

Price Pressure Around Mergers

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ABSTRACT

This paper examines the trading behavior of professional investors around 2,130 mergers announced between 1994 and 2000. We find considerable support for the existence of price pressure around mergers caused by uniformed shifts in excess demand, but that these effects are fairly short-lived, consistent with the notion that short-run demand curves for stocks are not perfectly elastic. We estimate that roughly one half of the negative announcement period stock price reaction for acquirers in stock-financed mergers reflects downward price pressure caused by merger arbitrage short selling.

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This paper examines price pressure in equity markets using a sample of 2,130 mergers announced between 1994 and 2000, where active trading between different investor types is common. Mergers are large corporate transactions that stimulate substantial trading for a variety of common investment strategies. For example, merger arbitrageurs are especially active at the announcement of most mergers and during pricing periods for certain types of stock-financed mergers. Similarly, index funds linked to the Standard and Poor's (S&P) indices are active traders at the merger closing for certain stock-financed mergers. While merger announcements convey information about the firms involved, merger closings and pricing periods are essentially void of new information, and therefore provide an interesting setting to study the magnitude and persistence of price pressure caused by uninformed trading.

Researchers studying the market for securities have long been interested in the notion of price pressure and downward sloping excess demand curves for stocks. In a perfect capital market excess demand curves for stocks are perfectly elastic—investors can buy or sell unlimited amounts of stock at a market price that reflects all relevant information. As a result, shifts in excess demand caused by uninformed trading will have no impact on price. In real world capital markets, market frictions will limit market forces from keeping excess demand curves perfectly elastic.

Scholes (1972) proposes two alternatives to the perfect capital market hypothesis. One alternative is the price pressure hypothesis, which asserts that prices will temporarily diverge from their information-efficient values with uninformed shifts in excess demand to compensate those that provide liquidity. Mechanically, this occurs when prices return to their information-efficient values, presumably over a short horizon. The second alternative is the long-run downward sloping demand curve hypothesis. If individual securities do not have perfect substitutes then arbitrage will be ineffective in keeping excess demand curves horizontal. Scholes is also one of the first to empirically test for price pressure effects by examining large block trades. However, it is difficult to hold the information effects associated with these trades

constant, and therefore to distinguish between competing hypotheses. If new information is revealed, all hypotheses predict a price change.

The most convincing evidence of price pressure for stocks comes from studies suggesting that uninformed demand affects prices. Harris and Gurel (1986) and Shleifer (1986) estimate abnormal returns for firms added to the S&P 500 index to be 3% on the inclusion day. Both papers argue that inclusions to the S&P 500 index convey no new information about future return distributions, but cause outward shifts in excess demand by investment strategies that track the S&P 500. Harris and Gurel interpret their findings as supportive of the price pressure hypothesis because they find nearly complete price reversal over a two-week interval. On the other hand, Shleifer views his results as evidence of downward sloping long-run demand curves for securities because he finds little evidence of a price reversal. Subsequently, several other studies have examined the S&P 500 inclusion effect and have generally found a partial price reversal, but an essentially permanent component as well (see Dhillon and Johnson (1991); Beneish and Whaley (1996); Lynch and Mendenhall (1997)). Recently, Wurgler and Zhuravskaya (2002) test the downward sloping demand curve hypothesis by classifying firms added to the S&P index on the basis of whether they have close substitutes. Consistent with the hypothesis that excess demand curves slope downward, the inclusion effect is greater for firms that lack close substitutes, where it is riskier for arbitrageurs to keep demand curves elastic.

To examine empirically the magnitude and persistence of price pressure effects in equity markets, we construct a comprehensive sample of mergers announced between 1994 and 2000. There are several critical points throughout a merger transaction that stimulate substantial trading activity, some of which is caused by new information about the future distribution of returns, but much of which is unrelated to new information. Merger pricing periods and closing dates reveal virtually no new information about future returns, but are central dates for merger arbitrage and investment strategies tracking the S&P indices. We measure changes in short interest and changes in stock prices around these critical points across the merger transactions, with special emphasis on those dates that contain no new information. We find considerable support for the

existence of price pressure around mergers caused by uniformed shifts in excess demand, but that these effects are fairly short-lived.

On average, acquiring firms paying with cash experience a positive stock price reaction at the merger announcement, while firms that use stock to finance their purchase encounter a negative reaction at announcement. For most stock mergers, the announcement period stock price reaction coincides with both the release of new information and large increases in short selling by merger arbitrageurs. However, for acquiring firms in floating-exchange ratio stock mergers, merger arbitrageurs do not short sell until a pricing period that is usually three months after the announcement. There is typically very little new information revealed about the future return distribution for the acquirers' stocks during the pricing period, as the terms of the transaction and the dates of the pricing period are pre-specified. The reaction to this type of merger at announcement is positive, but there is a negative stock price drift averaging -3.2% during the pricing period. Over the subsequent month, the acquirers' stock prices rebound 2.5% , on average.

We also find evidence of price pressure related to portfolio rebalancing by index funds. The consummation of a stock-financed merger triggers portfolio rebalancing for equity value-weighted investment strategies, such as those tracking the Standard and Poor's (S&P) Indices. To minimize tracking error, investment strategies linked to these indices must rebalance their portfolios as close to the merger closing date as possible. When a merger involving an S&P member firm is expected to require portfolio rebalancing, we find a stock price run-up of nearly 3% in the days around the merger closing, followed by a one-month reversal of roughly 1.5% . Interestingly, we find no evidence of price pressure effects around merger closings for transactions that are not expected to require portfolio rebalancing, such as for cash-financed mergers.

Finally, we document a link between the negative stock price reaction to stock-financed mergers and the amount of short selling that occurs over the month surrounding the announcement. The median increase in short interest for acquiring firms around fixed-exchange

ratio stock mergers is 40%. The level of short interest falls dramatically when the merger closes, consistent with the expected trading behavior of merger arbitrageurs. Moreover, the cross section of stock price reactions to stock-financed mergers is related to the change in short interest that occurs over the month surrounding the announcement. After controlling for changes in short interest due to merger arbitrageur trading, the negative average announcement period stock price reaction to stock-financed mergers is only -1.44%, whereas the average reaction is -2.65% without controlling for the effects of price pressure. This suggests that roughly half of the negative reaction reflects downward price pressure caused by merger arbitrage short selling.

This paper is organized as follows. Section I explains the timing and motive for trade by various professional investor types around mergers, Section II describes the data, Section III discusses price pressure effects from merger arbitrage, Section IV provides evidence on price pressure effects due to index rebalancing, Section V interprets the results and discusses the impact of price pressure on measuring the value effects of mergers and event studies in general, and Section VI concludes.

I. The Trading Patterns of Various Professional Investor Types Around Mergers

Professional investors are responsible for much of the trading in equity markets. Shleifer and Vishny (1997) emphasize that professional investors are often specialized, in that they focus on a single, or limited number, of investment strategies. In addition, the nature of professional money management "... is that brains and resources are separated by an agency relationship."¹ As a result, many professional investors are careful not to have their performance deviate too significantly from others that claim to follow similar investment strategies. For example, investment funds that track the S&P indices attempt to minimize their tracking error by purchasing new index additions as close to the closing price on the effective date as possible, despite having to pay a liquidity premium to do so. Another type of professional investor, the

¹ Shleifer (2000), page 89.

merger arbitrageur, specializes in buying targets after mergers are announced. The typical merger arbitrageur minimizes tracking error by avoiding the investment until after a formal announcement of the merger and then by liquidating immediately upon the close of the merger. This type of behavior by professional investors, such as S&P index funds and merger arbitrageurs, induces interesting trading patterns around mergers, especially for stock-financed mergers.

A. The Trading Behavior of Merger Arbitrageurs Around Mergers

The most obvious investment strategy that requires active trading around mergers is merger arbitrage (also called risk arbitrage). Merger arbitrage refers to a specialized investment strategy that essentially amounts to providing insurance to target firm shareholders against deal failures. As a result of a merger announcement, the future return distribution of the target firm is dramatically altered, as the target firm's stock trades at a small discount to the consideration offered by the acquiring company. If the merger is successful, this discount diminishes as the merger approaches consummation, generating a small positive holding period return. However, if the merger fails, the target firm's stock price usually falls dramatically, generating a large negative return. Merger arbitrageurs are compensated for bearing this transaction risk.²

The key to the merger arbitrage trade is the link between the target firm's shares and the consideration promised by the acquiring firm. This link is severed if the merger agreement falls apart, but otherwise guides the arbitrage trade. Since merger arbitrageurs specialize in isolating and bearing transaction risk, there is no reason for them to be exposed to overall market risk. Thus, merger arbitrageurs attempt to profit from the spread between the promised consideration and the current target firm stock price.

For cash mergers, the merger arbitrage trade is simple—buy shares of the target firm's stock and hold until the merger closes. The merger arbitrageur provides liquidity to the

² See Mitchell and Pulvino (2001) for a description of the risks and returns from merger arbitrage.

shareholders of the target firm that want to sell on the announcement day and in the days that follow. Trading activity is very high on the announcement day and remains high for several days as merger arbitrageurs enter their investment positions. When the merger transaction is consummated, the merger arbitrageurs, and any other shareholders of the target firm, receive cash for their shares. The investment is complete with no additional trading.

Capturing the arbitrage spread in stock mergers is slightly more complicated, involving trades in both the target and acquiring firms' stock. Again, the merger arbitrageur buys shares in the target firm. However, because the link between these shares and the promised consideration now involves shares in the acquiring firm rather than simply cash, isolating transaction risk requires the arbitrageur to also trade shares in the acquiring firm. The appropriate trade in the acquiring firm's stock depends on whether the stock offer is a fixed-exchange ratio offer, a floating-exchange ratio offer, or a collar offer.

