

**A Microstructure Examination of the Effect of Risk Arbitrage  
on the Trading in Acquiring Company Shares in Stock  
Mergers**

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# **A Microstructure Examination of the Effect of Risk Arbitrage on the Trading in Acquiring Company Shares in Stock Mergers**

## **Abstract**

This paper examines the changes that occur in the trading in the acquiring company's shares in stock mergers once the transactions are announced. Using a two-year sample that includes 13 million quotes and 15 million trades the impact of short-selling by risk arbitrageurs on the microstructure of the market in acquiring company shares is evaluated. The results show that the process of risk arbitrage and the related short-selling improves the efficiency of the market in the bidder's shares. We find that spreads between the bid and offer prices decline and the depth of the market increases. Additionally, the adverse selection component of the spread declines. We also present evidence that the use of collars in structuring stock mergers is an effective way to limit the effects of short-selling in the shares of the acquiring company.

## **1. Introduction**

Most merger research is concentrated on abnormal returns and the changes of trading in the target company's shares. In this paper we examine the changes that occur in the trading in the acquiring company's shares in stock mergers once the transactions are announced. When stock mergers are announced, risk arbitrageurs enter the market to establish positions in the target company's stock in order to profit from the transaction. In the case of stock-for-stock deals, unlike cash transactions arbitrageurs take two-sided positions. Shares of the target company are purchased. In order to hedge the transaction, the arbitrageur sells short the number of shares he or she expects to receive of the acquiring company's shares when the transaction is completed.<sup>1</sup> This short selling in the acquiring company's shares may have an effect on the market. Most published studies on the changes in the market that occur after merger announcements have

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<sup>1</sup> See Moore (1999) for a full description of hedging in stock-for-stock transactions.

focused either on the microstructure changes in the target company's stock or on the abnormal returns in the target or acquiring companies' shares.

Studies by Jennings (1994), Asciglu, McInish and Wood (2002) and Lai, Moore and Oppenheimer (2004) have focused on the changes that occur in the microstructure of the market for shares of the target company. These studies have shown that spreads between the bid and ask prices narrow and the adverse selection component of the spread declines after the transactions are announced and risk arbitrageurs enter the market. None of these studies address the impact that the process of risk arbitrage has on the trading of acquiring company shares.

Numerous papers have been published that study the process of short-selling and the effects that short-sellers have on the market. For instance, recently Christophe, Ferri and Angel (2004) published a paper that examined the degree of short selling prior to earnings announcements. They found evidence of informed trading since abnormal levels of short-selling were linked to abnormal returns. Mitchell, Pulvino and Stafford (2004) also examined the effect of short-selling but concentrated their study on the effect short-selling has on the acquiring company shares once stock-financed mergers are announced. They found that short-selling by risk arbitrageurs accounted for more than one-half the negative price pressure on the acquiring company's shares. In this paper we look to examine in more detail the changes that occur in the trading in acquiring company shares once stock mergers are announced and risk arbitrageurs begin to establish short positions.

Another aspect of stock-financed mergers that needs to be explored is the market effect that using collars has when structuring stock transactions. Several articles have been published recently that address the issue of collars and the motivation for their use. Fuller (2003) examined the wealth effects associated with collar offers and also addressed why target and acquiring companies institute the use of collars. A paper by Officer (2004) also examined the motivation for the use of collars in merger agreements. His work suggests that the use of collars is related to the sensitivities of the bidder and target companies to market-related risk. One other possible motivation for the use of collars when structuring a stock merger is to limit the activities of arbitrageurs and therefore the effect of arbitrage on the bidder's shares. Many in corporate management believe the trading by risk arbitrageurs and their short-selling activity creates a negative effect on the acquiring company's stock. In fact, Mitchell, Pulvino and Stafford (2004) found that arbitrageur's short-selling is an important factor in how the acquiring company's shares react once stock mergers are announced.

In this paper we look to address two related issues:

1. What are the microstructure effects on the acquiring company's shares once stock transactions are announced and risk arbitrageurs enter orders to sell-short shares of the acquiring company?
2. How effective are collars in limiting the effect of short-selling by risk arbitrageurs?

Using over 13 million quotes and 15 million trades, we show that the process of risk arbitrage and the related short-selling in the shares of the acquiring

company improve the efficiency of the market in the bidder's shares. Using various microstructure measures such as bid-ask spread, bid size, offer size, the percentage of orders classified as buy orders and the adverse selection component of the spread we find that arbitrageurs actually improve the market for bidder shares and decrease the cost of trading in these securities. Furthermore, we find that using collars is an effective way to limit the effect of arbitrage short-selling in the shares of acquiring companies.

The paper is organized as follows. Section 2 explores the theoretical considerations of the paper and past literature. Section 3 describes the sample and methodology used in the study. The results are discussed in Section 4 and the robustness of the results is reported in Section 5. Conclusions and a summary of the results are in Section 6.

## **2. Theoretical Considerations and Literature Review**

### **2.1 Market Microstructure Changes in Acquiring Company Shares After the Merger Announcement**

The two basic issues that we look to evaluate are the effect that the process of risk arbitrage and the related short-selling has on the trading in shares of bidding companies and whether collars are successful in having a limiting effect on arbitrageur's short-selling. When stock-for-stock transactions are announced arbitrageurs quickly analyze the transaction to evaluate the risk, potential rewards and the probability of the transaction successfully closing.<sup>2</sup> Unlike cash transactions where the arbitrageur establishes only a long position in the target

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<sup>2</sup> See Moore (1999) for a detailed discussion of the process of arbitrage.

company's stock expecting the merger to go through, a stock-for-stock transaction requires the arbitrageur to set up two separate but related positions. In addition to buying the shares of the target company, the arbitrageur sell short the number of acquiring company shares he or she expects to receive in exchange for the target shares once the deal closes. Perhaps the best way to demonstrate the trading strategy is to examine a sample transaction. We have chosen a stock merger from our sample to illustrate the arbitrage process.

On December 20, 1999 American Online announced that they had agreed to acquire the shares of MapQuest in a stock merger. The companies agreed to exchange .31558 shares of American Online for each share of Mapquest when the transaction was completed. If the arbitrageur decided to participate in the transaction and wanted to fully hedge the transaction, the arbitrageur would buy shares of MapQuest and sell-short .31558 shares of American Online for each share of MapQuest purchased. By setting up this two-sided position the arbitrageur has locked-in a spread between the target company's shares and the value to be received when the transaction closes. This spread would be realized regardless of the market moves in American Online's stock as long as the transaction closes and provides the MapQuest holders with .31558 shares of AOL at closing.

To illustrate this point, we have assumed that the arbitrageur has purchased a share of MQST and sold-short .31558 shares of AOL on the day the transaction was announced. Using the closing prices of \$25.437 for MQST and \$82.875 for AOL we have constructed the table below to demonstrate that

initiating a fully-hedged strategy, the arbitrageur can realize the spread between the deal value and the price of MQST regardless of how the stock of AOL fluctuates during the time from announcement to the actual closing of the transaction.

