. If a transaction occurs exactly at the quote midpoint, it is signed using the previous transaction price according to the tick test (i.e., buys if the sign of the last non-zero price change is positive and vice versa).

² According to Beneish and Whaley (1996), if the close-to-close return is largely driven by the close-to-open price movement, the efficiency of the market is supported. If the close-to-close return is largely driven by the open-to-close price movement on the day following the announcement, market inefficiency could be concluded.

Therefore, without trading costs, we can make a profit by adopting the “acquirers’ game” strategy¹. The abnormal return from the announcement day open until the effective day +60 close is positive and significant, indicating the influence is permanent.

The close-to-close returns of targets are reported in Panel A of Table 2. The cumulative abnormal return from the announcement day -1 close until the announcement day close is 24.2 percent with a *t*-ratio of 4.010, implying that during the announcement day, uninformed traders hear the tender offer announcement and they buy stocks of target firms because target shareholders receive the premium paid by acquirers. The result on announcement day is consistent with Sanders and Zdanowicz (1992) and King (2009)². The cumulative abnormal return from the announcement day close until the effective day close is 34.2 percent with a *t*-ratio of 4.739. Over the whole period, average abnormal returns are increasing, indicating that return of targets continue to increase after announcement day.

Table 2. Average cumulative abnormal return of target stocks in the days surrounding the announcement and effective days

Interval		Mean	T-value
From	Until		
Panel A. Close-to-close return			
Ann. day -1 close	Ann. day close	0.242***	4.010
Ann. day close	Eff. day close	0.342***	4.739
Ann. day close	Eff. day +1 close	0.513***	3.475
Ann. day close	Eff. day +10 close	0.267***	2.351
Ann. day close	Eff. day +20 close	0.268*	1.720
Ann. day close	Eff. day +40 close	0.292*	1.534
Ann. day close	Eff. day +60 close	0.179	0.702
Panel B. Returns between ann. and eff. days			
Ann. day close	Ann. day +1 open	0.270***	3.929
Ann. day +1 open	Ann. day +1 close	0.005	1.169
Ann. day +1 close	Eff. day close	0.024	0.398
Eff. day -1 close	Eff. day open	-0.096**	-2.047
Eff. day open	Eff. day close	0.006***	2.272
Eff. day close	Eff. day +1 open	-0.070	-1.311
Eff. day +1 open	Eff. day +1 close	-0.003	-0.528
Panel C. Open-to-close returns			
Ann. day open	Eff. day close	0.161***	4.681
Ann. day open	Eff. day +10 close	0.256**	2.076
Ann. day open	Eff. day +20 close	0.321***	2.236
Ann. day open	Eff. day +40 close	0.312**	1.874
Ann. day open	Eff. day +60 close	0.262	1.242

Note: ***, **, and * denote significant at 1%, 5%, and 10% level. Ann. day and Eff. day represent announcement day and effective day, respectively.

¹ Kappou et al. (2010) use a similar strategy and trading cost is 1.74%. Thus, after considering trading costs, net return of “acquirers’ game” is still positive.

² Abnormal returns on the announcement day in Sanders and Zdanowicz (1992) and King (2009) are 21.361% and 10.02%, respectively.

Average cumulative abnormal returns for different overnight and intraday intervals are reported in Panel B of Table 2. The average abnormal return from the announcement day close until the announcement day +1 open is 27.0 percent with a *t*-ratio of 3.929, while the average abnormal return from the open of the announcement day +1 to the close of the announcement day is 0.5 percent with a *t*-ratio of 1.169. Thus, we can conclude that the market for targets’ stocks are efficient since the close-to-close return is driven by the overnight return.

Moreover, we focus on the profitability of risk arbitrage. Buying the targets’ stocks at the close after the announcement day and selling them at the close on the effective day is referred to as the targets’ game strategy. The average abnormal return of acquirers’ game strategy is 16.1 percent (with a *t*-ratio of 4.681). Therefore, without trading costs, we can make a profit by adopting the “targets’ game” strategy. The abnormal return from the announcement day open until the effective day +60 close is positive and insignificant, indicating the influence is not permanent.

Overall, the abnormal returns of acquirers and targets are almost positive, which is consistent with the synergy hypothesis³, which assumes that the acquisition of control over the target enables acquirer to adjust the combined assets of the two firms to create higher value. Moreover, the average cumulative abnormal return of tender offer game strategy (buying the target stocks and selling the acquirer stocks on the announcement day close and reversing the position on the effective day close) is 12.00 percent (with a *t*-ratio of 3.625). Thus, we can make a profit by adopting the tender offer game strategy. Specifically, if we reverse the position on the specific day, we find the cumulative abnormal returns on the close after the announcement +1, +10, +20, +40, +60 are 0.486, 0.242, 0.245, 0.272, 0.144, respectively. Therefore, even without reversing the position on the effective day, arbitrageurs still can make profit by adopting the tender offer game strategy.

