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MARK-UP PRICING IN MERGERS AND ACQUISITIONS

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ABSTRACT

This paper studies the premiums paid in successful tender offers and mergers involving NYSE and Amex-listed target firms from 1975-91 in relation to pre-announcement stock price runups. It has been conventional to measure corporate control premiums including the price runups that occur before the initial formal bid. There has been little evidence on the relation between the pre-bid runup and the post-announcement premium (the premium paid to target stockholders measured from the date of the first bid). Under what circumstances are runups associated with larger total premiums? The evidence in this paper shows that in most cases, the pre-bid runup and the post-announcement premium are uncorrelated (i.e. little or no substitution between the runup and the post-announcement premium), so the runup is an added cost to the bidder. This has important implications for assessing the costs of illegal insider trading based on private information about a potential bid.

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1. Introduction

Many studies have documented the large premiums paid by bidder firms to acquire control of exchange-listed target firms. The size and variability of these control premiums raise several interesting questions. For example, it is conventional to include a period of pre-bid runup in the target's stock price as part of the control premium paid by winning bidders. As shown below, the average runup is about half of the total premium paid in successful takeovers (the other part of the premium is the markup over the stock price the day before the first bid is announced). What causes pre-bid runups, and how do they affect the total control premium? These questions provide the focus for this empirical study of 1,398 successful takeovers of New York Stock Exchange (NYSE) and American Stock Exchange (Amex) -listed target firms for the 1975-91 period.

The spate of insider trading cases associated with mergers and acquisitions (M&A) during the 1980s drew significant attention to the consequences of such activities. Meulbroek (1992) shows that daily stock returns are correlated with the illegal trading activities of insiders for firms where the Securities and Exchange Commission (S.E.C.) successfully prosecuted insider trading. She estimates that almost half of the runup in the month before initial merger or tender offer announcement occurs on the days when insiders traded illegally, although insiders traded on a small subset of the days in the runup period on average.

Jarrell and Poulsen (1989) study 172 successful cash tender offers in the 1981-85 period. They conclude that there are several sources of legitimate information available to market participants that allow investors to anticipate takeover announcements, including announcements of 13D filings when investors acquire more than 5% of the target firm's stock. They find weak evidence that pre-bid runups substitute for post-bid markups in their sample, so that premiums are higher *ceteris paribus* when runups are large.

The question of whether illegal insider trading damages bidders by raising the price paid to acquire a target firm has been highly contentious. There are many lawsuits against investment banks and others who might have leaked private information that led to illegal insider trading. For example, Anheuser-Busch sued Paul Thayer and A. G. Edwards because it felt that leaks of inside information by Thayer (a director of Anheuser-Busch) caused it to pay too much in acquiring Campbell Taggart in 1982.[1] Litton sued Lehman Brothers because insider trading by Dennis Levine allegedly caused Litton to pay too much when it acquired Itek in 1983.[2] Maxus sued Kidder Peabody, Ivan Boesky and Martin Siegel because the price it paid to acquire Natomas in 1983 was allegedly inflated by Boesky's illegal insider trading.[3] FMC Corporation sued Goldman Sachs, Boesky and others because the price it paid stockholders in its 1986 recapitalization plan was allegedly inflated by the insider trading activities of Boesky.[4]

This paper examines the theoretical and empirical relations between pre-bid runups and post-bid markups conditional on various types of information that were available in the market prior to merger or tender offer bids from 1975-91. Section 2 reviews the literature on auctions and develops the hypotheses to be tested. Section 3 describes the sample of mergers and acquisitions that are used in the tests. Section 4 analyzes several regression tests that relate pre-bid runups to post-bid markups. Section 5 analyzes alternate specifications for some of the statistical tests. Section 6 contains brief concluding remarks.

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[1] *Anheuser-Busch Cos. v. Paul Thayer, et al.*, No. CA3-85-0794-R (N.D. Tex. 1988). See Cornell and Sirri (1992) for an analysis of this case.

[2] *Litton Industries v. Lehman Brothers Kuhn Loeb* 734 F. Supp. 1071 (S.D.N.Y. 1990).

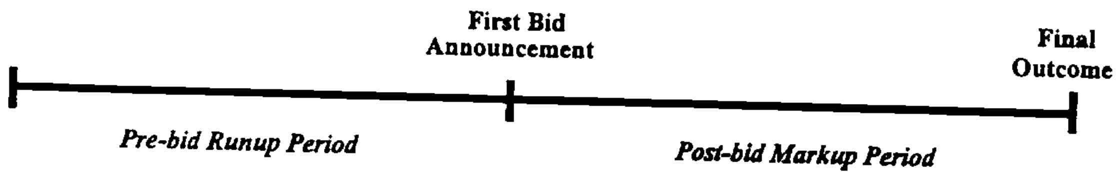
[3] *Maxus v. Kidder Peabody, etal.*, No. 87-15583-M (298 D. Tex. 1987).

[4] *FMC Corporation v. Boesky, et al.* 852 F.2d 981, 994 (7th Cir. 1988).

2. Auctions, private information and insider trading

To understand the effects of pre-bid runups on M&A negotiations, it is useful to think of the following time line of events:

Timeline of M&A Events (Measuring the Total Premium)



In the ***Pre-bid Runup Period***, the bidder knows that it is considering making a bid for a particular target firm, but no one else should have this private information. Of course, it is possible that more than one bidder is considering the acquisition of this target simultaneously, but the intentions of each bidder are not generally known by others. Any abnormal movement of the target's stock price in this period is called the ***Pre-bid Runup***. Once the **First Bid Announcement** occurs, public investors become aware of that bidder's intentions (at least to the extent that they are revealed by their bid). After that time, the target is "in play" and it is possible that other bidders may compete to acquire the target firm. Such a multiple bid auction usually leads to higher control premiums than when the initial bid is successful. The **Final Outcome** occurs when one bidder succeeds in taking over the target, or when all bidders quit trying. If the target is acquired by a bidder, the ***Post-bid Markup Period*** represents the period between the ***First Bid Announcement*** and the ***Final Outcome***, so that the change in the target firm's stock price in this period (perhaps adjusted for market movements) reflects the ***Post-bid Markup***.

2.1 Competitive bidding strategies

There are at least two competing hypotheses about the effects of early revelation of information in a merger or tender offer situation. If the bidder and target (managers and stockholders) are in a two-person bargaining situation, negotiation will lead to a consummated deal if the reservation price of the target is below the valuation placed on the target by the bidder. These valuations by the bidder and the target depend on the information each party has at the time of the negotiation. To the extent that both parties have more information than is reflected in the open market price for the target firm's stock (and they think there are no other traders with valuable private information), both the bidder and the target would ignore stock price movements that occur prior to and during the negotiation in setting the final deal price. As a result, the post-bid markup (measured from the announcement date through the time when all uncertainty about the consummation of the deal has been resolved) will be lower by the amount of the pre-bid runup. This is the ***substitution hypothesis*** -- each dollar of pre-bid runup offsets the post-bid markup one-for-one.

On the other hand, if the bidder or the target is uncertain about whether movements in the market price of the target's shares might reflect valuable private information of other traders, runups during the negotiations could well cause both parties to the negotiation to revise their valuations of the target's stock. For example, if the negotiating parties suspect that another bidder might be acquiring target shares in the open market, both the bidder and the target (management and stockholders) would probably revise their valuations of the target stock upwards. Bradley, Desai and Kim (1988) and Comment and Schwert (1994) show that the premiums paid in contested M&A transactions (auctions) are significantly higher than in cases where multiple bidders do not appear. In this case, the final deal price will increase by the amount of the pre-bid runup. The post-bid markup will be unaffected by the amount of the pre-bid runup. This is the ***markup pricing hypothesis*** -- each dollar of pre-bid runup gets added into the final deal price one-for-one.

As described above, the markup pricing hypothesis reflects rational behavior of bidders and targets in a situation where they have incomplete information. An additional explanation for a lack of substitution between the runup and the markup is based on irrational behavior by bidders. Roll (1986) calls this the "hubris hypothesis," where bidders are interested in winning a takeover contest irrespective of the cost. One way to distinguish between the markup pricing and hubris hypotheses is to study the stock returns to the bidder firm. If the bidder firm offers too much for the target firm, given the information available to the stock market at the time of the bid, one would expect a drop in the bidder's stock price.

2.2 *Relation to the literature on auctions*

An analogy to conventional open outcry English auctions is apt.[5] If the item being auctioned is marketable, as is clearly the case with the common stock of a publicly traded target firm, part of the value any bidder would place on the item is based on its potential resale value (this is called a common value auction). Of course, every bidder might also have unique reasons for wanting to own a particular item, and this valuation might be larger than the resale value (this is called a private value auction). In general, most auctions reflect a mixture of common and private values (this is called a correlated values auction). The typical situation where competing bidders can observe the bids of others causes complicated interactions among bidders' strategies. To the extent that another

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[5] See section X of McAfee and McMillan (1987) for a discussion of the correlated values auction model where bidders' valuations are affiliated. Milgrom (1989) provides an excellent survey of the economics literature on auctions, and Ashenfelter (1989) provides many interesting insights into the workings of auction markets for high quality wine and art.

bidder might have better information about the resale value of the target firm, his bid should alter the perceptions of competing bidders about resale value. In effect, each bidder learns by observing the current market price. This is the spirit of the self-fulfilling rational expectations models of asset prices developed by Grossman (1976, 1977).

The presence of people who trade on the information of either the bidder or the target without the knowledge of the negotiating parties is like having a shill in the audience at an open outcry auction. Based on unusual price and volume behavior in the secondary market for the target's stock, the bidder and target might falsely conclude that a legitimate competing bidder exists, and hence revise their valuations upward. By stealing information from the bidder or the target, insider trading can cause the final price in the auction (or negotiation) to be higher than it would otherwise be.

2.3 Relation to the efficient markets literature

The semi-strong form of the efficient markets hypothesis posits that the market price of common stock reflects all publicly available information [Fama (1970)]. Private information, such as the intention to bid for control of a target firm, would not generally be reflected in the market price of the target stock until an event occurs that causes many traders to infer that private information. An example would be pre-bid purchases of the target's stock by the bidder to establish a "toe-hold" position, which would lead to the filing of a 13D statement with the Securities and Exchange Commission (S.E.C.) after the bidder buys more than 5% of the target's stock. Unusual patterns of price and trading volume often attract attention from securities traders (as well as the stock exchanges and the S.E.C.), and of course public statements such as press releases and S.E.C. filings provide direct information about potential bids.

One implication of the efficient markets hypothesis is that future price changes are unpredictable based on publicly available information. It should not be possible to earn systematic abnormal profits by buying stock in companies that are potential targets (without access to private or inside information). There is much evidence to support the efficient markets hypothesis in the context of mergers and tender offers. For example, measured from the date of the first announced bid, there is no evidence that public investors can earn average abnormal returns from purchasing the stock of target firms. Not surprisingly, the stock prices of targets that are successfully taken over rise above the market price on the day after the first bid, on average, and prices fall if the targets are not successfully taken over, on average. But it is not possible to know which bids will succeed or fail at the time of the first bid, so it is not possible to profit.[6]

If future price changes are unpredictable, there should be no correlation between past price movements (such as pre-bid runups) and subsequent returns to target shareholders. If this were not true, it would be profitable to buy shares of stocks whose prices have risen recently (perhaps with unusual volume behavior). Pound and Zeckhauser (1990) find there are no abnormal profits available from buying the shares of companies that are written about in the *Wall Street Journal* "Heard on the Street" column as potential takeover targets (where most of the stories identify unusual price and volume behavior as one source of the rumor). Thus, from the perspective of target shareholders, it would not be surprising to find that pre-bid runups and post-bid markups are unrelated. The only exception to this rule would occur if the bidder and/or the target effectively pre-announce the bid. In that case, everyone (including bidder and target stockholders and management) knows the information in the actual offer before it is formally filed. The formal announcement of the offer would have little effect on the market price of the stock, since all of the relevant parties

[6] Dodd and Ruback (1977), Dodd (1980), and Bradley, Desai and Kim (1983) are early papers that document these facts. Also see the survey paper by Jensen and Ruback (1983).

already know this information.