Fixed-exchange ratio stock mergers are the most straightforward of the stock-financed mergers. At announcement, the acquirer agrees to exchange a fixed number of acquirer shares for each target share. Consequently, for each target share purchased, the merger arbitrageur sells short the fixed number of acquirer shares per the merger agreement. In order to minimize market risk, these trades are typically placed simultaneously, and often in terms of a limit spread order. While merger arbitrageurs may provide some liquidity in the target firm's stock, they demand liquidity in the acquirer's stock because the arbitrage trade requires the immediate shorting of acquirer shares. When the merger closes, the short position in the acquirer's shares is cancelled when the shares owned in the target firm are exchanged for acquirer shares.

For example, in September 2001, Hewlett Packard agreed to acquire Compaq Computer and pay 0.6325 shares of Hewlett Packard for each share of Compaq. The merger arbitrageur attempting to capture the arbitrage spread would soon after the announcement short sell 0.6325 shares of Hewlett Packard for every share of Compaq purchased. When the merger closed in May 2002, the long position in Compaq was converted into 0.6325 shares of Hewlett Packard,

exactly offsetting the original short position in Hewlett Packard, such that no additional trading was necessary.

Unlike fixed-exchange ratio offers that specify the number of acquirer shares to be exchanged for each target share, floating-exchange ratio stock offers specify the *value* (V_{Offer}) of the acquirer's stock to be exchanged for each target share. The number of acquirer shares that will ultimately be exchanged for each target share is determined later, by dividing the offer value by the acquirer's average stock price ($P_{Average}$) measured during a pre-specified pricing period. The pricing period typically occurs just before merger closing, which is at least 2 months after the merger is announced. From the arbitrageur's perspective, floating-exchange ratio mergers are similar to cash mergers before the pricing period begins, as the promised consideration is specified in units of dollars. However, after the pricing period ends, floating-exchange ratio mergers are identical to fixed-exchange ratio mergers, as the promised consideration is specified in units of acquirer shares. Therefore, the arbitrageur is not short any acquirer shares prior to the pricing period and is short $V_{Offer} / P_{Average}$ acquirer shares after the pricing period. The important point is that, to isolate transaction risk, arbitrageurs short sell the acquirer's stock during the pricing period. Therefore, price pressure effects on the acquirer's stock in floating-exchange ratio stock mergers are expected to be greatest during the pricing period, when short selling peaks. It is important to note that because the pricing period occurs well after the merger announcement (usually three months later), there is virtually no new information about the future return distribution of the acquirer's stock price revealed during the pricing period.

Finally, in addition to fixed and floating-exchange ratio offers, there are more complicated types of stock mergers, typically referred to as collars.³ For example, one common type of collar augments the floating-exchange ratio by providing both a maximum and a minimum number of acquirer shares that will be issued for each outstanding target share. Another type of collar augments a fixed-exchange ratio merger by specifying both a minimum

³ For a discussion of why firms use collars in mergers, see Fuller (2000) and Officer (2001).

and maximum value of the acquirer stock that will be issued. The consideration offered in collar transactions can be viewed as a portfolio consisting of the acquirer's stock and options on the acquirer's stock. As with any portfolio of options, collar transactions can be "delta-hedged" with stock positions or by trading in the options market. For the analysis presented in this paper, the important feature of collar transactions is that isolating transaction risk requires more short selling at announcement than is required for floating-exchange ratio stock mergers and less short selling at announcement than is required for fixed-exchange ratio stock mergers. To the degree that arbitrageurs delta hedge collar transactions, the short interest in the acquirer's stock will continuously change as the acquirer stock price changes.

B. The Trading Behavior of S&P Index Funds Around Mergers

The S&P 500 Composite Stock Price Index is the most common of the S&P equity indices, but there are numerous others, including the S&P MidCap 400 and the S&P SmallCap 600. All of the S&P indices are market value-weighted indices, which are tracked explicitly and implicitly by numerous mutual funds, pension funds, and other professional investors. Today, more than \$1 trillion is indexed to the S&P 500, accounting for 8.5% of its total value. Professional investors who track the S&P indices try to minimize deviations between their performance and that of the target index. As a result, changes in the composition of an index—either the actual members of the index or the weights of the existing members—can stimulate substantial portfolio rebalancing. Mergers are a frequent cause of both types of these changes.

The first situation where a merger stimulates trading by S&P index funds is when the merger itself triggers an addition or deletion in the S&P index. An acquisition of an S&P member firm always leads to its deletion from the index, and often leads to the addition of the acquiring firm if the acquirer is not already an S&P member. However, S&P does not always replace a target company with its acquirer. For example, General Re disappeared from the S&P 500 Index when Berkshire Hathaway acquired it in December 1998, but Berkshire, with its

\$2,000 share price, was not included because S&P felt that it was too illiquid. S&P instead added Carnival Corporation.

The second situation where a merger leads to rebalancing of an S&P index occurs when a stock-financed merger triggers an immediate rebalancing of an S&P index without a change in the names of the index members. This is the result of an S&P index rule that requires an immediate rebalancing in the event of a 5% or greater change (absent stock splits and dividends) in the number of shares in one of its members. Absent a 5% change in shares outstanding, the index rebalances quarterly on the basis of changes in shares outstanding. Stock mergers often trigger the 5% rule. When a stock-financed merger is consummated, the acquiring firm issues additional shares in exchange for the target shares outstanding. The target shares are cancelled, and the market value of the acquirer's equity increases. This increase in the acquirer's equity value affects value-weight investment strategies that have positions in the acquiring firm. Moreover, the magnitude of this rebalancing can be quite large. For example, in December 1996, WorldCom (member of S&P 500) acquired MFS Communications (non-member of S&P 500). Upon the close of this merger, WorldCom issued 462 million shares, more than doubling total shares outstanding from 409 million to 871 million. Correspondingly, S&P increased the weight of WorldCom in the S&P 500 Index from 0.74% to 1.58%, effective at the close of trading on December 31, 1996. With roughly 8.5% of the S&P 500 held by index funds, these funds would be expected to purchase an additional 29 million shares in WorldCom near the merger closing date. This situation is sometimes referred to as a "hidden addition."⁴ Hidden additions around certain stock-financed merger closings are interesting because they stimulate large trades that are not motivated by new information.

⁴ We thank Diane Garnick at State Street Global Advisors for discussions on this issue.

C. Implications for Price Pressure

The trading behavior by professional investors described above has several implications for price pressure around mergers. The cleanest situations in which to look for uninformed demand affecting prices is during pricing periods for floating-exchange ratio stock mergers and at closing dates for stock-financed mergers when the merger induces index rebalancing. At the same time, there should be no price pressure effect at merger closing when index rebalancing is unnecessary. This will be the case for cash-financed mergers, where cash is exchanged for other assets leaving the acquirer's equity value unchanged, and for stock-financed mergers between firms that are already members of the same S&P index.

II. Data Description

The dataset for this study includes all mergers and acquisitions of U.S. publicly-traded firms (NYSE, NASDAQ, and AMEX) that are delisted between 1994 and 2000 because of a merger or acquisition, as well as all U.S. publicly-traded firms that receive unsuccessful merger and acquisition bids. Critical transaction information such as announcement dates, agreement dates, termination dates, entry of a second bidder, and transaction terms is obtained by reading Dow Jones News Wires, Press Release Wires, Reuters Newswires, and *Wall Street Journal* articles relating to each merger transaction. For complicated transactions involving floating-exchange ratios and collars, information is gathered from merger agreements and 8-Ks filed with the Securities and Exchange Commission (SEC). The 1994 starting point for the sample coincides with the on-line availability of SEC filings.

In addition to merger transaction and stock price information, we obtain short interest data directly from the NYSE, NASDAQ, and AMEX over the period 1994-2001. We modify the short interest data in the following ways. First, we correct errors caused by stock splits and stock dividends, via comparisons with the CRSP stock split data. Second, we fill in missing short interest data when appropriate, using alternative sources, such as Bloomberg and Barron's. Third, we correct major outliers in the data, again using Bloomberg and Barron's. Fourth, we

convert the monthly short interest data to a specific date in each month. For example, NASDAQ reported January 2002 short interest on January 28, 2002. Member firms were required to report their January short interest figures to NASDAQ as of settlement on January 15 (firms must report short positions as of settlement on the 15th of each month, or the preceding trading day if the market is not open on the 15th). In order to account for the delay in trade reporting, we calculate a trade date computed as three business days preceding the reporting date. For instance, in January 2002, the 15th occurred on a Tuesday, and thus the corresponding trade date was Thursday, January 10. We convert each short interest month to a specific trading date in that month in order to precisely match changes in short selling to specific merger event dates.

Table 1 presents a summary of the mergers used in this study, separated by announcement year and transaction type. The sample consists of 2,130 mergers including 736 cash mergers, 64 floating-exchange ratio stock mergers, 244 collar mergers, and 1,086 fixed-exchange ratio stock mergers. Based on market equity values, acquirers tend to be considerably larger than targets. The relative sizes of targets to acquirers vary according to the type of transaction. In the typical fixed-exchange ratio merger, the target is about 25% as large as the acquirer, whereas targets are about 10% of the size of acquirers in cash mergers and tender offers. The size differential is greatest in floating-exchange ratio mergers where the median relative size of target firms to acquirers is only 3%. One possible reason for the large size differential in floating-exchange ratio mergers is that the number of acquirer shares that must be issued can vary wildly depending on the acquirer's stock price during the pricing period. A significant decrease in the acquirer's stock price between deal announcement and the pricing period can result in the issuance of many more shares than what was anticipated at the merger announcement. If the target and acquirer sizes were close enough, and if the price change were large enough, control of the combined firm could be transferred to target shareholders. As a result, acquirers are only likely to offer floating-exchange ratios when the target is relatively small. As relative size increases, one way to mitigate the possibility that target shareholders own too much of the combined entity is to use a collar. As previously noted, collars can be used to

augment floating-exchange ratio mergers by placing upper and lower bounds on the number of acquirer shares to be exchanged for each target share. They can also be used to augment fixed-exchange ratio mergers to limit the value of acquirer shares to be issued to each target shareholder. Panel C of Table 1 shows that for collar mergers, the ratio of target market capitalization to acquirer market capitalization is 13%, approximately half way between the ratios for floating-exchange ratio mergers and fixed-exchange ratio mergers.