1	2	3	4	5	6	7
AOL Price	Short Price of AOL	Gain(Loss) on Short ( x .31558)	Deal Value (.31558 x AOL)	Purchase Price of MapQuest	Gain or Loss on Long	Net Profit (Col. 5 - Col. 3)
85.000	82.875	-0.671	26.824	25.437	1.387	0.717
84.000	82.875	-0.355	26.509	25.437	1.072	0.717
83.000	82.875	-0.039	26.193	25.437	0.756	0.717
82.875	82.875	0.000	26.154	25.437	0.717	0.717
81.500	82.875	0.434	25.720	25.437	0.283	0.717
81.000	82.875	0.592	25.562	25.437	0.125	0.717
80.000	82.875	0.907	25.246	25.437	-0.191	0.717

We can see from the data above that once the arbitrageur has fully-hedged the long position in MQST by selling the proper ratio (.31558) of AOL shares, he or she can realize the deal spread (\$0.717) regardless of the ultimate price moves of the stock of AOL.<sup>3</sup>

As we can see from the MQST/AOL transaction, when deciding to sell-short, the arbitrageur is not making a judgment on the value of the bidder's shares. Instead he or she is simply setting up a hedge in order to profit from the discount from the consideration to be received. This lack of value judgment is significantly different from what generally occurs when traders decide to sell-short shares of a company. Short-selling is generally a tactic utilized to profit from identifying an overvalued security. The short-seller may traditionally has

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<sup>3</sup> The transaction actually closed on June 22, 2000. Using the closing price of AOL (\$56.50), the arbitrageur actually had a gain of \$8.324 on the short side ( $\$82.875 - \$56.50 \times .31558$ ) and a loss of \$7.607 ( $\$56.50 \times .31558 - \$25.437$ ) on the long position. The net gain of \$0.717 is exactly the spread initially created by the hedged position on the announcement date.

been considered to be an informed trader who believes they have been able to identify a mispricing in the marketplace. This typical scenario has been studied in various studies on short-selling. For instance, in Christophe, Ferri and Angel (2004) the authors examine the trading in over 900 NASDAQ - listed firms for evidence of informed trading by short-sellers. Using data that specifically identifies short-sale trades the authors find that increased levels of short-selling tend to occur prior to negative earnings releases and the level of short-selling is related to post-announcement returns of the companies' stocks. Earlier work, such as Diamond and Verrechia (1987), have developed theoretical models where short-sellers are operating as informed traders in the marketplace. While we expect the short-selling by arbitrageurs after stock mergers are announced has an effect on the trading in the acquiring company's shares, we are not considering these arbitrageurs to be informed traders. We believe that arbitrageurs are functioning like value-traders in the shares of the target company and therefore can be considered informed traders on the long-side but they are not making the traditional value decisions when trading shares of the acquiring company.<sup>4</sup> They are merely looking for an execution of their short order in order to establish a hedged position in the transaction.

At this point the execution of the short-sale should be more fully discussed since the mechanics of the short-sale has an effect on the results of this paper. In order to be able to sell shares short, the trader must abide by several rules. First,

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<sup>4</sup> Harris (2003) has pointed out that informational traders may be value traders, news traders, technical traders or arbitrageurs. Also, in a working paper, Lai, Moore and Oppenheimer (2004) have evaluated the trading of arbitrageurs in the trading in target company shares. They find evidence confirming that risk arbitrageurs function as informed traders and compete with specialists and market-makers in trading target company shares.

the security must be borrowed by the trader's brokerage firm in order to be able to deliver the physical shares to the buyer in the transaction. Secondly, in order to execute the order, the trader needs an uptick or a zero-plus tick in the underlying security.<sup>5</sup> This uptick requirement becomes important in understanding the mechanics of trading and the ability to sell shares short. The uptick rule prevents short-sellers from aggressively selling the shares of the issuing company and thus, causing the price to decline. While short-sellers cannot sell shares on the bid side (unless the bid represents an uptick or a zero-plus tick) an offering of shares above the last trade can possibly have a negative effect on the security's price going forward. Potential buyers may view the supply of stock being offered to be an indicator that there is no need to be aggressive in entering market buy orders. Instead the short offerings may encourage buyers to be less aggressive and bid for stock below the current offerings.

In this paper we include in the sample both pure stock-for-stock transactions as well as mergers where the target company receives both stock and cash proceeds. Mergers that include both cash and stock are referred to as mixed mergers. Both types can be examined to understand the impact that risk arbitrageurs have on the market in the acquiring company's shares. Martin (1996) used both types of mergers as well as cash mergers to analyze the motivation of the acquiring company to use stock as a medium of exchange. We find collars in both stock and mixed mergers in our sample.

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<sup>5</sup> An uptick is defined as the execution of a trade at a price that exceeds the previous trade price. A zero-plus tick is a trade that occurs at a price that is the same as the previous trade but the trade prior to the zero-plus trade was done on an uptick.

When arbitrageurs enter the market for the acquiring company's shares in both stock and mixed mergers, they are attempting to short shares of the acquiring company in order to set up a hedged position. If these arbitrageurs are informed traders we would see the spread between the bid and ask widen to compensate the specialists or market-makers for the increased level of informed trading.<sup>6</sup> However, as previously mentioned, we believe that in their trading in the acquiring company's shares, arbitrageurs are merely seeking execution in order to set up their hedged position. They are not making a value judgment on the price of the acquiring company's shares. The arbitrage orders to short the bidder's shares provide liquidity to the marketplace. In that way arbitrageurs can be considered to be liquidity traders. Ascioglu, McInish and Wood (2002) discuss the liquidity contribution of arbitrageurs, however, they consider arbitrageurs to function as liquidity traders when trading in the shares of the target company.

If arbitrageurs provide additional liquidity to the trading in the acquiring company's shares we expect to find that the spread in terms of dollars and percentage between the bid and ask narrows. This is consistent with the findings of Jennings (1994), Ascioglu, McInish and Wood (2002) and Lai, Moore and Oppenheimer (2004), however, all these papers examined the microstructure changes in the target company's shares. In the case of acquiring company shares we expect that arbitrageurs, in their effort to get a short-sale execution, will offer their shares below the current offering in order to get priority in the market. This

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<sup>6</sup> See Kyle (1985), Glosten and Milgrom (1985) and Easley and O'Hara (1987a) for a detailed description of the behavior of the bid-ask spread in the presence of informed traders.

action competes with the specialists and market-makers. The effect is to narrow the spread.

We should also see the effect of the short-sale offerings when we examine the changes in the offering side of the market. We expect to see significant increases in the number of shares offered in the acquiring company's stock. We will track the offering size over the life of the mergers and compare the results to a base period prior to the announcement of the transaction. While we do not have a dataset that specifically identifies trades and orders as short-sale transactions, we know that from the time the mergers are announced until the completion of the transactions, arbitrageurs are quite active in the market for bidder's shares.

In addition to expecting an increase in the number of shares offered in the acquiring company's stock, we also expect to see changes on the bid side. Since the announcement of a transaction frequently causes a dramatic increase in the volume of trading in the acquiring companies' shares, it is quite possible that we may see an increase in the number of shares market participants bid for in the market.<sup>7</sup> Also, since arbitrageurs will be offering shares to hedge their long positions at a discount to the prior level of offerings combined with the expectation that the offering size may increase, potential buyers of shares may not feel compelled to be as aggressive as they might have been but for the announcement of the mergers. Buyers will be aware that arbitrageurs seek execution on their short-sales. Other sellers may need to become more aggressive

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<sup>7</sup> Angel, Christophe and Ferri (2003) have noted that actively traded stocks experience more short-selling than inactive stocks.

with their sell orders in order to pre-empt the arbitrage short-sale orders. The overall market result could be that buyers become more patient and less aggressive. These actions could lead to an increase in bid sizes. An increase in bid size would be consistent with the results that Jennings (1994) found when studying bid and offer sizes of target companies after the transactions are announced.

