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Speculation spreads and the market pricing of proposed acquisitions

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Abstract

This paper examines speculation spreads following initial acquisition announcements in 362 cash tender offers spanning the 1981–1995 period. Speculation spreads in acquisitions, defined as the percentage difference between the bid price and market price one-day after the initial announcement, are the starting point for arbitrage returns, a subject receiving increased attention in practice and in the literature. Speculation spreads exhibit a positive mean, with considerable cross-sectional variation. In fact, over 23% of speculation spreads are negative, indicating a post-announcement price greater than the initial bid price. In spite of its importance, the informational content of the speculation spread and the reasons for its cross-sectional variation have not been previously examined. We model speculation spreads as the visible component of total speculative returns of the target. Rational traders set speculation spreads anticipating the expected price resolution and length of the acquisition bid. Empirically, we find strong support for key implications of our model. Speculation spreads are significantly related to bid and offer characteristics observable ex ante. Consistent with our model, they are also significantly negatively related to the magnitude of price revision and significantly positively related to offer duration. These results are robust to the inclusion of bid and offer characteristics known ex ante as well as those only revealed ex post. The results are consistent with market pricing of both offer duration and price resolution at the time of the initial announcement.

JEL classification: G3; G34
Keywords: Tender offer; Speculation; Risk arbitrage

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1. Introduction

Invariably, the market price of a target firm adjusts upward following the announcement of an acquisition bid. The remaining percentage difference between the bid and market price on the day after the acquisition announcement represents what we term a ''speculation spread''. Theory would suggest that speculation spreads are set conditional on the characteristics of the particular acquisition and anticipating the price resolution of the offer. In setting the bid price, the bidder reveals information about its valuation of the target. In contrast, the spread reveals the *market's* pricing of the target conditional on the existence of the bid. That is, the adjustment of market prices toward or even above the offered bid price contains important information about the market's interpretation of the offer in light of bidder, target, and bid characteristics. The literature contains little information about the characteristics of the speculation spread, its determinants, and its relation to subsequent revision returns. Why is it that after acquisition announcements some target prices adjust until they nearly equal the bid price while others adjust by lesser amounts? To what extent does the speculation spread forecast subsequent offer revisions and offer durations? What factors are associated with negative speculation spreads, where the target price adjusts *beyond* the initial bid price? To what extent do bid characteristics such as the bid premium, bidder toehold, managerial attitude, or managerial shareholdings affect the size of the speculation spread?

Speculation spreads are also inherently important because of their link to risk arbitrage and speculative activity. Indeed, the speculation spread is the base from which arbitrage returns begin. Although the popular press has discussed these topics for several decades, they are now receiving increased attention in the academic literature. Recent academic evidence indicates the existence of positive speculative returns over the post-announcement period. Baker and Savasoglu (2002) report abnormal returns of about 1% per month on a portfolio of risk arbitrage positions established over the period 1978 through 1996. Mitchell and Pulvino (2001) find that the relation between risk arbitrage returns and market returns varies with market conditions. Karolyi and Shannon (1999) cite annualized returns to traders exceeding 25% for 37 Canadian acquisition targets during the year 1997. Dukes et al. (1992) examine speculative activity around 761 cash tender offers filed between 1971 and 1985 reporting returns of approximately 25% for a 50-day period. Larcker and Lys (1987) report mean and median excess returns to arbitrageurs of 5% and 3%, respectively, from the time of investment to the resolution of the offer.[2]

In a related theoretical work, Cornelli and Li (2001) develop a model in which the probability of offer success is positively related to the increased presence of risk arbitrageurs. Arbitrageurs are more likely to trade in liquid stocks since it is easier to hide their trades. Both Cornelli and Li (2001) and Gomes (1999) link arbitrage activity and increased bid premia.

The starting point for speculative returns is the immediate post-announcement market price of a target firm which, when subtracted from the initial bid price (and expressed as a percentage), defines our speculation spread. In essence, the speculation spread defines the

[2] See Boesky (1985) and Wyser-Pratte (1982) for early anecdotal descriptions of merger arbitrage.

market pricing of proposed acquisitions contingent on the announced bid price and observed offer characteristics. In spite of its importance, we are unaware of existing cross-sectional analyses of speculation spreads. The contribution of our research is the modeling of this spread and the analysis of its relation to target and bid characteristics both known and unknown at the time of the initial announcement. In Section 2, we develop a theoretical and empirical model linking the speculation spread and key acquisition characteristics and test its implications on a sample of 362 cash tender offers. Our model decomposes total speculative returns into two parts: an initial, visible component represented by the speculation spread and the revision return associated with the price resolution of the offer. In Sections 3 and 4, we test the extent to which rational traders, setting the initial speculation spread, anticipate both the price resolution and duration of the offer. Additional contributions of our research include an analysis of offer duration and abnormal volume around acquisitions. We also analyze the relation between speculation spreads and bid characteristics, including those known and unknown at the time of the initial bid.

We find that the speculation spread has positive mean and exhibits considerable cross-sectional variation. In explaining this cross-sectional variation, we find empirical support for the key tenets of the model. Speculation spreads set at the time of the initial announcement anticipate not only the direction and magnitude of price revisions but the duration of an offer as well. That is, the market pricing of the target firm on the day following the initial bid announcement reflects both the size and direction of the subsequent bid outcome and the length of time until the bid is resolved.

2. Research design

2.1. The components of speculation returns

Define traders as anyone purchasing shares subsequent to an acquisition announcement. This includes individual investors as well as professional speculators (risk arbitrageurs).[3] Assume that these traders respond to the first formal acquisition announcement for a target firm at time t_0 and purchase shares in that firm the following day for price P_1.[4] Holding these shares until completion of the offer yields:

$$\mathrm{TR}_i = (P_{\mathrm{F}i} - P_{1i})/P_{1i} - H_i \tag{1}$$

where TR_i is the realized total percentage return to speculation for acquisition i, $P_{\mathrm{F}i}$ is the final price received for shares purchased in target firm i and H_i is the percentage holding

[3] At this point, the identity of these investors, or even the use of the word speculation, is not important. In our analysis, the identity or type of the post-announcement trader is unknown. Hence, we use the terms speculator, investor, and trader synonymously. The identity of the marginal trader does not alter our model of post-acquisition price adjustment.

