ELSEVIER Journal of Financial Economics 41 (1996) 153–192

JOURNAL OF Financial ECONOMICS

Markup pricing in mergers and acquisitions

G. William Schwert

William E. Simon Graduate School of Business Administration, University of Rochester, Rochester, NY 14627, USA

National Bureau of Economic Research, Cambridge, MA 02138, USA

(Received September 1994; final version received December 1995)

Abstract

This paper studies the relation between the premiums in takeover bids involving exchange-listed target firms from 1975–91 and the pre-announcement stock price runups. The evidence shows that the pre-bid runup and the post-announcement increase in the target's stock price (the 'markup') are generally uncorrelated. With little substitution between the runup and the markup, the runup is an added cost to the bidder. This finding has important implications for assessing the costs of insider trading. It also raises interesting questions about the role of information from public capital markets in private takeover negotiations.

Key words: Auctions; Insider trading; Takeovers; Premiums

JEL classification: G14; G34; G38

1. Introduction

Suppose that you are planning to bid for control of a company and, before you can announce your offer, the price of the target firm's stock begins to rise

The Bradley Policy Research Center, William E. Simon Graduate School of Business Administration, University of Rochester, provided support for this research. I received helpful comments from Yacine Aït-Sahalia, Michael Barclay, Michael Bradley, Jim Brickley, Linda DeAngelo, Ken French, David Hirshleifer, Michael Jensen, Eugene Kandel, Steven Kaplan, Lisa Meulbroek, Richard Ruback, Ralph Walkling, Jerold Zimmerman, and from an anonymous referee. I also benefited from the comments of participants at the 1994 American Finance Association meetings, the 1994 Harvard Finance and Control Conference, and seminars at the Universities of Chicago, Michigan, Ohio State, Rochester, and Virginia Tech. Discussions with Brad Cornell, Dan Fischel, Gregg Jarrell, and Mark Wolfson were also helpful. This paper is part of the NBER's research program in Asset Pricing. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

SSDI 0304-405X(95)00865-C

coincident with unusually high trading volume. You have not been buying the target company's stock, and there is no reliable public evidence to show who has been buying. Do you go forward with your offer exactly as you had planned (e.g., using a discounted cash flow analysis to determine the price you are willing to pay for the target firm)? Or do you take into account the recent movement in the target's stock price and adjust your bidding strategy? How will the shareholders and managers of the target firm react to your bid now that the market price of their stock has risen?

This hypothetical scenario has been played out in hundreds of transactions over the 1975–91 period. It provides a test of two competing views of capital markets. The efficient markets or rational expectations view is that market prices aggregate the information of many traders, so that a price rise reflects good news about the value of the stock. The other view is that since a bidder must have information that is not reflected in current market prices (at least prior to the price runup) to justify paying a substantial premium to gain control of the target company, he might ignore the runup if he thinks it merely reflects the information he already has.

Many studies have shown that bidder firms pay large premiums to acquire control of exchange-listed target firms. 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 the premium paid in successful takeovers (the other part of the premium is the markup or the increase in the stock price beginning the day the first bid is announced, $Premium = Runup + Markup$). What causes pre-bid runups, and how do they affect the total control premium? These questions provide the focus for this empirical study of 1,814 successful and unsuccessful takeovers during 1975–91 of target firms listed on the New Year Stock Exchange (NYSE) and the American Stock Exchange (AMEX).

The spate of insider trading cases associated with mergers and acquisitions (M&A) during the 1980s attracted significant attention. Recently, *Businessweek* (December 12, 1994) noted that pre-bid runups have occurred frequently in 1993–94. Meulbroek (1992) shows that daily stock returns are correlated with the pre-takeover trading activities of insiders when the Securities and Exchange Commission successfully prosecuted insider trading. She estimates that almost half the runup in the month before an initial merger or tender offer announcement occurs on the days when insiders traded, 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 when runups are large.

The question of whether 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 insider trading. For example, Anheuser-Busch sued Paul Thayer and A.G. Edwards because it felt that leaks of 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 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]

The tests below show little evidence of substitution between pre-bid runups and post-bid markups, so that control premiums paid to acquire target firms are higher, all else equal, when there has been a large runup in the target's stock price before the first bid is accounted. To the extent that insider trading causes the pre-bid runup, and the bidder and target firms cannot detect the cause of the runup, the bidder will pay more for the target firm.

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 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 statistical tests. Section 6 contains concluding remarks.

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 timeline of events shown in Fig. 1. 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. It is possible that more

[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*, No. 86-6447 (S.D.N.Y. 1990).

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

[4] *FMC Corporation v. Boesky et al.*, No. 86-9879 (N.D. Ill. 1988).

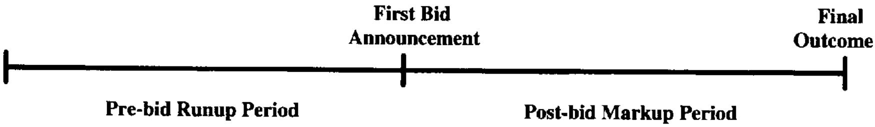

Fig. 1. Timeline of merger and acquisition events (measuring the total premium).

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 will 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-party bargaining situation, negotiation will lead to a consummated deal if the reservation price of the target is below the valuation of 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 that there are no other traders with valuable private information), both the bidder and the target will 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 reflect valuable private information of other traders, runups during the negotiations could well cause both the bidder and the target 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) will probably revise their valuations of the target stock upwards. Walkling and Edmister (1985), Bradley, Desai, and Kim (1988), and Comment and Schwert (1995) show that the premiums paid in contested M&A transactions (auctions) are significantly higher than when multiple bidders do not appear. The final deal price increases because of the pre-bid runup. If the markup is unaffected, each dollar of pre-bid runup is added into the final deal price one-for-one. This is the *markup pricing hypothesis.*

The markup pricing hypothesis reflects rational behavior of bidders and targets when they have incomplete information. Another 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', with bidders interested in winning a takeover contest irrespective of 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, the bidder's stock price should drop.

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 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, an auction will reflect a mixture of common and private values (this is called a correlated values auction). The typical situation in which competing bidders can observe the bids of others causes complicated interactions among bidder's strategies. To the extent that another 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 (efficient markets) models of asset prices developed by Grossman (1976, 1977).

[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.

The presence of people who trade on the information of either 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. Of course, if participants know the probability that shills (insider trading) will affect the auction process, they will adjust their behavior to avoid overpaying. This is one reason that shills (people with insider information) have incentives to disguise their behavior.[6]

2.3. Relation to the efficient markets literature

The semistrong 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, is not generally reflected in the market price of the target stock until an event occurs that causes many traders to infer that private information. An example of such an event would be pre-bid purchases of the target's stock by the bidder to establish a 'toehold' 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 (and 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 it should not be possible to earn systematic abnormal profits from 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 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.[7]

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[6]The theoretical literature on auctions usually does not deal with situations in which fraud or manipulation affect auctions in ways that are not foreseen by auction participants. One recent exception is Rothkopf and Harstad (1995).

[7]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). Section 3 shows updated statistics that confirm earlier findings.

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. Otherwise, it would be profitable to buy shares of stocks whose prices have risen recently (perhaps with unusual volume behavior). Pound and Zeckhauser (1990) find that there are no abnormal profits available from buying the shares of companies written about 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.

2.4. *Inferring information about the insider trading*

How likely is it that the market can infer the existence of insider trading? In the United States, which has severe punishments associated with insider trading, people who obtain inside information and trade on it have strong incentives to disguise their behavior. There are many mechanisms used by regulators to detect 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. Unusual price and volume behavior triggers a call to the affected company to ask whether there is material information that could explain the trading. In extreme cases, the S.E.C. is notified and begins its own investigation. Faced with the knowledge of these enforcement mechanisms, sophisticated traders who have inside information try to avoid easily detectable trading patterns by spreading their trading over many accounts and brokerage firms, and by spreading their trading over time (Boesky, 1985).

Even if there were no legal costs associated with insider trading, insiders have strong economic incentives to disguise their behavior so that other traders cannot easily infer the information they possess from their trading behavior. For example, an insider who submits many buy orders in a short period is 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 pre-offer price appreciation occurs in intermediate-sized trades (500 to 9,900 shares), rather than larger or smaller trades. They call this behavior '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).

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%

Another cost of too-obvious insider trading is that planned bids can be canceled. A bidder who sees the target price run up unexpectedly might decide to postpone or cancel a planned bid while trying to learn the cause of the runup. Diamond Shamrock canceled its planned bid for Natomas after Ivan Boesky's insider trading caused Natomas' stock price to rise by more than 20% 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).[8] 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

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

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 the extent of this insider trading several years before the U.S. government discovered it.

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, 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.

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*. Information about poison pills also comes from *Corporate Control Alert*. Security return and volume data and market indexes are from the Center for Research in Security Prices (CRSP).

There are 1,814 successful and unsuccessful takeovers from 1975–91 with enough return data available to be included in this study. A successful takeover is one in which a bidder obtains control of the target firm by acquiring a majority of target's shares, eventually leading to delisting of the target firm's stock (so partial and cleanup offers are excluded). An unsuccessful takeover occurs when the bidder's offer to acquire target shares does not lead to a change in control and there are no competing bids within the next 365 days.

For each of the target firms, I calculate the market model regression [Eq. (1)] for the 253 trading days (about one year) ending 127 trading days (about six months) 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).