We classify trades by buy and sell orders according to the methodology developed by Lee and Ready (1991). Those who believe that short-selling causes the acquiring stock price to decline might expect the percentage of orders classified as buy orders to decline once mergers are announced and arbitrageurs start to sell-short shares of the acquiring company. Since, however, arbitrageur executions of their short orders are limited by the uptick rule, we expect that the percentage of orders classified as buy orders will actually increase. The reason for this potential outcome is that the Lee and Ready (1991) order classification methodology classifies an order as a buy when the trade is executed above the midpoint between the bid and ask prices. If short-sellers cannot initiate a trade on a downtick, the only time they can sell on the bid side is when the bid represents a plus or zero-plus tick. Since this condition is rarely found in the market we expect to find that buyers may step up and pay above the midpoint in order to execute their buy order. An execution above the midpoint classifies the trade as a buy. As a result, we expect to see an increase in the percentage of buy orders when arbitrageurs are actively shorting shares of the acquiring company.

In their examination of adverse selection costs involving target company securities post-announcement, both Acscioglu, McInish and Wood (2002) and Lai, Moore and Oppenheimer (2004) found declining adverse selection component values. In this paper we are examining the trading in the acquiring companies' shares. As previously mentioned, we do not consider arbitrageurs to be informed traders in their short-selling activity in the acquiring company shares. Arbitrageurs are not making a value judgment on the acquiring company stock. They are merely interested in getting their short order executed in order to set up their hedged arbitrage position. Since arbitrageurs are not informed traders and provide liquidity to the marketplace we expect the adverse selection component to decline.

## **2.2 The Use of Collars in Merger Transactions and Their Effectiveness**

The utilization of collars in stock merger transactions has been examined by several authors. Houston and Ryngaert (1997) examined asymmetrical information in stock mergers with collars. They found evidence of the asymmetric information hypothesis and focused on the relationship between abnormal returns of bidder stocks and the elasticity of the bids.<sup>8</sup> More recently, both Fuller (2003) and Officer (2004) examined the motivation and effects of collars in stock transactions. Fuller (2003) found that collar offers are associated with stock offers that provide positive abnormal returns for target companies. She

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<sup>8</sup> The asymmetrical information hypothesis predicts that target company informational asymmetries are related to the relative size of the target company as compared to the bidder. Hansen (1987) examined the theory as it applies to mergers in general while Houston and Ryngaert (1997) applies the theory to stock mergers that include collars. In general, when targets are relatively large, they are more likely to utilize collars in the transactions.

also examined the reasons why collars are employed. Officer (2004) also examined the motivation for collar offers. Neither author, however, considered the possibility that one of the reasons that collars are negotiated is to limit the process of risk arbitrage and the resulting short-selling in acquiring company shares. Many officers of companies making stock acquisitions believe that the short-selling in their shares causes the acquiring company shares to decline. Work by Mitchell, Pulvino and Stafford (2004) attributed more than half the decline in the price of the acquiring companies' shares to be a result from arbitrage and the related short-selling activity. In this paper we examine whether collars are effective in limiting arbitrage activity.

Collars are designed in two basic forms. Both forms provide for changes in the exchange ratio based upon changes in the value of acquiring companies' shares. The fixed-exchange collar specifies a constant exchange ratio over a specified range of prices of the acquiring company. Should the acquiring companies shares trade outside of the range over a specified time period, the collar generally allows for an adjustment in the exchange ratio. The other type of collar arrangement is known as a fixed-payment collar. In the fixed-payment collar the stock merger consideration is specified as a specific dollar value that target company shareholders are to receive as long as the acquiring company's shares trade within a specified range. Under the fixed-payment collar, if the acquiring company's stock trades outside the specified range of prices, the target company generally receives a specific exchange ratio.

With both type of collars the concept is to limit the variation of merger consideration based on the price action in the underlying stock of the acquiring company. In virtually all collars, all the adjustments based on the movements in the acquiring companies' shares are based on a pricing period that occurs just prior to the transaction's closing. Generally the merger agreements specify a period that allows for the calculation to take into account the acquiring company's stock prices over a period such as ten or twenty days. The merger agreement specifies the specific time period and its boundaries in making the average price calculation to see if the collar adjustments are triggered. Collars usually also provide for either the target or acquiring company to cancel the agreement if the move in the acquiring company's stock falls outside a specified range of prices.

Using an example of a collar from our data sample, we can see how a collar works. Texas Instrument's acquisition of Unitrode in September 1999 utilized a fixed payment collar. The proxy statement filed with the Securities Exchange Commission included the following description:

...if the average of the daily high and low trading prices of Texas Instruments common stock for the 20 trading day period ending on the second day prior to the merger is greater than \$76.85, the exchange ratio will be 0.5023. If the average of the daily high and low trading prices of Texas Instruments common stock for the 20 trading day period ending on the second trading day prior to the merger is less than or equal to \$76.85 but greater than or equal to \$66.85, the exchange ratio will be determined by dividing \$38.60 by that average trading price. If the average of the daily high and low of the trading prices of Texas Instruments common stock for the 20 trading day period ending on the second trading day prior to the merger is less than \$66.85, the exchange ratio will be 0.5774.

Using the example above, we can see that the actual compensation received by the target company is not known until the merger is completed.

Generally the merger completion date is not known prior to the actual closing. The closing is controlled by the acquiring company and its attorneys. The impact of the collar calculations and the use of trading periods with an uncertain beginning and ending date have the effect of limiting short-selling activities by arbitrageurs during this period. Until the trading period on which the exchange ratio is based begins, the arbitrageur does not need to enter short orders to set up a hedged position. If the arbitrageur knew the exact date for the transaction's closing, he or she could begin their hedging activity as the trading period commences according to the merger agreement. However, since the closing date is not known, the arbitrageur must estimate the closing date and therefore estimate the date of the trading periods that determine the exchange ratio. The overall effect of this uncertainty regarding when the trading period begins and ends is that the arbitrage process is limited to the trading period at the end of the transaction and the arbitrageurs do not know the exact dates over which to hedge the transaction. We expect to find that arbitrageurs will be active entering their short-sale orders in the period that immediately precedes the closing of the stock mergers in our sample. We have designed our measurement methodology to attempt to capture the effects of arbitrage activity during this period.

Prior literature on collar merger transactions has not examined the microstructure aspects of the trading in the acquiring companies' shares. The study by Fuller (2003) focused on the wealth effects on the target and acquiring companies. She also examined the motivation for using collars. Officer (2004) also studied the motivations for the use of collars in merger agreements. Among

the reasons for using collars, however, they did not consider the possibility that acquiring companies wish to limit the process of arbitrage that involves the short-selling of acquiring company shares.

The main contribution of this paper will be to provide evidence of the changes that occur in the trading of the acquiring company's shares once stock merger transactions are announced. Additionally we will examine the effects of using collars and their effects on the arbitrage process.

### **3. Data and Methodology**

In order to study the impact of arbitrage on the trading of acquiring company share and the effect of using collars, we used four basic data sources: Thomson's Merger and Acquisition Database, and the New York Stock Exchange's TAQ Data, the CRSP database and proxy and registration filings made by acquiring companies with the Securities Exchange Commission. The trade and quote data is filtered to include only relevant trades and quotes.

We use all stock mergers and mergers that include a mixture of cash and stock (mixed mergers) involving target and acquiring companies listed on the New York Stock Exchange, American Stock Exchange and NASDAQ. We use the SDC Platinum Merger and Acquisition Database from Thomson Financial to obtain the overall sample of successful and unsuccessful stock and mixed mergers. We use a two-year period beginning on January 1, 1997 to December 31, 1999. We include all stock and mixed mergers that are announced during this two-year period. We omit transactions where the target company trades below \$5

per share since arbitrageurs are not likely to take positions in the target and therefore the acquiring company in these low-priced situations. In order to eliminate problems with liquidity, we also only examine transactions that have a deal value in excess of \$100 million.<sup>9</sup>

We collect trade and quote data on the acquiring companies in all the mergers from the TAQ Database over the following four time frames:

- 1.) Period -1: Five days of data ending 30 days prior to the initial merger announcement. This period is referred to as the base period.
- 2.) Period 1: Five days after the initial merger announcement (day 0 to day 4).
- 3.) Period 2: Five days in the middle between the initial merger announcement date and either the closing or cancellation of the transaction.
- 4.) Period 3: Five days prior to either the completion of the deal or the cancellation of the merger.