[4] We choose the following day to define a specific, realizable strategy in our estimates. In practice, traders are likely to time their trades advantageously, purchasing and selling as prices and information dictate. Moreover, traders will continuously monitor the speculation spread throughout the term of the offer and invest as perceived opportunities arise. Our choice of day 1 should bias us against finding significant results.

cost involved in the transaction.[5] In the case of a successful offer, P_{Fi} is the final price received from a bidder for target firm i; in an unsuccessful offer P_{Fi} represents the post-offer market price. Of course, to the extent that offer duration (e.g., time to completion) varies, the returns would need to be annualized. While this will not affect our model, in our empirical work we annualize as appropriate.

Let BP_i represent the first announced bid price for the target's shares.[6] Rewriting $P_{Fi} - P_{1i}$ as $(P_{Fi} - BP_i)+(BP_i - P_{1i})$ we see that the total speculative return has two components: one visible just after the announcement $(BP_i - P_{1i})$ and one subsequently observed and dependent on any (upward or downward) revisions in final prices as compared to the initial bid price $(P_{Fi} - BP_i)$. Thus,

$$TR_i = SS_i + RR_i - H_i \tag{2}$$

where $SS_i=(BP_i - P_{1i})/P_{1i}$, the *speculation spread* for acquisition i and $RR_i=(P_{Fi} - BP_i)/P_{1i}$, the *revision return*. Note that for offers that are not revised P_{Fi} equals BP_i, and the revision return equals zero. Also, our definition of revision return does not necessarily imply subsequent and higher bid premia. For unsuccessful offers, $P_{Fi} - BP_i$ is generally negative implying negative revision returns.

2.2. Understanding the speculation spread

The speculation spread is the visible component of expected returns.[7] The importance of the initial speculation spread is apparent from its relation to revision returns. Traders gain or lose the difference between their purchase and subsequent tendering or selling price $(P_{Fi} - P_{1i})$. The speculation spread represents an immediately visible component of the total expected return endogenously determined through the actions of traders bidding in the post-announcement period. The speculation spread is set cognizant of the expected risks and returns associated with the acquisition. For a fixed bid price, the post-announcement market price P_1 uniquely determines the expected rate of return to traders. This assumes, however, that the bid will be successful at the bid price, and that all of the shares of traders are tendered and accepted. In reality, upward revisions in the bid price are frequent and generate greater returns. Conversely, downward revisions, partial tender offers or bid failures produce lower or even negative returns.

[5] We recognize that while dividends will also affect realized returns, they are unlikely to affect the price resolution of the offer. Moreover, returns due to dividends are dwarfed in magnitude by the potential of offer revision. Consequently, we focus on the final pricing of the offers in our sample. We do not believe that this materially alters our results.

[6] Seven percent of our formal bid announcements are preceded by rumors. Obviously, purchasing on the rumor would add an additional dimension of risk. We focus on the first formal announcement for two reasons: first, it provides a definitive and more homogeneous benchmark for the analysis of arbitrage returns. A second reason is the stated policy of many arbitrageurs of not investing until the deal is announced. In addition, we wish to compare the components of the initial spread with variables often announced concurrently with the formal bid. Nevertheless, we will test the sensitivity of our results to the existence of rumors.

[7] If all shares are accepted at price BP, traders earn the difference $(BP_i - P_{1i})$. Since the speculation spread is determined by the post-announcement price P_1, investors expecting a higher final price P_F will raise the post-announcement price P_1. Higher post announcement prices P_1 create smaller (or possibly even negative) speculation spreads.

At any point, a target's value is the weighted average of possible future share prices times the probability of realizing these share prices. Incorporating the distribution of possible payoffs and anticipated holding costs, the expected return to traders after the announcement of a tender offer can be expressed as:

$$E(\mathrm{TR}_i) = \sum\nolimits_{\mathrm{F}} \mathrm{Prob}_{\mathrm{F}i}(P_{\mathrm{F}i} - P_{1i})/P_{1i} - H_i$$

Or equivalently,

$$E(\mathrm{TR}_i) = \mathrm{SS}_i + \sum\nolimits_{\mathrm{F}i} \mathrm{Prob}_{\mathrm{F}i}(P_{\mathrm{F}i} - \mathrm{BP}_i)/P_{1i} - H_i \tag{3}$$

where $\mathrm{Prob}_{\mathrm{F}i}$ is the probability of being able to sell the shares for $P_{\mathrm{F}i}$ dollars.

Qualitatively, one of three things will happen to the target price subsequent to day 1. The offer price will either be revised upward, downward, or remain unchanged. Each of these possibilities, including the probability of the offer succeeding at the initial bid price (i.e., unrevised and successful), is embedded in the second term of Eq. (3).

In addition to the potential gains and losses through share purchases, traders incur holding costs related to the use of funds tied up during the acquisition process. The longer the acquisition process, the higher the holding costs of funds involved. In words, Eq. (3) states that expected return to traders after an acquisition announcement is equal to the speculation spread plus expected revision returns (the second term on the right-hand side) minus holding costs.

2.3. Testable implications

This analysis suggests two immediate implications:

$\mathbf{H_1}$: If traders successfully anticipate the price resolution of offers, there will be a negative relation between speculation spreads and realized revision returns.

The intuition behind this hypothesis is straightforward: All prices (with or without acquisitions) are driven by the expectation of subsequent returns. Higher expected revision returns anticipated for acquisition i produce a higher immediate price P_{1i} and, thus, a smaller speculation spread. In fact, a stronger implication of our model is that, for a given expected total return, a regression of speculation spreads on revision returns will not only result in a significantly negative coefficient but one equal to -1.