The last two columns of Table 1 describe acquirer stock price reactions to merger announcements by year. For cash mergers and tender offers, the average acquirer abnormal returns tend to be positive, averaging 0.96% (t -statistic = 3.48). In contrast, the average acquirer abnormal return in fixed-exchange ratio stock offers tend to be significantly negative, averaging -2.73% (t -statistic = -10.57), becoming more negative later in the sample period. Interestingly, acquirer abnormal returns in floating-exchange ratio stock mergers are positive whereas acquirer abnormal returns are negative for fixed-exchange ratio and collar transactions. Previous studies that have noted the difference in returns between cash and stock mergers conclude that stock mergers convey negative information regarding the acquirer's stock price. In later sections of this paper, we provide empirical evidence that roughly half of the negative acquirer reaction observed in fixed-exchange ratio stock mergers is caused by price pressure associated with merger arbitrage short selling around merger announcements.

III. Price Pressure Effects from Merger Arbitrage

In general, detecting price pressure effects around announcements of corporate events is problematic because of the simultaneous effects of price pressure and information revelation. To disentangle the price pressure and information effects, we examine acquiring firms' stock price changes around mergers. Merger arbitrage investment strategies require short sales in the acquiring firms' stock soon after the announcement for fixed-exchange ratio stock mergers and during the pricing period for floating-exchange ratio stock mergers. Clearly, the potential effects of price pressure at merger announcement are clouded by the new information released by the

announcement itself. However, floating-exchange ratio stock mergers represent a unique sample because of the separation between the short selling by merger arbitrageurs and the information released in the announcement. On average, the pricing period is three months after the announcement.

Table 2 displays abnormal returns for various types of mergers around announcement, closing, pricing period, and the entire transaction window. Daily abnormal returns (*ARs*) are calculated using the market model. Market model parameters are estimated over a 150-day window beginning 21 days after the merger closing or failure date, where the value-weighted CRSP index proxies for the market portfolio.⁵ Post-merger acquirer betas are used to control for changes in underlying assets and capital structure of the acquiring firm associated with the merger.

Consistent with the notion that short selling by merger arbitrageurs exerts downward pressure on the acquirers' stock, the announcement period abnormal returns are negative for fixed-exchange ratio and collar stock mergers. Cash mergers and floating-exchange ratio stock mergers are associated with positive announcement period abnormal returns on average. More interesting, however, are the average abnormal returns during the pricing period for floating-exchange ratio stock mergers, which are significantly negative. In particular, the cumulative average abnormal return (*CAAR*) is -3.18% (t -statistic = -2.79).

Arguably, there is virtually no new information revealed about the distribution of future acquirer returns during the pricing period. Both the merger consideration and the pricing period dates had been previously determined at the merger announcement. The unique aspect of this situation is that merger arbitrageurs are actively short selling the stocks of the acquirers over this period, roughly the same amount each day. Figure 1 displays the event-time *CAAR* around the

⁵Market model regressions are estimated using an intercept, but the daily *AR* is calculated assuming that the intercept is zero. We require at least 50 valid observations for the estimation. Cumulative average abnormal returns (*CAARs*) are the sum of daily *ARs*. Test statistics for average *ARs* and *CAARs* are calculated by dividing the mean by the standard error of the mean.

pricing period. The typical pricing period lasts for 10 trading days, ending 3 days prior to the merger closing date. However, the actual length can be different across merger transactions. Therefore, the figure incorporates a break after the fifth day into the pricing period, and then starts with the fifth day prior to the pricing period ending date. The *CAAR* is relatively flat prior to the beginning of the pricing period. Once the pricing period begins, the *CAAR* starts to drift down, and then immediately reverses direction at the end of the pricing period. The pricing period drift of -3.18% is almost completely offset by a subsequent one-month reversal of 2.53% (t -statistic = 2.09). This pattern is consistent with temporary price pressure caused by merger arbitrageurs short selling the stock of these acquirers.

To establish a link more directly between short selling of acquirers' stocks and the downward stock price drift throughout the pricing period, we examine changes in short interest over this interval. Table 3 reports the median percentage change in monthly short interest in event-time around merger announcements, closings, and pricing periods, by deal type. The last column of Panel A shows that for floating-exchange ratio stock mergers, the median change in short interest is small in the months before and after the pricing period, but a statistically significant 12.1% during the pricing period. This estimate probably understates the true increase in short interest because of the nature of the short interest data. As described in Section II, short interest is measured by the exchanges only once a month, and therefore, will coincide with the end date of the pricing period only by chance. Typically, the effective date of the measured short interest will occur at some point within the pricing period, before merger arbitrageurs have completed their short selling of the acquirer's stock. The bottom chart in Figure 2 also illustrates this increase in short interest during the month of the pricing period.

In addition, Figure 2 and Table 3 show changes in short interest around merger announcements and closings for all four types of mergers. For cash mergers and floating-exchange ratio mergers, where we have no reason to believe that merger arbitrageurs short sell the acquirer's stock, changes in short interest are essentially zero around both merger announcements and closings. On the other hand, for fixed-exchange ratio stock mergers, where

we expect merger arbitrageurs to short sell the acquirer's stock soon after the announcement and then maintain this short position until the merger closes, we find a large increase in short interest in the month of the announcement. The median change in short interest in the announcement month for fixed-exchange ratio stock mergers is 40%, and short interest continues to increase in the months between the merger announcement and close. In the month the merger is consummated, the median decrease in short interest is 31% as merger arbitrageurs have their short positions in the acquirers' stocks cancelled when their long positions in the targets' stocks are exchanged.⁶ For collar transactions that can be dynamically hedged, the level of merger arbitrage short selling around merger announcements is expected to be greater than the level observed for cash and floating-exchange ratio mergers and lower than the level observed for fixed-exchange ratio mergers. Figure 3 and Table 2 confirm that not only is this the case, but as with fixed-exchange ratio mergers, the observed increase in short interest reverses after merger closing. This evidence, combined with the pricing period abnormal returns for floating-exchange ratio stock mergers, suggests that short selling by merger arbitrageurs exerts significant downward price pressure on acquirers' stocks. Additional evidence establishing a direct link between merger arbitrage short selling and announcement period returns for fixed-exchange ratio and collar mergers is provided in Section V.

IV. Price Pressure Effects from Index Trading

As described in Section I, index funds tracking the S&P indices are active buyers of acquiring firms around the closing of certain stock-financed mergers. These purchases represent outward shifts in excess demand for the stocks of acquiring firms. Because these demand shifts are not driven by new information about future return distributions, they provide another setting to detect the presence of price pressure effects.

⁶ Note that the decline in short interest at the merger closing is less than the cumulative increase during the merger period in fixed-exchange ratio stock mergers. Much of this is simply because post-merger short interest is being compared to pre-merger short interest, without controlling for the increase in shares outstanding.

Figure 3 shows acquirer abnormal returns around merger announcement dates and closing dates. In the few days that precede the merger closing, acquiring firms in fixed-exchange ratio stock mergers (Panel C) experience a stock price run-up of about 2%, which is immediately reversed over the next several days. The run-up and subsequent reversal is not observed for cash and floating-ratio stock mergers (Panels A and B). As we show below, much of this abnormal return pattern can be linked to increases in index fund demand for these acquirer stocks.

Figure 4 separates mergers on the basis of whether index rebalancing is expected. The top panel of Figure 4 displays *CAARs* in cases where index rebalancing is expected. Here, *CAARs* drift up significantly in the days preceding the merger closing, and then partially reverse after the closing of the merger. In the bottom panel of Figure 4 where index rebalancing is not expected, the *CAARs* are essentially flat around merger closings. The graphs are consistent with the notion that index fund purchases exert upward price pressure on stocks.

In conjunction with Figure 4, Table 4 reports stock price run-ups and reversals around stock merger closings, again separated on the basis of whether the merger triggers index rebalancing. In particular, stock price run-ups are calculated as short-window *CAARs* beginning three days prior to merger closing through the peak day, where the peak day is identified as the day between closing and two days after closing that maximizes the *CAAR*. Stock price reversals are calculated as *CAARs* measured from one day after the peak day to twenty days after the merger closing.

A clear example where a merger completion leads to index rebalancing, requiring substantial purchases of the acquirer's stock, is when an S&P index member acquires a non-S&P member with stock. The consummation of this transaction increases the market value of the acquiring firm's equity as additional shares are issued in exchange for the target shares outstanding. This results in the acquiring firm now having a larger weight in the value-weighted index, effective on the day after the merger closing. For this type of merger, as shown in the top panel of Figure 4 and in Panel A of Table 4, the stock price run-up from three days before the

merger closing through one day after the close is 3.36%, with a t -statistic of 5.20. Over the next month, there is a partial stock price reversal of -1.32% (t -statistic = -1.44).

Index rebalancing due to a stock-financed merger completion can also trigger additional purchases of the acquirer's stock when both the acquirer and target are S&P members, but of different indices. Additional purchases are required when the index-tracking fund family only manages the index in which the acquirer is located, or because the fund family has a relatively smaller proportion of assets tracking the index in which the target is located versus the index in which the acquirer is located. Based on aggregate assets tracking specific indices, price pressure is likely to be greatest when (1) a S&P 500 firm acquires a S&P MidCap 400 firm or a S&P 600 SmallCap firm, or (2) a S&P MidCap 400 firm acquires a S&P SmallCap 600 firm. In these situations, the average stock price run-up is 1.63% (t -statistic = 2.31), followed by a complete stock price reversal over the subsequent twenty trading days of -2.51% (t -statistic = -1.75).