Estimates of (1) are used to estimate abnormal returns, ε_{it}, for the runup and markup periods ($t > -127$).

Fig. 2 shows the plot of the cumulative average abnormal returns (*CAR*s) from 126 trading days before the first bid announcement (day 0) through 253 trading days after the first bid for all 1,814 mergers and tender offers in this sample. It also breaks down the target returns by successful and unsuccessful takeovers. The *CAR*s start to rise around day −42 (about two months before the first bid announcement), with the largest pre-bid rise occurring from days −21 to −1. The *CAR* is about 25% for successful offers on day 0 and about 19% for unsuccessful offers, suggesting that the market can partially forecast the likelihood the target shareholders will receive a control premium. After the announcement date, the *CAR* for the entire sample is flat for the next year, while the *CAR* for successful takeovers drifts upward to about 37% and the *CAR* for unsuccessful takeovers drifts back down to zero as it becomes clear that no bidder will acquire the target firm.

Based on the evidence in Fig. 2, the runup used in the regression tests below is the cumulative abnormal return to the target stock over the 42-day runup

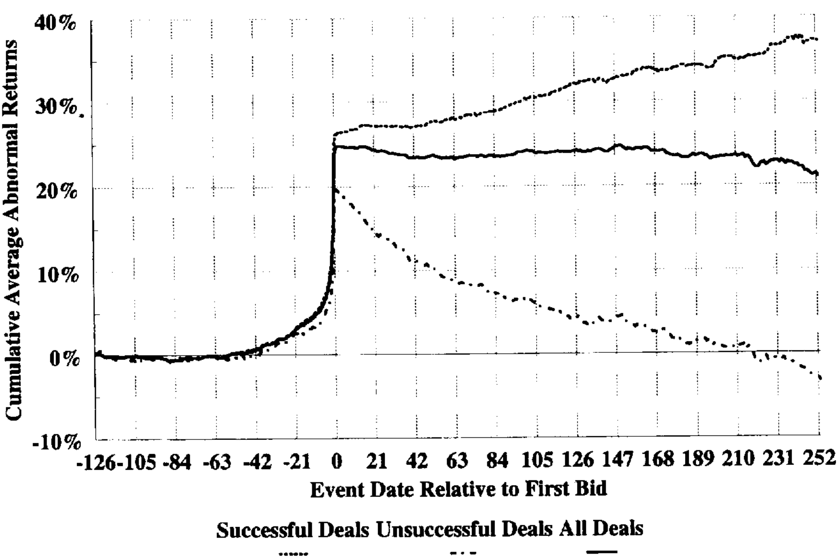

Fig. 2. Cumulative average abnormal returns to target firms' stocks from trading day −126 to +253 relative to the first bid for all NYSE- and AMEX-listed target firms in the period 1975–91. Market model parameters used to define abnormal returns are estimated using the CRSP value-weighted portfolio for days −379 to −127. The 1,401 target firms that are successfully taken over are shown with a dotted line. The 414 target firms that are not taken over within the next year are shown with a dashed line. The full sample of 1,815 successful or unsuccessful firms is shown with a solid line.

period (roughly two months) before the first bid,

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

and the markup is the cumulative abnormal return from the data of the first bid announcement through delisting or 126 trading days (roughly six months) after the first bid, whichever comes first,

$$Markup_i = \sum_{t=0}^{\min[126,\, \text{delisting}]} \varepsilon_{it}. \tag{3}$$

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

I focus on the sample of cases for which 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 overcome. The noise added to the stock returns of these target firms due to the delay is the primary reason for ignoring these cases. I also exclude cases in which 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, 1995). After excluding these exceptional cases, there are 1,523 target firms remaining. This is called the 'main sample' hereafter.

3.1. Average runups and markups and sample characteristics

Table 2 shows the average runups and markups for the total sample and the main sample. It also shows average runups and markups for (and the proportion of the target firms in) subsamples with the following deal characteristics: 1) whether or not the deal was ultimately successful (Success), 2) whether or not there was pre-bid news implying that a bid might be forthcoming (News), 3) whether or not the target firm has a poison pill in place (Pill), 4) whether or not there were multiple bidders (Auctions), 5) whether or not the deal was a tender offer (Tender Offers), 6) whether or not the deal was a management buyout (MBO), 7) whether payment to the target shareholders was only in the form of cash (Cash) or equity (Equity), and 8) whether or not the S.E.C. later prosecuted insiders for illegal trading (Insiders).[9] Table 2 also shows runups and markups for samples based on the year in which the first takeover bid occurs, as well as

[9]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.

Table 2

Average pre-bid runups (*Runup*) and post-announcement markup (*Markup*) for different samples of successful and unsuccessful 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. The remaining columns show the proportions of each sample in which the target firm is taken over (Success), or there is pre-bid news implying that a bid might be forthcoming (News), or the target firm has a poison pill in place (Pill), or there are multiple bidder auctions (Auctions), or the deal is a tender offer (Tender offer), or the deal is a management buyout (MBOs), or there is an all-cash payment to target shareholders (Cash), or there is an all-equity payment to target shareholders (Equity), or the S.E.C. later accused someone of engaging in insider trading prior to the takeover (insiders). The rows show different samples of the data based on the characteristics of the deal. The 'main sample' excludes deals that took longer than one year to consummate and target firms whose equity value is small (below $10 million) or whose pre-runup stock price is low (below $2 per share). All of the following samples are subsets of the main sample.

		Returns		Proportion of sample								
Sample	Sample size, N	Runup	Markup	Success	News	Pills	Auctions	Tender offers	MBOs	Cash	Equity	Insiders
All	1,814	0.133	0.101	0.772	0.443	0.136	0.207	0.350	0.112	0.600	0.172	0.079
Main	1,523	0.133	0.105	0.771	0.459	0.150	0.205	0.370	0.114	0.611	0.167	0.089
Successful	1,174	0.143*	0.158	1.000	0.456	0.140	0.192	0.451	0.122	0.636	0.173	0.115
Unsuccessful	349	0.100*	−0.074	0.000	0.470	0.186	0.249	0.097	0.086	0.527	0.146	0.000
News	699	0.151*	0.079	0.765	1.000	0.239	0.265	0.418	0.124	0.624	0.119	0.119
No news	824	0.118*	0.127	0.775	0.000	0.075	0.154	0.330	0.104	0.601	0.208	0.063
Poison pill	229	0.119	0.176*	0.716	0.729	1.000	0.362	0.520	0.096	0.703	0.096	0.118
No pill	1,294	0.135	0.092*	0.781	0.411	0.000	0.177	0.344	0.117	0.595	0.179	0.083
Auction	312	0.127	0.182*	0.721	0.593	0.266	1.000	0.532	0.103	0.670	0.074	0.099
No auction	1,211	0.134	0.085*	0.784	0.424	0.121	0.000	0.329	0.116	0.596	0.191	0.086

Tender offers	564	0.156*	0.201*	0.940	0.518	0.211	0.294	1.000	0.082	0.817	0.014	0.140
Mergers	959	0.119*	0.049*	0.672	0.424	0.115	0.152	0.000	0.132	0.490	0.257	0.058
MBOs	173	0.105*	0.089	0.827	0.503	0.127	0.185	0.266	1.000	0.763	0.012	0.110
Cash	931	0.141	0.142*	0.802	0.468	0.173	0.224	0.495	0.142	1.000	0.000	0.099
Equity	254	0.092*	0.077	0.799	0.327	0.087	0.091	0.031	0.008	0.000	1.000	0.047
Insiders	135	0.183*	0.212*	1.000	0.615	0.200	0.230	0.585	0.141	0.681	0.089	1.000
No insiders	1,388	0.128*	0.095*	0.749	0.444	0.146	0.202	0.349	0.111	0.604	0.174	0.000
By year of the first bid												
1975	25	0.087	0.133	0.800	0.160	0.000	0.080	0.360	0.040	0.520	0.320	0.000
1976	43	0.157	0.156	0.907	0.209	0.000	0.140	0.372	0.000	0.558	0.256	0.023
1977	68	0.229*	0.128	0.853	0.206	0.000	0.162	0.294	0.044	0.574	0.250	0.015
1978	87	0.199*	−0.021*	0.759	0.253	0.000	0.172	0.356	0.034	0.586	0.149	0.034
1979	92	0.222*	0.036*	0.717	0.304	0.000	0.207	0.337	0.033	0.543	0.141	0.022
1980	92	0.167	0.073	0.783	0.337	0.000	0.152	0.272	0.054	0.554	0.207	0.054
1981	79	0.117	0.182*	0.823	0.392	0.000	0.215	0.354	0.063	0.557	0.203	0.228
1982	81	0.145	0.175*	0.889	0.481	0.000	0.136	0.309	0.185	0.580	0.160	0.173
1983	84	0.119	0.084	0.893	0.524	0.000	0.167	0.238	0.190	0.583	0.226	0.131
1984	101	0.123	0.065	0.832	0.455	0.010	0.188	0.416	0.218	0.683	0.129	0.109
1985	123	0.119	0.082	0.821	0.528	0.073	0.211	0.382	0.179	0.602	0.138	0.228
1986	160	0.103*	0.106	0.725	0.475	0.194	0.219	0.450	0.119	0.675	0.119	0.063
1987	129	0.086*	0.108	0.767	0.535	0.264	0.256	0.442	0.163	0.605	0.155	0.062
1988	165	0.129	0.210	0.709	0.636	0.430	0.345	0.479	0.145	0.697	0.091	0.042
1989	114	0.086	0.040	0.605	0.667	0.395	0.237	0.377	0.088	0.667	0.140	0.053
1990	50	0.076	0.069	0.700	0.500	0.540	0.100	0.280	0.060	0.600	0.260	0.180
1991	30	0.138	0.237	0.667	0.500	0.367	0.033	0.167	0.033	0.433	0.400	0.033

Average runups and markups that are different from the main sample mean at the 5% significance level are marked with an asterisk (*).

the proportions of target firms in the yearly subsamples with the various deal characteristics.