$\mathbf{H_2}$: If traders successfully anticipate the duration of the offer, there will be a positive relation between speculation spread and realized holding costs, ceteris paribus.

Although traders can sell their holdings at any time in a liquid market, the realized return will be a function of the final price ($P_{\mathrm{F}i}$) and the holding costs. We focus on the realized duration of the offer as the proxy for holding costs. Duration is measured as time from the announcement till the resolution of the offer. Offers with longer expected duration will be associated with higher holding costs and correspondingly larger speculation spreads.

A third hypothesis follows from the work of Cornelli and Li (2001) and Gomes (1999) who analyze the importance of risk arbitrageurs in the takeover process. In the Cornelli and Li (2001) model, the probability of offer success is positively related to the increased presence of risk arbitrageurs since accumulations by arbitrageurs facilitate the offer process. Arbitrage is more likely in liquid stocks since it is easier to hide trades. We model liquidity (and the presence of arbitrageurs) by the abnormal volume of trading that occurs around acquisitions and test the third hypothesis:

H_3: The implications of our model will be stronger in offers with increased liquidity (i.e. higher abnormal volume).

Our empirical tests proceed as follows: First, we describe the nature of our sample and selected sample characteristics. We also examine the size and significance of potential returns to speculators following a simple strategy of investing in the common stock of announced targets. The formal tests of our hypotheses begin by studying the relation between speculation spreads, duration of the acquisition, and revision returns as well as other relevant sample characteristics. Two sets of independent variables are related to speculation spreads. The first set includes variables known at the time of the bid. The second set includes variables revealed ex post. We test our third hypothesis using subsets of offers where speculative activity is likely to be greater. Finally, we examine the robustness of our results.

3. Description of the sample

3.1. Sample selection

Our analysis focuses upon a sample of initial acquisition bids without recent bid activity. This is important since the existence of previous bid activity has implications for subsequent price revisions. Creating this sample involves a multi-step process. We start with a list of (successfully and unsuccessfully acquired) target firms from the period January 1, 1981, to December 31, 1995, derived from Securities Data (SDC). We select all cash tender offers where the bidder seeks to own 100% of the firm, the value of the transaction exceeds $10 million, and where the target is listed on the NYSE, AMEX, or NASDAQ exchanges 20 trading days prior to the acquisition announcement date. Traders in partial offers and stock offers are faced with the additional difficulty of pricing shares not accepted in the tender or valuing the bidders stock—a value which is also likely to be affected by the current acquisition. Moreover, traders in stock offers often implement more complex hedging strategies.[8] While these are interesting situations, worthy of their own analysis because of their unique problems, we focus on 100% cash tender offers to achieve a homogeneous sample. In addition, as a check on our data, we require that the acquisition be announced in a major newspaper covered by Lexis-Nexis. Following this initial

[8] See, for example, "Ivan Boesky They Ain't", *Barrons*, October 25, 1993. Also, from an academic perspective, see Mitchell et al. (2000) who examine price pressure around critical trading points often associated with arbitrage activity.

selection, we examine Lexis-Nexis and SDC for the previous six months to determine if there was a prior bid for the target. Where this occurs, the earlier bid becomes our starting point and we repeat the process until we locate the initial bid announcement.[9]

Our calculation of speculation spreads, revision returns, and total returns stem from the first formally announced bid for a particular target. The existence of rumors concerning the acquisition is noted from Lexis-Nexis and is analyzed in a latter part of the paper. Financial and public utility companies are excluded. No ex ante restriction is imposed with regard to information not publicly available at the time of the offer. Thus, a trader could implement all of our sample selection criteria at the time of an acquisition announcement.

3.2. Distribution of the sample, speculation spreads, and revision returns over time

Our screening procedure results in a sample of 362 cash tender offers over the 1981 to 1995 period. Panels A and B of Table 1 also reveal the distribution of mean speculation spreads, revision returns and total returns partitioned by year, and for the entire sample, respectively. The largest number of firms enters our sample in the mid- to late-1980s and in 1995. The decline in acquisition activity noted in the late 1980s and early 1990s is consistent with Comment and Schwert (1995).[10]

The mean and median speculation spreads are 1.9% and 2.0%, respectively. Thus, the typical stock price of a target firm on the day after the acquisition announcement increases to an amount just below the initial bid price. The dispersion of speculation spreads is large: the minimum and maximum speculation spreads are -30% and 42%, respectively. In fact, over 23% of the speculation spreads are negative: in terms of our model, $P_{1i}>\mathrm{BP}_i$. The percentage of cases with negative speculation spreads varies from a low of 4% in 1994 to highs of 43% in 1981 and 40% in 1992. Note that both of the latter two years involve a small number of cases (seven in 1981 and five in 1992).[11]

The average (unannualized) revision return across the entire sample is 6.9%. In comparison, the associated speculation spreads shown in Table 1 are typically one-third the size of revision returns. The average revision return is positive for all but one year in our sample (a year with only seven cases). As with speculation spreads, the distribution of revision returns is large, ranging from a low of -55% to a high of 101%.

The average total return (the sum of the speculation spread and revision returns) is positive for each year of the sample. In spite of this, the next column reveals that the number of cases with positive total returns in a given year varies from a low of 80% in 1992 to a high of 100%; the high is achieved in four separate years of the sample. For the entire sample, 93% of the cases produce positive total returns. Although we give

[9] A few transactions in our sample involve target firms smaller than $10 million. This is due to our treatment of preceding offers—if an offer shows up in our initial sample and we determine that there was another tender offer in the prior 6 months, we use the prior tender offer in our sample as the initial offer. In a few cases, the size of these firms was less than $10 million at the time of the initial offer.