The cases above are sometimes referred to as the hidden additions, as there is infrequent attention paid to index rebalancing caused by these mergers. The third type of index rebalancing mergers are the more familiar additions to a S&P index as a consequence of a non-member S&P index firm acquiring a S&P index firm. Here, the stock run-up is 2.33% (t -statistic = 1.20) with a reversal of -1.16% (t -statistic = -1.12).

Interestingly, when merger completions do not lead to index rebalancing, which is the case for stock-financed mergers between acquirers and targets from the same S&P Index and for cash mergers, there is virtually no evidence of a stock price run-up or reversal. These cases are displayed in the bottom panel of Figure 4 and Table 4, respectively. For stock mergers involving members of the same index, the stock run-up is only 0.26% (t -statistic = 0.27) with a reversal of -0.73% (t -statistic = -0.68). For cash mergers, there is no run-up at all. Finally, in the case of stock mergers where neither the acquirer nor the target is a member of an S&P Index, there is a marginally significant stock price run-up of 1.00% (t -statistic = 1.94), followed by a complete reversal of -1.84% (t -statistic = -2.63) over the next month. Index effects for which we have not controlled likely cause this. Our analysis has focused solely on rebalancing of the S&P 400,

S&P 500, and S&P 600. If we were able to perfectly control for rebalancing of other stock indices, we would expect no run-up or reversal around merger closings for non-index acquirers that buy non-index targets.

Overall, it appears that outward shifts in demand linked to index rebalancing around merger closings lead to significant stock price increases, which at least partially reverse in the weeks that follow. This implies that excess demand curves for stocks are downward sloping in the short-run. There are two especially important aspects to these findings. First, for the results presented in Panel A of Table 4, the increases in demand are not motivated by new information about the distribution of future returns for the acquirers, but simply the rebalancing of the index caused by the merger completion. Second, this is not a general phenomenon that occurs around all merger closings, but only those where index funds are expected to make substantial purchases of the acquirers' stocks.

V. Reinterpreting Announcement Period Stock Price Reactions to Mergers

The negative stock price reaction to stock-financed mergers is often taken as support for information-based theories (Myers and Majluf (1984)) of financial policy, and investment policy (Jensen (1986) and Shleifer and Vishny (2002)). Researchers have interpreted the negative reaction either as (1) a signal that the acquirer's stock was previously overvalued or (2) an indication that the market perceives the merger to be a negative NPV project. The evidence presented in this paper suggests that some of the negative reaction to stock merger announcements is due to downward price pressure caused by merger arbitrage short selling of acquirers' stocks. In particular, if demand curves for stocks are downward sloping in the short-run, then increases in the supply of stock will cause the equilibrium price to decrease. Although the common assumption that stocks' supply curves are vertical and fixed may be reasonable in many situations, it is unlikely to hold during mergers, where short sellers dramatically increase the effective supply of shares soon after the merger announcement. This shift in the supply

curve, combined with downward sloping short-run demand, is likely to explain some of the negative reaction to stock-financed mergers.

In addition to our findings, there is other evidence that is consistent with the notion that short selling by merger arbitrageurs is at least partially responsible for the negative stock price reaction for acquirers at announcement of certain types of mergers. For example, Houston and Ryngaert (1997) examine announcement-period returns for 209 acquisitions in the banking industry. Unlike previous studies that focus on cash and fixed-exchange ratio stock mergers, Houston and Ryngaert also examine collar transactions. By modeling the collar offer as a portfolio of options, they estimate the sensitivity of the target shareholder's payoff to changes in the bidder's stock price. Results from their study indicate that when the target payoff sensitivity is zero (e.g. pure cash mergers), the acquirer stock price reaction is flat. Conversely, when the target payoff sensitivity is one (e.g. fixed-exchange ratio stock mergers), the acquirer stock price reaction is negative. For intermediate sensitivities, the acquirer stock price reaction is moderately negative and is directly related to the target's payoff sensitivity. Houston and Ryngaert interpret their results as supporting the adverse selection model of Hansen (1987), who argues that acquirers that are relatively undervalued will make cash mergers and stock mergers will be made by acquirers that are relatively overvalued. However, this interpretation is inconsistent with evidence provided by Fuller, Netter, and Stegemoller (2002) who examine announcement period abnormal returns for frequent acquirers. In their sub-sample of private targets, the average acquirer announcement period abnormal return is positive, independent of whether stock or cash is used as consideration.

Unlike the information-based adverse selection hypothesis, evidence related both to private transactions and collar transactions is consistent with price pressure caused by the trading behavior of merger arbitrageurs. Clearly, merger arbitrageurs are unable to buy equity in private targets, and therefore have no interest in shorting the acquirers' stocks. This is consistent with the positive acquirer returns observed for stock acquisitions of private targets. Furthermore, evidence related to collar transactions is consistent with merger arbitrageurs attempting to isolate

transaction risk by hedging against changes in the acquirer's stock price. As the sensitivity of the target's payoff to the bidder's price increases, merger arbitrageurs will more aggressively short sell the acquirer's stock. Price pressure caused by this short selling can produce negative announcement period returns.

A summary of acquirer announcement period returns from previous studies is provided in Table 5. With one exception (cash mergers in the banking sector analyzed by Houston and Ryngaert), average abnormal returns are negative when short selling of acquirers' stocks is expected soon after announcement, and positive when no short selling is expected. The negative acquirer stock price drift during pricing periods (see Figure 1) for floating-exchange ratio stock mergers reinforces the price pressure interpretation. In fact, the average abnormal return for floating-exchange ratio stock acquirers is -3.2% during pricing periods, which is more negative than the average reaction to other stock mergers at announcement.

Table 6 reports one additional link between acquirers' announcement period stock price movements and short selling by merger arbitrageurs. In particular, we examine the relation between acquirer announcement period *CAARs* and changes in days of short interest.⁷ Panel A shows that on average, there is virtually no change in short interest around cash and floating-exchange ratio merger announcements, but there is a significant increase around fixed-exchange ratio stock merger and collar merger announcements. For fixed-exchange ratio mergers, the median increase in short interest is equal to 1.7 days worth of the acquirer's trading volume, and the average increase exceeds 5 days of acquirer volume.

To determine how much of the announcement period return can be attributed to price pressure from merger arbitrage short selling, we examine average *CAARs* for different types of mergers after controlling for expected arbitrage activity. These estimates can be compared to

⁷ The change in days of short interest (ΔDSI) is measured as the change in short interest from pre-merger announcement to post-merger announcement, divided by the acquirer's median daily share volume. Median daily share volume is measured over the 63 trading days (one quarter) beginning 67 days before announcement and ending 5 days before announcement.

those that do not control for merger arbitrage short selling to determine whether price pressure effects are significant.

As a proxy for merger arbitrage activity, we estimate the expected change in days of short interest due to merger arbitrage trading. Note that our focus is only on the change in days of short interest attributable to merger arbitrageurs, not that which may come from fundamental traders. Therefore, we model the expected change in days of short interest as a function of deal attributes that guide arbitrage trading:

$$E(\Delta DSI) = \begin{cases} b_0 + b_1 \cdot \ln(RELSIZE) + b_2 HOSTILE & \text{if fixed - exchange ratio} \\ c_0 + c_1 \cdot \ln(RELSIZE) + c_2 HOSTILE & \text{if collar} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

Equation (1) is motivated by the observation that at announcement, merger arbitrageurs do not short sell the stocks of acquirers in cash mergers or in floating-exchange ratio stock mergers, as described in Section III. For fixed-exchange ratio stock mergers, merger arbitrageurs short sell the acquirers' stocks roughly in proportion to the relative size of the target and acquirers' market capitalizations. In a fixed-exchange ratio stock merger, where the exchange ratio is R , merger arbitrageurs short sell R shares of the acquirer for each share of the target that they buy. If merger arbitrageurs were to purchase all of the target shares outstanding, then the number of acquirer shares to be sold short is R x target shares outstanding. To make this measure of merger arbitrage short selling comparable across acquirers, we scale it by acquirer shares outstanding. As shown in equation (2), at merger completion, this measure is equivalent to the ratio of target to acquirer market capitalization:

$$RELSIZE = \frac{Price_{Target} \cdot Shares_{Target}}{Price_{Acquirer} \cdot Shares_{Acquirer}} = \frac{R \cdot Shares_{Target} \cdot Price_{Acquirer}}{Price_{Acquirer} \cdot Shares_{Acquirer}} = \frac{R \cdot Shares_{Target}}{Shares_{Acquirer}} \quad (2)$$

Additionally, merger arbitrageurs tend to reduce their exposure to deals that are viewed as "hostile." The dummy variable, *HOSTILE*, is included to capture this effect. To allow for

differences in arbitrage trading strategies for fixed-exchange ratio and collar mergers, the *RELSIZE* and *HOSTILE* coefficient estimates are allowed to take different values for fixed-exchange ratio and collar mergers.

Panel B of Table 6 reports results from estimation of equation (1). Consistent with the predicted trading behavior of merger arbitrageurs, the coefficient of *RELSIZE* is positive and highly statistically significant for both fixed-exchange ratio and collar mergers, while the coefficient on the *HOSTILE* dummy variable is reliably negative for fixed-exchange ratio deals.

The fitted values from the first-stage estimation, representing the expected change in days of short interest due to merger arbitrage, $E(\Delta DSI)$, are used as an independent variable in the second-stage regression:

$$CAAR = c_1 \cdot CASH + c_2 \cdot FLOAT + c_3 \cdot COLLAR + c_4 \cdot FIXED + c_5 \cdot E(\Delta DSI) \quad (3)$$

where *CASH*, *FLOAT*, *COLLAR*, and *FIXED* are dummy variables reflecting the terms of the merger transaction.⁸ There is no common intercept in this regression, as each transaction type has a separate intercept measuring the average *CAAR* for that deal type after controlling for the expected short selling behavior of merger arbitrageurs.