2.4 Inferring information about illegal insider trading

How likely is it that the market can infer the existence of illegal insider trading? In the United States, which has severe punishments associated with illegal insider trading, people who acquire inside information and trade on it have strong incentives to disguise their behavior. There are many mechanisms used by regulators to detect illegal insider trading. For example, the New York Stock Exchange monitors trading of all of its listed stocks and uses statistical screens to identify unusual patterns of price or volume. These events trigger investigations by calling the affected company to ask whether there is material information that could be causing the unusual trading pattern. In extreme cases, the S.E.C. is notified and it begins its own investigation. Faced with knowledge of these enforcement mechanisms, sophisticated traders who have inside information try to avoid trading patterns that would lead to easy detection by spreading their trading over many accounts and brokerage firms, and by spreading their trading over time [Stewart (1991)].

Even if there were no legal costs associated with insider trading, insiders have strong incentives to disguise their behavior so that other traders cannot easily infer the information they possess from their trading behavior. For example, many buy orders submitted by an insider in a short period are likely to attract attention from "tape watchers" who trade based on current market movements. To maximize the value of the private information he possesses, an insider must delay the revelation of that information to other traders as long as possible (until he has bought as many target shares as he wants). Barclay and Warner (1993) study trading patterns in the shares of 105 tender offer targets from 1981-84 during the 30 trading days before formal offers. They find that most of the price appreciation before formal bids occurs in intermediate-sized trades (500 to 9,900 shares), rather than larger or smaller trades. They refer to this behavior as "stealth trading." Of course, once the insider accumulates his desired position, he benefits from speedy revelation of his private information (which is one reason insiders might share information with others whom they know will trade on inside information).

Another cost that can result if insider trading is readily apparent is that planned bids can be canceled. A bidder who sees the target price runup unexpectedly might decide to postpone or cancel a planned bid while trying to learn why the runup had occurred. Diamond Shamrock canceled its planned bid for Natomas after Ivan Boesky's insider trading caused a more than twenty percent runup in Natomas' stock price during February 1983. Shortly after the decision to cancel the offer, Natomas' stock price plummeted, in large part due to selling pressure from Boesky (who had been tipped by Martin Siegel, Diamond's investment banker).[7] If insider trading results in a canceled offer, the profitability of the inside information is negated by the insider's trading behavior.

While the highly publicized cases involving Dennis Levine, Boesky and Siegel have focused attention on insider trading associated with M&A transactions in recent years, these cases were discovered several years after the insider trading took place. Moreover, they were discovered through a very indirect sequence of circumstances [Stewart (1991)]. Table 1 shows the number of stories on *Dow Jones News Retrieval (DJNR)* containing the words "insider trading" for the years 1979-92. This is a noisy measure of the public's awareness of insider trading associated with M&A transactions, since many of these stories do not involve mergers or tender offers. The explosion of stories about insider trading began in 1986 with the Boesky revelations, so it is unreasonable to think that investors or bidder or target firm managers should have known about insider trading several

[7] *Maxus v. Kidder Peabody, Boesky, Siegel, etal.*, Second Amended Original Petition by Plaintiff, No. 87-15583-M (298 D. Tex. 1987)..

years before the U. S. government discovered it.

Thus, the question of whether pre-bid runups caused by insider trading affect the price negotiated between a bidder and a target in a merger or tender offer revolves around whether all parties to the transaction (bidder and target management and stockholders) understand that the insider trading merely reflects the private information of the negotiating parties. In general, since insider trading is illegal, and because the profits of the insider will generally be higher if he can delay the process by which other traders infer his information, we should expect that targets and bidders will not know with certainty that pre-bid runups merely reflect their own information. In terms of the hypotheses stated earlier, it is unlikely that the substitution hypothesis (pre-bid runups substitute for post-bid markups) is a good description of the world. The tests below show how runups and markups are related in a large sample of actual merger and tender offer transactions in the 1975-91 period.

3. Mergers and tender offers, 1975-91

To study the relation between pre-bid runups and post-bid markups, I use Robert Comment's proprietary database containing information about all mergers and tender offers for NYSE and Amex-listed target firms from 1975-91. These announcements were obtained through various keyword searches of the *Dow Jones News/Retrieval* database, by inspection of the *Wall Street Journal Index*, and from Commerce Clearing House's *Capital Changes Reporter* (the original source for CRSP delisting codes). Security return and volume data and market indexes are from the Center for Research in Security Prices (CRSP).

There are 1,398 successful takeovers from 1975-91 with enough return data available to be included in this study. For each of these firms, I calculated the market model regression equation

(1) for the 253 trading days ending 127 trading days before the first public announcement of a tender offer or merger,

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \qquad t = -379, \ldots, -127 \tag{1}$$

where R_{it} is the continuously compounded return to the stock of target firm i and R_{mt} is the continuously compounded return to the CRSP value-weighted portfolio of NYSE and Amex-listed stocks for day t. Firms are included if they have at least 100 daily returns available to estimate the parameters of (1). The runup is the cumulative abnormal return to the target stock over the 42-day runup period before the first bid,

$$\text{Runup}_i = \sum_{t=-42}^{-1} \varepsilon_{it}, \tag{2}$$

and the markup is the cumulative abnormal return from the date of the first bid announcement through delisting or 126 trading days after the first bid, whichever comes first,

$$\text{Markup}_i = \sum_{t=0}^{\text{delisting}} \varepsilon_{it}. \tag{3}$$

The total premium paid by the successful bidder (Premium_i), adjusted for market movements, is the sum of Runup_i and Markup_i.

Because there are some deals that take a long time to consummate, I focus on the sample of cases where the length of time between the first bid and delisting is no more than a year. Some deals take a long time to complete because regulatory hurdles have to be jumped. The noise added to the stock returns of these target firms due to the delay is the primary reason for ignoring these cases. In addition, there are some cases where the size of the target firm is so small (less than $10 million market value of equity) or the price of the target stock is so low (less than $2 per share) that the measured stock returns could be unreliable. Low-priced stocks are likely to be more affected by market microstructure effects, such as large proportional bid-ask spreads [Ball, Kothari and Shanken (1994)]. After excluding these exceptional cases, there are 1,173 target firms remaining. This is called the "main sample" hereafter.

The choice of a 42 trading day (about two calendar months) runup period is suggested by the empirical evidence from prior studies on mergers and tender offers. Figure 1 shows the plot of the cumulative average abnormal returns (CAR) from 126 trading days before the first bid announcement (day 0) through 253 trading days after the first bid for the 1,398 successful mergers and tender offers in this sample, where the market model parameters were estimated using returns for days -379 to -127 relative to the announcement day. The CAR starts to rise around day -42, but the largest pre-bid rise occurs from days -21 to -1.

3.1 Average runups and markups

Table 2 shows the average runups and markups for the total sample and for several subsets. It also shows the proportion of the various samples that have pre-bid news implying that a bid might be forthcoming (News), or that involve multiple bidders (Auctions), or that are tender offers (Tender Offers), or that are management buyouts (MBOs), or where cash is the only form of payment to target shareholders (Cash), or where equity is the only form of payment to target shareholders (Equity), or where the S.E.C. later accused someone of engaging in insider trading prior to the takeover (Insiders).[8] Results are shown for each of these samples, along with samples of deals that began in each year from 1975-91. Finally, table 2 shows the standard deviations for the sample of all 1,398 deals and the main sample of 1,173 transactions in the rows immediately following the averages for these samples.

Runups are large for all these samples. The average for the main sample is 14.2%, and it is a little higher for cases where there was foreshadowing news (16.0%), in tender offers (15.9%), and in cases where the S.E.C. later accused insiders of trading illegally (18.5%). Average runups are slightly lower in cases that later become auctions (12.2%), when there is an MBO (11.4%), and in cases where equity is the only form of payment made to target shareholders (11.4%). The average runups and markups shown in ***bold italics*** in table 2 are reliably different from the main sample averages at the 5% significance level.

Average runups were larger in 1977-80 than at other times during the 1975-91 period. Average runups were slightly lower after the prosecutions of Levine, Boesky and Siegel that began in 1986, although the average runups remain substantial (from 7.1% to 13.5% from 1986-91). The following regression provides a simple test of the effects of the Insider Trading Sanctions Act of 1984 (ITSA84) and the Insider Trading and Securities Fraud Enforcement Act of 1988 (ITSFE88),

$$\underset{}{\text{Runup}_i} = \underset{(0.0084)}{0.1779} - \underset{(0.0120)}{0.0644}\ \text{ITSA84}_i + \underset{(0.0155)}{0.0033}\ \text{ITSFE88}_i + u_i \qquad (4)$$

where White's (1980) heteroskedasticity-consistent standard errors are in parentheses. The insider trading law variables are equal to zero before 1984 and 1988, respectively, and equal to one

[8] Information on insider trading prosecutions came from the *Dow Jones News Retrieval*, the *Wall Street Journal Index*, and the *Lexis* S.E.C. Release file.

afterwards. This regression suggests that the 1984 Act is associated with significantly lower pre-bid runups (-6.4% lower), but the 1988 Act had no significant additional effect. This simple regression does not take account of other changes in the legal and takeover environments that occurred in this period, so these conclusions are tentative at best.

Average post-bid markups are similar to average runups for most of the samples. The average markup for the main sample is 15.9%. The most obvious exception is for auctions, where the average markup is 28.0% and the average runup is 12.2%. This is easy to understand if the competition among multiple bidders is generally not anticipated at the time of the first bid. The average premium (the sum of runup plus the markup) is between 24.0% (in 1978) and 40.9% (in 1988). A regression similar to (4) to estimate the effects of the changes in insider trading legislation on post-bid markups suggests that markups increased reliably (by 8.3%) following the 1988 Act, but not following the 1984 Act,

$$\underset{}{\text{Markup}_i} = \underset{(0.0103)}{0.1376} + \underset{(0.0154)}{0.0078}\ \text{ITSA84}_i + \underset{(0.0228)}{0.0832}\ \text{ITSFE88}_i + u_i. \tag{5}$$

However, it is likely that other changes in the merger and acquisition environment could also explain the higher premiums after 1988. For example, Comment and Schwert (1994) argue that increases in antitakeover protection that occurred from 1983-91 increased the premiums paid to target firms that were taken over.

3.2 Composition of the sample

There are prior news events suggesting that the target may be in play in 47.3% of the cases in the main sample. News equals one when any of the following events have occurred within the past calendar year:

(a) there was a news story, confirmed by either the target or the bidder firm, saying that a merger or acquisition was being actively discussed, or
(b) there was a news story saying that a 13D form had been filed with the S.E.C. showing that a new buyer had bought at least 5% of the target's stock, or
(c) there was a news story saying that the firm is a potential target, or
(d) the target firm adopts a new poison pill security as an anti-takeover device (based on information from *Dow Jones News Retrieval* and *Corporate Control Alert*).

Mikkelson and Ruback (1985) find that the market interprets at least some 13D announcements as showing that the likelihood of a takeover has increased. Comment and Schwert (1994) show that poison pill security adoptions frequently foreshadow takeover bids. These pre-bid news events happen more frequently in auctions (59.2%) and when there is an insider trading prosecution (62.7%). The frequency of prior news events is lower before 1980, because coverage by *Dow Jones News Retrieval* begins in mid-1979, and other sources of this information have less coverage.