[10] We also calculate the traditional abnormal returns around the first announcement. Our results, not shown for brevity, are typical of the acquisition literature: the average target firm earns 20.4% in the two-day announcement period $(-1, 0)$ and smaller positive abnormal returns in the pre-announcement period.

[11] In sensitivity tests we will also examine the relation of hot and cold markets (intense and light activity) on speculation spread.

Table 1
Average speculation spreads, revision returns and total returns over the sample period

Panel A: Average speculation spread, duration, revision return, and total return by year of the sample

Year	Total acquisitions per year	Average speculation spread (%)	Average revision return (%)	Average total return (%)	% Of cases with positive total returns	% Of cases with negative speculation spread	Average duration (days)	Average annualized revision return (%)	Average annualized total return (%)
81	7	− 1.71	18.57	16.86	86	43	88	79.2	67.9
82	9	3.23	10.54	13.76	100	11	70	46.7	68.8
83	7	1.26	4.86	6.12	100	14	57	39.7	34.5
84	19	2.98	1.90	4.88	84	21	52	12.0	36.9
85	29	2.31	7.80	10.10	90	17	74	20.6	34.1
86	47	0.05	6.06	6.11	89	32	67	38.4	38.5
87	31	0.30	4.28	4.59	87	35	74	18.2	21.1
88	65	2.70	14.56	17.26	94	28	89	64.1	82.3
89	39	1.04	7.11	8.15	97	31	74	38.7	46.5
90	18	4.42	1.82	6.24	100	6	60	7.1	42.0
91	7	2.00	− 0.62	1.38	86	29	77	0.2	14.5
92	5	0.94	5.09	6.03	80	40	49	24.1	34.2
93	11	2.66	7.02	9.68	100	9	64	44.9	67.5
94	24	3.57	2.30	5.87	96	4	70	11.7	35.3
95	44	1.85	3.67	5.52	93	16	55	19.7	35.4
Total	362	1.86	6.93	8.79	93	23	71	33.19	46.50

Panel B: Distribution of speculation spreads, revision returns and total returns over the entire sample ($n = 362$)

	Mean	Min	Q1	Median	Q3	Max	Standard deviation	% Negative
Speculation spread (%)	1.86	− 30.10	0.00	1.96	4.35	41.46	6.99	23.1
Revision return (%)	6.93	− 55.56	0.00	0.00	12.65	101.49	14.98	4.1
Total return (%)	8.79	− 51.85	1.54	3.30	11.85	91.05	15.06	7.5
Annual revision return (%)	33.20	− 566.80	0.00	0.00	56.80	481.10	89.30	4.1
Ann. Total Return (%)	46.50	− 453.40	13.20	24.90	75.10	431.60	80.40	7.5

Panel A reports average speculation spreads, revision returns, total returns and number of offers over the sample period. Our sample includes all 100% cash tender offers exceeding $10 million in value, announced between January 1, 1981, and December 31, 1995, and covered by both Securities Data Corp and Lexis-Nexis. We also require the target to be listed on the NYSE, AMEX, or NASDAQ exchanges 20 trading days prior to the acquisition announcement date. Our calculation of speculation spreads and revision returns stem from the first formally announced bid for a particular target. Financial and public utility companies are excluded. Speculation spread is defined as $(BP - P_1)$ divided by P_1 where BP is the announced bid price by the first bidder, and P_1 is market price 1 day after the first announcement of the tender offer. Revision return equals $(P_F - BP)/P_1$, where P_F is the final bid price in a successful offer or market price at the announcement of a failed offer. Total return is equal to $(P_F - P_1)/P_1$. Duration of tender offer reports the number of days between the announcement of the tender offer and either the announced date of purchase of tendered shares or date of the first newspaper article indicating withdrawal of the offer. Panel B reports the distribution of speculation spreads, revision returns and total returns over the entire sample.

considerable attention to offer duration in a latter section of the paper, we note here that the average duration is 71 days with substantial variation. Since offers are outstanding for differing periods of time, it is important to calculate annualized post-announcement and annualized total returns.[12]

Annualized revision returns average 33% across the entire sample. They range from a low of just above zero in 1991 to a high of nearly 80% in 1981. Annualized total returns, analyzed in more detail in the following section, have a mean and median across the entire sample of 46.5% and 25%, respectively. The low value is 14.5% in 1991; the high is over 80% in 1988, the year with the largest number of cases (65).

3.3. Dollar payoffs and abnormal returns to post-announcement traders

To understand the economic and statistical significance of total returns to risk arbitrage activity, we calculate the return from the simplest trading strategy surrounding an acquisition: buying a target firms' stock 1 day after announcement and holding until resolution of the offer. Fig. 1 shows portfolio returns for this strategy. The right axis tracks the number of stocks in the portfolio on a daily basis. When there is no tender offer outstanding on a particular day, we splice in the return for the value-weighted portfolio. All takeover targets are held in the portfolio from 1 day after the announcement until the resolution of the offer. To assess the economic significance of the returns to this strategy we also report a payoff to investing $1 into value- and equal-weighted CRSP portfolios.

Table 2 reports the same dollar payoffs in a table that allows for different starting periods. Regardless of the starting year of the investment, the passive arbitrage portfolio earns approximately 1 1/2 to 2 times the amount earned by the market portfolio. For example, $1 invested in 1981 grows to $7.06 as of December 1995 when invested into every cash tender offer 1 day after the announcement and holding until the resolution. The same investment into the CRSP value-weighted portfolio grows to $3.14 over the same period.[13] The average beta of takeover targets in our sample is 0.71. Of course, it is likely that this analysis understates the returns that could be earned by informed traders actively selecting deals and holding periods. Nevertheless, additional analysis of risk is necessary before concluding that simply buying targets and holding until resolution outperforms on a risk adjusted basis.