Runups are large for all of these samples. The average for the main sample is 13.3%, and it is a little higher when the takeover attempt was successful (14.3%), when there was foreshadowing news (15.1%), in tender offers (15.6%), and when the S.E.C. later accused insiders of trading illegally (18.3%). Average runups are lower when the takeover attempt was later unsuccessful (10.0%), when there was no foreshadowing news (11.8%), in mergers (11.9%), when there is an MBO (10.5%), when equity is the only form of payment made to target shareholders (9.2%), and when the S.E.C. did not prosecute anyone for insider trading (12.8%).

There are prior news events suggesting that the target might be in play in 45.9% of the cases in the main sample. News equals one when any of the following events occur during the calendar year prior to the announcement of a merger or tender offer:

(a) there is 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;
(b) there is a news story, confirmed by either the target or the bidder firm, saying that a merger or acquisition is being actively discussed; or
(c) there is a new story (not confirmed by the bidder or target) saying that the firm is a potential target.

Mikkelson and Ruback (1985) find that the market infers from at least some 13D announcements that the likelihood of a takeover has increased. The results in Table 2 show that these news stories do not forecast successful takeovers (the success rate is 76.5% versus 77.1% for the main sample). News occurs more frequently when firms adopt poison pills and when there are multiple bidder auctions. Insider trading prosecutions also occur more frequently when there is pre-bid news. The frequency of prior news events is lower before 1980, partly because coverage by *Dow Jones News Retrieval* begins in mid-1979, and other sources of this information have less coverage.

Auctions occur in 20.5% of the cases in the main sample. They are more frequent when there is a tender offer (29.4%). The frequency of multiple bidder auctions increased in the late 1980s, rising to 34.5% of the takeovers in 1988. As the number of takeovers fell in 1990–91, the frequency of auctions also fell.

Tender offers represent 37.0% of the main sample. They are more frequent when there is a subsequent insider trading prosecution (58.5%). They are less frequent (only 26.6%) when the winning bidder involves the incumbent management of the target firm (an MBO). The years 1984–89 had a higher rate of tender offers than the other parts of the period (from 37.7% to 47.9%). Management buyouts (MBOs) represent 11.4% of the main sample. All-cash deals represent 61.1% and all-equity deals represent 16.7% of the main sample.

Average runups were larger in 1977–79 than at other times during the 1975–91 period. They were lower after the prosecutions of Levine, Boesky, and

Siegel that began in 1986, although the average runups remain substantial (from 7.6% to 13.8% during 1986–91). There were insider trading prosecutions in 8.9% of the cases. The rate of insider trading prosecutions is highest for the deals that began from 1981–85 (from 10.9% to 22.8%). Of course, the increased rate of prosecutions could reflect a higher frequency of insider trading, 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 pre-tender offer trading patterns 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, i.e., the officers, directors, and beneficial owners of the target firm, 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. These 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 in which 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 following regression provides a crude test of the effects of the Insider Trading Sanctions Act of 1984 ($ITSA84$) and the Insider Trading and Securities Fraud Enforcement Act of 1988 ($ITSTE88$):

$$\underset{}{Runup_i} = \underset{(0.0077)}{0.1668} - \underset{(0.0109)}{0.0601}\ ITSA84_i + \underset{(0.0132)}{0.0019}\ ITSFE88_i + u_i\,, \tag{4}$$

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 afterwards. This regression suggests that the 1984 Act is associated with reliably lower pre-bid runups (-6.0% lower), but the 1988 Act had no reliable additional effect. Of course, this simple regression does not take into account other changes in the legal and takeover environments that occurred in this period.

The average post-bid markup for the main sample is 10.5%. Successful takeovers have higher average markups (15.8%), and auctions have even higher markups (18.2%). As noted by Comment and Schwert (1995), markups are higher for target firms that have poison pills. Average markups are also higher for tender offers and when the S.E.C. later prosecuted for insider trading, but these facts are partially due to the higher success rates for these subsets of cases (94% of the tender offers led to takeovers and 100% of the prosecuted cases were related to successful takeovers).

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. However, 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 premium paid by the bidder and the pre-bid runup,

$$Premium_i = a + b\,Runup_i + u_i\,. \tag{5}$$

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 (5) 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 (5) 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 (with the coefficient b representing that fraction).

Since the total premium is the sum of the runup plus the markup, Eq. (5) is equivalent to the regression of the markup on the runup,

$$Markup_i = a + (b-1)\,Runup_i + u_i. \tag{6}$$

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, the 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., the markup is unrelated to runup).

Table 3 contains estimates of the regression model (5) for all 1,814 takeover attempts, for the main sample of deals concluded within a year, for successful and unsuccessful deals, for samples with and without foreshadowing news, for samples with and without poison pills, for samples with single and multiple bidders, for tender offers and mergers, for management buyouts, for all-cash and for all-equity deals, and for deals that subsequently had or did not have insider trading prosecutions. The second column shows the proportion of the main

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 and unsuccessful 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. $Markup_i$ 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 substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. $S(u)$ is the standard error of the regression and $\overline{R^2}$ is the adjusted coefficient of determination. White's (1980) heteroskedasticity-consistent standard errors are used to calculate t-statistics. The 'main sample' excludes deals that took longer than one year to consummate and target firms whose equity value is small (below $10 million) or whose pre-runup stock price is low (below $2 per share). All of the following samples are subsets of the main sample.

Sample	Proposition of sample	Sample size, N	Runup coefficient, b	T-statistic $t(b = 1)$	Intercept a	T-statistic $t(a = 0)$	$S(u)$	$\overline{R^2}$
All		1,814	1.130	2.88	0.084	8.34	0.315	0.35
Main		1,523	1.075	1.66	0.095	9.05	0.296	0.33
Successful	77.1%	1,174	1.018	0.45	0.156	15.11	0.252	0.37
Unsuccessful	22.9%	349	1.062	0.45	− 0.081	− 3.32	0.358	0.26
News	45.9%	699	1.118	2.16	0.061	4.20	0.295	0.37
No news	54.1%	824	1.053	0.74	0.121	8.16	0.295	0.30
Poison pill	15.0%	229	1.074	0.45	0.167	4.95	0.341	0.27
No pill	85.0%	1,294	1.080	1.85	0.082	7.72	0.286	0.35
Auction	20.5%	312	0.862	− 0.97	0.200	7.09	0.358	0.16
No auction	79.5%	1,211	1.124	2.89	0.068	6.41	0.274	0.39
Tender offers	37.0%	564	0.903	− 1.62	0.216	14.89	0.247	0.31
Mergers	63.0%	959	1.110	1.82	0.036	2.69	0.307	0.34
MBOs	11.4%	173	0.866	− 0.94	0.103	4.03	0.267	0.22
Cash	61.1%	931	1.003	0.07	0.141	11.84	0.284	0.32
Equity	16.7%	254	1.177	1.18	0.061	2.23	0.313	0.37
Insiders	8.9%	135	0.667	− 3.07	0.273	9.53	0.218	0.19
No insiders	91.1%	1,388	1.087	1.83	0.083	7.65	0.300	0.33
By year of the first bid								
1975	1.6%	25	1.281	1.06	0.109	1.77	0.293	0.37
1976	2.8%	43	0.932	− 0.36	0.167	3.01	0.254	0.32
1977	4.5%	68	0.764	− 1.83	0.182	3.95	0.213	0.27
1978	5.7%	87	1.041	0.26	− 0.029	− 0.60	0.300	0.27
1979	6.0%	92	0.995	− 0.04	0.037	0.92	0.247	0.40
1980	6.0%	92	1.160	1.38	0.046	1.31	0.261	0.45
1981	5.2%	79	1.200	1.11	0.159	3.51	0.304	0.30
1982	5.3%	81	0.898	− 0.81	0.189	5.78	0.212	0.46
1983	5.5%	84	1.456	2.69	0.030	0.70	0.269	0.53
1984	6.6%	101	1.212	1.12	0.039	1.03	0.243	0.43
1985	8.1%	123	1.090	0.53	0.071	2.39	0.249	0.26
1986	10.5%	160	0.949	− 0.53	0.111	4.47	0.266	0.29
1987	8.5%	129	0.923	− 0.55	0.115	3.38	0.328	0.23
1988	10.8%	165	1.384	2.85	0.161	4.51	0.321	0.41
1989	7.5%	114	0.990	− 0.04	0.041	0.90	0.381	0.24
1990	3.3%	50	0.945	− 0.19	0.073	1.50	0.371	0.14
1991	2.0%	30	1.396	1.54	0.182	3.72	0.361	0.45

For definitions of the sample groupings, see Table 2.

sample represented by each sample and the third column shows the number of target firms used in each regression. The fourth and fifth columns contain, respectively, estimates of the slope, b, and the t-test, $t(b = 1)$, for whether there is substitution between runup and markup. The sixth and seventh columns contain, respectively, estimates of the intercept, a, and the t-statistic for whether a equals zero, $t(a = 0)$. Finally, columns eight and nine contain the standard error of the regression, $S(u)$, and the adjusted coefficient of determination, $\overline{R}^2$. The subsamples contain deals that could have different information environments, so it is interesting to see whether the degree of substitution varies across these types of transactions.