Panel C reports the results from the second-stage regression. Controlling for merger arbitrage short selling has a very significant impact. The coefficient on $E(\Delta DSI)$ of -0.0023 (t -statistic = -2.88) implies that the average increase in short interest around a fixed-exchange ratio merger announcement of five days would lead to a -1.2% incremental abnormal return for the acquirer. After controlling for the increase in short interest expected because of merger arbitrage trading, the reaction to fixed-exchange ratio stock mergers is only -1.44% and the t -statistic is -2.91. This can be compared to the coefficient estimate of -2.65% and t -statistic of -10.54 (Panel D) obtained without controlling for arbitrage short selling. Based on this comparison, we conclude that merger arbitrage short selling explains roughly one half of the

⁸ Standard errors in the second stage regression are adjusted to reflect the estimation error in the $E(\Delta DSI)$ variable.

negative announcement period return observed for fixed-exchange ratio stock mergers. For collar transactions, controlling for the increase in short interest associated with merger arbitrage again has a noticeable impact. The announcement period reaction is negative (-0.54%) when there is no control for merger arbitrage short selling and positive (0.26%) when the control for merger arbitrage short selling is included in the regression.

An alternative explanation for the observed relationship between changes in short interest and announcement period returns is that the announcement of a stock-financed merger signals that the acquirer's stock is overvalued. To correct this mispricing, traders may short the acquirer's stock resulting in an increase in short interest. According to this explanation, the increase in short interest is not caused by arbitrageurs, but rather by fundamental investors reacting to new information. However, unlike short selling by arbitrageurs, this alternative explanation cannot explain the pattern of short interest exhibited in the middle panel of Figure 2 and the Closing Period column in Panel B of Table 3. Both the figure and the table show a significant drop in short interest in the month when the merger closes. Fundamental short sellers would be expected to close their short positions when prices revert to fundamental values, not necessarily when mergers close. Moreover, we find no relation between changes in days of short interest and announcement period abnormal returns for cash mergers, even conditioning on those with negative *CAARs* where the market interprets the merger as bad news relative to expectations (results not reported). Fundamental traders seem to play virtually no role in explaining the results presented in Table 6.

There are two important implications of these findings. First, and most important, wealth effects estimated from announcement period event studies are biased down for certain types of mergers. This is not to say that price pressure effects dominate information effects. Rather, price pressure effects can be significant and should be accounted for before attempting to quantify the information content of merger announcement period returns. This applies to results from event studies of other corporate actions as well. Correctly interpreting event study findings around corporate announcements requires an understanding of the traders that are likely to be

active in the market, and the price pressure that they generate (see also, Maloney and Mulherin (1992), Frank and Jagannathan (1998), and Ederington and Goh (2001)). Second, these results have implications for the interpretation of short interest levels. In addition to reflecting the sentiment of investors with negative opinions, short interest levels reflect hedging activity by arbitrageurs around major corporate events. In the case of merger arbitrage and convertible bond arbitrage (see Mitchell, Pulvino, and Stafford (2002)), short selling by arbitrageurs is likely to dominate overall short interest levels.

VI. Conclusion

This paper studies price pressure effects in equity markets by examining the trading behavior of professional investors around mergers. We find support for the notion that index fund rebalancing and short selling by merger arbitrageurs lead to temporary price changes, which suggests that short-run demand curves for stocks are not perfectly elastic.

The evidence presented in this paper strengthens previous findings of price pressure effects, which for the most part all come from the same small sample of S&P 500 Index additions. While some of our evidence is index related, the pricing period results from floating-exchange ratio stock mergers are distinct, as is the direct link between downward stock price pressure and increases in short interest.

Finally, price pressure effects are likely to bias estimates of the wealth effect of stock mergers downwards. For the sample of mergers studied in this paper, we find that about one half of the negative announcement period stock price reaction to stock-financed mergers is due to downward price pressure caused by merger arbitrage short selling of acquirers' stocks. This is likely to be a problem for interpreting a variety of event study findings where the nature of the event triggers trading by uninformed investors.

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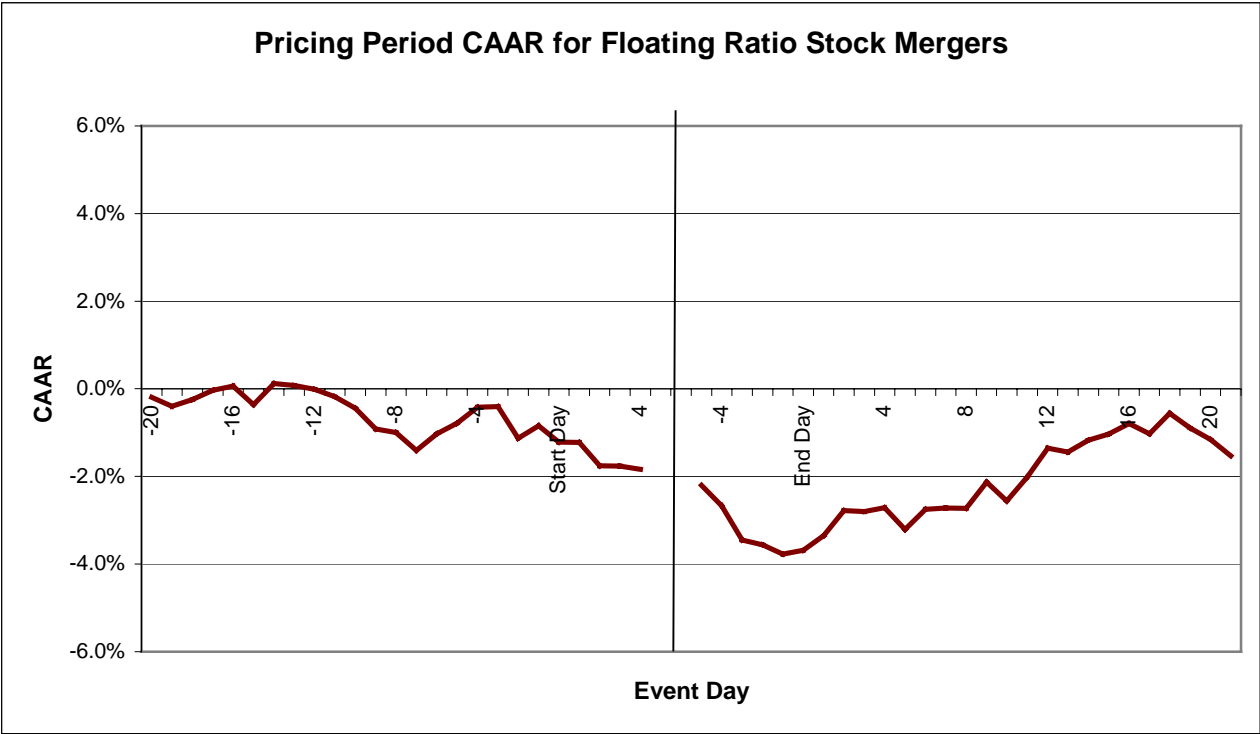


Figure 1. Acquirer Cumulative Average Abnormal Return During Floating-Exchange Ratio Pricing Periods. This figure displays average acquirer abnormal returns over the pricing period for successful floating-exchange ratio stock mergers during 1994–2000. The gap between the beginning of the pricing period and the end of the pricing period is caused by cross-sectional differences in pricing period lengths. Vertical locations of the beginning and ending segments are determined such that the correct average CAAR from 20 days prior to the beginning of the pricing period to 20 days after the end of the pricing period is maintained.