Period -1 is the base period calculation that is based on data one month prior to the merger being announced. This is done to avoid the effects of insider trading or the trading on rumors in the marketplace.

We compute the mean for the different segments of five-day trading data in order to run our statistical tests on both the individual acquiring companies as well as on pooled data. The data is examined both in the overall sample as well as by sub-samples. We examine the differences based on whether the mergers have collars or no collars in order to determine the differences and the effect collars have on the short-selling and hedging by risk arbitrageurs in the acquiring company's shares. We examine the results over the three five-

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<sup>9</sup> Generally arbitrageurs do not concentrate their activity on deals that have a value less than \$100 million.

day time periods after mergers are announced and compare these results with the base period in order to see the changes that occur due to the trading of arbitrageurs in the acquiring companies shares. We also examine the final five-day period and compare the results with the various periods to evaluate the effectiveness and effects of mergers that utilize collars.

Excess volume is calculated as follows:

$$EV_{f,t} = V_{f,t} - V_f \quad t = -105, \dots, +41 \quad (1)$$

$V_{f,t}$  is equal to the volume on day  $t$  for firm  $f$ , and  $V_f$  is the mean of  $V_{f,t}$  for the days -105 to -21.

Cumulative excess volume for day  $t$  of firm  $f$  is then calculated as follows:

$$CEV_{f,t} = V_{f,t} - CEV_{f,t-1} \quad t = -105, \dots, +41 \quad (2)$$

We examine excess volume to provide evidence of short-selling by arbitrageurs as well as to explain changes in the market microstructure of acquiring companies once merger transactions are announced. We use price and volume data from the CRSP database to perform our analyses. The methodology is similar to that used by Asciglu, McInish and Wood (2002).

The dollar spread between the bid and ask prices is calculated as follows:

$$\text{Dollar Spread} = \text{Ask (or Offer) Price} - \text{Bid Price} \quad (3)$$

Percentage spread is calculated as follows:

$$\text{Percentage Spread} = (\text{Ask Price} - \text{Bid price}) / \text{Mean of Bid and Ask Prices} \quad (4)$$

The bid size and offer size is calculated for each acquiring company from the TAQ Database based on the acquiring company's primary stock exchange listing. We then calculate the mean bid and ask size over each five-day period

and determine the mean of the entire sample. This mean is reported in the tables.

The classification of orders being either buy or sell orders is determined using the methodology developed by Lee and Ready (1991). This means that trades that occur at prices above the mid-point of the bid and ask prices are considered to be buy orders. Similarly, trades that occur at prices below the mid-point are considered to be sell orders. Trades occurring at the mid-point are classified according to the “tick test.”<sup>10</sup>

The calculation of the adverse selection component of the bid-ask spread according to the models of Huang and Stoll (1997) and Lin, Sanger and Booth (1995). The model is a one-step decomposition of the information component of the spread as a percentage of the overall spread. In this model, the components of the spread are determined by measuring how prices change as a function of the prior trade in the marketplace.

We estimate the adverse selection component from the following regression equation:

$$Q_{t+1} - Q_t = \lambda Z_t + e_{t+1} \quad (5)$$

Where:

$Q_t$  = the quote midpoint at time t.

$A_t$  = asking price at time t.

$B_t$  = bid price at time t.

$Z_t = P_t - Q_t$

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<sup>10</sup> In the tick test, we look to see if the trade is done on an uptick or downtick. If the trade is on an uptick, the trade is classified as a buy. Conversely, if the trade represents a downtick, the trade is classified as a sell order.

$Z_t$  = one-half of the signed effective spread at time  $t$ .

$P_t$  = trade price of stock at time  $t$ .

$\lambda$  = the proportion of the spread due to adverse information costs (the adverse selection component of the spread).

## **4. Results**

### **4.1 Descriptive Statistics**

We started out with a sample of 406 stock and mixed mergers that were announced over the two-year period from January 1, 1998 to December 31, 1999. The distribution of the merger announcements can be seen in Table 1. In each year mergers that contained collars accounted for approximately 20% of the total sample of stock and mixed mergers. Examining the sample on a quarter by quarter basis reveals no clustering issues. With the exception of the third quarter in 1998 and the third quarter of 1999 collar transactions accounted for between 16% and 28% of all stock and mixed merger announcements.

In the entire sample, 62.8% of the acquiring companies involved in the merger sample were listed on the New York Stock Exchange. The remainder of the acquiring companies were listed on NASDAQ (36.2%) and the American Stock Exchange (1.0%).

Panel C shows that approximately 90% of all the stock and mixed mergers in the sample were successfully completed.

Table 2 shows the breakdown of transactions in our sample by type of merger. Stock mergers represent 87% of the total sample with mixed mergers accounting for

the remaining 13%. While only 17.56% of pure stock mergers utilized a collar, almost 34% of mixed mergers included a collar. The breakdowns by year were quite similar, so that again, we do not seem to have any clustering issues.

## **4.2 Excess Volume**

In order to determine the effects that the process of risk arbitrage has on the trading in shares of the acquiring company and in order to assess the effectiveness of using collars in stock transactions we initially look at excess volume as an indicator of arbitrageurs operating in the market as well as an indicator of short-selling. We measure excess volume similar to the paper by Ascioglu, McNish and Wood (2002).

In Table 3 we notice that we lose some observations over our data period due to incomplete data in the CRSP database on our target companies. Later, we have a similar result when using TAQ data on our acquiring companies. From the data in Table 3 we can see the volume of trading in the acquiring companies increases significantly once stock and mixed mergers are announced. In the overall sample, trading as measured by excess volume increases to 188% over the pre-announcement measurement period. We did not include the twenty trading days just prior to the merger announcements in order to avoid any bias created by insider trading or the effects of rumors. When we examine the non-collar subsample, we see that post-announcement, trading increase to 199% of the pre-announcement base period level. Both increases are statistically significant at the 1% level.

Stock and mixed mergers that employ the use of collars do not initially see the same level of increased trading. In the initial five-day trading period following the announcement, we find excess volume of only 146% with collar transactions. In the middle five-day trading period, the level of excess volume is also less in collar deals versus non-collar deals (33% vs. 44%). We had expected a lower level of trading in collar transactions since there is no need for arbitrageurs to be entering short-sell orders until the collar pricing period is in effect. These results confirm that using collars limits the process of arbitrage and short-selling. In the final five-day period (Period 3) we have the expected result of increased excess volume with collar transactions. The measure of excess volume in this period is 213% of pre-announcement levels and is significant at the 1% level. This compares to 146% in non-collar transactions. Again we find evidence that collars are an effective tool in limiting the effect of arbitrage and short-selling in the market.

### **4.3 Dollar Spreads**

Once transactions are announced and arbitrageurs enter the market, the question becomes what changes occur in the market microstructure of trading in the acquiring companies' shares? We first examine the changes in the spread between the acquiring companies' bid and ask spreads. When arbitrageurs enter the market in the acquiring companies' shares, they do so by entering orders to sell-short shares of the acquiring company. The overall effect we find is that this activity causes the spread between bid and ask prices (in terms of dollars) to decline.