Auctions occur in 19.0% of the cases in the main sample. They are more frequent when there is a tender offer (30.4%). The frequency of multiple bidder auctions increased in the late 1980s, rising to 35.3% of the takeovers in 1988. As the number of takeovers fell in 1990-91, the frequency of auctions also fell.

Tender offers represent 44.8% of the main sample. They are more frequent when there is a subsequent insider trading prosecution (58.2%). They are less frequent when the winning bidder involves the incumbent management of the target firm (an MBO), only 30.7%. The years 1984-89 had a higher rate of tender offers than the other parts of the period (from 44.6% to 63.9%). Management buyouts (MBOs) represent 11.9% of the main sample. Cash deals represent 63.5% and equity deals represent 17.3% of the main sample.

There were insider trading prosecutions in 11.4% of the cases. The rate of insider trading prosecutions is highest for the deals that began from 1981-85 (from 13.1% to 27.7%). Of course, the increased rate of prosecutions could reflect a higher frequency of illegal insider trading, or a higher rate of discovering and prosecuting illegal trading, or both. One explanation for this drop in prosecution rates is the increased penalties associated with the Insider Trading Sanctions Act of 1984 and the Insider Trading and Securities Fraud Enforcement Act of 1988.

Arshadi and Eyssell (1991) find that insiders who must register their trades with the S.E.C. changed their trading patterns before tender offers after the 1984 Act. Before 1984, registered insiders were strong net buyers of their own firm's stock, but afterwards they became weak net sellers. They also find that pre-bid runups are positively correlated with the trading of registered insiders. Of course, the sample of insiders used by Arshadi and Eyssell is a small subset of the types of people who have been prosecuted by the S.E.C. for insider trading before mergers or tender offers -- the officers, directors and beneficial owners of the target firm. Their trades are easiest to monitor, since they have to be reported to the S.E.C. on a timely basis (which is the source of data used by Arshadi and Eyssell). In unnegotiated offers, these people might not even be aware of the intentions of the bidding firm. The most prominent insider trading cases prosecuted by the S.E.C., and the ones where the cause of the pre-bid runup would be ambiguous to the target and bidding firms, involve third party insider trading -- people who obtain and misuse information from agents of the bidder or the target.

The evidence in table 2 provides a useful summary of the characteristics of the sample, both in terms of the types of deals covered and the times when they occurred. The tests below provide a more structured basis for judging the effects of runups on the price paid by bidders in successful mergers and tender offers.

4. Regression tests for substitution between runups and premiums

4.1 Simple regression tests

The easiest way to test whether there is substitution between pre-bid runups and post-bid markups is to consider the relation between the total premium paid by the bidder and the pre-bid runup,

$$\text{Premium}_i = \mathbf{a} + \mathbf{b}\,\text{Runup}_i + u_i. \qquad (6)$$

As described in section 2.1, the substitution hypothesis implies that the total premium is not affected by pre-bid runup, so the slope coefficient **b** in (6) should equal zero. On the other hand, the markup pricing hypothesis implies that the total premium increases one-for-one with the pre-bid runup, so the slope coefficient **b** in (6) should equal one. An estimate of **b** between zero and one implies partial substitution; that is, the pre-bid runup increases the total premium paid by the bidder, but only as a fraction of the size of the runup (where the coefficient **b** represents that fraction).

Since the total premium is the sum of the runup plus the markup, the regression equation (6) is equivalent to the regression of markup on runup,

$$\text{Markup}_i = \mathbf{a} + \mathbf{(b\text{-}1)}\,\text{Runup}_i + u_i. \qquad (7)$$

If the substitution hypothesis is true, the regression of Markup_i on Runup_i should have a coefficient of -1 (i.e., when runup is higher, markup is lower by the same amount). If the markup pricing hypothesis is true, the regression of Markup_i on Runup_i should have a coefficient of zero (i.e., markup is unrelated to runup).

Table 3 contains estimates of the regression model (6) for the all 1,398 merger and acquisitions, for the main sample of deals consummated within a year, and for samples with prior foreshadowing news (News=1), for samples without prior foreshadowing news (News=0), for auctions (Auctions=1), for single-bidder deals (Auctions=0), for tender offers (Tender Offers=1), for mergers (Tender Offers=0), for management buyouts (MBOs=1), for all-cash deals (Cash=1), for all-equity deals (Equity=1), for deals that subsequently had insider trading prosecutions (Insiders=1), and for deals that did not have insider trading prosecutions (Insiders=0). The second column shows the proportion of the main sample represented by each sample and the third column shows the number of target firms used in each regression. The fourth through sixth columns contain estimates of the intercept, a, its standard error, S(a), and the t-statistic for whether **a** equals zero, t(**a**=0). The seventh and eighth columns contain estimates of the slope, **b**, its standard error, S(**b**), while the ninth column shows a t-test, t(**b**=1), for whether there is substitution between runup and markup in determining the total premium paid by successful bidders (i.e., is the coefficient **b** significantly different from one?). Finally, columns ten and eleven contain the standard error of the regression S(u) and the adjusted coefficient of determination, $\overline{R}^2$.

In the main sample, the estimate of the coefficient for Runup, **b**, is 1.017, which is close to the value implied by the markup pricing hypothesis, and the t-statistic for whether **b** equals one is 0.42. Across the samples based on deal characteristics, the lowest estimate of **b** is 0.649 (in deals where there was subsequent prosecution for insider trading) and the t-statistic for whether this estimate is different from one is -3.20. The other sample where the estimate of **b** is reliably lower than one is for tender offers, where the coefficient estimate is 0.881 with a t-statistic of -2.04. Thus, even the smallest estimates of the substitution coefficient imply that at least 65% of the pre-bid runup is added to the total price paid by the bidder in acquiring a target stock.

The intercept in equation (6) estimates the average post-bid markup paid in mergers and acquisitions when there is no pre-bid runup. Note that in cases where the slope coefficient **b** is less than one, the intercept **a** is larger than the average markup in table 2 (for example, in insider trading cases, **a** = 0.278 and the average markup in table 2 is 0.213). This difference measures the effect of pre-bid runup on lowering the average post-bid markup -- another way of seeing that the effect of substitution is not large.

Table 3 also shows estimates of the regression model (6) for samples based on the year when the first bid occurs. Most of the estimates of the coefficient for $Runup_i$, **b**, are close to one (the range of these estimates is from 0.76 to 1.34). Only one of the t-statistics for substitution is below -2 (1986), and three are larger than 2 (1980, 1983 and 1988), which implies that premiums are higher than average in cases with large runups. Overall, there is little reason to think that there is variation in the amount of substitution over the 1975-91 period.

4.2 Multiple regression models for substitution

Table 4 combines the effects of these different samples into a multiple regression. Since several characteristics of successful deals are correlated (e.g., cash deals and tender offers), it is not possible to disentangle separate effects of these characteristics from the simple regressions in table 3. Instead, the multiple regression,

$$\text{Premium}_i \;=\; \mathbf{a}_0 + \mathbf{b}_0 \;\text{Runup}_i + \sum_{k=1}^{7} \mathbf{a}_k \, D_{ki} + \sum_{k=1}^{7} \mathbf{b}_k \, D_{ki} \;\text{Runup}_i \;+\; \varepsilon_i, \qquad (8)$$

where the dummy variables D_{ki} equal one if the k^{th} characteristic (News, Auctions, Tender Offers, MBOs, Cash, Equity, or Insiders) applies to case i, and equal zero otherwise, allow the intercept a and the slope b to vary with the characteristics of the deal. Consistent with the evidence in table 3, the estimates of the markup paid if the runup equals zero (i.e., the intercepts) are reliably higher when there is a multiple bidder auction (coefficient = 11.8%, t-statistic = 4.36), when there is a tender offer (coefficient = 8.3%, t-statistic = 3.76), when cash is used to pay target shareholders (coefficient = 9.9%, t-statistic = 3.03), and when there is illegal insider trading that is later prosecuted (coefficient = 12.3%, t-statistic = 4.02). The large sample joint test for whether all seven intercept-change coefficients equal zero equals 99.1, which has a p-value less than 0.01% compared with a χ^2 distribution with 7 degrees of freedom.

The runup coefficient estimate is 1.146, with a standard error of 0.132, when all of the seven deal characteristics equal zero. Most of the slope change coefficients ($\mathbf{b_k}$) for the deal characteristics are small, and only the insider trading coefficient (-0.372) is reliably less than zero (t-statistic of -3.22). The large sample joint test for whether all seven slope change coefficients equal zero equals 15.0, which has a p-value of 3.6% compared with a χ^2 distribution with 7 degrees of freedom. To estimate the sensitivity of the total price paid to the pre-bid runup for a deal with some of these seven characteristics, the base case slope coefficient, $\mathbf{b_0}$ = 1.1456, is added to the appropriate slope change estimates. For example, for a cash tender offer that is not an auction or an MBO, and where there is no subsequent insider trading prosecution, the estimated slope coefficient is 1.1456 - .1417 - .0539 = .9500.

The estimates in table 4 confirm the results from table 3. There is some substitution between pre-bid runups and post-bid markups for cases where the S.E.C. subsequently prosecutes illegal insider trading, and possibly for tender offers. Overall, however, the extent of substitution is small. The effects of different types of deal characteristics on the size of the average markup, given the size of the runup, is much larger and more reliable.

4.3 Differential substitution during the runup period

To this point, the runup period has been held fixed at 42 trading days. I have also estimated some of the results in this paper using shorter and longer runup and markup periods, with no substantial change in the results. To explore this more systematically, I consider nine nonoverlapping runup periods: [(-1,-1), (-2,-5), (-6,-10), (-11,-21), (-22,-42), (-43,-63), (-64,-84), (-85,-105), and (-106,-126)], and fourteen markup periods: [(0,126), (0,delisting), (0,0), (1,1), (2,5), (6,10), (11,21), (22,42), (43,63), (64,84), (85,105), (106,126), (127,253) and (254,delisting)]. Table 5 contains estimates of multiple regressions of the returns for the main sample for each of the fourteen markup periods on the nine runup returns,

$$\text{Markup}_{ij} = \mathbf{a} + \sum_{k=1}^{9} \mathbf{b}_k \,\text{Runup}_{ik} + \varepsilon_i, \qquad (10)$$

where the coefficients $\mathbf{b}_k$ should equal zero if the markup pricing hypothesis is true and they should equal -1 if the substitution hypothesis is true. The coefficient estimates that are more than two standard errors from zero are shown in ***bold italics***.

There is evidence of partial substitution using the markup return on days 0 and +1, since the coefficient estimates are negative for many of the runup periods. The largest of these estimates are for the announcement day markup return (day 0) and the runup periods covering the week before the first bid. Day -1 has a coefficient of -0.252 and days -2 through -5 have a coefficient of -0.234, implying that the markup return on the announcement day is lower by about -0.25 times the runup that occurred in the prior week. When looking at longer markup periods, such as the (0,126) period used elsewhere in this paper, the evidence for partial substitution for the day -1 runup remains reliably different from zero (coefficient of -0.335 with a t-statistic of -4.06). However, the estimates of the runup coefficients for earlier periods are generally positive, and some are reliably different from zero. The small negative coefficients for the announcement day 0 are offset by small positive coefficients at longer lags. Most of the coefficients that are more than two standard errors from zero after day +1 are positive [for example, in the ranges (11,21) through (106,126)]. Thus, the strongest evidence in favor of the substitution hypothesis finds the markup is reduced by only about a quarter to a third of the runup in the week before the first bid. There is no reliable evidence of substitution in other runup periods.