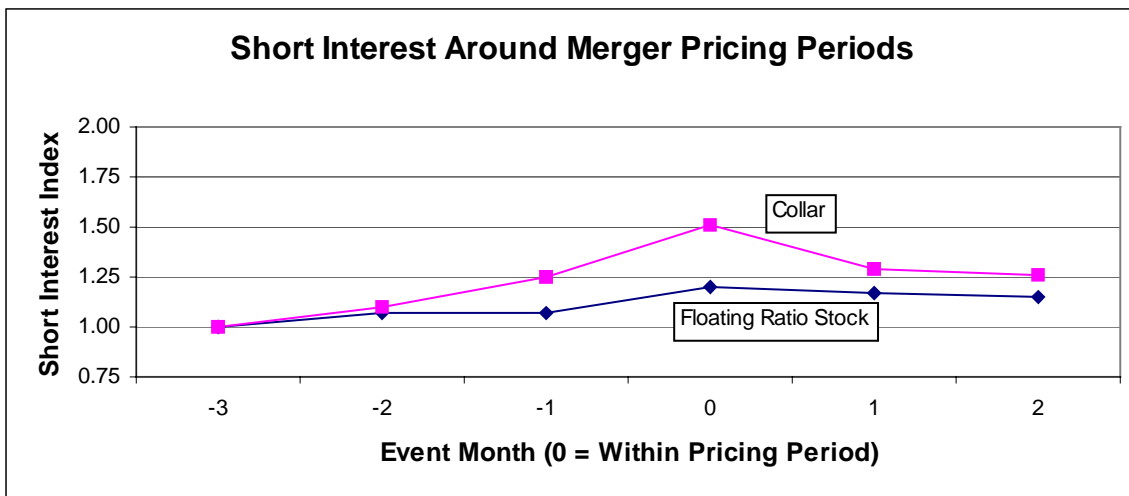
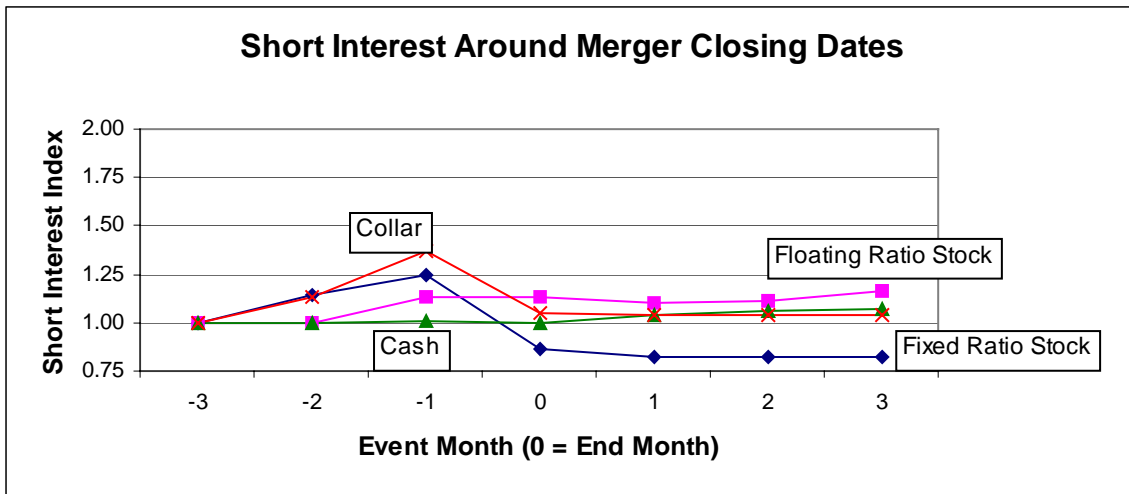
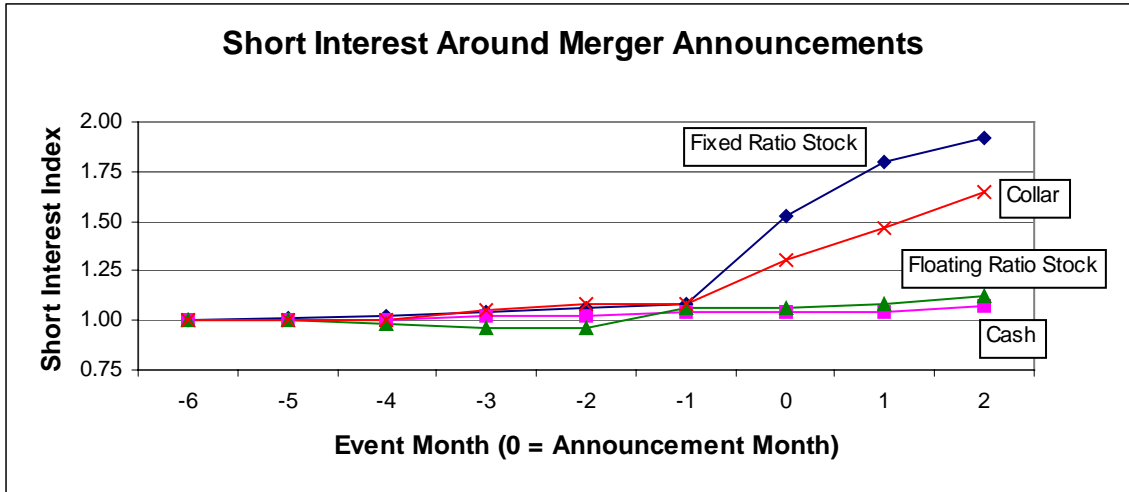


Figure 2. Acquirer Short Interest. This figure displays acquirer short interest as a fraction of short interest measured six months prior to merger announcement in Panel A, three months prior to closing in Panel B, and three months prior to the pricing period in Panel C. The top figure shows short interest around merger announcements for cash mergers, fixed-exchange ratio stock mergers, and floating-exchange ratio stock mergers during 1994–2000. The middle graph shows the short interest fraction around merger closing dates and the last figure shows the short interest fraction around the pricing period for floating-exchange ratio and collar mergers.

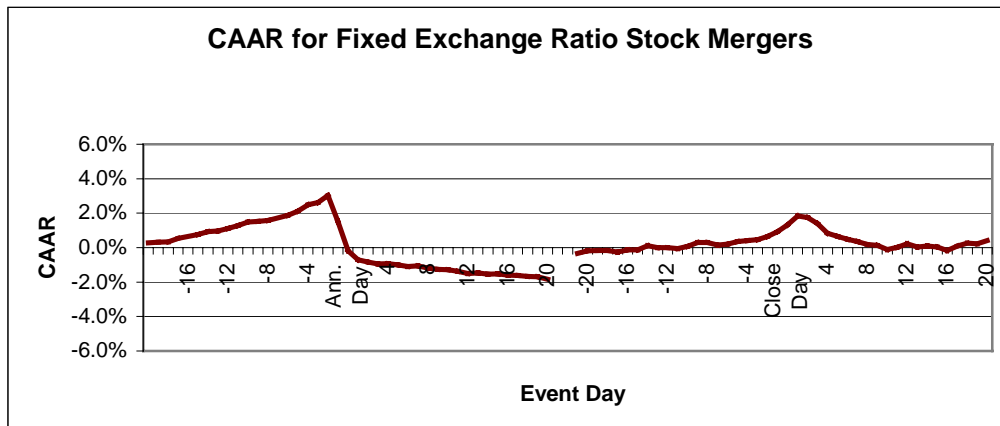
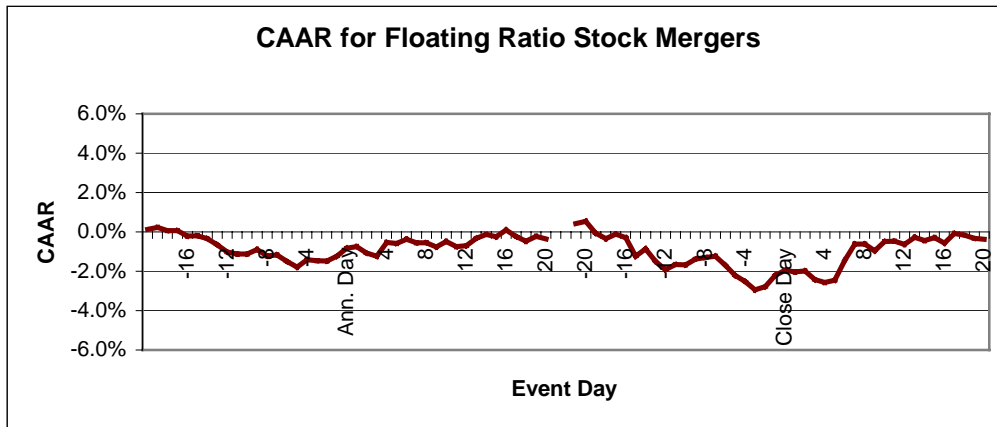
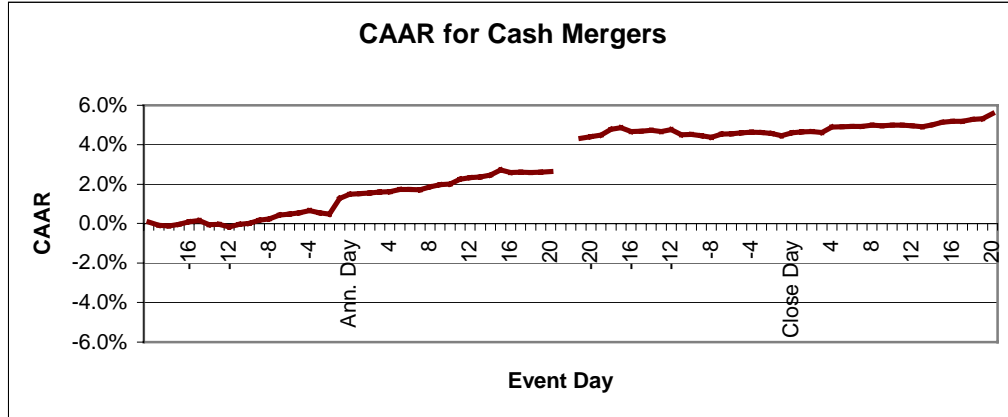


Figure 3. Acquirer Cumulative Average Abnormal Returns Around Merger Announcements and Closings. This figure displays average acquirer announcement period and closing period abnormal returns for cash mergers, fixed-exchange ratio stock mergers, and floating-exchange ratio stock mergers from 1994 – 2000. Gaps between announcement period segments and closing period segments are caused by differences in time-to-completion across mergers. Vertical locations of the announcement period and closing period segments are determined such that the correct average CAAR from 20 days prior to announcement to 20 days after closing is maintained.