In our overall sample, we see declines in all three post-announcement periods that are statistically significant at the 1% level. In the first five-day period after the

announcements, the spread declined \$0.0282 or 14.7% from the base five-day period that ends thirty days prior to the announcement dates. As we described with our excess volume calculations, we eliminated the thirty-day period just prior to the announcements to reduce the possibility of biases in our estimates.

The decline in the dollar spread was the greatest in the five-day period that just precedes the closing or cancellation of the mergers. In this period the dollar spread represented a 20% decline from the pre-announcement levels. The next question that should be addressed is – why do these spreads decline? We believe the answer lies in the level of competition in the market once mergers are announced. Arbitrageurs need to sell shares short in the acquiring company in order to hedge their long positions in the target company. While arbitrageurs could offer the shares short at the existing offer level that exists in the market, it is more likely that since arbitrageurs are more sensitive to order execution on the short side as opposed to execution price, they may be attracted to offer their shares below the existing offer level. As long as this offer represents an uptick from the previous trade, a lower offer improves the chances that the arbitrageur's offer will be executed. Improving the offer level puts the arbitrageurs in direct competition with the specialist, market-makers and other traders. This increased competition has the effect of compressing the bid-ask spread and it also improves the efficiency of the market. As we discussed earlier, on the short-side arbitrageurs are most interested in order execution as opposed to their functioning as value traders in the target companies' stocks.

In cases where there are no collars utilized in the mergers, arbitrageurs are actively shorting shares of the acquiring companies in all three post-announcement periods. In all three periods we found the expected result. Dollar spreads declined, with the largest

decline occurring in the final five-day trading period. All three declines are significant at the 1% level.

When we examine the dollar spreads in collar transactions, we find a different result. The decline in the spread between the bid and ask in the first two five-day periods are less than with non-collar deals and are only significant at the 5% level in the first post-announcement period. The decline in the middle five-day period is not statistically significant. The spread decline, however, is the largest in the final five-day period when arbitrageurs would be actively shorting shares. These results are consistent with our expectation that the use of collars limits the effect of arbitrage to the final time period that includes the pricing period contemplated by the collar merger agreement. The dollar spread in the final five-day period represents a decline of over 23% from the base measurement period. The result in the period where arbitrageurs are actively shorting shares is also significant at the 1% level. We also compare the statistical significance of the decline from Period 2 to Period 3 in Panel C of Table 4. This decline is \$0.0192 and is significant at the 5% level.

#### **4.4 Percentage Spreads**

The next parameter we examine is the percentage change in spread between the bid and ask prices. These results are included in Table 5. Similar to our results using the dollar spread, overall we find that percentage spread between the bid and offer prices decline once stock mergers are announced. In the first five days after merger announcements we had a 14% from our base period measurement. While the decline was mitigated slightly in the middle five-day period, the decline in the final five-day period was almost as large as in the initial period after the merger announcements. The declines

in all three post-announcement periods were statistically significant. We attribute the declines to the activities of arbitrageurs entering the market. In their effort to seek execution of their orders to sell-short shares, we believe they compete with other market participants. This competition narrows the spread and improves market efficiency.

When we examine stock mergers that do not include collars, we again see that the trading of arbitrageurs leads to a decline in spreads. While the decline is statistically significant in all periods, it is most significant (at the 1% level) in the first five-day period after the merger announcements. The decline in the spread in the other two measurement periods is less significant.

We find different results when examining mergers that utilize collars. In this subsample we expected to see the largest effect in the final five-day period since that would be when arbitrageurs would be shorting shares of the acquiring company. Our findings confirmed our expectation. Collars, again, seem to limit the effects of arbitrage trading. While the percentage spread also declined in the first two measurement periods, the declines were not statistically significant.

#### **4.5 Bid Size**

The next aspect of trading we examine is the behavior of bid size for the acquiring company. After the mergers were announced we found significant increase in the size of the bid in all three measurement periods with the largest coming in the first five-day period. These results can be seen in Table 6. In the initial period after the announcements we found an increase of an average of 978 shares or 33.4% from the base period measurement. We found similar increases in mergers with and without collars.

We believe these results may be explained in two ways. First of all, we found that trading activity in the acquiring companies' shares increases dramatically after stock merger announcements. This increased level of trading activity could tend to attract additional traders to the security. Potential buyers could be attracted as well as potential sellers. Additionally, while arbitrageurs are active on the sell side, knowledgeable traders recognize this activity. Since they know that arbitrageurs need an uptick to short shares, there may be a "ready supply" of shares on an uptick. Buyers may believe that instead of seeking an immediate execution with a market order, they can instead enter a limit order for the shares. By initially being less aggressive in their actions to purchase shares, they may receive a lower execution price if a motivated seller enters the market. This motivated seller, if they are not selling-short, may need to be more aggressive in pricing their order if the order is superceded by arbitrage short orders. The way this motivated seller obtains an execution is to either entering a market order to sell or a limit order to sell at a price that may represent a downtick. This aggressiveness may result in the stock trading on a downtick and in doing so, the bidder receives an execution on the bid side of the market.

When examining stock mergers with no collars, we find statistically significant increase in bid size in all three post-announcement periods. However, in collar transactions, the only statistically significant increase in bid size occurs in the final five-day period prior to closing or cancellation. This is the period that arbitrageurs are most active on the sell side shorting shares of the acquiring companies. Apparently, short-selling activity results in an increase in bid size in the acquiring companies.

## 4.6 Offer Size

Overall, we expected to see a large increase in the number of shares offered for sale after arbitrageurs enter the market. We expected to see the effect of arbitrage short orders to appear as increase in the offer size. Using our results in Table 7, we find the result that we expected. In all three five-day periods after stock mergers are announced the offering size increase and the increases are statistically significant. Initially the offering size increases from a mean of 3,432 shares to a mean of 6,192 shares. This 80% increase is a result of the arbitrage process. Arbitrageurs are actively trading in the acquiring company's shares using orders to sell short. The arbitrageurs need an uptick in order to set-up their hedged position. One way to accomplish this goal and receive an execution is to offer shares of the acquiring company at the lowest price possible that still represents an uptick. Overall, this activity provides additional liquidity to the market. The additional liquidity combined with the spread results discussed in earlier sections leads to a more liquid and viable market for acquiring company shares.

The increase in offering size is also evident in mergers that do not utilize a collar. This is what we would expect since arbitrageurs are initiating short orders throughout the time that the merger is outstanding. In these cases, we have statistically significant increases in offer size in all three post-announcement periods. The largest increase in both absolute and percentage terms occurs in the first five days of trading after the stock mergers are announced. In this period the offer size increases by an average of 2,887 shares to 6,246 shares. This represents an increase of 85.9%.

When we examine the results in Table 7 we find that when collars are employed, the largest increase in offering size, both in terms of absolute shares and percentage, occurs

in the final five-day period. In Period 3 the offering size increased 73.3% to a mean of 2,737 shares. This is the expected result since it is the period in which arbitrageurs would be hedging the stock merger by selling-short shares of the acquirer. The collar would cause the arbitrageur to wait for this final period to execute their short orders. Our data confirms this and demonstrates that collars are effective in primarily containing the short-selling activity to the final period.

#### **4.7 Buy Orders as a Percentage of Total Orders**

Another parameter that allows us to learn about the changes that occur when arbitrageurs enter the market is by examining the percentage of executed orders that can be classified as buy or sell orders. While our dataset does not specifically identify orders as buys or sells we estimate the nature of the order using methodology developed by Lee and Ready (1991). Table 8 shows the results of using the Lee and Ready (1991) methodology. In this table we classify each order as either a buy or sell order and the number of buy orders as a percentage of total orders is reported. Unlike those who believe that short-selling has a negative impact on trading that could lead to additional selling, our results actually show an increase in the percentage of orders classified as buy orders after stock mergers are announced. Despite arbitrageurs entering the market with their short-selling orders, buy orders increase in all three post-announcement periods. The increases are all significant in the overall sample at the 1% level using the Wilcoxon non-parametric test.