4.4 Effects of runup in the bidder's stock price

In addition to the runup in the target's stock price, market participants can also observe the runup in the bidder's stock price before the date of the first bid. To the extent that information about a pending bid leaks to the market, it should be reflected in the bidder's stock price as well as the target's (if there are significant value implications for the bidder). To check whether the bidder's runup affects the premium paid for the target firm, I include the 42-day runup in the bidder's stock return along with the target runup,

$$\text{Premium}_i = \mathbf{a} + \mathbf{b}\ \text{Runup}_i + \mathbf{c}\ \text{Runup}_{ib} + \varepsilon_i. \qquad (11)$$

Estimates of (11) are shown in table 6 in a format similar to table 3 for the 761 cases where the bidding firm is an exchange-listed firm. For the main sample of 657 matched targets and bidders, the estimate of the bidder runup coefficient **c** is 0.121 (t-statistic of 1.20), showing a weak positive relation between the runup of the bidder's stock price and the premium paid for the target. The estimates of the bidder firm runup coefficient are positive for most of the samples. The largest positive bidder runup coefficient estimates are for auctions (0.576, with a t-statistic of 2.64) and for tender offers (0.254, with a t-statistic of 2.51). Only the estimate for the small sample of 16 MBOs (where a publicly traded firm participates along with the target firm's management to make a bid) has a large negative estimate of -0.435 (t-statistic of -1.15), and the average bidder runup for this sample is -2.4%, implying that the target's premium is higher as a result of the negative bidder runup in these cases.

Table 6 also shows the average bidder runup and markup (measured from the date of the first bid through 126 trading days after the first bid) for each of the samples. Compared with the target runups, the bidder runups are small, but most are positive. The largest positive bidder runups are when there is foreshadowing news (1.7%) and when the S.E.C. subsequently prosecutes illegal insider trading (2.4%). Unlike the pattern with target firms, where the average runup and markup are similar, the markups for bidder firms are generally negative. The average for the main sample is -2.4%. The most negative bidder markups are for auctions (-8.2%), MBOs (-7.7%) and for all-equity deals (-6.3%). To the extent that auctions are unanticipated at the time of the first bid, the negative bidder markups reflect the costs of increased competition for the target firm. On the other hand, since the average runups and markups have different signs for most of the samples, it seems that the act of bidding conveys negative information that was not known during the runup period.

4.5 Effects of abnormal trading volume

Besides price runups, it is also common to see unusually high levels of share trading volume before announcements of merger and acquisition activity. For example, Pound and Zeckhauser (1990, Table 5) show that takeover rumors published in the "Heard on the Street" column of the *Wall*

Street Journal often mention unusual price and volume behavior for the stock in question. Meulbroek (1992, Table XIII) shows that trading volume is unusually high on days when insiders trade before takeovers. She also shows that trading volume is unusually high during the 20 trading days before takeover bids, even after netting out the trades of insiders who were prosecuted for insider trading.[9]

Information about trading volume, as well as price, prior to a formal merger or tender offer bid might help bidders judge whether their information had been leaked to the market. To check this possibility, I use data from CRSP to estimate a model for daily share trading volume for the 1,169 target firms for which adequate share trading volume are available. The volume model is:

$$\ell n(q_{it}/q_{it-1}) = \mu + \rho\ \ell n(q_{it-1}/q_{it-2}) + \gamma_0\ \ell n(q_{mt}/q_{mt-1}) + \gamma_1\ \ell n(q_{mt-1}/q_{mt-2}) + \delta_0 R_{it} + \delta_1 R_{it-1} + v_{it}, \quad (12)$$

where ℓn is the natural logarithm, q_{it} is share trading volume for firm i on day t, q_{mt} is share trading volume for the exchange where this firm is traded (either NYSE or Amex) on day t, and R_{it} is the stock return for firm i on day t. This model expresses the growth rate in share trading volume, $\ell n(q_{it}/q_{it-1})$, as a function of the previous growth rate, the current and lagged growth rate of market trading volume, $\ell n(q_{mt}/q_{mt-1})$, and the current and lagged return on the stock. Modeling share trading volume in terms of its growth rate, with lagged values of the explanatory variables is in the form of an "error-correction model."[10] This allows share trading volume to be non-stationary, but it also allows for transitory movements in volume that affect future volume growth. The average estimates of the parameters of this model are in table 7, along with the average t-statistics.

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[9] Donaldson and Hatheway (1993) also study intraday price and volume behavior before a small number of tender offers.

[10] Engle and Granger (1987) discuss the error correction model and its application to economic time series.

The average estimate of the coefficient of lagged share volume, ρ, implies a tendency for unusual movements in share volume to be partially reversed. If this coefficient was zero, changes in log share volume would be entirely permanent (e.g., log share volume would follow a random walk, ignoring the other parameters in the model). When this coefficient is negative, changes in log share volume are partly transitory. The average coefficient estimate of -0.417, with an average t-statistic of -7.25, is consistent with log share volume having both permanent and transitory components.

The average estimates of the market share volume growth coefficients, γ_0 and γ_1, imply comovement of trading volume across stocks. The long-run effect of a one percent increase in market trading volume is $(\gamma_0 + \gamma_1) / (1 - \rho)$, which averages 0.790 across these 1,169 firms.

There is a weak positive association between share trading volume growth and stock returns. The average estimate of the contemporaneous coefficient, δ_0, is 3.878, with an average t-statistic of 1.56. The long-run effect of a one percent increase in the stock return is $(\delta_0 + \delta_1) / (1 - \rho)$, which averages 2.488.

Using the regression models summarized in table 7, I predict the growth in trading volume from 42 days before through 126 days after announcement of the first bid. Figure 2 shows the proportion of abnormal returns and volumes that are positive for the event days from -40 to +40 around the date of the first bid (day 0). The pattern is similar for returns and volume in the pre-bid period, with mostly positive abnormal returns and volume in the three days before the bid. After the bid, the abnormal returns are positive about half the time, but for the first week after the bid volume is lower than predicted for many firms (about 80% of the abnormal volumes are non-positive on day -2). After day +10, the abnormal volumes return to more normal behavior, being positive about half the time.

Table 8 summarizes the volume runup, which is the cumulative abnormal share volume from days -42 to -1 relative to the first bid,

$$\text{Volume runup}_i = \sum_{t=-42}^{-1} v_{it}, \tag{13}$$

where v_{it} is the prediction error for share volume growth from (12). Across the main sample of 1,169 firms, where delisting occurred within one year of the first bid, the average volume runup is about 92%. The average is somewhat lower for deals that subsequently turned into auctions, and much higher for deals where the S.E.C. subsequently prosecuted illegal insider trading.

Panel B of table 8 contains estimates of a regression model that includes dummy variables for all of the deal characteristics examined previously. It also includes the pre-bid stock price runup, to see whether the relation between volume and stock prices estimated outside the deal period is altered in the runup period before a deal is announced. Based on this regression, the average pre-bid volume runup is significant even when none of the other deal characteristics is positive, including the stock price runup. The estimate of the intercept is 66%, with a t-statistic of 3.00. The abnormal stock price runup has a coefficient of 1.163 (t-statistic of 2.27), implying that stock returns and volume growth move together more in the runup period than in the prior estimation period. The auction coefficient is -41.4% (t-statistic of -2.11), implying that volume growth is abnormally low in cases that later turn into auctions. Finally, in cases where the S.E.C. later prosecuted illegal insider trading, abnormal volume of is higher by 63% with a t-statistic of 2.33. This raises the possibility that extremely large pre-bid trading volumes trigger S.E.C. investigations.

A remaining question about the behavior of volume runup is whether it influences the post-bid markup. When the volume runup is added to the regression model estimated in table 4 to explain the total premium paid by successful bidders, the t-statistic for the volume runup coefficient is 1.26, implying no reliable effect on the total premium. None of the other regression coefficients is materially affected. Thus, although there is abnormal volume runup before bids, it does not seem to affect the price paid by bidders, given the other characteristics of the deal, including the price runup.

5. Specification analysis

5.1 Runup as an artifact of deal size

One interpretation of the pre-bid runup is that it is the probability of a takeover times the total premium that will be paid if a takeover occurs:

$$\text{Runup}_i = \text{Prob}_i \cdot \text{Premium}_i. \quad (14)$$

Suppose that the total premium for target firms is determined exogenously, and known to the market in advance, so that the only uncertainty concerns whether a successful takeover will occur. In this scenario, the size of the premium determines the size of the runup, so the regressions in tables 3 and 4 would reflect reverse causality.

Suppose that a combination of legitimate and illegitimate sources of information caused every deal to be anticipated with $\text{Prob}_i = 0.5$ before the first bid. Then, every runup would be half as large as the total premium. The coefficient of runup in (6) would be (1/Prob), or two, however, and the post-bid markup would be perfectly correlated with the pre-bid runup. Remember that the markup pricing hypothesis implies a regression coefficient on runup equal to one, and that the runup and the post-bid markup are uncorrelated. Appendix A shows that with weaker assumptions about the probability of a takeover before the first bid (e.g., it is random, but uncorrelated with the size of the total premium), the coefficient of runup in (6) will have a probability limit that is lower than $\{1/E(Prob_i)\}$, but greater than one (i.e., runups and markups would be positively correlated). Therefore, even if one were to suppose that the total premium paid in successful deals was known in advance, and unaffected by early disclosure of information that causes the runup, the one-to-one relation between runups and total price paid cannot be explained.

5.2 The runup index

If the size of the premium was known *a priori*, the probability of a successful takeover, $Prob_i$, could be estimated for any given deal as the runup divided by the total premium, $Prob_i = Runup_i / Premium_i$. This is called the "runup index" by Jarrell and Poulsen (1989) and an equivalent measure is used by Meulbroek (1992).

What can we learn from the runup index? There are several practical problems that must be addressed. First, how do you treat situations where the runup is negative? Typically, one of two choices is made: set the runup index to zero, or omit this observation. Second, how do you deal with cases where the post-bid markup is negative? Again, the usual solution is to set the runup index to one, or omit this observation. Unfortunately, while these solutions leave a sample of runup indexes that have the appealing property that they are between zero and one (as a probability measure should be), this truncation can induce a significant bias into the relation between runup and total premium.

As an example, table 9 contains estimates of the means and standard deviations of the runup index and the average runup and premium for the main sample of 1,173 takeovers that were consummated within a year. It shows the results for the unadjusted data (previously summarized in table 2), and for both methods of correcting runups and markups so that runup indexes are all between zero and one. It also shows estimates of the substitution coefficient **b** from the regression of total premium on runup (6) for the five sets of data.

The average runup index is 0.589 for the main sample, but it has a standard deviation of 16.73, reflecting many observations outside the (0,1) interval. When some of the outliers are eliminated by ignoring observations with negative pre-bid runups, there are 912 estimates of the runup index (77.7% of the main sample). The average runup index from this sample is 0.525, with a standard deviation of 4.093. When observations with negative post-bid markups are also ignored, there are only 712 estimates of the runup index (60.7% of the main sample). The average runup index from this sample is 0.480, with a standard deviation of 0.262. As expected, the average runup and the average premium are higher, both by about 7%, compared with the original sample. The estimate of the regression coefficient of total price paid on runup, **b**, is 0.896 for this sample, with a standard error of 0.051, so the markup and the runup are reliably negatively correlated. This is an artifact of truncating the sample to eliminate negative runups and markups. When the negative runups and markups are set equal to zero, so that the runup index equals zero when runup equals zero, and it equals one when markup equals zero, the average runup index is 0.462, with a standard deviation of 0.372. The average runup and markup are higher than for the original sample, but not by as much as when the negative observations are simply omitted from the calculation. The regression coefficient estimate is 0.951, with a standard error of 0.038, which does not show reliable evidence of substitution.