In the main sample, the estimate of the coefficient for *Runup*, b is 1.075, which is close to the value implied by the markup pricing hypothesis, and the t-statistic for whether b equals one is 1.66. Across the samples based on deal characteristics, the lowest estimate of b is 0.667 (in deals when there was subsequent prosecution for insider trading). The t-statistic for whether this estimate is different from one is -3.07. This is the only case in which the t-statistic testing for substitution is lower than -2.0. It seems that insiders are not completely able to hide their activity from bidders and targets since there is partial substitution of runup for markup. Nevertheless, even the smallest estimates of the substitution coefficient imply that at least 67% of the pre-bid runup is added to the total price paid by the bidder in acquiring a target stock.

The intercept in Eq. (5) estimates the average post-bid markup paid in mergers and acquisition when there is no pre-bid runup. Note that when slope coefficient b is less than one, the intercept a is larger than the average markup in Table 2 (in insider trading cases, for example, $a = 0.273$ and the average markup in Table 2 is 0.212). 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 (5) 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 1.46). None of the t-statistics for substitution is below -2.0, and two are larger than 2.0 (1983 and 1988), implying that markups 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 the separate effects of these characteristics from the simple regressions in Table 3. Instead, the

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 and unsuccessful mergers and tender offers for exchange-listed target firms, 1975–91

$$Premium_i = a_0 + b_0\ Runup_i + \sum_{k=1}^{9} a_k D_{ki} + \sum_{k=1}^{9} b_k D_{ki}\ Runup_i + \varepsilon_i$$

where $Premium_i = Runup_i + Markup_i$. The sample excludes deals that took longer than one year to consummate and target firms whose equity value is small (below $10 million) or whose pre-runup stock price is low (below $2 per share). 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: the target firm is taken over (Success), there is news implying that a bid might be forthcoming (News), the target firm has a poison pill in place (Pill), there are multiple bidders (Auction), the deal is a tender offer (Tender offer), the deal is a management buyout (MBO), there is an all-cash payment to target shareholders (Cash), there is an all-equity payment to target shareholders (Equity), and the S.E.C. later accused someone of engaging in insider trading before the takeover (Insider). The substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. $\overline{R^2}$ 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 large-sample $\chi^2(9)$ distributions, and their p-values are also shown.

Sample	Runup coefficient, b_k	t-statistic $b_k = 1$ or 0	Intercept, a_k	t-statistic $a_k = 0$
Constant			−0.138	−4.83
Runup	1.115	0.82		
Success	0.061	0.49	0.192	7.48
News	0.075	0.83	−0.088	−4.33
Pill	0.078	0.48	0.079	2.54
Auction	−0.210	−1.44	0.122	4.20
Tender offer	−0.105	−1.27	0.078	3.72
MBO	−0.228	−1.77	0.004	0.17
Cash	−0.101	−0.98	0.083	3.18
Equity	−0.006	−0.03	0.050	1.38
Insider	−0.328	−2.99	0.115	3.94
Degrees of freedom		1,503		
$\overline{R^2}$		0.45		
Standard error of the regression		0.268		
Test for joint significance, χ^2 (9)		21.2		259.9
p-value		1.19%		0.00%

multiple regression,

$$Premium_i = a_0 + b_0\,Runup_i + \sum_{k=1}^{9} a_k D_{ki} + \sum_{k=1}^{9} b_k D_{ki}\,Runup_i + u_i\,, \tag{7}$$

in which the dummy variables D_{ki} equal one if the kth characteristic (Success, News, Pill, Auction, Tender Offer, MBO, Cash, Equity, or Insider) applies to case i and zero otherwise, allow the intercept a and the slope b to vary with the characteristics of the deal.

In Table 5, the runup coefficient estimate is 1.115 and the t-statistic for whether this estimate is different from one is 0.82. Most of the slope change coefficients (b_k) for the deal characteristics are small, and only the insider trading coefficient (-0.328) is reliably less than zero (t-statistic of -2.99). The large-sample joint test for whether all nine slope change coefficients equal zero equals 21.2, which has a p-value of 1.2% compared to a χ^2 distribution with nine degrees of freedom. To estimate the sensitivity of the total price paid to the pre-bid runup for a deal with some of these nine characteristics, the base case slope coefficient, $b_0 = 1.115$, is added to the appropriate slope change estimates. For example, for a cash tender offer that is not an auction or an MBO, and with no subsequent insider trading prosecution, the estimated slope coefficient is $1.115 - 0.105 - 0.101 = 0.909$.

Consistent with the evidence in Table 5, the estimates of the markup paid if the runup equals zero (i.e., the intercepts) are reliably higher when the deal is successful (coefficient = 0.192, t-statistic = 7.48), when the target firm has a poison pill (coefficient = 0.079, t-statistic = 2.54), when there is a multiple bidder auction (coefficient = 0.122, t-statistic = 4.20), when there is a tender offer (coefficient = 0.078, t-statistic = 3.72), when case is used to pay target shareholders (coefficient = 0.083, t-statistic = 3.18), and when there is insider trading that is later prosecuted (coefficient = 0.115, t-statistic = 3.94). The large-sample joint test for whether all nine intercept-change coefficients equal zero equals 259.9, which has a p-value less than 0.01% compared to a χ^2 distribution with nine degrees of freedom.

The estimates in Table 6 confirm the results from Table 3. There is some substitution between pre-bid runups and post-bid markups for cases in which S.E.C. subsequently prosecutes insider trading. 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 fixed at 42 trading days. Using shorter and longer runup and markup periods has no substantial effect on 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 11 markup periods [(0, 0), (1, 1) (2, 5), (6, 10), (11, 21), (22, 42), (43, 63), (64, 84), (85, 105), (106, 126), and (0, 126)]. Table 5 contains estimates of multiple regressions of the abnormal returns for the main sample for each of the 11 markup periods on the nine runup returns,

$$Markup_{ij} = a_j + \sum_{k=1}^{9} b_{jk}\, Runup_{jk} + u_i\,, \qquad j = 1, \ldots, 11\,, \tag{8}$$

where the coefficients b_{jk} 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 with an asterisk.

There is evidence of partial substitution using the announcement-day markup return (day 0), since the coefficient estimates are negative for several runup periods. The largest of these estimates are for the runup periods covering the week before the first bid. Day −1 has a coefficient of −0.218 and days −2 through −5 have a coefficient of −0.201, implying that the markup return on the announcement day is lower by about 20% of 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 −0.246 with a standard error of 0.088). However, the estimates of the runup coefficient for earlier periods are generally positive, and some are reliably greater than zero. The small negative coefficients for the announcement day are offset by small positive coefficients at longer lags. Thus, the strongest evidence in favor of the substitution hypothesis shows that the markup is reduced by only about one-fifth to one-quarter 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 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. Pound and Zeckhauser (1990, Table 5) show the 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. Of course, one reason for unusually high volume could be the accumulation of a toehold position by the bidder.

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. $\overline{R^2}$ is the adjusted coefficient of determination and $S(u)$ is the standard error of the regression. The sample includes 1,523 NYSE and AMEX-listed target firms that received takeover bids in the 1975–91 period. It excludes cases that took longer than one year to consummate, or where the equity value of the target firm is small (below $10 million), or where the pre-runup stock price is low (below $2 per share).