To assess the statistical significance of the abnormal returns earned by this strategy we estimate the Fama and French (1993) three-factor model. We regress the difference of average monthly target portfolio returns minus the risk-free rate on: the market risk premium, the difference in returns between portfolios of small and big stocks (SMB), and

[12] We annualize by multiplying the period return by the quotient of (365/offer duration). An alternate approach, assuming compounding of returns throughout the year, produces similar conclusions in our multivariate tests. The statistical properties of this procedure are less desirable, however, indicating more substantial departures from normality.

[13] We also perform this analysis assuming trading costs equal to 1.5% of stock price for every market transaction. The analysis, not reported, gives qualitatively similar results.

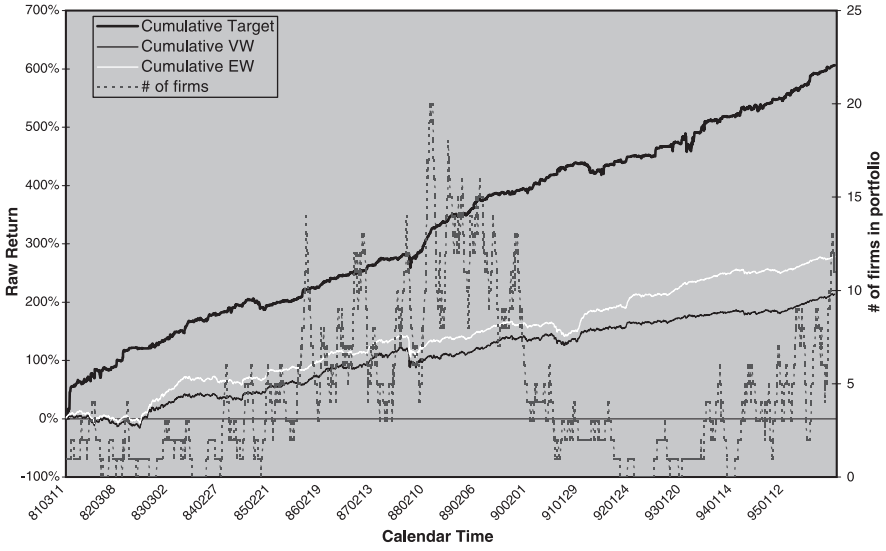

Fig. 1. Portfolio returns.

the difference in returns between portfolios of high and low book-to-market stocks.[14] Explicitly, we estimate the following model:

$$(R_{\text{Target}} - \text{rf}) = \alpha + \lambda_{\text{Mkt}}(R_{\text{Mkt}} - \text{rf}) + \lambda_{\text{SMB}}\text{SMB} + \lambda_{\text{HML}}\text{HML} + e \tag{4}$$

In this model, α is interpreted as the monthly abnormal return to the risk arbitrage portfolio. The results (t-statistics in parentheses below each coefficient) are as follows:

$$(R_{\text{Target}} - \text{rf}) = \underset{(4.53)}{2.01} + \underset{(1.70)}{0.20}^{*}(R_{\text{Mkt}} - \text{rf}) + \underset{(2.28)}{0.43}^{*}\text{SMB} + \underset{(0.76)}{0.15}^{*}\text{HML} \tag{5}$$

with an adjusted R^2 of 0.03. The intercept, positive and highly significant, implies an abnormal monthly return of 2.01%. This is slightly higher than the results of Baker and Savasoglu (2002) and Mitchell and Pulvino (2001).[15] The other estimated coefficients are similar to previous research.

Overall, the total returns to risk arbitrage appear both economically and statistically significant. While our objective is not studying the magnitude of the total returns but rather the relation between its components (speculation spread and revision return) and other target and bid characteristics, we note that we obtain similar results as other studies of returns to risk arbitrage.

[14] If no tender offer is outstanding in a particular month (no target is 'at play') we splice in the return on CRSP value-weighted portfolio.

[15] Differences in results are probably due to different sample selection criteria.

Table 2
Dollar payoffs to post-announcement traders

Starting year	$1 invested in Portfolio of Takeover Targets (US$)	$1 invested in CRSP VW (US$)	$1 invested in CRSP EW (US$)
1981	7.06	3.14	3.78
1984	5.29	2.73	3.10
1987	4.44	2.24	2.66
1990	3.12	1.73	2.16
1993	2.34	1.41	1.53

The value of $1 investment for various portfolios and various starting times is shown—the end of the investment horizon is December 1995. All takeover targets are held in the portfolio until resolution of the deal. A portfolio of takeover targets consists of all firms that were a cash tender offer target between 1981 and 1995. When there is no tender offer outstanding on a particular day, we splice in the return for the value-weighted portfolio.

3.4. Variables influencing the speculation spread

The intent of the analysis in the preceding section is to indicate the size and significance of acquisition related returns to post-announcement traders. All such returns and strategies begin with the speculation spread defined by the initial bid price and the market's reaction inherent in P_1. This underscores the importance of understanding the components of this spread. To what extent does it anticipate revision returns? To what degree does it incorporate bid and offer characteristics? We turn to a description of these characteristics.

According to Eq. (3), the relevant characteristics to relate to speculation spreads are those that influence either the probability of realizing a particular price (Prob_F), the magnitude of that price (P_F), or holding costs (H_j). Each of the variables analyzed here has been linked in the literature to the probability of bid success, the probability of bid revision, or the price resolution of the offer.[16] In discussing the variables, we emphasize the relation between these variables and the probability of bid revision. Many of these variables play a dual role, however, since they relate to the probability of the deal succeeding at the initial bid price. Variables that increase the possibility of completing the deal offered by the initial bidder should narrow spreads. But increased probability of realizing the initial bid price implies a reduced probability of revision—this will widen spreads. As a result, the net impact of many of the variables is an empirical issue. We will show that a large percentage of offers is unrevised; their revision returns are zero. Even after including these cases, however, the average revision return is three times the average speculation spread. Thus, we expect the relation of variables to the probability of revision to be the dominant factors.