5.3 Regressions of premiums on the runup index

Jarrell and Poulsen (1989) suggest using a regression of the premium on the runup index to test whether deals where a larger proportion of the premium occurs as runup are also deals with larger premiums. Compared with the regression in (6), the regression of the premium on the runup index,

$$\text{Premium}_i = a' + c\,(\text{Runup}_i / \text{Premium}_i) + u_i, \tag{15}$$

has several statistical problems. First, the regressor in (6), Runup_i, is divided by the dependent variable, Premium_i, to create the runup index, which could induce negative correlation between the premium and the runup index. Second, to the extent that the sample or the data must be truncated to make the runup index lie in the (0,1) interval, this could induce a correlation between the errors, u_i, and the runup index because the dependent variable Premium_i is in the denominator of the runup index.

To show these problems, I use a bootstrap simulation where the runups from the main sample of 1,173 takeovers discussed above are added to markups that are randomly selected from the same set of transactions. This experiment is repeated 1,000 times to show the effects of the statistical problems with the runup index regression. By construction, the markup pricing hypothesis is true in this experiment, because the runups and markups are uncorrelated.

Table 10 shows estimates of the runup index regression (15) for the real data and several summary statistics from the simulated samples. Using the real data, it seems that there is a reliable negative relation between the runup index and the premium when the cases involving negative markups and negative runups are omitted (the fourth column of table 10), since the coefficient estimate is -0.115 and its standard error is 0.031. In the other columns, the coefficient of the runup index is not more than two standard errors from zero. This would seem to imply that takeovers where the runup was large (relative to the total premium) were not cases with large premiums.

However, the simulation evidence in the remaining rows of table 10 shows that these regression results are not meaningful evidence against the markup pricing hypothesis. In the simulations, premiums are created by combining runups with randomly chosen markups, so there is no way that either the bidder or the target could react to a higher than average runup by reducing the subsequent markup as the substitution hypothesis predicts. The average coefficient of the runup index is close to zero for the full sample and for cases where the runup is truncated by omitting negative runups or setting them equal to zero (columns 2, 3 and 5 in table 10). In cases where the markup is truncated by omitting negative markups or setting them equal to zero (columns 4 and 6 in table 10), however, there is a strong negative bias; the average runup coefficient is -0.1334 when negative markups are omitted and -0.0988 when they are set to zero. Thus, although the data are constructed so that the markup pricing hypothesis is true, the runup index regressions seem to show a lack of relation, or even a negative relation between runup indexes and premiums. These results are artifacts of underlying statistical problems.

The last two rows of table 10 show the averages and standard deviations of the t-tests for whether the runup index coefficient equals zero. Under the null hypothesis that the runup index and the premium are unrelated, the t-test should have a mean of zero and a standard deviation of one. The average t-tests show a pattern similar to the average coefficients, with strong negative bias when negative markups are omitted or transformed (average t-tests of -4.10 and -5.47 in columns 4 and 6). When the negative markups are not omitted or transformed, however, the effect of dividing the runup by a premium the is close to zero or negative in some cases is to create many outliers, which explains the very large standard deviations for the t-tests in columns 2, 3 and 5. Thus, the runup index regression is plagued by two problems: either the runup is divided by the dependent variable (which includes some values that are close to zero or negative, so outliers occur), or if data are omitted or transformed to solve the outlier problem, this process creates a correlation between the errors and the regressors, inducing substantial bias.

5.4 Can the market predict premiums?

Besides the statistical problems caused by negative runups or markups, the runup index has an important conceptual problem that makes it useless to bidders or targets during the process of a transaction. While the price and volume runups can be seen by both the bidder and the target at the time of the first bid, and could affect the subsequent behavior of either party to the transaction, the runup index can only be calculated after the consummation of the deal (or at least at the end of the bidding). The hypothetical assumption that the total premium is somehow known in advance is inconsistent with all of the evidence in this paper.

From table 2, most of the reliable variation of premiums is related to the variation of markups as the type of deal is learned by the market (e.g., all-cash deals, tender offers, and especially auctions). There is much less variation in runups across different types of deals. Comment and Schwert (1994) use several accounting and stock market performance measures to predict takeovers of exchange-listed firms from 1975-91 and to predict premiums (including a 20 trading day runup period) conditional on a takeover. They find only weak evidence that accounting and stock market performance variables predict either takeovers or premiums. The most reliable variables explaining premiums are auctions, all-cash deals and tender offers, along with yearly dummy variables. Even including the explanatory variables that are not known at the time of the first bid, the adjusted coefficient of determination for predicting premiums is only 19.2%. In short, it seems that the type of competition that the bidder fears is the best systematic explanation for variation in takeover premiums, and this is not generally known before the first bid occurs.

6. Conclusions

The preponderance of evidence in this paper supports the markup pricing hypothesis; that is, the premiums paid to target shareholders in successful mergers and tender offers (measured from the date of the first bid announcement through delisting) are essentially unrelated to the size of the price or volume runups that occur before the announcement of the first bid. Even selecting the results that are most favorable to the notion of substitution between runups and post-bid markups, which involve cases where the S.E.C. subsequently prosecuted someone for insider trading, the regression tests show that the post-bid markup is only reduced by one third of the pre-bid runup. In other words, at least two-thirds of the runup is added to the total premium by successful bidders (the sum of runups and post-bid markups).

This markup pricing behavior is consistent with rationality since, in general, neither bidders nor targets (management or shareholders) are certain about the causes of pre-bid runups. To the extent that an increase in the market price of the target's stock reveals information held by other potential bidders, perhaps foreshadowing an auction, it is to be expected that the successful deal price will adjust to reflect this information. From this perspective, the kinds of third party insider trading prosecuted by the S.E.C. in the 1980s (e.g., Dennis Levine, Ivan Boesky and Martin Siegel) impose large costs on financial markets. By stealing a bidder or target firm's proprietary information, these third party insider traders act like shills in an auction -- they fraudulently fool legitimate bidders into thinking that there are competing bidders with potentially different private information who are interested in buying the target. Even the strongest critics of insider trading regulations in the United States [e.g., Carlton and Fischel (1983) or Manne (1966)] do not argue that third party insider trading based on misappropriated information has societal benefits.

Some of the results raise interesting questions about the enforcement of insider trading laws. There is some evidence that the cases where the S.E.C. subsequently prosecuted people for insider trading are different from the overall sample. For example, this subset of about 10% of the sample has partial substitution between the pre-bid runup and the post-bid markup, and the pre-bid price and volume runups are unusually large for these cases. Since the prosecutions are generally announced long after the deal is consummated, it seems that the market can partially infer the existence of this insider trading before the S.E.C. does. This is consistent with the results of Meulbroek (1992), who finds that much of the price movements during runup periods occur on days when insiders are trading. One interpretation is that insider trading occurs in a much larger fraction of the cases, but the S.E.C. only prosecutes the cases where the effects on price and volume are largest.

In summary, one way to think about the results in this paper is in terms of the random walk model for stock prices -- the market price on the day before the first bid in a merger or tender offer sets the level on which subsequent control premiums are determined. It generally does not matter how that market price was achieved (i.e., how big was the runup during the last month).

Appendix A. The relation between runup and premium when premium is predetermined

Define runup for firm i, $\mathbf{R}_i$, as the product of the total premium paid if a successful takeover were to occur, $\mathbf{P}_i$, times the probability of a takeover perceived before the date of the first bid, π_i. Both $\mathbf{R}_i$ and $\mathbf{P}_i$ are measured as market-adjusted stock returns, so they represent a percentage deviation from the stock market price measured at the beginning of the runup period. Suppose that the total premium paid is known in advance to all participants. Further, suppose that the probability of takeover is uncorrelated with $\mathbf{P}_i$.

The expected runup would be

$$E(\mathbf{R}_i) = E(\mathbf{P}_i) \cdot E(\pi_i). \tag{A1}$$

The variance of the runup would be

$$\mathrm{Var}(\mathbf{R}_i) = \mathrm{Var}(\mathbf{P}_i) \bullet \mathrm{Var}(\pi_i) + E(\pi_i)^2 \bullet \mathrm{Var}(\mathbf{P}_i) + E(\mathbf{P}_i)^2 \bullet \mathrm{Var}(\pi_i), \tag{A2}$$

and the covariance of runup with the total price would be

$$\mathrm{Cov}(\mathbf{R}_i, \mathbf{P}_i) = E(\pi_i) \cdot \mathrm{Var}(\mathbf{P}_i). \tag{A3}$$

Thus, the probability limit of the coefficient from the regression of total premium on runup in (13) is

$$\begin{aligned} plim\ \mathbf{b} &= \mathrm{Cov}(\mathbf{R}_i, \mathbf{P}_i) \ / \ \mathrm{Var}(\mathbf{R}_i) \\ &= E(\pi_i) \bullet \mathrm{Var}(\mathbf{P}_i) / [\mathrm{Var}(\mathbf{P}_i) \bullet \mathrm{Var}(\pi_i) + E(\pi_i)^2 \bullet \mathrm{Var}(\mathbf{P}_i) + E(\mathbf{P}_i)^2 \bullet \mathrm{Var}(\pi_i)] \\ &= 1 \ / \ \{ E(\pi_i) \bullet [\ 1 + (\mathrm{Var}(\pi_i) / E(\pi_i)^2) \bullet [\ 1 + (E(\mathbf{P}_i)^2 / \mathrm{Var}(\mathbf{P}_i))\ ]\ ]\ \}. \end{aligned} \tag{A4}$$

If the probability of a takeover is constant across all deals, $\mathrm{Var}(\pi_i) = 0$, and *plim* $\mathbf{b} = 1 / E(\pi_i)$. In general, *plim* $\mathbf{b} > 1$, since the denominator of (A4) will be less than 1. Table A1 shows the values of *plim* $\mathbf{b}$ implied if the takeover probability has a uniform distribution over the range [l,u] for different values of the upper and lower limits l and u. It assumes the values of the mean and variance of the total price from the 1,173 firms in the main sample of exchange-listed takeover targets, $E(\mathbf{P}_i) = 0.302$, and $Var(P_i) = 0.102$. The probability limits for b range from 2.00 to 1.23, being inversely related to the variance of π_i.

Table A1

Coefficients for runup, $\mathbf{R}_i$, in a regression of total premium paid, $\mathbf{P}_i$, on $\mathbf{R}_i$, where the probability of a successful takeover, π_i, is drawn from a uniform distribution over the interval [l,u]. $E(\pi)$ and $Var(\pi)$ are the mean and variance of the takeover probability, respectively. *plim* b is the probability limit of the coefficient of $\mathbf{R}_i$ implied by this model for runup from (A4), with $E(\mathbf{P}_i) = 0.302$, and $Var(\mathbf{P}_i) = 0.102$ (the values from the main sample of 1,173 takeovers of exchange-listed target firms, 1975-91).