2.2. Trading volume. To separate abnormal trading volume in the specific day, we compute the ratio of daily trading volume to average daily trading volume from the announcement day -200 to announcement day -100. If the daily volume is greater (less) than normal, the ratio is greater (less) than one.

³ Seth and Dastidar (2009) propose three empirically testable hypotheses about incidence of acquisition explanations and value creation/destruction: the synergy hypothesis, the managerialism hypothesis, and the bounded rationality hypothesis, whose total value of acquirer and target after acquisition is larger, equal to, or smaller than that before acquisition respectively.

Panels A and B of Table 3 indicate that average trading volume of acquirers (targets) is 1.294 (1.346) times normal (with a t -ratio of 2.122(3.097)) from the announcement day -30 through announcement day -1. This indicates that the announcement news have leaked out prior to the formal announcement, which is consistent with Meulbroek (1990), Jarrell and Poulsen (1989) and King (2009)¹. That is to say, there is significant informed trading before the tender offer announcement².

Moreover, the targets' abnormal volume on the announcement day is 34.679 times with a t -ratio of 7.993, implying that during the announcement day, investors buy targets' stocks and informed traders sell stocks, thus trading volume increases sharply. The result on announcement day is consistent with Meulbroek (1990), and Jarrell and Poulsen (1989).

Table 3. Abnormal trading volume of acquirers' and targets' stocks in the days surrounding the announcement and effective days

Interval		Mean	T-value
From	Until		
Panel A. Acquirers' abnormal trading volume			
Ann. day -30	Ann. day -1	1.294***	2.122
Ann. day -1		1.257***	2.681
Ann. day		2.530***	3.040
Ann. day +1		2.064***	4.824
Ann. day	Eff. day	1.368***	4.020
Eff. day -1		1.439***	2.688
Eff. day		1.855***	2.543
Eff. day +1		1.486***	4.335
Eff. day +1	Anno. day +252	1.554***	7.077
Panel B. Targets' abnormal trading volume			
Ann. day -30	Anno. day -1	1.346***	3.097
Ann. day -1		2.407***	3.053
Ann. day		4.679***	7.993
Ann. day +1		3.738***	9.110
Ann. day	Eff. day	4.143***	6.623
Eff. day -1		1.242	0.638
Eff. day		1.790*	1.620
Eff. day +1		1.289	0.703

Note: ***, **, and * denote significant at 1%, 5%, and 10% level. Ann. day and Eff. day represent announcement day and effective day, respectively.

The trading volume of acquirers (or targets) is 2.530 (or 4.679) times normal (with a t -ratio of 3.040 (or 7.993)) on the day after the announcement³, 2.064

(or 3.738) times normal (with a t -ratio of 4.824 (or 9.110)) across all days between the announcement day and the effective day, and 1.855 (or 1.790) times normal (with a t -ratio of 2.543 (or 1.620)) on the effective day. The overall increasing abnormal trading volume from the day after the announcement to the effective day is consistent with Lee et al. (1994), Jennings (1994), and Smith et al. (1997). After the announcement day, abnormal volume could be resulted from diversity of opinion instead of private information. According to Holthausen and Verrecchia (1990), and Cao and Yang (2009), volume is associated with differences among traders in interpreting news. Since the success of tender offer is uncertain, there would be different ways in which traders interpret the announcement. Thus, this results in higher post-announcement volume.

The abnormal volume ratio of acquirers remains more than 55 percent above normal from effective day +1 through announcement day +252. Obviously, the trading volume is influenced permanently by the tender offer. The main potential explanation is that the acquirer stocks become more liquid because they are scrutinized more fully by investors, institutions, and analysts. On the contrary, the trading volume of targets is insignificantly positive on the day after the effective day, implying investors do not pay close attention to target stocks after the effective day.

2.3. The bid-ask spread. After considering the trading volume, we examine the changes in the bid-ask spread by computing the ratio of the average bid/ask spread across all quotes on a particular day to the average of the average daily bid-ask spread from the announcement day -200 to announcement day -100⁴.

The relative quoted spread results, reported in Panels A and B of Table 4, are more distinct than those reported for the absolute quoted spread⁵. The relative quoted spread of acquirers (or targets) is 1.944 (or 1.499) times normal (with a t -ratio of 3.213 (or 2.835)) from the announcement day -30 through announcement day -1, 2.097 (or 0.574) times normal (with a t -ratio of 2.847 (or -4.662)) on the announcement day +1, 2.220 (or 1.747) times normal (with a t -ratio of 4.418 (or 2.053)) across all days between the announcement day and the effective day. The overall pattern of abnormal relative quoted spreads of acquirers and targets from the announcement day -30 through the effective day is increasing. The market makers increase the spread to resist the informed traders. Interestingly, the

¹ Nevertheless, Sanders and Zdanowicz (1992) find no evidence of positive average abnormal volume prior to the announcement day.