3.4.1. Probability factors

Factors relating to the probability of offer success include target managerial attitude, the distribution of power in the target firm, the size of the bid premium, characteristics of the target firm and its industry, and the experience of the bidder. As mentioned above, since

[16] See, for example, Song and Walkling (2000).

offer success is target firm specific, these factors will also relate to the probability of bid revision.

Target managerial attitude has been shown to be the decisive deterrent to offer success (Walkling, 1985; Schwert, 2000). Speculators, however, do not care who acquires a particular firm, only that they are able to realize an appropriate return on investment. Nevertheless, hostile offers are more likely to involve multiple bidders increasing the *probability of bid revision* by the initial or subsequent bidders; smaller spreads are expected (Jennings and Mazzeo, 1993). Friendly offers imply a smaller chance of revision and are expected to be associated with larger spreads (i.e., a lower P_1 relative to the announced bid price).

The *distribution of power* in the target firm is also known to affect the outcome of an offer. We consider the shareholdings of four distinct groups: officers and directors, blockholders, institutions, and bidders. The ownership of officers and directors can be used to encourage or thwart acquisition by a particular bidder. Hence, conditioning on managerial attitude can be important.[17] Hostile management with increased shareholdings is more likely to remain independent, implying larger spreads. Friendly management with increased shareholdings will be better able to bargain for higher premia. If this bargaining has not occurred prior to the announcement, spreads will be smaller. Otherwise, the impact of ownership may already be reflected in the premia offered. Toeholds by the bidding firm increase their influence over the managerial team and will increase the bargaining power of that bidder.[18] Since this lowers the probability of bid revision, spreads are expected to increase with bidder toeholds. Traditional sources of data on these shareholdings (from proxy statements, Value Line, etc.) are unlikely to reflect any recent changes in ownership. *Unusual volume* activity, *rumors* of acquisition activity and *runups* of target stock price are other indicators of shifts in ownership distribution; each of these factors is likely to be associated with increased speculative activity and the accumulation of shares in more neutral hands. These arguments imply a lower spread in the anticipation of bid revisions. Several of these factors are likely to be correlated with other bid characteristics. Rumors, for example, could be more prevalent in friendly acquisitions, which are expected to be associated with larger spreads. As mentioned before, the impact and significance of these factors is an empirical issue.

Larger percentage *bid premiums* will deter competing bids (Jennings and Mazzeo, 1993) and make the probability of bid revision less likely; larger spreads are expected. We note that bid premia are likely to be correlated with other factors. For example, Jarrel and Poulsen (1989) find rumors of an acquisition to be the strongest variable explaining the pre-bid runup, which leads to lower premiums. Another proxy for synergistic opportunities is the *existence of a previous acquisition* in the target's industry which could indicate the possibility of increased bidding for this target; smaller spreads are expected. A *bidder's experience* in the acquisition process should give it a competitive edge and make it more

[17] The role of blockholders and institutions in an offer is also likely to depend on their relationship with management (Brickley et al., 1988). Unfortunately, we do not have data on the nature of these relationships. See also Stulz et al. (1990) for the impact of ownership on the distribution of tender offer gains.

[18] Alternatively, toeholds are a way to hedge the position of an initial bidder if a subsequent bidder acquires the target.

likely that they will complete the acquisition. To the extent that this implies a lower probability of revision, larger spreads are expected.

3.4.2. Factors affecting holding costs

Speculators investing in acquisition targets incur holding costs proportional with the *duration of the offer*. In practice, of course, shares may be sold prior to the completion of an offer. However, successful offers generally involve a higher price at the completion of an acquisition. Spreads are expected to increase with the duration of the offer. *Microstructure effects* may also influence the cost of risk arbitrage activity. In particular, investments in small priced stocks may involve higher costs related to the discrete amounts at which shares are traded. That is, the typical 1/8 increment in tick size is a higher percentage of share price for smaller priced stocks. In addition, stocks with smaller capitalization are likely to be less liquid, which would also increase the cost of taking positions in the target.

3.5. Data and descriptive statistics on bid characteristics

Data on managerial attitude and toeholds is obtained from SDC and confirmed through Lexis-Nexis. The bid premium is calculated as the dollar difference ($BP_i - P_b$) divided by P_b (where P_b is the average pre-bid price from $t = -30$ to $t = -10$ relative to announcement date of the tender offer). The market value of equity of the target is measured 42 days prior to the takeover announcement (Schwert, 1996). Ownership of the target firm by officers and directors is obtained from proxy statements filed before the offer is announced.

Panel A of Table 3 reveals the distribution of offer outcomes, managerial attitude, bid competition, and offer revisions. Only attitude is known at the time of the bid. Nearly 80% of the target managements are friendly or neutral towards the initial bid; slightly more than 20% are openly hostile. Approximately 70% of the offers involve a single bidder. Over 40% of the offers are revised by either the initial or a subsequent bidder. Initially surprising is the fact that nearly all (96.7%) of our targets are acquired. The result is less surprising considering that our sample is restricted to cash tender offers for 100% of a target's shares and that this measure of offer outcome is not bidder specific. That is, the offer is considered as completed if a particular target is subsequently acquired by the first or any competing bidder. Our results concerning the success rate are also consistent with Schwert (1996) who reports a tender offer success rate of 94%.[19]

Although most cash tender offers are completed, the amount lost in the few unsuccessful deals could still result in financial disaster for a risk arbitrageur. It has been reported that the 1989 leveraged buyout of UAL not only destroyed the takeover boom but also left numerous risk arbitrageurs with huge losses.[20] Also, Long-Term Capital took considerable positions in takeover deals (e.g. Tellabs and Ciena, Travelers Group-Citicorp,

[19] Discussions with arbitrageurs also support these figures. In addition, we confirmed the validity of this result using a sample of successful and unsuccessful offers from W.T. Grimm as well as from SDC. It should be noted that the completion rate is target specific; the typical success/completion rate reported in the literature takes the point of view of a particular bidder. If we assume all multiple bids involve just two bidders (a conservative assumption) our bidder specific success rate is 75% (350/(362 + 103)) which is comparable to the existing literature.