Lower limit, l	Upper limit, u	E(π)	Var(π)	*plim* b
0.00	1.00	0.50	0.083	1.23
0.05	0.95	0.50	0.067	1.32
0.10	0.90	0.50	0.054	1.42
0.15	0.85	0.50	0.041	1.53
0.20	0.80	0.50	0.030	1.63
0.25	0.75	0.50	0.021	1.73
0.30	0.70	0.50	0.013	1.82
0.35	0.65	0.50	0.007	1.89
0.40	0.60	0.50	0.003	1.95
0.45	0.55	0.50	0.001	1.99
0.50	0.50	0.50	0.000	2.00

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Table 1

Number of Stories in *Dow Jones News Retrieval* Containing "Insider Trading" from 1979-92

Year	Stories	Percent of Total
1979	6	0.3%
1980	25	1.4%
1981	54	3.1%
1982	83	4.8%
1983	74	4.3%
1984	99	5.7%
1985	52	3.0%
1986	212	12.2%
1987	269	15.5%
1988	204	11.7%
1989	193	11.1%
1990	187	10.7%
1991	149	8.6%
1992	134	7.7%
Total	1,741	100%

Table 2

Average pre-bid runups (Runup) and post-announcement markups (Markup) for different samples of successful mergers or tender offers of exchange-listed target firms, 1975-91. Runup is the cumulative abnormal return to the target's stock from day -42 to day -1 relative to the first bid. Markup is the cumulative abnormal return to the target's stock from the day of the first bid through delisting or 126 trading days after the first bid, whichever comes first. Also, the proportions of each sample that have pre-bid news implying that a bid might be forthcoming (News), or that involve multiple bidder auctions (Auctions), or that are tender offers (Tender Offer), or that are management buyouts (MBO), or that involve the payment of cash to target shareholders (Cash), or that involve the payment of equity to target shareholders (Equity), or where the S.E.C. later accused someone of engaging in insider trading prior to the takeover (Insiders).

Sample	Sample Size, N	Runup	Markup	News	Auctions	Tender Offers	MBO	Cash	Equity	Insiders
All Deals	1,398	0.1415	0.1486	0.3970	0.1595	0.3763	0.1001	0.5329	0.1452	0.0959
Standard Deviation		0.1980	0.2700	0.4895	0.3663	0.4846	0.3003	0.4991	0.3524	0.2945
Main Sample	1,173	0.1432	0.1591	0.4731	0.1901	0.4484	0.1194	0.6351	0.1731	0.1142
Standard Deviation		0.1907	0.2528	0.4995	0.3926	0.4975	0.3243	0.4816	0.3785	0.3182
No News	618	0.1284	0.1723	0.0000	0.1472	0.3754	0.1100	0.6278	0.2152	0.0809
News	555	***0.1598***	0.1444	1.0000	0.2378	0.5297	0.1297	0.6432	0.1261	0.1514
Auctions	223	***0.1222***	***0.2796***	0.5919	1.0000	0.7175	0.1121	0.7354	0.0583	0.1390
No Auction	950	0.1482	0.1309	0.4453	0.0000	0.3853	0.1211	0.6116	0.2000	0.1084
Tender Offers	526	***0.1590***	***0.2160***	0.5589	0.3042	1.0000	0.0817	0.8213	0.0114	0.1483
Mergers	647	0.1304	0.1129	0.4034	0.0974	0.0000	0.1499	0.4838	0.3045	0.0866
MBOs	140	***0.1138***	0.1258	0.5143	0.1786	0.3071	1.0000	0.7786	0.0000	0.1357
Cash	745	0.1451	***0.1945***	0.4792	0.2201	0.5799	0.1463	1.0000	0.0000	0.1221
Equity	203	***0.1136***	***0.1084***	0.3448	0.0640	0.0296	0.0000	0.0000	1.0000	0.0591
Insiders	134	***0.1850***	***0.2126***	0.6269	0.2313	0.5821	0.1418	0.6791	0.0896	1.0000
No Insiders	1,039	0.1379	0.1522	0.4533	0.1848	0.4312	0.1165	0.6295	0.1838	0.0000
1975	19	0.1208	0.2020	0.0526	0.4211	0.0526	0.5789	0.2632	0.0000	0.0000
1976	35	0.1659	0.1536	0.2571	0.1143	0.3143	0.0000	0.5429	0.2857	0.0286
1977	59	***0.2281***	0.1365	0.2034	0.1695	0.3390	0.0339	0.5763	0.2373	0.0169
1978	65	***0.1941***	***0.0456***	0.2462	0.1385	0.4154	0.0462	0.6000	0.1385	0.0462
1979	68	***0.2516***	***0.1079***	0.2941	0.1765	0.3971	0.0000	0.5735	0.1324	0.0294
1980	72	***0.1959***	***0.1035***	0.3611	0.1806	0.2917	0.0833	0.6111	0.2222	0.0556
1981	65	0.1386	***0.2329***	0.3846	0.2000	0.4000	0.0615	0.5692	0.2000	0.2769
1982	72	0.1461	0.1825	0.5278	0.1528	0.3194	0.1944	0.6111	0.1667	0.1944
1983	75	0.1247	0.1285	0.5733	0.1600	0.2533	0.2133	0.6267	0.1867	0.1467
1984	84	0.1396	***0.1109***	0.4524	0.1905	0.4762	0.2024	0.7381	0.1071	0.1310
1985	101	0.1278	***0.1135***	0.4851	0.1485	0.4455	0.1287	0.6337	0.1386	0.2772
1986	116	***0.0939***	0.1657	0.5345	0.1810	0.5862	0.1552	0.7069	0.1121	0.0862
1987	99	***0.0995***	0.1837	0.5859	0.2727	0.5455	0.1818	0.6162	0.1919	0.0808
1988	119	0.1345	***0.2745***	0.6807	0.3529	0.6387	0.1597	0.7311	0.1176	0.0588
1989	68	0.1124	0.1777	0.6912	0.2206	0.6029	0.0882	0.6765	0.1471	0.0882
1990	35	***0.0714***	0.1864	0.5429	0.0571	0.4000	0.0571	0.5714	0.3429	0.2571
1991	21	0.1064	0.2044	0.4762	0.0000	0.2857	0.0476	0.4286	0.4762	0.0476

Note: Average runups and markups that are reliably different from the main sample mean at the 5% significance level are shown in ***bold italics***.

Table 3

Regressions of the total premium paid to target stockholders ($Premium_i$) on the pre-bid runup ($Runup_i$) for various samples of successful mergers and tender offers for exchange-listed target firms, 1975-91:

$$Premium_i = a + b\ Runup_i + u_i,$$

where $Premium_i = Runup_i + Markup_i$. $Runup_i$ is the cumulative abnormal return to the target's stock from day -42 to day -1 relative to the first bid. Markup is the cumulative abnormal return to the target's stock from the day of the first bid through delisting or 126 trading days after the first bid, whichever comes first. The substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. S(u) is the standard error of the regression and $\bar{R}^2$ is the adjusted coefficient of determination. White's (1980) heteroskedasticity-consistent standard errors are used.

Sample	Proportion of Sample	Sample Size, N	Constant a	Std Error S(a)	T-statistic t(a=0)	Slope b	Std Error S(b)	T-statistic t(b=1)	S(u)	$\bar{R}^2$
All Deals		1,398	0.1382	0.0105	13.11	1.0733	0.0427	1.72	0.2697	0.383
Main Sample		1,173	0.1567	0.0104	15.14	1.0169	0.0403	0.42	0.2529	0.370
No News	52.7%	618	0.1683	0.0145	11.63	1.0318	0.0589	0.54	0.2538	0.349
News	47.3%	555	0.1420	0.0148	9.62	1.0151	0.0552	0.27	0.2515	0.395
Auctions	19.0%	223	0.2783	0.0244	11.40	1.0103	0.1169	0.09	0.2745	0.268
No Auction	81.0%	950	0.1254	0.0111	11.28	1.0371	0.0421	0.88	0.2391	0.419
Tender Offers	44.8%	526	0.2349	0.0144	16.28	0.8812	0.0584	-2.04	0.2410	0.311
Mergers	55.2%	647	0.1024	0.0136	7.52	1.0808	0.0525	1.54	0.2521	0.411
MBOs	11.9%	140	0.1348	0.0243	5.55	0.9211	0.1087	-0.73	0.2063	0.336
Cash	63.5%	745	0.1984	0.0118	16.88	0.9732	0.0475	-0.56	0.2383	0.376
Equity	17.3%	203	0.0952	0.0232	4.10	1.1161	0.0990	1.17	0.2638	0.400
Insiders	11.4%	134	0.2776	0.0291	9.55	0.6486	0.1098	-3.20	0.2181	0.178
No Insiders	88.6%	1,039	0.1467	0.0108	13.53	1.0402	0.0423	0.95	0.2555	0.384
1975	1.6%	19	0.2108	0.0535	3.94	0.9270	0.2690	-0.27	0.2363	0.310
1976	3.0%	35	0.1645	0.0664	2.48	0.9341	0.2182	-0.30	0.2698	0.302
1977	5.0%	59	0.1913	0.0528	3.63	0.7597	0.1472	-1.63	0.2174	0.255
1978	5.5%	65	0.0203	0.0521	0.39	1.1305	0.1511	0.86	0.2382	0.428
1979	5.8%	68	0.1553	0.0497	3.12	0.8115	0.1340	-1.41	0.2067	0.343
1980	6.1%	72	0.0592	0.0395	1.50	1.2260	0.1129	2.00	0.2354	0.518
1981	5.5%	65	0.2454	0.0483	5.07	0.9101	0.1981	-0.45	0.2676	0.223
1982	6.1%	72	0.1885	0.0358	5.26	0.9594	0.1349	-0.30	0.2120	0.481
1983	6.4%	75	0.0902	0.0318	2.84	1.3065	0.1320	2.32	0.2138	0.606
1984	7.2%	84	0.1093	0.0266	4.11	1.0116	0.1341	0.09	0.1966	0.434
1985	8.6%	101	0.1047	0.0284	3.69	1.0683	0.1499	0.46	0.1950	0.351
1986	9.9%	116	0.1882	0.0237	7.93	0.7597	0.1007	-2.39	0.2253	0.236
1987	8.4%	99	0.1979	0.0346	5.73	0.8571	0.1287	-1.11	0.2814	0.269
1988	10.1%	119	0.2293	0.0444	5.17	1.3363	0.1618	2.08	0.3256	0.400
1989	5.8%	68	0.1478	0.0385	3.84	1.2655	0.1453	1.83	0.2765	0.496
1990	3.0%	35	0.1746	0.0483	3.61	1.1658	0.2430	0.68	0.2631	0.387
1991	1.8%	21	0.1940	0.0564	3.44	1.0973	0.3926	0.25	0.3071	0.273
Joint test for equality of the yearly intercepts or slopes, 1975 to 1991, distributed $\chi^2(16)$					35.49			30.36		

Table 4

A multiple regression of the total premium paid to target stockholders ($Premium_i$) on the pre-bid runup ($Runup_i$) and dummy variables for various characteristics of successful mergers and tender offers for exchange-listed target firms, 1975-91:

$$Premium_i = a_0 + b_0 Runup_i + \sum a_k D_{ki} + \sum b_k D_{ki} Runup_i + u_i,$$

where $Premium_i = Runup_i + Markup_i$. The dummy variables appear separately to represent changes in the intercept a_k, and they interact with $Runup_i$ to represent differences in the effect of pre-bid runups on the total premium paid, b_k. $Runup_i$ is the cumulative abnormal return to the target's stock from day -42 to day -1 relative to the first bid. $Markup_i$ is the cumulative abnormal return to the target's stock from the day of the first bid through delisting or 126 trading days after the first bid, whichever comes first. The characteristics of deals that are used in the regression include: pre-bid news implying that a bid might be forthcoming (News), multiple bidder auctions (Auctions), tender offers (Tender Offer), management buyouts (MBO), the payment of cash to target shareholders (Cash), the payment of equity to target shareholders (Equity), and whether the S.E.C. later accused someone of engaging in insider trading before the takeover (Insiders). The substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. $\bar{R}^2$ is the adjusted coefficient of determination. White's (1980) heteroskedasticity-consistent standard errors are used. The t-statistic for the runup coefficient tests whether it is equal to one; the other t-statistics test whether the coefficients equal zero. The tests for whether all of the coefficients representing intercept (a_k) and slope changes (b_k) equal zero, which have a large sample χ^2 (7) distributions, and their p-values are also shown.