² The insider trading-information leakage hypothesis proposed by Keown and Pinkerton (1981) states that information leakage take places when private information is spilled to market investors who could use this information to trade against uninformed investors.

³ Smith et al. (1997) use intraday transactions data during the first trading day following the takeover announcement and find that following the reopening of trading, volume remains abnormally high, although decreasing throughout the first five hours.

⁴ Cao et al. (2005) define this period as a benchmark.

⁵ The untabulated results indicate that the abnormal absolute quoted spread results are all insignificant. There is neither a temporary nor a permanent reduction in the absolute quoted spread.

spreads of targets on the announcement day and the announcement day +1 decrease significantly. Conrad and Niden (1992) also find persistent decline in the level of the spreads of targets' firms (averaging about five cents lower than normal), which result from a dramatic increase in trading activity, at and after the announcement¹. The quoted bid-ask spread increase immediately after the announcement, but spreads quickly return to normal.

The relative quoted spread of acquirers is 3.095 times normal (with a *t*-ratio of 6.466) from the effective day +1 through effective day +252. The permanent increase in the relative quoted spread implies that market makers pay more attention to the acquirers' stocks because there are more informed traders.

Table 4. Abnormal relative quoted bid-ask spread of acquirers' and targets' stocks in the days surrounding the announcement and effective days

Interval		Mean	T-value
From	Until		
Panel A. Acquirers' abnormal relative spread			
Ann. day -30	Ann. day -1	1.944***	3.213
Ann. day -1		2.034***	2.857
Ann. day		2.029***	3.276
Ann. day +1		2.097***	2.847
Ann. day	Eff. day	2.220***	4.418
Eff. day		2.413***	4.155
Eff. day +1		2.184***	4.007
Eff. day +1	Anno. day +252	3.095***	6.466
Panel B. Targets' abnormal relative spread			
Ann. day -30	Anno. day -1	1.499***	2.835
Ann. day -1		1.389***	2.267
Ann. day		0.770***	-2.322
Ann. day +1		0.574***	-4.662
Ann. day	Eff. day	1.747**	2.053
Eff. day		2.330***	2.246

Note: ***, **, and * denote significant at 1%, 5%, and 10% level. Ann. day and Eff. day represent announcement day and effective day, respectively.

2.4. Efficiency. The results in Table 5 report serial regressions for returns and univariate regressions of returns on lagged order imbalance². Panels A and B present the regression results of acquirers and targets. Regressions are computed by individual stocks and the table reports the average coefficients. Lagged returns are all insignificant predictors of future returns in three periods; i.e., these stocks achieve weak-form efficiency only after 1.5 mi-

minutes³. The lagged order imbalances are all insignificant predictors of future returns in three periods, i.e., these stocks achieve strong-form efficiency only after 1.5 minutes. Strong-form efficiency is the appropriate criterion because investors who are not at the exchange cannot observe order imbalances immediately; only the market makers and perhaps astute floor traders can inspect order imbalances promptly. The above results indicate that before announcement (from announcement day -5 to announcement day -1), informed trading (even insider trading) improve the accuracy of stock price, and support the efficient market. Specifically, informed trading results in quick price discovery which decrease the time of many uninformed investors to collect the same information. Therefore, the stocks of acquirers and targets can achieve weak-form and strong-form efficiency only after 1.5 minutes. At and after the announcement (announcement day and from announcement day +1 to announcement day +5), because the information is released, liquidity traders would dominate informed traders. According to Chordia et al. (2008), liquidity facilitates efficiency, in the sense that the market's capacity to accommodate order flow is larger when the market is more liquid. Higher efficiency would be associated with higher abnormal volume at and after the announcement. Thus, the stocks of acquirers and targets can achieve weak- and strong-form efficiency only after 1.5 minutes.