As we discussed in an earlier section of the paper, this result can be explained when we consider the classification methodology. Orders are classified by using the midpoint between the bid and ask prices. A buy order is determined when a trade occurs above the

midpoint. Sell orders are classified by a trade that occurs below the midpoint price. Since short-sellers need an uptick, they rarely can be aggressive in initiating the trade. Usually they have to offer their shares in the market at a price that represents an uptick. As a result, the execution of their order is dependent on a buyer entering the market on the offering side of the market. Should this happen the order would be executed at a price above the midpoint and therefore, would be classified as a buy order.

When we examine the sub-sample with no collars, we find similar results. In all three post-announcement periods the number of buy orders as a percentage of total orders increase significantly. Arbitrageurs are active during this entire period and their activity results in an increase in buy orders.

Table 8 also breaks out the results for stock mergers that utilize collars. We expected to see the effect of arbitrage to be concentrated in the five-day period just prior to the mergers either closing or being cancelled. The results do not confirm the expectation. In fact, the most significant change occurs in the first five days of trading after the announcements. The number of orders classified as buy orders increases to 55.41%. Increases also occur in the other two five-day periods but are not statistically significant. We currently do not have an explanation for this result.

#### **4.8 Adverse Selection Component**

The final aspect of trading we examine in our study is the adverse selection component of the spread. The adverse selection component is calculated according to the model by Lin, Sanger and Booth (1995). The results for our sample are shown in Table 9. While arbitrageurs can be considered to be informed traders when they trade in the stocks of target companies, the arbitrage trades in the acquiring companies are different.

In trading the acquiring company's shares, the arbitrageur is simply seeking an execution to set up a hedged position. When analyzing the target company the arbitrageur may be compared to an informed value trader as he or she evaluates the pricing of the target, the potential returns from the deal, the risk of non-completion and the probability that the merger will successfully close.<sup>11</sup> Once the arbitrageurs determines to set up a position in a specific stock merger, they are trading in the acquiring company to set up the short side of the hedged position. Since they are not operating as value traders or informed traders, we would not expect the adverse selection component to expend. In traditional microstructure research, when informed traders enter the market, market makers widen the spread to compensate for trading with informed traders.<sup>12</sup> In the case of trading in the acquiring company shares after stock mergers are announced arbitrageurs are providing liquidity to the market. They increase the supply of shares being offered in the market and the effect of their activities causes the spread between the bid and ask prices to decline. All these factors lead to a more efficient market in the securities of acquiring companies' shares.

Table 9 shows that in all three post-announcement five-day periods the adverse selection component declines. In the overall sample all three declines are significant at the 5% level using the Wilcoxon test. Using a sample of only stock mergers that do not incorporate collars into their merger agreements we get similar results. The trading of arbitrageurs results in a decline in the adverse selection component.

We also report the results on our collar sub-sample in Table 9. The announcement of stock mergers and the resulting changes in the trading of the acquiring companies'

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<sup>11</sup> See Moore (1999) for a full description of the key elements of the arbitrage process.

<sup>12</sup> See Kyle (1985) for an explanation of informed trading and its effects on the adverse selection component.

shares results in a decline in the adverse selection component. This decline is statistically significant in the middle and final five-day periods. Clearly, when stock mergers are announced and arbitrageurs enter the market we see significant changes in the market.

## **5. Robustness of the Results**

In addition to evaluating the changes based on whether the mergers include a collar or not, we classified our sample according to different characteristics. For instance, our sample includes both stock and mixed mergers. Since stock mergers are “pure” stock mergers with no cash consideration it is possible that these two types of transactions have different types of characteristics. We split our overall sample into the two types of transactions and evaluated the various microstructure parameters.<sup>13</sup> The results involving dollar and percentage spreads were quite similar to reported results for the overall sample. Both dollar and percentage spreads declined significantly after the deals were announced. Additionally, both bid and offer sizes increased for both stock and mixed mergers. The increase in offer size was largest in mixed mergers as compared to both “pure” stock transactions and the overall sample.

The percentage of orders classified as buy orders were also similar despite splitting our sample by type of transaction. In both cases the percentage of orders classified as buy orders increased. The increase, however, was not as large when we examined mixed mergers. When we calculated the adverse selection component depending upon the type of transaction, the adverse selection component declined for both stock and mixed mergers. The decline in mixed mergers was however less than that for stock mergers and the overall sample.

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<sup>13</sup> While these results are not specifically reported in the tables, they are available upon request.

We also split our overall sample to see if whether the transaction was successfully completed (vs. being cancelled) had a significant or different effect on the trading characteristics after the arbitrage process was introduced to the acquiring companies' shares. Results for dollar and percentage spreads as well as for bid and offer sizes were similar to those results already reported in the paper. While the declines in the spread for cancelled mergers were less than for successfully completed transactions and the overall sample, that result could be due to the small sample size. Only about 10% (22) of our transactions were terminated.

After splitting the sample into completed and cancelled transactions we did not find much of a difference in our results when considering the percentage of orders classified as buy orders or the adverse selection component. The percentage of buy orders generally rose regardless of the deal's outcome and the adverse selection component declined in each sub-sample. Therefore, our overall results and conclusions do not differ depending upon whether the transaction is successfully completed.

## **6. Summary and Conclusions**

In this paper we studied a sample of over 400 mergers for stock or a combination of stock and cash. We used over 13 million quotes and 15 million trades in our sample to examine the effect that the process of risk arbitrage has on shares of the acquiring company as well as the effectiveness of using collars in stock transactions. Overall, we found that the process of risk arbitrage and the related short-selling in the shares of the acquiring company improves the efficiency of the market in the bidder's shares.

We found that once stock transactions are announced, trading levels increase significantly in the shares of the acquiring company. Using excess volume calculations we find evidence that using collars in structuring stock mergers limits the effects of risk arbitrage and short-selling.

We also found that once stock mergers are announced and arbitrageurs enter orders to sell-short shares of the acquiring company the market for acquiring company shares becomes more efficient and less costly for traders and investors, alike. Both dollar and percentage spreads between the acquiring company's bid and ask price levels decline significantly after the announcements. In collar transactions these declines occur are most significant at the end of the transaction. This confirms that using collars limits the effects of arbitrage and short-selling.

By tracking bid and offer size after stock mergers are announced we find that both bid and offer size increase giving the market additional depth. The additional depth is evident in all three of our measurement periods in stock mergers that do not employ collars. In cases where the parties institute collars, the additional depth is concentrated in the collar period. This result again confirms the effectiveness of collars in limiting the effect of arbitrage and the related short-selling of acquiring company shares.

Our results when examining the percentage of total trades classified as buy orders and the adverse selection component of the spread also confirm our expectations that the process of risk arbitrage has some positive effects on the market. We also find that collars are an effective way to limit the effect of arbitrage short-selling in the shares of acquiring companies.

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## **Tables**

**Table 1**

**Sample Descriptive Statistics**

This table summarizes the mergers used in this paper, based on whether the announced mergers have collars or no collars. Panel A details a breakdown by whether the merges include a collar. The table includes mergers that entirely for stock as well as mergers that have consideration of both stock and cash. All mergers are classified by the date of the initial merger announcement. Panel B summarizes mergers by exchange listing while Panel C shows whether the mergers were completed or cancelled.