	Intercept, a_k			Slope, b_k		
Variable	Coefficient	Std Error	T-Statistic	Coefficient	Std Error	T-Statistic
Constant	0.0404	0.0366	1.10			
Runup				1.1456	0.1324	1.10
News	-0.0468	0.0204	-2.29	-0.0056	0.0807	-0.07
Auctions	0.1180	0.0270	4.36	0.0693	0.1254	0.55
Tender Offers	0.0827	0.0220	3.76	-0.1417	0.0811	-1.75
MBOs	-0.0211	0.0249	-0.85	-0.0892	0.1093	-0.82
Cash	0.0988	0.0327	3.03	-0.0539	0.1136	-0.47
Equity	0.0519	0.0411	1.26	0.0080	0.1527	0.05
Insiders	0.1229	0.0306	4.02	-0.3717	0.1155	-3.22
Degrees of Freedom		1,157				
$\bar{R}^2$		0.4379				
Standard Error		0.2389				
Test for joint significance, χ^2 (7)		99.1			15.0	
p-value		0.00%			3.58%	

Table 5

Multiple regressions of markups (cumulative abnormal returns for the target firm) measured over various spans of trading days after the first bid (day 0) on a constant and the runups (cumulative abnormal returns) measured over nine periods before the first bid. Perfect substitution between the pre-bid runup and the post-bid markup would show as a coefficient of -1. White's (1980) heteroskedasticity-consistent standard errors are in parentheses below the coefficient estimates. $\bar{R}^2$ is the adjusted coefficient of determination and S(u) is the standard error of the regression. The sample includes 1,173 NYSE and Amex-listed target firms that were taken over in the 1975-91 period.

Runup Period (Independent Variable)	Markup Measurement Period (Dependent Variable)													
	(0,126)	(0,Delist)	0	1	(2,5)	(6,10)	(11,21)	(22,42)	(43,63)	(64,84)	(85,105)	(106,126)	(127,253)	>253
Constant	***0.1717***	***0.1717***	***0.1350***	***0.0126***	***0.0048***	-0.0002	***0.0075***	***-0.0082***	0.0056	0.0024	***0.0066***	***0.0056***	-0.0003	0.0004
	(0.0104)	(0.0113)	(0.0057)	(0.0023)	(0.0021)	(0.0020)	(0.0030)	(0.0036)	(0.0031)	(0.0028)	(0.0029)	(0.0021)	(0.0035)	(0.0006)
-1	***-0.3347***	***-0.2749***	***-0.2523***	***-0.0388***	-0.0203	0.0335	-0.0010	0.0101	***-0.0536***	-0.0121	-0.0206	0.0203	***0.0810***	-0.0212
	(0.0824)	(0.0942)	(0.0420)	(0.0150)	(0.0177)	(0.0208)	(0.0225)	(0.0318)	(0.0255)	(0.0206)	(0.0242)	(0.0170)	(0.0384)	(0.0216)
(-2,-5)	-0.0991	-0.0932	***-0.2344***	-0.0134	0.0300	0.0285	0.0037	***0.0750***	0.0227	0.0242	0.0047	***-0.0402***	0.0305	-0.0246
	(0.0810)	(0.0918)	(0.0410)	(0.0161)	(0.0172)	(0.0161)	(0.0220)	(0.0264)	(0.0229)	(0.0205)	(0.0285)	(0.0188)	(0.0336)	(0.0221)
(-6,-10)	0.0952	0.1457	-0.0642	-0.0002	-0.0170	0.0362	0.0121	0.0785	0.0185	0.0116	0.0229	-0.0034	0.0606	-0.0101
	(0.1403)	(0.1458)	(0.0632)	(0.0242)	(0.0230)	(0.0211)	(0.0309)	(0.0558)	(0.0363)	(0.0380)	(0.0347)	(0.0192)	(0.0395)	(0.0081)
(-11,-21)	0.1603	0.1791	***-0.1034***	0.0124	-0.0025	0.0213	-0.0099	***0.1184***	***0.0624***	0.0397	0.0058	0.0160	0.0157	0.0031
	(0.1026)	(0.1078)	(0.0448)	(0.0193)	(0.0192)	(0.0172)	(0.0246)	(0.0389)	(0.0268)	(0.0321)	(0.0264)	(0.0162)	(0.0301)	(0.0046)
(-22,-42)	0.0304	0.0445	***-0.1138***	***-0.0214***	0.0078	0.0087	0.0068	0.0332	***0.0675***	0.0162	-0.0013	***0.0268***	0.0180	-0.0039
	(0.0602)	(0.0680)	(0.0313)	(0.0100)	(0.0129)	(0.0113)	(0.0150)	(0.0239)	(0.0182)	(0.0160)	(0.0133)	(0.0105)	(0.0255)	(0.0029)
(-43,-63)	0.0295	0.0699	***-0.1089***	-0.0062	-0.0064	0.0070	0.0149	***0.0706***	***0.0479***	0.0222	-0.0041	-0.0076	0.0290	0.0114
	(0.0711)	(0.0764)	(0.0334)	(0.0133)	(0.0124)	(0.0153)	(0.0163)	(0.0229)	(0.0182)	(0.0166)	(0.0182)	(0.0139)	(0.0325)	(0.0087)
(-64,-84)	0.0987	0.1452	-0.0223	***-0.0249***	0.0183	0.0053	0.0065	0.0474	-0.0074	***0.0451***	0.0208	0.0099	0.0457	0.0009
	(0.0723)	(0.0792)	(0.0337)	(0.0116)	(0.0144)	(0.0122)	(0.0221)	(0.0282)	(0.0251)	(0.0172)	(0.0179)	(0.0135)	(0.0257)	(0.0026)
(-85,-105)	***0.2670***	***0.2641***	-0.0575	-0.0014	0.0198	0.0139	***0.0469***	***0.0689***	0.0443	***0.1103***	0.0085	0.0133	0.0040	-0.0069
	(0.0904)	(0.0996)	(0.0389)	(0.0127)	(0.0144)	(0.0128)	(0.0228)	(0.0310)	(0.0243)	(0.0241)	(0.0285)	(0.0162)	(0.0384)	(0.0054)
(-106,-126)	***0.2005***	***0.2196***	0.0304	-0.0026	-0.0013	0.0166	0.0220	0.0495	***0.0766***	-0.0429	0.0278	0.0245	0.0080	0.0111
	(0.0758)	(0.0994)	(0.0387)	(0.0187)	(0.0141)	(0.0147)	(0.0220)	(0.0287)	(0.0251)	(0.0300)	(0.0167)	(0.0125)	(0.0391)	(0.0133)
$\bar{R}^2$	0.034	0.031	0.063	0.001	0.000	0.005	0.000	0.048	0.037	0.046	-0.003	0.007	0.006	-0.002
S(u)	0.2484	0.2729	0.1280	0.0540	0.0514	0.0483	0.0699	0.0864	0.0779	0.0648	0.0671	0.0505	0.0863	0.0452

Note: Coefficient estimates that are more than two standard errors from zero are shown in ***bold italics***.

Table 6

Regressions of the total premium paid to target stockholders ($Premium_i$) on the pre-bid runup for the target firm ($Runup_i$) and for the bidder firm ($Runup_{ib}$) for various samples of successful mergers and tender offers for exchange-listed target firms, 1975-91:

$$Premium_i = a + b\ Runup_i + c\ Runup_{ib} + u_i.$$

where $Premium_i = Runup_i + Markup_i$. $Runup_i$ ($Runup_{ib}$) is the cumulative abnormal return to the target's (bidder's) stock from day -42 to day -1 relative to the first bid. Markup is the cumulative abnormal return to the target's stock from the day of the first bid through delisting or 126 trading days after the first bid, whichever comes first. The substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. The average 42-day runup for the bidder is in the fourth column from the right and the average 127-day markup for the bidder is in the third column from the right. S(u) is the standard error of the regression and $\bar{R}^2$ is the adjusted coefficient of determination. White's (1980) heteroskedasticity-consistent standard errors are used to compute the t-statistics.

Sample	Proportion of Sample	Sample Size, N	Constant a	T-statistic t(a=0)	Slope b	T-statistic t(b=1)	Slope c	T-statistic t(c=0)	Avg Bidder $Runup_{ib}$	Avg Bidder $Markup_{ib}$	S(u)	$\bar{R}^2$
All Deals		761	0.1329	9.94	1.0141	0.29	0.1561	1.70	0.0063	-0.0264	0.2708	0.344
Main Sample		657	0.1522	11.12	0.9794	-0.41	0.1214	1.20	0.0085	-0.0241	0.2541	0.350
No News	55.0%	361	0.1587	8.96	0.9977	-0.03	0.1066	0.72	0.0013	-0.0201	0.2556	0.324
News	45.1%	296	0.1417	6.68	0.9740	-0.35	0.1529	1.18	0.0173	-0.0289	0.2530	0.374
Auctions	19.3%	127	0.2782	8.07	1.0676	0.43	0.5761	2.64	-0.0056	-0.0824	0.2676	0.360
No Auction	80.7%	530	0.1229	8.64	0.9690	-0.63	-0.0120	-0.14	0.0119	-0.0101	0.2375	0.387
Tender Offers	44.4%	292	0.2329	11.31	0.8368	-2.20	0.2541	2.51	0.0070	-0.0036	0.2397	0.306
Mergers	55.6%	365	0.1013	5.71	1.0253	0.37	0.0504	0.33	0.0097	-0.0404	0.2555	0.371
MBOs	2.4%	16	0.0225	0.54	1.0431	0.21	-0.4350	-1.15	-0.0241	-0.0771	0.1584	0.614
Cash	50.1%	329	0.1997	11.24	0.9258	-1.10	0.1590	1.60	0.0029	-0.0002	0.2468	0.344
Equity	26.5%	174	0.1081	3.94	1.0624	0.57	0.0204	0.08	0.0125	-0.0633	0.2687	0.349
Insiders	12.8%	84	0.2710	6.62	0.5895	-2.76	0.2209	1.05	0.0239	0.0007	0.2157	0.134
No Insiders	87.2%	573	0.1430	9.95	0.9996	-0.01	0.1088	0.98	0.0062	-0.0277	0.2582	0.363

Table 7

Average estimates of the coefficients of the daily share trading volume prediction model for 1,169 NYSE and Amex-listed target firms that were taken over from 1975-91 (omitting target firms with stock prices below \$2 per share, with equity capitalization less than \$10 million, and where it takes more than one year from the first bid to consummate the transaction). For each firm, a year of daily share trading volume data is used to estimate the regression,

$$\ell n\,(q_{it} / q_{it-1}) = \mu + \rho\, \ell n\,(q_{it-1} / q_{it-2}) + \gamma_0\, \ell n\,(q_{mt} / q_{mt-1}) + \gamma_1\, \ell n\,(q_{mt-1} / q_{mt-2}) + \delta_0 R_{it} + \delta_1 R_{it-1} + v_{it},$$

where q_{it} is share trading volume for target firm i on day t, q_{mt} is share trading volume for all shares on the exchange where target firm i is listed on day t, and R_{it} is the continuously compounded return to the stock of target firm i on day t for trading days -379 to -127 relative to the first bid date. The results in this table show the average values of these coefficients and the average t-statistics from these 1,169 regressions. The implied long-run effects of a one percent change in either market trading volume growth, or of the target firm's stock return are also shown (adjusting for the effects of including lagged values of the variables). S(v) is the average standard deviation of the residuals from these regression estimates.