Runup period (independent variables)	Markup measurement period (dependent variable)										
	0	1	(2,5)	(6,10)	(11,21)	(22,42)	(43,63)	(64,84)	(85,105)	(106,126)	(0,126)
−1	−0.218*	−0.054*	−0.006	0.054*	0.010	−0.026	−0.081*	0.005	0.021	0.049*	−0.246*
	(0.037)	(0.014)	(0.019)	(0.021)	(0.023)	(0.035)	(0.029)	(0.026)	(0.030)	(0.021)	(0.088)
(−2, −5)	−0.201*	−0.011	0.017	0.012	0.026	0.086*	0.057*	0.030	−0.029	−0.016	−0.030
	(0.037)	(0.015)	(0.019)	(0.020)	(0.023)	(0.028)	(0.027)	(0.027)	(0.034)	(0.022)	(0.098)
(−6, −10)	−0.083	0.000	−0.044	0.028	0.031	0.026	0.022	−0.048	0.028	−0.012	−0.050
	(0.051)	(0.020)	(0.029)	(0.021)	(0.029)	(0.051)	(0.039)	(0.057)	(0.040)	(0.030)	(0.153)
(−11, −21)	−0.090*	−0.003	−0.003	0.036*	−0.027	0.081*	0.061	0.019	0.035	0.011	0.120
	(0.037)	(0.018)	(0.023)	(0.016)	(0.024)	(0.037)	(0.031)	(0.033)	(0.035)	(0.021)	(0.100)
(−22, −42)	0.097*	−0.016	0.009	0.003	0.049*	0.022	0.066*	0.035	0.015	0.060*	0.146*
	(0.025)	(0.012)	(0.015)	(0.011)	(0.015)	(0.024)	(0.023)	(0.022)	(0.023)	(0.016)	(0.065)
(−43, −63)	−0.081*	−0.018	−0.006	0.018	−0.004	0.108*	0.067*	0.026	0.063*	0.005	0.176*
	(0.029)	(0.012)	(0.012)	(0.015)	(0.021)	(0.024)	(0.021)	(0.020)	(0.026)	(0.020)	(0.072)
(−64, −84)	−0.038	−0.011	0.015	0.005	0.018	0.055	0.021	0.058*	0.016	0.011	0.150
	(0.029)	(0.015)	(0.014)	(0.015)	(0.020)	(0.029)	(0.024)	(0.021)	(0.024)	(0.016)	(0.076)
(−85, −105)	−0.051	−0.010	0.025	0.025	0.046*	0.073*	0.047	0.087*	0.048	0.031	0.321*
	(0.032)	(0.011)	(0.014)	(0.013)	(0.021)	(0.026)	(0.029)	(0.027)	(0.034)	(0.017)	(0.079)
(−106, −126)	0.025	0.015	0.008	0.022	0.027	0.018	0.076*	−0.015	0.085*	0.057*	0.318*
	(0.031)	(0.019)	(0.012)	(0.014)	(0.020)	(0.029)	(0.023)	(0.028)	(0.022)	(0.016)	(0.073)
$\overline{R^2}$	0.049	0.003	0.002	0.012	0.012	0.038	0.038	0.021	0.021	0.020	0.046
$S(u)$	0.124	0.056	0.057	0.055	0.074	0.098	0.091	0.085	0.090	0.070	0.289

Coefficient estimates that are more than two standard errors from zero are shown with an asterisk (*).

Information about trading volume (with price) prior to a formal merger or tender offer bid might help bidders judge whether their information had leaked to the market. To check this possibility, I use data from CRSP to estimate a model for daily share trading volume for the 1,506 target firms for which adequate share trading volume data are available for the 254 trading days ending 127 days before the first bid announcement. The volume model is

$$q_{it} = \mu + \rho q_{it-1} + \gamma_0 q_{mt} + \gamma_1 q_{mt-1} + v_{it}, \quad t = -379, \ldots, -127, \qquad (9)$$

where q_{it} is the growth rate of share trading volume for firm i on day t (the first difference of the natural logarithm of volume) and q_{mt} is the growth rate of share trading volume for the exchange on which this firm is traded (either NYSE or AMEX) on day t. This model expresses the growth rate in share trading volume as a function of the previous growth rate and the current and lagged growth rates of market trading volume. The average estimates of the parameters of this model are in Table 6, along with the average t-statistics.

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 were zero, changes in log share volume would be entirely

Table 6

Average estimates of the coefficient of the daily share trading volume prediction model for 1,506 NYSE- and AMEX-listed target firms that received takeover bids from 1975–91 (omitting target firms with stock prices below $2 per share, with equity capitalization less than $10 million, and for which it takes more than one year from the first bid to conclude the transaction)

For each firm, a year of daily share trading volume data is used to estimate the regression,

$$q_{it} = \mu + \rho q_{it-1} + \gamma_0 q_{mt} + \gamma_1 q_{mt-1} + v_{it},$$

where q_{it} is the growth rate of share trading volume for target firm i on day t and q_{mt} is the growth rate of share trading volume for all shares on the exchange where target firm i is listed 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 1,506 regressions. The implied long-run effects of a 1% change in market trading volume growth is 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	−0.001	−0.01
Lagged share volume growth, ρ	−0.413	−7.19
Market share volume growth, γ_0	0.794	2.71
Lagged market share volume growth, γ_1	0.339	1.11
Standard error of regression, $S(v)$	0.983	
Long-run effects of a 1% change in:		
Market share volume, $(\gamma_0 + \gamma_1)/(1 - \rho)$	0.800	

permanent (i.e., 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 -0.413, with an average t-statistic of -7.19, 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_i, imply positive comovement of trading volume across stocks. The long-run effect of a 1% increase in market trading volume is $(\gamma_0 + \gamma_1)/(1 - \rho)$, which averages 0.800 across these 1,506 firms.

I use the regression models summarized in Table 6 to predict the growth in trading volume from 42 days before through 126 days after announcement of the first bid. Table 7 summarizes the volume runup, which is the cumulative abnormal share volume from days -42 to -1 relative to the first bid:

$$Volume\ runup_i = \sum_{t=-42}^{-1} v_{it}\,, \tag{10}$$

where v_{it} is the prediction error for share volume growth from (9). Across the main sample of 1,506 firms, for which delisting occurred within one year of the first bid, the average volume runup is about 127.8%. The average volume runup is lower for deals that are unsuccessful, for deals in which the target firm has

Table 7

Cumulative average abnormal share trading volume growth for days -42 to -1 relative to the announcement of the first bid for 1,506 NYSE- and AMEX-listed target firms that received takeover bids from 1975-91

For each firm, a year of daily share trading volume data is used to estimate a regression model (see Table 6) to predict daily share volume, ending 126 trading days before the date of the first bid.

Sample	Sample size, N	Average volume runup
Main	1,506	1.278
Successful	1,170	1.361
Unsuccessful	336	0.990
News	691	1.360
No news	815	1.209
Poison pill	228	0.974
No pill	1,278	1.332
Auction	307	1.064
No auction	1,199	1.333
Tender offers	562	1.548
Mergers	944	1.117
MBOs	171	1.440
Cash	923	1.303
Equity	251	1.097
Insider trading	135	2.155
No insider trading	1,371	1.192

Table 8
Cross-sectional regression model explaining pre-bid volume runups during days −42 to −1 relative to the announcement of the first bid for 1,506 exchange-listed target firms that received takeover bids from 1975–91

The model expresses runups as a function of whether the target firm is taken over, whether there is news that might foreshadow the bid, whether the target firm has a poison pill, whether multiple bidders eventually compete to acquire this firm, whether the bid is a tender offer, whether the bid is a management buyout (MBO), whether cash is the sole compensation for target stockholders, whether equity is the sole compensation for target stockholders, and whether the S.E.C. eventually prosecuted for insider trading in this transaction. $\overline{R^2}$ is the adjusted coefficient of determination and $S(v)$ is the standard deviation of the regression residuals. The t-statistics use White's (1980) heteroskedasticity-consistent standard errors.

Variable	Coefficient	T-statistic
Constant	1.114	5.06
Successful	0.093	0.47
News	0.160	1.06
Pill	−0.439	−2.21
Auction	−0.332	−1.96
Tender offers	0.435	2.50
MBOs	0.180	0.70
Cash	−0.135	−0.79
Equity	−0.131	−0.59
Insider trading	0.838	3.47
Degrees of freedom		1,496
$\overline{R^2}$		0.015
Standard error of regression, $S(v)$		2.753

a poison pill, and for deals that subsequently turned into auctions. The average volume runup is higher before tender offers and especially for deals in which the S.E.C. subsequently prosecuted insider trading.

Table 8 shows estimates of a regression model that includes dummy variables for all of the deal characteristics examined previously. Based on this regression, the average pre-bid volume runup is significant even when none of the other deal characteristics are positive. The estimate of the intercept is 1.114, with a t-statistic of 5.06. The poison pill coefficient is −0.439 (t-statistic of −2.21) and the auction coefficient is −0.332 (t-statistic of −1.96). Finally, when the S.E.C. later prosecuted insider trading, abnormal volume is higher by 83.8% with a t-statistic of 3.47. 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 price 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 volume runup coefficient is 0.0035 (with a t-statistic of 2.04), implying a small positive effect on the total premium. None of the other regression coefficients are materially affected. Thus, abnormal volume runup before bids, along with the price runup, increases the price paid by bidders.

4.5. *Effects of runup in the bidder's stock price*

Besides 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). There is a problem with measuring the runups and markups in bidders' stock prices over long intervals because exchange-listed bidder firms tend to have experienced unusual stock price rises prior to their decision to make takeover bids (Asquith, 1983). The dotted line in Fig. 3 shows the plot of the cumulative average abnormal returns from 126 trading days before the first bid announcement (day 0) through 253 trading days after the first bid for the 790 exchange-listed bidders in the main sample. The *CAR* for the bidders drifts downward through most of this 18-month period. The average market model intercept is 0.018% per day for the bidders (compared with −0.007% for the target firms) and the average beta coefficient is 0.991 for the bidders (compared with 0.767 for the target firms). Since the *CAR* for the target firms is flat for the periods (−126, −42) and (1, 253), I conclude that the market model estimated over the interval (−379, −127) provides a reasonable benchmark for calculating abnormal stock returns. In contrast, the negative drift for the bidder firms in Fig. 3, with the evidence that the average intercept for bidders is unusually high, leads me to conclude that the market model for days (−379, −127) is not a good benchmark for normal returns to bidders. As a crude correction, I calculate abnormal returns to bidder firms by constraining each bidder's market model intercept to equal zero. Thus, the abnormal return for bidder i is

$$\varepsilon_{it} = R_{it} - \beta_i R_{mt}, \qquad t = -126, \ldots, 253. \tag{11}$$

The solid line in Fig. 3 shows the *CAR* for bidder firms using this method of estimating abnormal returns. This correction seems to solve most of the problems with the usual method of calculating abnormal returns, since there is no longer a pronounced downward drift in the bidders' *CAR*. In fact, the corrected bidder *CAR* rises from day −42 to the day of the first bid (day 0), and then falls for at least the next 21 trading days back to a level of about zero. The bidders' *CAR* remains flat from day 21 to day 189 (from about one to nine months after the first bid), but then there is a drop of about 2% from days 189 to 231 (months 10 and 11). I use the corrected abnormal returns from Eq. (11) in the subsequent regression tests.