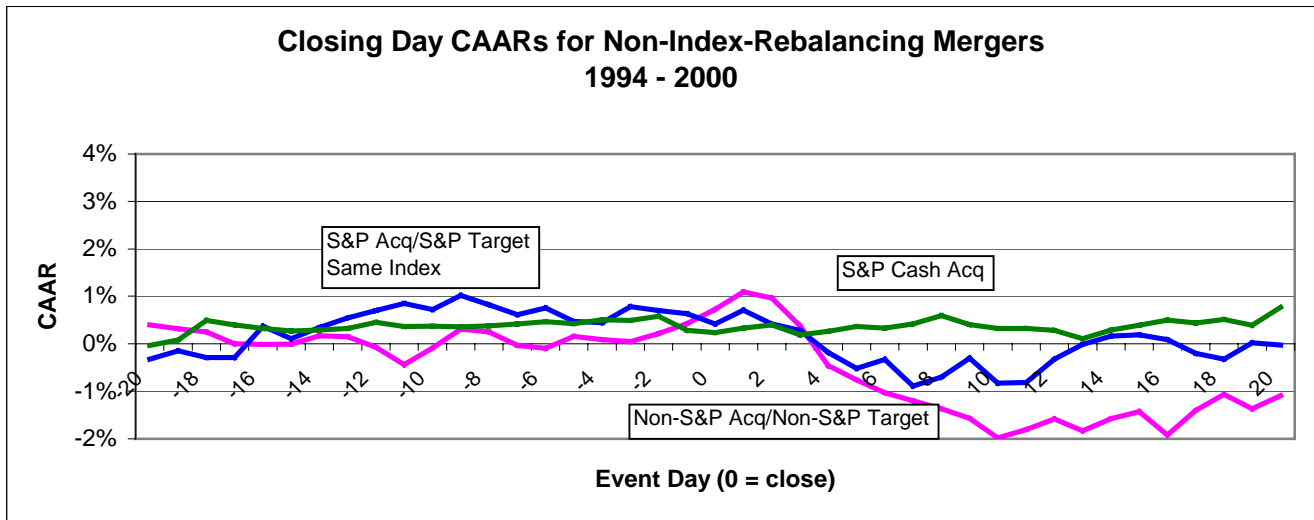
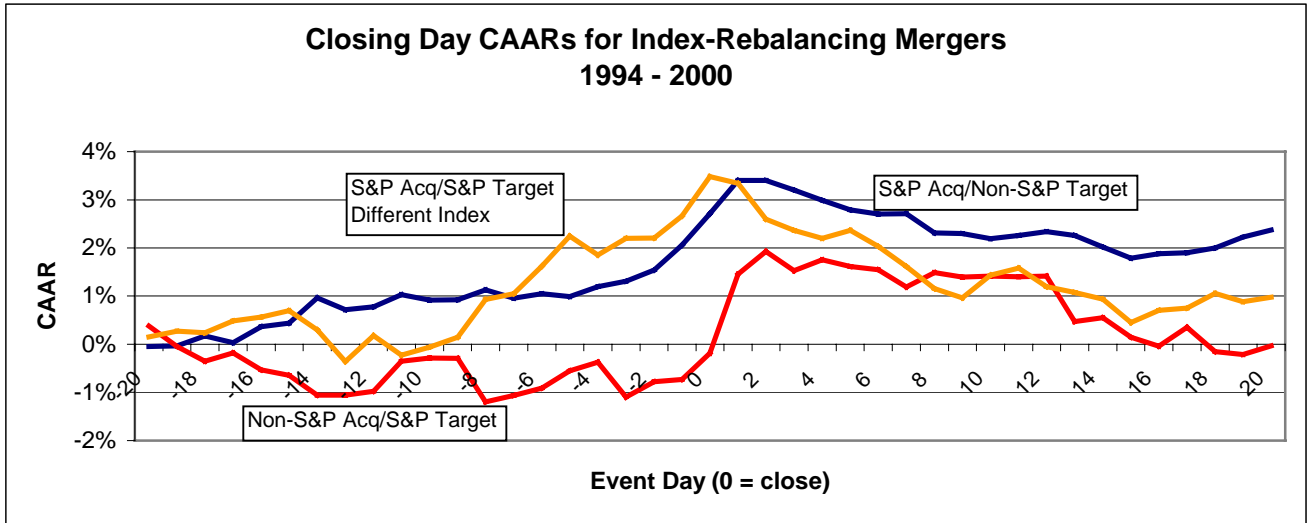


Figure 4. Effect of Index Trading on Acquirer Closing Period Returns. This figure displays average acquirer abnormal returns around merger closings for fixed-exchange ratio mergers during 1994–2000. The top graph presents acquirer returns for mergers where significant S&P 400, S&P 500, and S&P 600 index rebalancing is expected. The bottom graph presents acquirer returns for mergers where significant S&P 400, S&P 500, and S&P 600 index rebalancing is not expected.

Table 1
Merger Sample Summary, 1994 - 2000

This table summarizes the mergers used in this paper, based on form of consideration paid. Cash transactions consist of mergers where the consideration is 100% cash. Floating-exchange ratio stock transactions consist of mergers where the number of acquirer shares to be exchanged for each target share is specified as a dollar value per share divided by the average acquirer price over a pricing period that is specified at the merger announcement. Floating-exchange ratio transactions that contain an additional cash component are included in the sample. Collar transactions consist of mergers where the floating exchange ratio is limited by upper and lower bounds, or where the dollar value of acquirer stock to be issued in the merger is limited by upper and lower bounds. Fixed-exchange ratio stock transactions consist of mergers where the consideration is 100% stock and where the number of acquirer shares to be exchanged for each target share is fixed and specified at merger announcement. Acquirer equity market values are measured on the day after the merger announcement. The acquirer CAAR is measured over a three-day window surrounding the merger announcement date (see Table 2 for further explanation).

Year	Number Announced	Acquirer Market Equity (\$Millions)		Relative Size Median Target Equity Value/ Acquirer Equity Value	Acquirer CAAR[-1,+1]	
		Median	Average		Average	t-statistic
Panel A: Cash Mergers and Tender Offers						
1994	74	1,770	3,660	0.17	1.35%	2.09
1995	94	1,068	5,936	0.17	0.87%	1.49
1996	79	1,746	11,100	0.07	1.44%	2.43
1997	107	1,854	11,700	0.11	1.48%	2.45
1998	91	1,655	11,700	0.12	0.49%	0.84
1999	149	2,411	26,700	0.10	2.56%	2.66
2000	142	2,116	16,100	0.10	-1.23%	-2.39
Total	736	1,869	14,000	0.10	0.96%	3.48
Panel B: Floating-Exchange Ratio Stock Mergers						
1994	5	1,730	2,484	0.02	-1.20%	-1.73
1995	4	6,197	13,900	0.02	3.13%	1.22
1996	9	3,607	9,100	0.03	-0.10%	-0.11
1997	19	5,163	39,100	0.07	-0.12%	-0.12
1998	14	6,137	30,400	0.01	0.50%	0.50
1999	8	11,500	58,100	0.05	1.78%	2.10
2000	5	28,700	39,100	0.01	2.47%	1.70
Total	64	5,099	30,600	0.03	0.58%	1.28

Table 1 (continued)

Year	Number Announced	Acquirer Market Equity (\$Millions)		Relative Size	Acquirer CAAR[-1,+1]	
		Median	Average	Median Target Equity Value/ Acquirer Equity Value	Average	t-statistic
Panel C: Collar Stock Mergers						
1994	17	1,381	2,271	0.06	-1.07%	-1.36
1995	29	1,016	2,860	0.10	-2.06%	-2.08
1996	44	1,396	2,981	0.15	0.72%	0.84
1997	50	816	3,051	0.24	-0.06%	-0.06
1998	39	4,621	10,500	0.10	-1.50%	-1.25
1999	49	2,401	12,800	0.10	-1.97%	-2.15
2000	16	1,945	3,864	0.09	-0.67%	-0.20
Total	244	1,579	6,165	0.13	-0.88%	1.97
Panel D: Fixed-Exchange Ratio Stock Mergers						
1994	107	496	2,257	0.24	-1.82%	-2.50
1995	128	1,030	2,413	0.26	-1.84%	-2.75
1996	141	1,199	3,575	0.28	-2.12%	-3.53
1997	168	1,267	4,932	0.28	-2.21%	-4.23
1998	154	1,645	9,174	0.40	-3.26%	-5.13
1999	209	1,825	21,200	0.24	-3.23%	-4.85
2000	179	2,799	28,000	0.20	-3.86%	-4.72
Total	1,086	1,408	11,800	0.25	-2.73%	-10.57

Table 2
Announcement Period, Closing Period, and Pricing Period Cumulative Average Abnormal Stock Returns for Acquirers

Cumulative average abnormal returns (CAARs) are measured using a one-factor market model. Market model parameters are estimated over a 150-day window beginning 21 days after the merger close or fail date using the value-weighted CRSP index as a proxy for market returns. Event day 0 corresponds to the first day that merger effects can be incorporated into securities prices. Closing date returns are calculated for successful deals only. Mergers are classified as “Cash,” “Fixed-Exchange Ratio Stock,” and “Floating-Exchange Ratio Stock” based on the form of payment to target shareholders. In fixed-exchange ratio stock mergers, the number of acquirer shares to be given to each target shareholder is determined on the announcement date. In floating-exchange ratio stock mergers, the *value* of acquirer shares per target share is fixed on the announcement date. The actual number of acquirer shares issued per target share is obtained by dividing value by the average acquirer price during a later pricing period defined in the merger agreement. Test statistics are calculated using the standard error of the mean.

	Cash (No Hedge)	Floating-Exchange Ratio Stock (Late Hedge)	Collar Stock Mergers (Dynamic Hedge)	Fixed-Exchange Ratio Stock (Early Hedge)
Announcement Date [-1,+1]				
CAAR	0.96%	0.58%	-0.88%	-2.73%
<i>t</i> -statistic	3.48	1.28	-1.97	-10.57
N	736	64	244	1,086
Closing Date [-1,+1]				
CAAR	0.07%	0.73%	0.47%	1.18%
<i>t</i> -statistic	0.38	1.63	1.27	5.61
N	621	58	219	880
Pricing Period (variable length)				
CAAR	n.a.	-3.18%	-0.97%	n.a.
<i>t</i> -statistic		-2.79	-1.43	
N		59	221	
Pseudo Pricing Period ^a				
CAAR	-0.05%	n.a.	n.a.	0.43%
<i>t</i> -statistic	0.16			1.33
N	628			894
Entire Event Window [Announcement – 20, Close + 20]				
CAAR	5.58%	-3.38%	-0.92%	0.41%
<i>t</i> -statistic	4.92	0.14	-0.45	0.38
N	563	55	202	876

^aPseudo pricing periods for cash and fixed-exchange ratio stock deals are computed using acquirer stock prices over the 10 days ending 3 days before merger closing.

Table 3
Acquirer Short Interest Around Merger Events

This table presents short interest of acquirers around merger event dates. Panel A displays the median monthly percentage change in short interest around announcement, closing, and pricing period dates. Panel B displays short interest normalized by three different variables. The first measure normalizes short interest by acquirer shares outstanding; the second measure normalizes short interest by the median, over the 63 trading days ending 5 days before merger announcement, of acquirer volume (measured in number of shares); the third measure normalizes short interest in a given event month by the maximum short interest over the period beginning three months before merger announcement and ending 2 months after merger closing. Mergers are classified as “Cash,” “Fixed-Exchange Ratio Stock,” and “Floating-Exchange Ratio Stock” based on the form of payment to target shareholders. In fixed-exchange ratio stock mergers, the number of acquirer shares to be given to each target shareholder is determined on the announcement date. In floating ratio stock mergers, the *value* of acquirer shares per target share is fixed on the announcement date. The actual number of acquirer shares issued per target share is obtained by dividing value by the average acquirer price during a later pricing period defined in the merger agreement.