**Panel A**

Year	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<b>1998</b>										
<b>Non-Collar Mergers</b>	42	77.78%	47	83.93%	33	94.29%	37	71.15%	159	80.71%
<b>Collar Mergers</b>	12	22.22%	9	16.07%	2	5.71%	15	28.85%	38	19.29%
<b>Total</b>	54	100.00%	56	100.00%	35	100.00%	52	100.00%	197	100.00%
<b>1999</b>										
<b>Non-Collar Mergers</b>	41	83.67%	46	80.70%	43	69.35%	37	90.24%	167	79.90%
<b>Collar Mergers</b>	8	16.33%	11	19.30%	19	30.65%	4	9.76%	42	20.10%
<b>Total</b>	49	100.00%	57	100.00%	62	100.00%	41	100.00%	209	100.00%
<b>Total</b>										
<b>Non-Collar Mergers</b>	83	80.58%	93	82.30%	76	78.35%	74	79.57%	326	80.30%
<b>Collar Mergers</b>	20	19.42%	20	17.70%	21	21.65%	19	20.43%	80	19.70%
<b>Total</b>	103	100.00%	113	100.00%	97	100.00%	93	100.00%	406	100.00%

**Panel B - Acquiring Company**

Exchange Listing	Number	Percent
<b>NYSE</b>	255	62.81%
<b>AMEX</b>	4	0.99%
<b>NASDAQ</b>	147	36.21%
<b>Total</b>	406	100.00%

**Panel C**

Deal Outcome	Number	Percent
<b>Completed</b>	365	89.90%
<b>Cancelled</b>	41	10.10%
<b>Total</b>	406	100.00%

**Table 2****Distribution of Stock and Mixed Mergers**

This table summarizes the breakdown of mergers announced between January 1, 1998 and December 31, 1999. The data is broken-down by type of merger. Stock mergers include mergers whose sole consideration is stock of the acquiring company. Mixed mergers are mergers which include both the stock of the acquiring company as well as a cash component. All mergers are classified according to the initial transaction announcement.

Year	1998		1999		Two-Year Total	
	Number	Percent	Number	Percent	Number	Percent
<b>Stock Mergers</b>						
<b>Non-Collar</b>	149	81.87%	142	83.04%	291	82.44%
<b>Collar</b>	33	18.13%	29	16.96%	62	17.56%
<b>Total</b>	182	100.00%	171	100.00%	353	100.00%
<b>Stock and Cash</b>						
<b>Non-Collar</b>	10	66.67%	25	65.79%	35	66.04%
<b>Collar</b>	5	33.33%	13	34.21%	18	33.96%
<b>Total</b>	15	100.00%	38	100.00%	53	100.00%
<b>Total</b>						
<b>Non-Collar</b>	159	80.71%	167	79.90%	326	80.30%
<b>Collar</b>	38	19.29%	42	20.10%	80	19.70%
<b>Total</b>	197	100.00%	209	100.00%	406	100.00%

**Table 3****Acquiring Company Excess Volume**

This table shows the excess volume in the acquiring companies' trading in the three post-announcement 5-day periods. Excess volume is calculated as follows:

$$EV_{f,t} = V_{f,t} - V_f \quad t = -105, \dots, +41$$

$V_{f,t}$  is equal to the volume on day  $t$  for firm  $f$ , and  $V_f$  is the mean of  $V_{f,t}$  for the days -105 to -21.

Cumulative excess volume for day  $t$  of firm  $f$  is then calculated as follows:

$$CEV_{f,t} = V_{f,t} - CEV_f, t-1 \quad t = -105, \dots, +41$$

	Period One	Period Two	Period Three
<b>Panel A - All Mergers</b>			
N	377	377	377
Mean - Excess Volume	1.8855	0.4195	1.5995
t-value	10.4083	7.5100	4.9365
Significance	***	***	***
<b>Panel B - No Collars</b>			
N	301	301	301
Mean - Excess Volume	1.9916	0.4404	1.4635
t-value	9.1584	6.6931	3.9486
Significance	***	***	***
<b>Panel C - Collars</b>			
N	76	76	76
Mean - Excess Volume	1.4659	0.3365	2.1383
t-value	5.7898	3.5719	3.2612
Significance	***	***	***
<b>Panel D - All Stock Mergers</b>			
N	332	332	332
Mean - Excess Volume	1.9571	0.4468	1.5919
t-value	9.7523	7.2834	4.4128
Significance	***	***	***
<b>Panel E - All Mixed Mergers</b>			
N	45	45	45
Mean - Excess Volume	1.3577	0.2180	1.6553
t-value	4.1448	1.8794	3.0575
Significance	***	*	***

**Table 4****Dollar Spreads - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows the mean dollar spreads between the acquiring company's bid and ask prices over four different 5-day time periods. The dollar spread is calculated as follows: Dollar Spread = Ask Price - Bid Price. The spread for each day is calculated for each company from the TAQ database on the acquiring company's primary stock exchange. We then calculate the mean dollar spread over each 5-day period and then take the mean of the entire sample. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial acquisition announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>	<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>					
Period -1 vs Period 1	366	0.1918	0.1636	-0.0282 ***	-5.2008
Period -1 vs Period 2	363	0.1918	0.1637	-0.0281 ***	-4.2026
Period -1 vs Period 3	340	0.1918	0.1534	-0.0384 ***	-6.4110
<b>Panel B - All Transactions with No Collars</b>					
Period -1 vs Period 1	295	0.1926	0.1639	-0.0287 ***	-4.8399
Period -1 vs Period 2	292	0.1926	0.1638	-0.0288 ***	-3.9793
Period -1 vs Period 3	273	0.1926	0.1556	-0.0370 ***	-5.5504
<b>Panel C - All Transactions with Collars</b>					
Period -1 vs Period 1	71	0.1887	0.1623	-0.0264 **	-2.0441
Period -1 vs Period 2	71	0.1887	0.1635	-0.0252	-1.4402
Period -1 vs Period 3	67	0.1887	0.1443	-0.0444 ***	-3.2589
Period 1 vs Period 2	71	0.1623	0.1635	0.0012	0.4121
Period 1 vs Period 3	67	0.1623	0.1443	-0.0180	-1.5208
Period 2 vs Period 3	67	0.1635	0.1443	-0.0192 **	-1.8744

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.

**Table 5****Percentage Spreads - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows the mean percentage spreads between the acquiring company's bid and ask prices over four different 5-day time periods. The percentage spread is calculated as follows: Percentage Spread = (Ask Price - Bid Price)/Mean of Bid and Ask Prices. The spread for each day is calculated for each company from the TAQ database on the acquiring company's primary stock exchange. We then calculate the mean dollar spread over each 5-day period and then take the mean of the entire sample. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial acquisition announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>	<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>					
Period -1 vs Period 1	366	0.5725	0.4926	-0.0799 ***	-2.8871
Period -1 vs Period 2	363	0.5725	0.5165	-0.0560 **	-2.0035
Period -1 vs Period 3	340	0.5725	0.4995	-0.0730 **	-2.3543
<b>Panel B - All Transactions with No Collars</b>					
Period -1 vs Period 1	295	0.5838	0.5046	-0.0792 **	-2.4768
Period -1 vs Period 2	292	0.5838	0.5311	-0.0527 *	-1.7633
Period -1 vs Period 3	273	0.5838	0.5127	-0.0711 *	-1.8447
<b>Panel C - All Transactions with Collars</b>					
Period -1 vs Period 1	71	0.5257	0.4429	-0.0828	-1.5382
Period -1 vs Period 2	71	0.5257	0.4564	-0.0693	-0.9180
Period -1 vs Period 3	67	0.5257	0.4456	-0.0801 *	-1.7168
Period 1 vs Period 2	71	0.4429	0.4564	0.0135	0.6120
Period 1 vs Period 3	67	0.4429	0.4456	0.0027	0.2684
Period 2 vs Period 3	67	0.4564	0.4456	-0.0108	-0.8052

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.