To check whether the first bidder's runup affects the premium paid for the target firm, I include the 42-day runup in the bidder's stock return, $Runup_{ib}$,

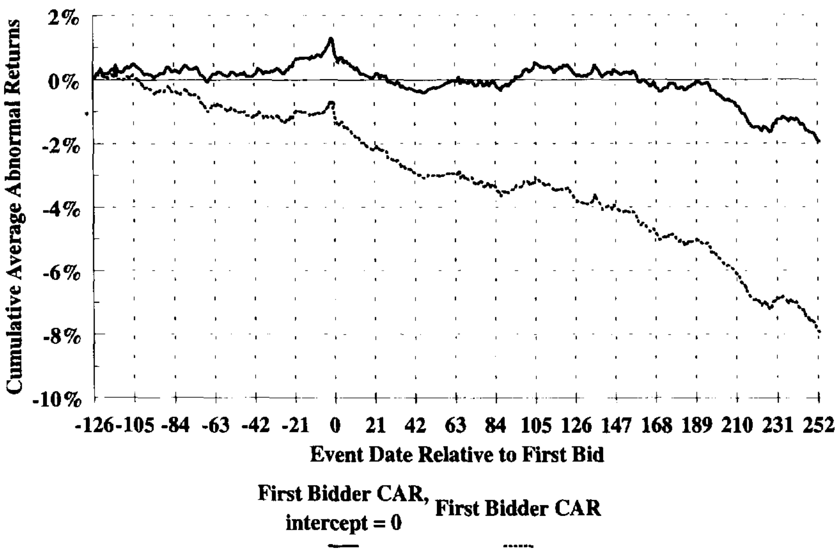

Fig. 3. Cumulative average abnormal returns to bidder firms' stocks from trading day −126 to +253 relative to the first bid for NYSE- and AMEX-listed target firms from 1975–91. Market model parameters used to define abnormal returns are estimated using the CRSP value-weighted portfolio for days −379 to −127. The solid line shows the effect of setting the intercepts to zero, since the bidder firms seem to have abnormally high stock returns during the estimation period (shown by the dotted line that drifts downward from day −126 to day +253). There are 790 NYSE- or AMEX-listed bidder firms that made the first bid for exchange-listed target firms in this period.

along with the target runup,

$$Premium_i = a + b\,Runup_i + c\,Runup_{ib} + u_i\,. \qquad (12)$$

Estimates of (12) are shown in Table 9 in a format similar to Table 3 for the 915 cases in which the bidding firm is an exchange-listed firm. For the main sample of 790 matched targets and bidders, the estimate of the bidder runup coefficient c is 0.085 (t-statistic of 0.91), 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 only reliably positive bidder runup coefficient estimate occurs when multiple bidders eventually compete (0.526, with a t-statistic of 1.99).

Table 9 also shows the average runup and markup (measured from the date of the first bid through 126 trading days after the first bid) for bidders and targets for each sample. Compared with the target runups, the bidder runups are small, but most are positive. The largest positive bidder runups occur when the target firm has a poison pill (3.0%) and when the S.E.C. subsequently prosecutes insider trading (2.4%). Unlike the pattern with target firms, for which the average runup and markup are similar, the markups for bidder firms are

Table 9

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. $Markup_i$ 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 substitution hypothesis implies $b < 1$, while the markup pricing hypothesis implies $b = 1$. The average 42-day runup for the target (bidder) is in the second (fourth) column in the lower panel and the average 127-day markup for the target (bidder) is in the third (fifth) column in the lower panel. $S(u)$ is the standard error of the regression and $\overline{R}^2$ 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	Target runup coeff., b	T-statistic $t(b = 1)$	Bidder runup coeff., c	T-statistic $t(c = 0)$	Constant, a	T-statistic $t(a = 0)$
All deals		915	1.005	0.08	0.103	1.18	0.105	7.66
Main sample		790	0.973	−0.45	0.085	0.91	0.118	8.12
Successful	84.3%	666	0.968	−0.64	0.042	0.44	0.151	11.04
Unsuccessful	15.7%	124	0.856	−0.57	0.180	0.82	−0.036	−0.81
News	42.7%	337	1.039	0.52	0.124	0.87	0.086	4.21
No news	57.3%	453	0.938	−0.68	0.055	0.45	0.138	6.99
Pill	11.8%	93	0.930	−0.25	0.156	0.69	0.243	4.54
No pill	88.2%	697	0.992	−0.16	0.050	0.51	0.100	7.26
Auction	20.8%	164	0.657	−1.66	0.526	1.99	0.248	6.02
No auction	79.2%	626	1.032	0.65	−0.005	−0.05	0.089	6.48
Tender offers	40.3%	318	0.847	−2.17	0.149	1.44	0.209	10.60

Mergers	59.7%	472	0.986	−0.16	0.053	0.42	0.070	3.68
MBOs	2.9%	23	0.832	−0.91	−0.433	−1.41	0.077	1.50
Cash	49.1%	388	0.897	−1.53	0.096	0.83	0.170	9.61
Equity	26.3%	208	0.977	−0.14	−0.006	−0.03	0.101	3.24
Insider	10.6%	84	0.613	−2.56	0.126	0.52	0.269	6.31
No insider	89.4%	706	0.980	−0.31	0.076	0.78	0.108	7.11

Sample	Avg. target $Runup_i$	Avg. target $Markup_i$	Avg. bidder $Runup_{ib}$	Avg. bidder $Markup_{ib}$	$S(u)$	$\overline{R^2}$
All deals	0.146	0.107	0.012	−0.011	0.287	0.32
Main sample	0.147	0.116	0.015	0.010	0.274	0.32
Successful	0.153	0.147	0.016	−0.002	0.251	0.35
Unsuccessful	0.116	−0.051	0.010	−0.053	0.330	0.22
News	0.181	0.095	0.016	−0.037	0.266	0.38
No news	0.122	0.131	0.015	0.010	0.279	0.27
Pill	0.126	0.239	0.030	−0.001	0.310	0.26
No pill	0.150	0.099	0.013	−0.011	0.265	0.34
Auction	0.146	0.199	0.002	−0.035	0.338	0.15
No auction	0.147	0.094	0.019	−0.004	0.248	0.40
Tender offers	0.175	0.185	0.017	0.025	0.240	0.30
Mergers	0.128	0.069	0.014	−0.034	0.285	0.32
MBOs	0.144	0.068	−0.036	−0.090	0.184	0.40
Cash	0.155	0.155	0.012	0.007	0.262	0.30
Equity	0.110	0.098	0.019	−0.045	0.293	0.30
Insider	0.200	0.194	0.024	0.000	0.217	0.12
No insider	0.141	0.106	0.014	−0.011	0.278	0.33

generally negative. The average for the main sample is −1.0%. The most negative bidder markups are for unsuccessful takeovers (−5.3%), for cases with foreshadowing news (−3.7%), for auctions (−3.5%), for mergers (−3.4%), and for all-equity deals (−4.5%). To the extent that deal characteristics such as auctions are unanticipated at the time of the first bid, the bidder markups reflect negative information that was not known during the runup period.

In general, the results in Table 9 do not show much relation between the behavior of the bidder's stock price during the runup period and the target's stock price during the markup period. Of course, to the extent that the implications of the transaction for the value of the bidder firm are small in proportion to its capitalization, this test would have low power. Also, it is plausible that some investors might infer information about the probability that a given firm is likely to become a target, without learning who the bidder might be.

4.6. Effects of target runup on the bidder's stock price

As mentioned in Section 2.1, Roll's (1986) hubris hypothesis predicts that bidder managers will sometimes pursue takeover success even when the price is too high. To the extent that pre-bid runup in the target's stock price reflects the bidder's own information, bidders who do not adjust their bidding strategy to substitute a lower markup could suffer from a form of hubris (Michael Bradley calls this the 'Punxsutawney Phil effect' – the bidder is afraid of his own shadow). To test for hubris, Table 10 shows regressions of the premium (runup plus markup) for the first bidders on the runup for the bidders and the runup for the target stock,

$$Premium_{ib} = a + b\,Runup_{ib} + c\,Runup_i + u_i\,. \tag{13}$$

Estimates of b greater than one (less than one) imply a position (negative) relation between the bidder's runup and markup. Estimates of c should be less than zero if a large runup in the target's stock price is related to a drop in the bidder's stock price after his bid is announced. The only subset for which this is true is the auction subsample, with a target runup coefficient estimate of −0.253 (t-statistic of −2.29). When there is no auction, the estimate of c is 0.117 (t-statistic of 2.80). Thus, the relation between the bidder's markup and the target's runup is conditioned on whether additional bidders arise. There is little evidence to support the hubris hypothesis, in the sense that the stock market punishes bidders who pay too much because of large target runups.