Panel A: Median Percentage Change in Short Interest Around Merger Announcements				
Event Month	Cash Mergers (No Hedge)	Floating-Ratio Stock Mergers (Late Hedge)	Collar Stock Mergers (Dynamic Hedge)	Fixed-Ratio Stock Mergers (Early Hedge)
-3	1.91%	-1.28%	4.54%	1.63%
-2	0.55%	-0.24%	3.32%	1.59%
-1	1.22%	9.88%	0.51%	2.63%
0	0.25%	0.09%	20.21%	40.37%
+1	0.40%	1.90%	12.17%	18.32%
+2	2.85%	4.27%	12.41%	6.63%
+3	0.87%	-0.85%	-0.13%	2.54%

Panel B: Median Percentage Change in Short Interest Around Merger Closings and Pricing Periods						
Event Month	Closing Period				Pricing Period	
	Cash Mergers (No Hedge)	Floating-Ratio Stock Mergers (Late Hedge)	Collar Stock Mergers (Dynamic Hedge)	Fixed-Ratio Stock Mergers (Early Hedge)	Floating-Ratio Stock Mergers (Late Hedge)	Collar Stock Mergers (Dynamic Hedge)
-3	--	--	--	--	-2.94%	7.39%
-2	-0.01%	-0.68%	12.82%	14.05%	6.82%	9.73%
-1	0.34%	13.97%	21.38%	9.21%	0.22%	14.20%
0	-0.34%	-0.34%	-23.68%	-30.90%	12.11%	20.21%
+1	4.39%	-2.54%	-0.71%	-4.59%	-2.43%	-14.11%
+2	1.22%	1.02%	0.04%	-0.30%	-2.06%	-2.49%
+3	1.61%	4.80%	0.47%	0.75%	-1.70%	0.04%

Table 3 (continued)**Panel C: Short Interest Measures for Fixed-Exchange Ratio Stock Mergers (Medians)**

Event Day	Announcement Period			Closing Period		
	Short Interest/ Shares Outstanding	Short Interest/ Median Daily Volume	Short Interest/ Shares Issued	Short Interest/ Shares Outstanding	Short Interest/ Median Daily Volume	Short Interest/ Shares Issued
-3	1.12%	3.7	3.97%	--	--	--
-2	1.13%	3.7	3.74%	3.19%	11.6	17.58%
-1	1.16%	3.9	3.83%	3.79%	12.6	20.19%
0	2.14%	7.3	8.31%	2.25%	7.3	10.27%
+1	2.59%	9.2	10.22%	1.95%	6.1	6.80%
+2	2.80%	9.8	11.22%	1.92%	6.3	6.84%
+3	2.58%	9.1	10.64%	2.02%	6.7	7.82%

Table 4
Effects of Indexing on Acquirers' Closing Returns

This table reports stock price run-ups and reversals around merger closings. Cumulative average abnormal returns (CAARs) are presented for the period beginning three days prior to the closing day and ending on the peak day, as well as for the period beginning one day after the peak day and ending 20 days after the closing day. The peak day is defined as the day from the closing day to two days after the closing that maximizes the stock price run-up. Test statistics are calculated using the standard error of the mean.

	CAAR [Closing Day – 3, Peak Day] (Stock Price Run-up)	CAAR [Peak Day +1, Closing Day + 20] (Stock Price Reversal)
Panel A: Index-Rebalancing Mergers		
<i>Stock Merger with S&P Acquirer of Non-S&P Target (Hidden Addition)</i>		
CAAR	3.36%	-1.32%
<i>t</i> -statistic	5.20	-1.44
N	166	166
Peak Day	Closing Day +1	Closing Day +1
<i>Stock Merger with S&P Acquirer of S&P Target from Different Index (Hidden Addition)</i>		
CAAR	1.63%	-2.51%
<i>t</i> -statistic	2.31	-1.75
N	52	52
Peak Day	Closing Day	Closing Day
<i>Stock Merger with Non-S&P Acquirer of S&P Target</i>		
CAAR	2.33%	-1.16%
<i>t</i> -statistic	1.20	-1.12
N	50	50
Peak Day	Closing Day +2	Closing Day +2
Panel B: Non-Index-Rebalancing Mergers		
<i>Stock Merger with S&P Acquirer of S&P Target from Same Index</i>		
CAAR	0.26%	-0.73%
<i>t</i> -statistic	0.27	-0.68
N	78	78
Peak Day	Closing Day +1	Closing Day +1
<i>Cash Merger</i>		
CAR	-0.10%	0.37%
<i>t</i> -statistic	-0.45	0.69
N	342	336
Peak Day	Closing Day +2	Closing Day +2
<i>Stock Merger with Non-S&P Acquirer of Non-S&P Target</i>		
CAAR	1.00%	-1.84%
<i>t</i> -statistic	1.94	-2.63
N	420	412
Peak Day	Closing Day +1	Closing Day +1

Table 5
Results from Previous Studies of Acquirer Announcement Period Returns

This table reports acquirer announcement period abnormal returns from recent studies.

Sample	Study	Acquirers Announcement Period Abnormal Return
<i>Short Selling of Acquirers' Stocks Expected At Merger Announcement</i>		
Stock-Financed (1973-1998)	Andrade, Mitchell, and Stafford (2001)	-1.5%
Fixed-Exchange Ratio Stock (1994-2000)	This paper	-2.7%
Stock-Financed Publicly-Traded Acquirer and Target (1990-2000)	Fuller, Netter, and Stegemoller (2002)	-1.9%
Fixed-Exchange Ratio Stock (Banks, 1985 - 1992)	Houston and Ryngaert (1997)	-3.3%
Stock Collars (Banks, 1985 - 1992)	Houston and Ryngaert (1997)	-1.3%
Fixed-Exchange Ratio Stock (1992 – 1997)	Fuller (2001)	-2.2%
<i>No Short Selling of Acquirers' Stocks Expected At Merger Announcement</i>		
No Stock-Financing (1973-1998)	Andrade, Mitchell, and Stafford (2001)	0.4%
Floating-Exchange Ratio Stock (1994-2000)	This paper	0.6%
Floating-Exchange Ratio Stock (1992 – 1997)	Fuller (2001)	1.0%
Cash, Debt, Preferred Stock (Banks, 1985 – 1992)	Houston and Ryngaert (1997)	-0.6%
Stock-Financed Publicly-Traded Acquirer / Private Target (1990-2000)	Fuller, Netter, and Stegemoller (2002)	2.5%
Cash-Financed Publicly-Traded Acquirer / Private Target (1990-2000)	Fuller, Netter, and Stegemoller (2002)	1.5%
Cash-Financed Publicly-Traded Acquirer and Target (1990-2000)	Fuller, Netter, and Stegemoller (2002)	0.4%

Table 6
Effect of Changes in Short Interest on Announcement Period Abnormal Returns

This table describes the effects of changes in short interest on acquirers' CAARs measured from day -1 to day +1 around merger announcements. Panel A describes the independent variable, change in days short interest (ΔDSI), which is defined as the change in short interest from pre-merger announcement to post-merger announcement, divided by the acquirer's median daily share volume. Median daily share volume is measured over the 63 trading days (one quarter) beginning 67 days before announcement and ending 5 days before announcement. Mergers are classified as "Cash," "Fixed-Exchange Ratio Stock," and "Floating-Exchange Ratio Stock" based on the form of payment to target shareholders. In fixed-exchange ratio stock mergers, the number of acquirer shares to be given to each target shareholder is determined on the announcement date. In floating ratio stock mergers, the *value* of acquirer shares per target share is fixed on the announcement date. The actual number of acquirer shares issued per target share is obtained by dividing value by the average acquirer price during a pricing period defined in the merger agreement. Panel B reports results for the first-stage regression of ΔDSI on a constant, the natural logarithm of target-to-acquirer market capitalizations, and a dummy variable reflecting whether the transaction was hostile for fixed-exchange ratio and collar mergers. Panel C reports the results from the second-stage regression of CAARs on the fitted values from the first-stage regression, $E(\Delta DSI)$, and dummy variables reflecting the terms of the merger transaction. Panel D reports regression results from a baseline regression of CAARs on the financing term dummy variables.

Panel A: Summary Statistics for ΔDSI				
	Cash Mergers (No Hedge)	Floating- Exchange Ratio (Late Hedge)	Collar Stock Mergers (Dynamic Hedge)	Fixed- Exchange Ratio (Early Hedge)
Median	0.00	-0.01	0.92	1.70
Mean	0.15	-0.26	3.48	5.15
<i>t</i> -statistic (mean)	(0.57)	(0.85)	(4.90)	(12.87)

Panel B: First-Stage Regression Explaining ΔDSI Due to Merger Arbitrage						
Fixed-Exchange Ratio			Collar			R^2 / N
Intercept	ln(RelSize)	Hostile	Intercept	ln(RelSize)	Hostile	
8.31	1.78	-5.43	8.51	2.25	-6.90	0.1949
(17.13)	(8.30)	(-2.04)	(7.03)	(4.99)	(-1.05)	1,554

Panel C: Second-Stage Regression Explaining $CAAR[-1,+1]$					
Cash	Float	Collar	Fixed	$E(\Delta DSI)$	R^2 / N
0.0062	0.0052	0.0026	-0.0144	-0.0023	0.0723
(2.07)	(0.57)	(0.44)	(-2.98)	(-2.29)	1,554

Panel D: Base-Line Regression Explaining $CAAR[-1,+1]$				
Cash	Float	Collar	Fixed	R^2 / N
0.0062	0.0052	-0.0054	-0.0265	0.0677
(2.07)	(0.57)	(-1.05)	(-10.54)	1,554