Table 5. Univariate regressions predicting returns

Panel A. Acquirer firms					
Return interval (minutes)					
Expl. var.	1.5	5	10	15	30
From ann. day -5 to ann. day -1					
<i>Return</i> _{t-1}	0.001 (0.171)	0.002 (0.052)	-0.008 (-0.030)	0.003 (0.090)	0.000 (0.063)
<i>OI</i> _{t-1}	-0.000 (0-0.004)	-0.000 (-0.052)	-0.000 (-0.067)	0.000 (0.003)	-0.000 (-0.138)
Ann. day					
<i>Return</i> _{t-1}	-0.030 (-0.050)	-0.041 (-0.312)	-0.056 (-0.318)	0.002 (0.113)	-0.062 (-0.137)
<i>OI</i> _{t-1}	1.068 (0.259)	-0.000 (-0.542)	-0.000 (-0.103)	0.000 (0.130)	0.000 (0.465)
From ann. day +1 to ann. day +5					
<i>Return</i> _{t-1}	-0.003 (-0.237)	-0.006 (-0.143)	-0.021 (-0.353)	-0.018 (-0.302)	-0.001 (-0.234)
<i>OI</i> _{t-1}	-0.000 (-0.224)	-0.000 (-0.118)	-0.000 (-0.006)	-0.000 (-0.079)	-0.000 (-0.051)
Panel B. Target firms					
From ann. day -5 to ann. day -1					
<i>Return</i> _{t-1}	-0.000 (-0.308)	0.020 (0.031)	0.013 (0.253)	0.072 (0.190)	-0.074 (-0.166)
<i>OI</i> _{t-1}	0.000 (0.101)	0.000 (0.207)	0.000 (0.102)	0.000 (1.160)	0.000 (0.177)

¹ Nevertheless, Jennings (1994) documents that there is little evidence that spreads of targets' firms increase before the announcement.

² We obtain similar results by means of multiple regressions of returns with both lagged returns and lagged OI as predictors.

³ Lim (2009) examines five stock markets in the Middle East and Africa and finds that the stock returns still contain predictable nonlinearities that contradict the unpredictable criterion of weak-form efficient markets hypothesis. Dong Loc et al. (2010) review developments in the Stock Trading Center (STC) in Vietnam and finds that the STC is not efficient in the weak form.

Table 5 (cont). Univariate regressions predicting returns

Expl. var.	Return interval (minutes)				
	1.5	5	10	15	30
Ann. day					
$Return_{t-1}$	-0.002 (0.793)	0.033 (0.266)	0.007 (0.087)	0.033 (-0.029)	0.115 (-0.140)
Ol_{t-1}	0.000 (0.230)	8.824 (0.056)	-0.000 (-0.590)	-0.000 (-0.295)	-0.000 (-0.155)
From ann. day +1 to ann. day +5					
$Return_{t-1}$	-3.933 (-0.291)	-0.093 (-0.207)	-0.104 (-0.200)	-0.110 (-0.352)	-0.056 (-0.049)
Ol_{t-1}	-0.000 (-0.099)	-0.000 (-0.071)	0.000 (0.011)	0.000 (0.137)	-0.000 (-0.147)

Note: ***, **, and * denote significant at 1%, 5%, and 10% level. Ann. day and Eff. day represent announcement day and effective day respectively.

Conclusion

This study examines cash tender offer acquirers and targets from January 1, 2000 through December 31, 2007. We find that during the announcement day, uninformed traders hear the tender offer announcement and they sell (or buy) stocks of acquiring firms (or target firms) since acquiring firms always contribute neutral or negative returns in the tender offer (or target firms always receive premium paid by acquirers). Even considering trading costs, we can make a profit by adopting the “tender offer game” strategy, which involves buying the target stocks and selling the acquirer stocks on the announcement day close and reversing the position on the effective day close. Specifically, even without reversing the position on the effective day, arbitrageurs can still net a profit by adopting the tender offer game strategy.

Before the merger announcement, the abnormal trading volume of acquirers and targets indicates that the

announcement news has leaked out prior to the formal announcement, implying that significant informed trading exists before the tender offer announcement. After the announcement day, the overall increasing abnormal volume of acquirers and targets could result from diversity of opinion instead of private information. Obviously, the trading volume of acquirers is influenced permanently by the tender offer. The main potential explanation is that the acquirer stocks become more liquid since they are scrutinized more fully by investors, institutions, and analysts.

The overall pattern of abnormal relative quoted spreads of acquirers and targets is increasing. The market makers increase the spread to resist the informed traders. The quoted bid-ask spread of targets increase immediately after the announcement, but spreads quickly return to normal. The permanent increase in the relative quoted spread of acquirers implies that market makers pay more attention to the acquirers' stocks since there are more informed traders.

Lagged returns (or lagged order imbalances) are all insignificant predictors of future returns in three periods; i.e., these stocks achieve weak-form (or strong-form) efficiency only after 1.5 minutes, indicating that before announcement, informed trading (even insider trading) improves the accuracy of stock price and support efficient market. At the time of and after the announcement, because the information is released, liquidity traders would dominate informed traders. According to Chordia et al. (2008), liquidity facilitates efficiency, in the sense that the market's capacity to accommodate order flow is larger when the market is more liquid. Higher efficiency would be associated with higher abnormal volume at the time of and after the announcement.

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