5. Specification analysis

5.1. Runup as an artifact of the size of the premium

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

Table 10

Regressions of the total abnormal stock return received by the stockholders of the first bidder firm ($Premium_{ib}$) on the pre-bid runup for the target firm ($Runup_{ib}$) and for the bidder firm ($Runup_i$) for various samples of successful mergers and tender offers for exchange-listed target firms, 1975–91

$$Premium_{ib} = a + b\ Runup_{ib} + c\ Runup_i + u_i,$$

where $Premium_{ib} = Runup_{ib} + Markup_{ib}$. $Runup_{ib}(Runup_i)$ is the cumulative abnormal return to the bidder's (target's) stock from day −42 to day −1 relative to the first bid. $Markup_{ib}$ is the cumulative abnormal return to the bidder's stock from the day of the first bid through delisting or 126 trading days after the first bid, whichever comes first. This regression shows the effect of pre-bid runup in the target's stock price on the price of the bidder's stock. If the hubris hypothesis that bidders pay too much is related to the size of the target's runup, the estimate of c should be reliably negative. $S(u)$ is the standard error of the regression and $\overline{R^2}$ 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	Bidder runup coeff., b	T-statistic $t(b = 1)$	Target runup coeff., c	T-statistic $t(c = 0)$	Constant, a	T-statistic $t(a = 0)$	$S(u)$	$\overline{R^2}$
All deals		915	0.919	−0.98	−0.003	−0.06	−0.009	−0.99	0.146	0.107
Main sample		790	0.874	−1.46	0.056	1.36	−0.016	−1.78	0.147	0.116
Successful	84.3%	666	0.893	−1.12	0.059	1.30	−0.009	−0.96	0.153	0.147
Unsuccessful	15.7%	124	0.801	−1.08	0.004	0.04	−0.051	−2.10	0.116	−0.051
News	42.7%	337	0.899	−0.63	0.072	1.15	−0.049	−3.13	0.181	0.095
No news	57.3%	453	0.854	−1.53	0.078	1.52	0.002	0.22	0.122	0.131
Pill	11.8%	93	1.111	0.35	0.038	0.28	−0.009	−0.36	0.126	0.239
No pill	88.2%	697	0.836	−1.90	0.063	1.50	−0.019	−1.85	0.150	0.099
Auction	20.8%	164	1.207	1.00	−0.253	−2.29	0.002	0.10	0.146	0.199
No auction	79.2%	626	0.780	−2.50	0.117	2.80	−0.017	−1.66	0.147	0.094
Tender offers	40.3%	318	0.955	−0.31	−0.010	−0.13	0.027	1.59	0.175	0.185
Mergers	59.7%	472	0.828	−1.66	0.064	1.37	−0.039	−3.62	0.128	0.069
MBOs	2.9%	23	0.948	−0.26	−0.095	−0.62	−0.078	−1.87	0.144	0.068
Cash	49.1%	388	0.923	−0.58	0.062	0.91	−0.002	−0.15	0.155	0.155
Equity	26.3%	208	0.688	−2.27	−0.011	−0.18	−0.037	−2.34	0.110	0.098
Insider	10.6%	84	1.001	0.00	0.143	0.93	−0.028	−0.98	0.200	0.194
No insider	89.4%	706	0.861	−1.50	0.049	1.16	−0.016	−1.69	0.141	0.106

occurs:

$$Runup_i = \Delta Prob_i \cdot Premium_i . \tag{14}$$

Suppose that the 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, and the regressions in Tables 3 and 4 will reflect reverse causality.

As a specific example, suppose that a combination of legitimate and illegitimate sources of information causes every deal to be anticipated with $Prob_i = \frac{1}{2}$ before the first bid. Then, from (14), every runup would be half as large as the premium. The coefficient of runup in (5) will be $(1/Prob)$, or two, however, and the post-bid markup will be perfectly correlated with the pre-bid runup. However, the markup pricing hypothesis implies that the regression coefficient on runup equals one and that the runup and the post-bid markup are uncorrelated. The Appendix shows that with weaker assumptions about the probability of a takeover before the first bid (e.g., that it is random, but uncorrelated with the size of the premium), the coefficient of runup in (5) will have a probability limit that is lower than $[1/E(Prob_i)]$ but greater than one (i.e., runups and markups will be positively correlated).

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 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). Unfortunately, both the runup and the premium samples include values that are negative or close to zero, so that the distribution of the ratio of the runup to the premium contains many outliers. This is a general problem in analyzing the ratio of two random variables where the variable in the denominator can take on values on both sides of zero; e.g., Kendall and Stuart (1969, p. 268) show that the ratio of two independent normal variables with mean zero and unit variance has a Cauchy distribution, which has such fat tails that it has no moments. Fig. 4 shows the distribution of the runup index for the main sample of 1,174 successful takeovers, which has many values outside the [0, 1] range.

Is there a way to cure the erratic behavior of the runup index? One suggestion, made by Jarrell and Poulsen (1989, p. 240), is to either (a) set the runup index equal to zero or one in those cases (henceforth called 'truncation') or (b) omit observations where the runup or the premium is negative (henceforth called 'censoring'). Both of these methods have the benefit that they can reduce or

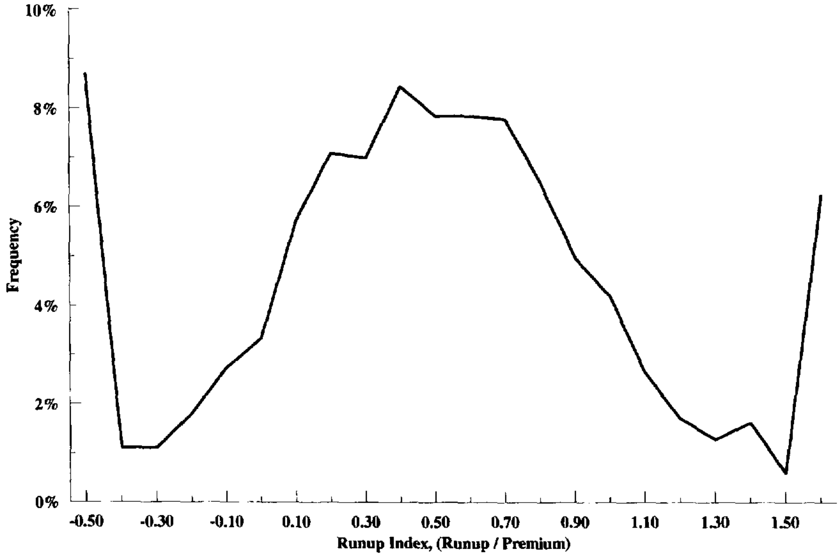

Fig. 4. Frequency distribution of the runup index (42-day runup divided by the sum of the 42-day runup and the 126-day markup) for 1,174 successful mergers or tender offers for exchange-listed target firms, 1975–91. The runup and the markup are measures of the abnormal price movement for target firms' stock surrounding the announcement of a merger or tender offer. The runup index is supposed to represent the probability of a takeover that is perceived by the market before the first formal bid is announced. Note that many values of the runup index lie well outside the (0, 1) interval that would be implied by the interpretation of the index as a probability measure. This happens because some of the runups and markups are negative.

eliminate outliers, but both truncation and censoring affect the inferences one would draw from the runup index.

For example, Table 11 contains estimates of the means and standard deviations of the runup index and the average runup and premium for the main sample of 1,174 successful takeovers that were consummated within a year. It also shows estimates of the regression coefficient relating the premium to the runup from Eq. (5). It shows the results for the unadjusted data (previously summarized in Tables 2 and 3) and for both the truncated and censored data. Two methods of sample adjustment are used. Method I adjusts or omits cases in which the runup or the premium are negative, and method II adjusts or omits cases in which the runup or the markup are negative.

The average runup index is 0.556 for the main sample, but it has a standard deviation of 17.41, reflecting many observations outside the (0, 1) interval. When some of the outliers are eliminated by adjusting observations with negative pre-bid runups or negative premiums (truncation method I) and eliminating observations in which both the runup and the premium are negative, there are

Table 11
Effects of truncating or censoring the distributions of runups, markups, or premiums on the distribution of the runup index (runup/premium); also the effects of truncation or censoring on the average runup, the average premium, and the regression relation between the premium and the runup

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. White's (1980) heteroskedasticity-consistent standard errors are used to calculate t-tests for whether the coefficient in the regression of premium on runup equals one. The 'main sample' includes 1,174 successful mergers and tender offers for exchange-listed target firms, 1975–91. It excludes deals that took longer than one year to consummate and target firms whose equity value is small (below $10 million) or whose pre-runup stock price is low (below $2 per share).