[20] See Riva Atlas in *Institutional Investor* (1999).

Worldcom-MCI, and Berkshire Hathaway-General Re). While some deals collapsed, others were affected by market panic that sent stock prices plunging, leaving the fund with considerable losses.

Panel B of Table 3 reveals the distribution of selected target and bidder-specific characteristics. Measured 42 days prior to the announcement date of the tender offer, our mean and median firm has a market value of equity of $338 million and $93 million, respectively. As is typical, firm size exhibits considerable skewness. Equity holdings of officers and directors average 20% but are considerably dispersed. Insider ownership at the first and third quartiles is 4% and 32%, respectively. Blockholders, defined as individuals or institutions owning more than 5% of shares outstanding and who are not obvious insiders, have mean and median holdings of 16% and 12%, respectively. As with other measures of ownership, the range is large; the minimum is 0% and the maximum is 87%. Mean institutional ownership is 37% and 35%, respectively. The skewness of target size is also apparent in the number of institutional holders of their stock. On average, 71 firms hold shares in a target firm; the median (35 firms) is much smaller.

Sixty-one percent of targets had takeover activity in the prior year in their three-digit SIC industry (as defined by SDC). Although we will not explore the myriad possibilities involving options trading around acquisitions, we will examine whether the existence of options on the target firms is related to speculation spreads; 16% of our targets had listed options.[21]

Mean and median values for the bid premium are 47% and 42%, respectively. Although the median firm does not have a toehold by a bidder, there are some targets where bidder ownership is very large. The maximum bidder ownership is 87%.[22] Seven percent of our offers are preceded by rumors. In 43% of our cases, the bidder had made an acquisition in the previous three years.

3.6. The distribution of offer duration

The uncertainty facing traders in the post-announcement period surrounds not only the price resolution of the offer but also the duration of the offer. Longer offers create increased holding costs. Our second hypothesis asserts that the speculation spread incorporates the anticipated holding cost of an offer. Specifically, holding costs increase with the length of the offer so speculation spreads should rise as well. To begin to understand this, we measure the outcome and duration of the offers. The outcome and outcome date are noted in SDC and confirmed through Lexis-Nexis. In the event of disagreement, we use the Lexis-Nexis information. In a few cases, there is no formal announcement of the outcome. Where this occurs, we consider an offer to be unsuccessful if there is no additional indication of acquisition activity and if the target remains independent three months after the withdrawal date indicated by SDC. In these cases, the SDC withdrawal date is used as the outcome date. Note: for multiple bid and

[21] The authors would like to thank Sorin Sorescu (Texas A&M) and Bart Danielsen (De Paul University) for providing data on option listing.

[22] The corresponding 90th, 95th, and 99th percentiles of toehold are 15.6%, 47.6%, and 67.7%, respectively. Sensitivity tests without extreme values (larger than the 95th percentile—47.6%) produce similar results.

Table 3
Characteristics of the sample

Panel A: Distribution of the sample by outcome, managerial resistance, competition, and bid revisions

Year	Total per year	Outcome		Attitude		Competition		Bid revisions	
		Completed	Withdrawn	Friendly	Hostile	Multiple bidders	Single bidder	Revised	Unrevised
81	7	7	–	6	1	3	4	4	3
82	9	9	–	9	–	2	7	3	6
83	7	7	–	6	1	3	4	3	4
84	19	17	2	17	2	7	12	8	11
85	29	28	1	19	10	8	21	11	18
86	47	47	–	37	10	12	35	22	25
87	31	30	1	22	9	12	19	18	13
88	65	62	3	42	23	33	32	39	26
89	39	38	1	31	8	8	31	17	22
90	18	18	–	17	1	1	17	2	16
91	7	7	–	7	–	–	7	3	4
92	5	5	–	4	1	2	3	1	4
93	11	11	–	11	–	3	8	4	7
94	24	23	1	20	4	3	21	5	19
95	44	41	3	37	7	6	38	11	33
Total	362	350	12	285	77	103	259	151	211
	100%	96.7%	3.3%	78.7%	21.3%	28.5%	71.5%	41.7%	58.3%

Panel B: Target, bidder, and other offer characteristics

	Mean	Min	Q1	Median	Q3	Max	Standard deviation
Target-specific characteristics							
Market value of equity (000)	338,237	5138	35,269	93,166	244,896	13,347,709	941,684
Holdings of officers and directors (%)	20.02	0.03	4.14	12.67	31.9	89.6	19.76

Blockholder ownership (%)	16.45	0	5.2	12.03	25	87	16.84
Institutional ownership (%)	36.68	0	20.02	34.97	53.07	89.78	21.21
Number of shareholders	4968	20	761	1994	4800	67,910	8549
Number of institutional holders	71	0	18	35	71	2425	153
Previous acquisition in target's industry	0.61	0	0	0	1	1	0.49
Option on target	0.16	0	0	0	0	1	0.37
Stock price < $5	0.12	0	0	0	0	1	0.33
Bidder/offer-specific characteristics							
Bid premium (%)	46.56	1.11	25.09	41.85	59.49	215.64	29.71
Toehold (%)	5.87	0	0	0	1.6	87.1	15.06
Runup (%)	13.96	− 38.50	− 0.55	11.73	25.69	81.56	19.86
Rumor	0.07	0	0	0	0	1	0.25
Experienced bidder	0.43	0	0	0	1	1	0.50