**Table 6****Bid Size - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows the mean bid size for all acquiring companies in the sample over four different 5-day time periods. The bid size is quoted in terms of 100 share trade lots from the TAQ database. The bid size for each day is calculated for each company from the TAQ database on the acquiring company's primary stock exchange listing. We then calculate the mean bid size over each 5-day period and then take the mean of the entire sample. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial acquisition announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>	<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>					
Period -1 vs Period 1	366	29.25	39.03	9.78 ***	3.7279
Period -1 vs Period 2	363	29.25	31.76	2.51 *	1.9011
Period -1 vs Period 3	340	29.25	35.20	5.95 ***	3.0236
<b>Panel B - All Transactions with No Collars</b>					
Period -1 vs Period 1	295	28.97	38.66	9.69 ***	3.5162
Period -1 vs Period 2	292	28.97	31.33	2.36 *	1.6543
Period -1 vs Period 3	273	28.97	33.55	4.58 **	2.4257
<b>Panel C - All Transactions with Collars</b>					
Period -1 vs Period 1	71	28.97	38.66	9.69	1.1914
Period -1 vs Period 2	71	28.97	31.34	2.37	0.9343
Period -1 vs Period 3	67	28.97	33.55	4.58 **	1.9937
Period 1 vs Period 2	71	38.66	31.34	-7.32	-0.3101
Period 1 vs Period 3	67	38.66	33.55	-5.11	-0.7838
Period 2 vs Period 3	67	31.34	33.55	2.21	1.1034

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.

**Table 7****Offer Size - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows the mean offer size for all acquiring companies in the sample over four different 5-day time periods. The offer size is quoted in terms of 100 share trade lots from the TAQ database. The offer size for each day is calculated for each company from the TAQ database on the acquiring company's primary stock exchange listing. We then calculate the mean offer size over each 5-day period and then take the mean of the entire sample. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial acquisition announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>	<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>					
Period -1 vs Period 1	366	34.32	61.92	27.60 ***	6.2852
Period -1 vs Period 2	363	34.32	42.97	8.65 ***	2.6169
Period -1 vs Period 3	340	34.32	48.62	14.30 ***	3.8267
<b>Panel B - All Transactions with No Collars</b>					
Period -1 vs Period 1	295	33.59	62.46	28.87 ***	5.9438
Period -1 vs Period 2	292	33.59	42.33	8.74 **	2.5121
Period -1 vs Period 3	273	33.59	44.67	11.08 ***	3.3154
<b>Panel C - All Transactions with Collars</b>					
Period -1 vs Period 1	71	37.36	59.65	22.29 *	1.8687
Period -1 vs Period 2	71	37.36	45.57	8.21	0.8037
Period -1 vs Period 3	67	37.36	64.73	27.37 **	2.0363
Period 1 vs Period 2	71	59.65	45.57	-14.08	-1.1383
Period 1 vs Period 3	67	59.65	64.73	5.08	0.2301
Period 2 vs Period 3	67	45.57	64.73	19.16	1.3121

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.

**Table 8****Buy Orders as a Percentage of Total Orders - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows the percentage of buy orders executed in the acquiring companies stocks contained in the sample. The classification of whether an order is a buy or sell order was determined using methodology developed by Lee and Ready (1991). The bid and ask sizes as well as the execution price and size are used to determine the type of order. The percentage for each security for each day is calculated for each company from the TAQ database on the acquiring company's stock exchange primary listing. We then calculate the mean percentage of orders executed as a buy order for all acquiring companies in the sample over four different 5-day time periods. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>		<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>						
Period -1 vs Period 1	370	51.56%	54.91%	3.35%	***	6.0165
Period -1 vs Period 2	368	51.56%	53.61%	2.05%	***	3.1492
Period -1 vs Period 3	345	51.56%	54.29%	2.73%	***	4.8651
<b>Panel B - All Transactions with No Collars</b>						
Period -1 vs Period 1	299	51.31%	54.79%	3.48%	***	5.3629
Period -1 vs Period 2	297	51.31%	53.62%	2.31%	***	3.0474
Period -1 vs Period 3	278	51.31%	54.16%	2.85%	***	4.5872
<b>Panel C - All Transactions with Collars</b>						
Period -1 vs Period 1	71	52.62%	55.41%	2.79%	***	2.5779
Period -1 vs Period 2	71	52.62%	53.59%	0.97%		0.8919
Period -1 vs Period 3	67	52.62%	54.82%	2.20%		1.5844
Period 1 vs Period 2	71	55.41%	53.59%	-1.82%	*	-1.8401
Period 1 vs Period 3	67	55.41%	54.82%	-0.59%		-0.7624
Period 2 vs Period 3	67	53.59%	54.82%	1.23%		1.1545

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.

**Table 9**

**Adverse Selection Component - All Stock and Mixed Mergers**

This table contains the sample of acquiring companies involved in stock and mixed (cash and stock) mergers from January 1, 1998 to December 31, 1999. The table shows adverse selection component of the spread in the acquiring companies stocks contained in the sample. The calculation of the adverse selection component was determined using the methodology developed by Lin, Sanger and Booth (1995). The bid and ask sizes as well as the execution price and size are used to determine the adverse selection cost. The component for each security for each day is calculated for each company from the TAQ database on the acquiring company's stock exchange primary listing. We then calculate the mean adverse selection cost for all acquiring companies in the sample over four different 5-day time periods. The initial 5-day base period (Period -1) is the 5-day period that ends on the 30th day prior to the initial announcement. The second 5-day period (Period 1) represents the mean of the 5-day period from the announcement date until the fourth day after the initial announcement. The next period (Period 2) is the 5-day period midway between the announcement date and the closing or cancellation date. The final period (Period 3) includes the 5-day period prior to the closing or cancellation of the merger. The data is presented for all mergers (Panel A), for mergers without collars (Panel B) and mergers with collars (Panel C).

	<b>Number of Observations in Last Period</b>	<b>Mean Initial Period</b>	<b>Mean Last Period</b>	<b>Difference</b>		<b>Wilcoxon Z</b>
<b>Panel A - All Deals</b>						
Period -1 vs Period 1	370	0.3986	0.3781	-0.0205	**	-2.1767
Period -1 vs Period 2	368	0.3986	0.3715	-0.0271	**	-2.4749
Period -1 vs Period 3	345	0.3986	0.3855	-0.0131	**	-2.4801
<b>Panel B - All Transactions with No Collars</b>						
Period -1 vs Period 1	299	0.3870	0.3690	-0.0180	*	-1.8676
Period -1 vs Period 2	297	0.3870	0.3657	-0.0213	*	-1.7558
Period -1 vs Period 3	278	0.3870	0.3825	-0.0045	**	-1.8901
<b>Panel C - All Transactions with Collars</b>						
Period -1 vs Period 1	71	0.4472	0.4165	-0.0307		-1.1795
Period -1 vs Period 2	71	0.4472	0.3960	-0.0512	**	-2.2049
Period -1 vs Period 3	67	0.4472	0.3977	-0.0495	*	-1.8891
Period 1 vs Period 2	71	0.4165	0.3960	-0.0205		-1.4525
Period 1 vs Period 3	67	0.4165	0.3977	-0.0188		-0.6243
Period 2 vs Period 3	67	0.3960	0.3977	0.0017		0.3195

Note: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10% level.