	Sample selection method				
Selection criteria	Main sample	Truncation method I	Censoring method I	Truncation method II	Censoring method II
Runup < 0	Include	Index = 0	Omit	Index = 0	Omit
Markup < 0	Include			Index = 1	Omit
Premium < 0	Include	Index = 1	Omit		
Runup < 0 & Markup < 0				Omit	
Runup < 0 & Premium < 0		Omit			
Summary statistics for the runup index (runup/premium)					
Average	0.556	0.766	0.876	0.493	0.481
Std. dev.	17.412	3.199	3.579	0.364	0.262
Maximum	417.286	92.206	92.206	1.000	0.999
Minimum	−375.063	0.000	0.001	0.000	0.001
Sample size	1,174	1,056	836	1,098	713
Summary statistics for runup and its relation with the premium					
Avg. runup	0.143	0.172	0.221	0.160	0.213
Avg. premium	0.301	0.360	0.420	0.343	0.460
Runup coeff.	1.018	0.761	0.814	0.829	0.894
t-test for runup coeff. = 1	0.45	−5.70	−3.63	−4.56	−2.11

1,056 estimates of the runup index. The average runup index from this sample is 0.766, with a standard deviation of 3.199. Omitting all cases where either the runup or the premium is negative (censoring method I) leaves 836 estimates of the runup index. The average runup index from this sample is 0.876, with a standard deviation of 3.579. As seen in Table 11, adjusting or omitting negative runups and markups (truncation or censoring method II) results in runup indexes that are constrained to the (0, 1) interval. For truncation method II, there are 1,098 observations with an average runup index of 0.493 and a standard deviation of 0.364. For censoring method II, there are 713 observations with an average runup index of 0.481 and a standard deviation of 0.262.

While the various truncation and censoring methods seem to result in runup indexes that are appealing, the effects on the estimates of average runups and premiums and on the relation between premiums and runups are disturbing. The average runup and the average premium are higher in all of the truncated or censored samples. Moreover, the estimates of the regression coefficient relating premiums to runups seem to be reliably less than one, with t-tests between -2.11 and -5.70. All of these results are an artifact of truncating or censoring the sample to eliminate negative runups and markups (or negative runups and premiums). In effect, adjusting the sample as a function of the dependent variable (premium) induces correlation between the regressor (runup) and the error term in the regression, biasing the regression coefficient downward.

5.3. *Can the market predict premiums?*

The premise of Eq. (14) is that the market knows what the premium will be if a takeover occurs. The results in this paper cast doubt on that hypothesis. One reason for analyzing samples of transactions with different deal characteristics throughout the paper is to identify factors associated with different runups, markups, premiums, and with different relations between runups and markups. There are few, if any, tangible variables that the market could use before the first bid is announced to predict the premium paid in successful transactions.

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. From Tables 2 and 4, most the reliable variation of premiums is related to the variation of markups as the type of deal is learned by the market (e.g., successful deals, all-cash deals, tender offers, and especially auctions). There is much less variation in average runups across different types of deals. Comment and Schwert (1995) use several accounting and stock market performance measures to predict takeovers of exchange-listed firms from 1975–91 and to predict premiums (included 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, the type of competition feared by the bidder is the best systematic explanation for variation in takeover premiums, and whether this type of competition will occur 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 markups paid to target shareholders in successful mergers and tender offers (measured from the day before 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. 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 the runup was during the previous month). Even selecting the results that are most favorable to the notion of substitution between runups and post-bid markups, which involve cases in which 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 paid by successful bidders (the sum of runups and post-bid markups).

6.1. Markup pricing and rationality

Markup pricing behavior is consistent with rationality since, in general, neither bidders nor targets (management nor 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.

There is no relation between the runup in the target's stock price and the behavior of the bidder's stock price over the term of the transaction. This finding is inconsistent with Roll's (1986) hubris hypothesis that bidders pay too much to win takeover contests. At least at the time of the transaction, the market does not systematically interpret target runups as evidence that the bidder is paying too high a price to acquire the target.

6.2. Misappropriation and insider trading

The evidence in this paper implies that 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) imposed large costs on financial markets. By stealing a bidder or target firm's proprietary information, these third-party insider traders acted like shills in an auction – they fooled legitimate bidders into thinking that there were competing bidders with potentially different private information who were interested in buying the target. Even the strongest critics of insider trading regulations in the United States (e.g., Carlton and Fischel, 1983; Manne, 1966) do not argue that third-party insider trading based on misappropriated information has societal benefits.

There is some evidence that the cases in which 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. becomes involved. This is consistent with the results of Meulbroek (1992), who finds that much of the price movement during runup periods occurs on days when insiders are trading. One interpretation is that insider trading occurs in a larger fraction of the cases, but the S.E.C. only prosecutes when the effects on price and volume in the runup period are largest. To the extent that the market, and the bidder and target management and stockholders, correctly infer that the runup is due to leakage of the bidder's private information, the costs of misappropriated information are lower.

The question of the appropriate remedy for insider trading based on misappropriated information is interesting (see, for example, Hauch, 1987; Warren, 1987). If bidders end up paying a higher premium to all target shareholders than they would otherwise, the costs borne by the bidder are generally much larger than the profits realized by the people trading on inside information. The history of the civil litigation to date suggests that it is difficult to identify defendants with sufficient resources and sufficient guilt to warrant protracted litigation.

6.3. *What determines the outcome of takeover negotiations?*

The results in this paper raise a general question about the role played by the market in affecting the outcome of takeover negotiations. In particular, if the market price of the target stock rises, how does that affect the bargaining strategies of the bidder and the target? Tracking the history of offers and counteroffers as the market price of the target firm changes would be an interesting way to examine this question. It would also be interesting to study the changes, if any, in the valuations of the target firm by investment bankers representing both the bidder and the target as the market price of the target firm changes. DeAngelo (1990) and Kaplan and Ruback (1995) study the valuation analyses performed by investment bankers as part of the fairness opinions justifying the terms of negotiated takeovers, but I am not aware of anyone who has studied a time series of valuations concerning a specific transaction during a period when the target's stock price rose substantially.

Grossman and Hart (1980) argue that target firms should acquire a toehold position before commencing a tender offer so that the bidder can acquire some target shares at nonpremium prices. On the other hand, many bidders do not acquire any target shares before commencing an offer, presumably because they fear that such pre-bid accumulations will raise the eventual cost of a successful takeover. The essence of the argument between these positions is whether any pre-bid runup caused by the bidder's accumulation of target shares raises the eventual price that must be paid for the target firm. The evidence in this paper suggests that, all else equal, the runup is an added cost to the bidder.

Appendix

The relation between runup and premium when the premium is predetermined

Define the runup for firm i, R_i, as the product of the premium if a successful takeover were to occur, P_i, and the probability of a takeover perceived before the date of the first bid, π_i. Both R_i and 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 premium is known in advance to all participants. Suppose, further, that the probability of takeover is uncorrelated with P_i.

The expected runup would be

$$\mathrm{E}(R_i) = \mathrm{E}(P_i)\cdot\mathrm{E}(\pi_i)\,. \tag{A.1}$$

The variance of the runup would be

$$\mathrm{var}(R_i) = \mathrm{var}(P_i)\cdot\mathrm{var}(\pi_i) + \mathrm{E}(\pi_i)^2\cdot\mathrm{var}(P_i) + \mathrm{E}(P_i)^2\cdot\mathrm{var}(\pi_i)\,, \tag{A.2}$$

and the covariance of runup with the premium would be

$$\mathrm{cov}(R_i, P_i) = \mathrm{E}(\pi_i)\cdot\mathrm{var}(P_i)\,. \tag{A.3}$$

Thus, the probability limit of the coefficient from the regression of the premium on runup in Eq. (5) is

$$\begin{aligned}\mathrm{plim}\, b &= \mathrm{cov}(R_i, P_i)/\mathrm{var}(R_i)\\ &= \mathrm{E}(\pi_i)\cdot\mathrm{var}(P_i)/[\mathrm{var}(P_i)\cdot\mathrm{var}(\pi_i) + \mathrm{E}(\pi_i)^2\cdot\mathrm{var}(P_i) + \mathrm{E}(P_i)^2\cdot\mathrm{var}(\pi_i)]\\ &= 1/\{\mathrm{E}(\pi_i)\cdot[1 + (\mathrm{var}(\pi_i)/\mathrm{E}(\pi_i)^2)\cdot[1 + (\mathrm{E}(P_i)^2/\mathrm{var}(P_i))]]\}\,. \end{aligned} \tag{A.4}$$

If the probability of a takeover is constant across all deals, $\mathrm{var}(\pi_i) = 0$, and $\mathrm{plim}\, b = 1/\mathrm{E}(\pi_i)$. In general, $\mathrm{plim}\, b > 1$, since the denominator of (A.4) is less than one. Table A.1 shows the values of $\mathrm{plim}\, b$ 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 premium from the 1,523 firms in the main sample of exchange-listed takeover targets, $\mathrm{E}(P_i) = 0.238$ and $\mathrm{var}(P_i) = 0.131$. The probability limits for b range form 2.00 to 1.36 and they are inversely related to the variance of π_i.

Table A.1
Coefficients for runup, R_i, in a regression of premium, P_i, on 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 R_i implied by this model for runup from (A.4), with $E(P_i) = 0.238$ and $var(P_i) = 0.131$ (the values from the main sample of 1,523 takeovers of exchange-listed target firms, 1975–91). In general, the pre-bid markup and the post-bid runup will be positively correlated, as shown by plim $b > 1$, when the premium is predetermined.

Lower limit, l	Upper limit, u	$E(\pi)$	$var(\pi)$	plim b
0.00	1.00	0.50	0.083	1.36
0.05	0.95	0.50	0.067	1.44
0.10	0.90	0.50	0.054	1.53
0.15	0.85	0.50	0.041	1.62
0.20	0.80	0.50	0.030	1.71
0.25	0.75	0.50	0.021	1.79
0.30	0.70	0.50	0.013	1.86
0.35	0.65	0.50	0.007	1.92
0.40	0.60	0.50	0.003	1.97
0.45	0.55	0.50	0.001	1.99
0.50	0.50	0.50	0.000	2.00

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