Variable	Average Coefficient	Average t-statistic
Intercept, μ	-0.0076	-0.12
Lagged share volume growth, ρ	-0.4171	-7.25
Market share volume growth, γ_0	0.7785	2.63
Lagged market share volume growth, γ_1	0.3430	1.12
Stock return, δ_0	3.8776	1.56
Lagged stock return, δ_1	-0.3443	-0.08
Standard error of regression, S(v)	0.9818	
<u>**Long-run effects of a one percent change in:**</u>		
Market share volume, $(\gamma_0 + \gamma_1) / (1 - \rho)$	0.7902	
Stock Return, $(\delta_0 + \delta_1) / (1 - \rho)$	2.4883	

Table 8

Cumulative average abnormal share trading volume growth for days -42 to -1 relative to the announcement of the first bid for 1,398 NYSE and Amex-listed target firms that were taken over from 1975-91. For each firm, a year of daily share trading volume data is used to estimate a regression model (see table 7) to predict daily share volume, ending 126 trading days before the date of the first bid.

Sample	Sample Size, N	Average Volume Runup
Full Sample	1,398	0.8973
Main Sample	1,169	0.9160
News	555	0.9522
Auctions	223	0.6343
Tender Offers	525	1.0375
MBOs	140	1.0630
Cash	742	0.9179
Equity	203	0.8259
Insiders	134	1.5407

Cross sectional regression model explaining pre-bid volume runups during days -42 to -1 relative to the announcement of the first bid for 1,169 exchange-listed target firms taken over from 1975-91 as a function of the stock price runup, whether there is news that might foreshadow the bid, whether the bid is a tender offer, whether the bid is an MBO, whether cash is the sole compensation for target stockholders, whether equity is the sole compensation for target stockholders, whether multiple bidders eventually compete to acquire this firm, and whether the S.E.C. eventually prosecuted people for insider trading in this transaction. $\bar{R}^2$ is the adjusted coefficient of determination and S(v) is the standard deviation of the regression residuals. The standard errors use White's (1980) heteroskedasticity-consistent method.

Variable	Coefficient	Standard Error	T-statistic
Constant	0.6597	0.2195	3.00
Stock price runup	1.1627	0.5132	2.27
News	-0.0205	0.1752	-0.12
Tender Offers	0.2937	0.2025	1.45
MBOs	0.2533	0.2883	0.88
Cash	-0.0945	0.2044	-0.46
Equity	0.0218	0.2705	0.08
Auctions	-0.4139	0.1960	-2.11
Insiders	0.6298	0.2709	2.33
Degrees of freedom		1,160	
$\bar{R}^2$		0.0098	
Standard error of regression, S(v)		2.9213	

Table 9

Average runup index ($Runup_i$ / $Premium_i$), pre-bid runup ($Runup_i$), and post-bid markup ($Markup_i$) for the main sample of 1,173 exchange-listed target firms, 1975-91. Standard deviations are shown in parentheses under the averages. $Premium_i = Runup_i + Markup_i$. The coefficient from the regression of $Premium_i$ on $Runup_i$ and its standard error are shown in the last row. Five samples are used. Column 2 contains estimates from the original untransformed data (previously shown in tables 2 and 3). Column 3 shows what happens when the cases where $Runup_i < 0$ are omitted. Column 4 shows the effects of omitting cases where either $Runup_i < 0$ or $Markup_i < 0$. Column 5 shows what happens when negative values of $Runup_i$ are set equal to 0. Column 6 shows the effects of setting negative values of either $Runup_i$ or $Markup_i$ equal to 0.

Statistic	Main Sample	Negative Runups Omitted (Sample truncation)	Negative Runups and Markups Omitted (Sample truncation)	Negative Runups Set to 0 (Data truncation)	Negative Runups and Markups Set to 0 (Data truncation)
Sample Size	1,173	912	712	1,173	1,173
Average Runup Index (Standard Deviation)	0.5888 (16.7254)	0.5249 (4.0928)	0.4804 (0.2617)	0.6243 (3.0339)	0.4621 (0.3724)
Average 42-day Runup (Standard Deviation)	0.1432 (0.1907)	0.2121 (0.1507)	0.2138 (0.1518)	0.1649 (0.1595)	0.1649 (0.1595)
Average 126-day Markup (Standard Deviation)	0.1591 (0.3564)	0.1663 (0.2323)	0.2476 (0.1880)	0.1591 (0.1999)	0.1936 (0.1999)
Coefficient of $Runup_i$ (Standard Error)	1.0169 (0.0403)	0.9444 (0.0518)	0.8958 (0.0510)	1.0076 (0.0460)	0.9513 (0.0378)

Table 10

Coefficients of the runup index ($Runup_i$ / $Premium_i$), and t-tests for whether the runup index coefficient equals zero in a regression of $Premium_i$ ($Runup_i$ + $Markup_i$) on the runup index. The first rows show coefficient estimates and White's (1980) heteroskedasticity-consistent standard errors using real data for the main sample of 1,173 exchange-listed target firms, 1975-91. The remaining rows show the averages and standard deviations for the coefficient estimates and the t-tests from 1,000 simulations where the pre-bid runups are added to randomly selected post-bid markups from the set of 1,173 takeovers to create premiums such that the markups and the premiums are uncorrelated (i.e., the markup pricing hypothesis is true by construction). Five samples are used. Column 2 contains estimates using the full set of 1,173 observations. Column 3 shows what happens when the cases where $Runup_i < 0$ are omitted. Column 4 shows the effects of omitting cases where either $Runup_i < 0$ or $Markup_i < 0$. Column 5 shows what happens when negative values of $Runup_i$ are set equal to 0. Column 6 shows the effects of setting negative values of either $Runup_i$ or $Markup_i$ equal to 0.

Statistic	Main Sample	Negative Runups Omitted (Sample truncation)	Negative Runups and Markups Omitted (Sample truncation)	Negative Runups Set to 0 (Data truncation)	Negative Runups and Markups Set to 0 (Data truncation)
Real Data					
Coefficient of Runup Index (Standard Error)	-0.0001 (0.0005)	0.0008 (0.0034)	-0.1149 (0.0306)	-0.0049 (0.0015)	-0.0055 (0.0185)
Bootstrap Simulations (runups added to randomly chosen markups to create premiums)					
Average Coefficient of Runup Index	0.0002	0.0006	-0.1334	0.0017	-0.0988
Standard Deviation of Coefficient of Runup Index	0.0013	0.0025	0.0280	0.0032	0.0150
Average t-test for Whether the Coefficient of Runup Index Equals Zero, t(c=0)	-0.01	-0.09	-4.10	0.45	-5.47
Standard Deviation of t-test for Whether the Coefficient of Runup Index Equals Zero, t(c=0)	5.73	6.10	0.86	5.70	0.81

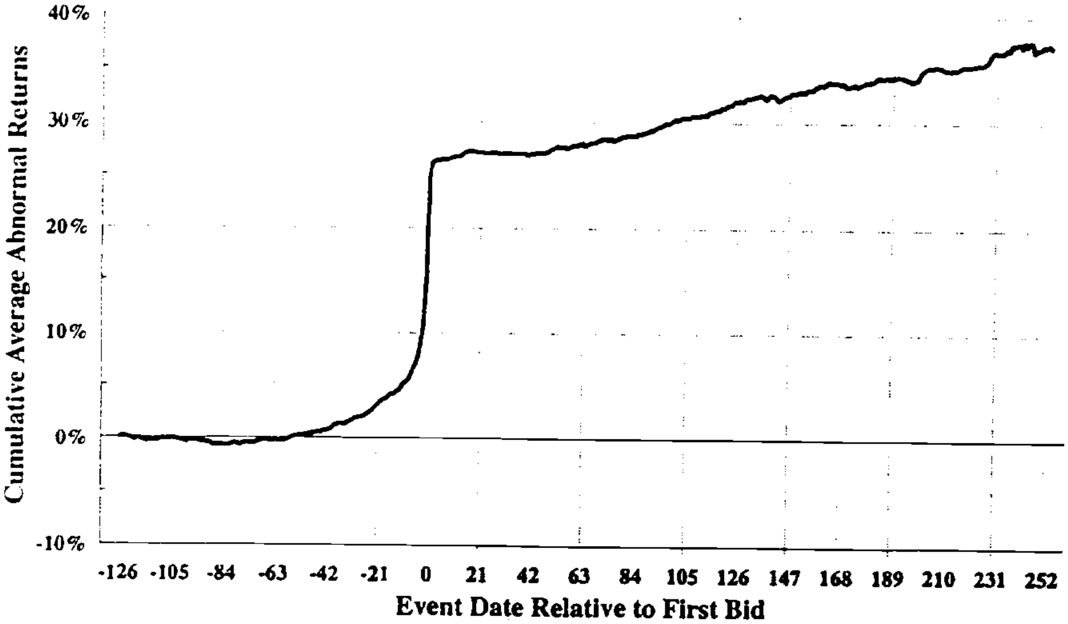

Figure 1. Cumulative average abnormal returns to target firms' stocks from trading day -126 to +253 relative to the first bid. All NYSE and Amex-listed targets that were successfully taken over in the period 1975-91. Market model parameters used to define abnormal returns are estimated using the CRSP value-weighted portfolio for days -379 to -127.

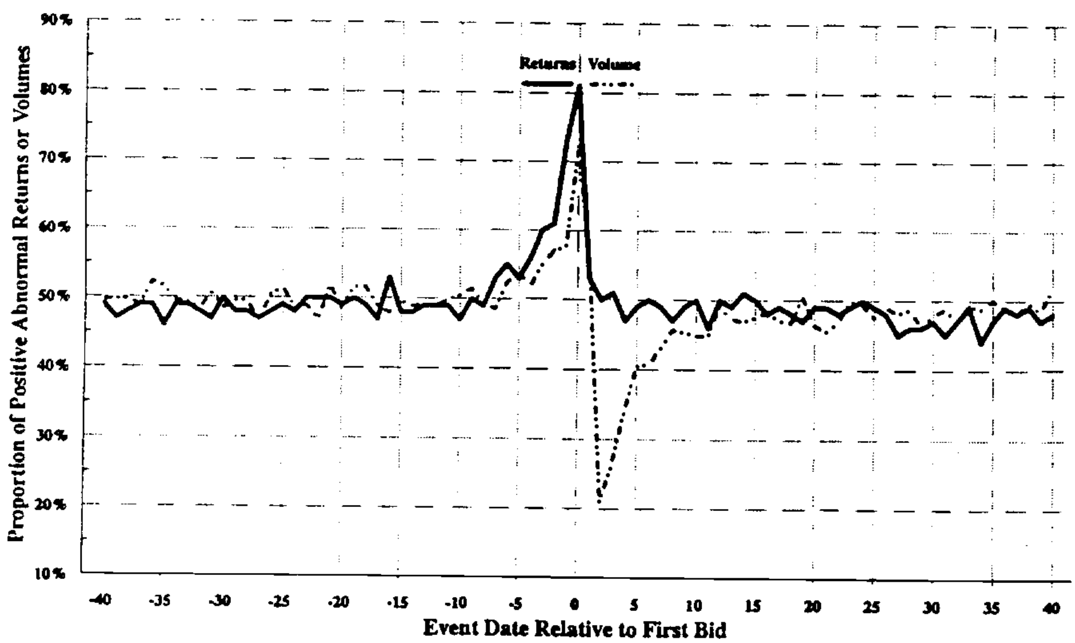

Figure 2. Proportion of abnormal returns and volume growth rates that are positive for each of the trading days from -40 to +40 relative to the first bid. Based on all NYSE and Amex-listed targets that were successfully taken over in the period 1975-91. Regression models used to define abnormal returns or volume are estimated using data for days -379 to -127 relative to the day of the first bid.