The sample consists of 362 tender offers filed between January 1, 1981, and December 31, 1995. Speculation spread calculated as (BP − P_1) divided by P_1 where BP is bid price, P_1 is market price 1 day after announcement of the tender offer. Panel A shows offer outcomes, bid revisions, managerial attitude, and bid competition (source: SDC, Lexis-Nexis). Panel B reports the distribution of continuous variables associated with 362 tender offers filed between January 1981 and December 1995.Measures of market capitalization are expressed in thousands of dollars and are obtained by multiplying share price by the number of shares outstanding 42 days prior to or at the announcement date of the tender offer as indicated. O&D Ownership and Institutional Ownership are variables reflecting the share ownership of officers and directors and institutions as reported in a proxy statement and S&P Guide (institutions). Blockholders are defined as the sum of holdings of all outsiders (nonobvious insiders) who hold more than 5% as reported in a proxy statement. Number of shareholders is collected from proxy statements while number of institutional holders is from S&P Guide. The bid premium is calculated as the dollar premium (BP − P_b) divided by P_b (where P_b is the average pre-bid price from $t = -30$ to $t = -10$ relative to announcement date of the tender offer). Toehold represents the percentage of shares held by the bidder prior to the announcement of the tender offer. Duration of tender offer reports the number of days between the announcement of the tender offer and either the announced date of purchase of tendered shares or date of the first newspaper article indicating withdrawal of the offer. Runup measures return from 42 days prior to till the day of the announcement. Stock price < $5 is a dummy variable set to 1 if the average price of the target between days −30 and −10 is less than $5 and to 0 otherwise. Previous acquisition codes for the presence of takeover activity in target's three-digit SIC industry in a prior year (= 1 and 0 otherwise). Experienced bidder is a dummy variable equal to 1 if the first bidder in our sample attempted an acquisition in prior three years and 0 otherwise. An offer is defined as completed when a bidder acquires at least 80% of all shares outstanding. The multiple bidder dummy is set equal to 1 when a second bidder submits a bid. An offer is defined as revised when initial offer price does not equal the last offer/transaction price. Attitude is coded with respect to the first bidder. All unsolicited tender offers are classified as friendly.

Table 4
The distribution of offer duration

Panel A: Frequency distribution of the offer duration

Range	Number of observations	Proportion of sample (%)	Cumulative number of observations	Cumulative proportion of sample (%)	Number of offers that are		
					Revised down	Unrevised	Revised up
<30 days	10	2.76	10	2.76	2	7	1
[30, 60)	213	58.84	223	61.60	3	163	47
[60, 90)	63	17.40	286	79.01	0	21	42
[90, 120)	24	6.63	310	85.64	5	6	13
[120, 150)	18	4.97	328	90.61	2	3	13
[150, 180)	12	3.31	340	93.92	0	5	7
>180	22	6.08	362	100.00	3	2	17

Panel B: Distribution of the offer duration (in days)

	N	Mean	Min	Q1	Median	Q3	Max
Whole sample	362	72	14	35	48	81	565
Revised up	140	96	28	52	75	121	304
Unrevised	207	49	28	34	37	48	294
Revised down	15	132	14	47	101	147	565

Panel A reports the distribution of offer duration. Offer durations are measured as the length of time between the first formal announcement of an acquisition bid and the announced resolution of the offer. Number of offers that are revised down, unrevised, and revised up is also reported. Panel B shows the distribution of offer duration in days for the whole sample as well as across categories of final offer revision.

revised offers, the outcome date extends to the appropriate date of the last related bid for this target. If a bid occurs within 90 days of an announcement it is considered related.

Panel A of Table 4 displays the frequency distribution of offer duration. Less than 3% of the offers have a duration under a month, while a few (6%) last more than half a year. The majority of offers (62%) are completed within two months. Panel B reveals additional details. The unconditional mean and median duration of offers in the sample is 72 and 48 days, respectively. The range of durations is large, from a minimum of 14 days to more than a year and three quarters (565 days).

The last three rows of panel B reveal information on duration conditional on the direction of bid resolution. Fifteen of our 362 offers involve negative revision returns, 207 are unrevised with zero revision returns, and 140 contain positive revision returns. We refer to these as negatively revised, unrevised and positively revised offers, respectively.[23] Either the initial or a subsequent bidder revises and completes over 40% of the offers; that is, they produce positive revision returns. The majority of the tender offers (207) are completed at the initially announced bid price. Fifteen of the offers (4.1% of the sample) involve negative revision returns—the final price is lower than the initial price $P_{Fi} < P_{1i}$. In 10 of these cases this is because the offer failed. In five cases, the terms of the offer are actually revised downward. For example, the bid for Tonka was revised downward from $7 to $5 when the offer was amended to

[23] Note that we measure revisions using the final price at the completion or withdrawal of the bid, not interim offer prices.

include purchase of the bonds. Similarly, Pacific Gamble Robinson accepted a second friendly bid at $28 over a hostile initial bid at $29.

Revisions can occur from either the initial or a subsequent bidder. As expected, very few (5.3%) of the unrevised offers involve multiple bidders. These unrevised, multiple bidder cases typically involve either withdrawn or unsuccessful offers by the competing bidder. Three fifths of the positively revised cases involve multiple bidders while only a third of the negatively revised cases involve multiple bidders. All of the unrevised offers are completed. Almost all of the positively revised offers are completed; there are positively revised offers that fail, however. Only a third of the negatively revised offers are successful.

The mean time of 49 days for unrevised offers is less than both the 96 days for positively revised offers and 132 days for negatively revised offers. It is apparent from this data that longer offers are not necessarily positively revised. In fact, negatively revised offers are associated with the longest holding periods. Median durations show a similar ordering: shortest for unrevised offers, longest for negatively revised offers and in between for positively revised offers. This ordering is also preserved for the minimums, maximums, and for quartiles 1 and 3. Panel A also reveals the concentration of unrevised offers at the shorter durations.

The last three columns of Panel A reveal the distribution of offer duration conditional on the existence and direction of offer revision. These columns reveal that while over 82% of the unrevised offers (170 of 207) are completed in the first 60 days following the initial announcement, this is true for only 34% (48 of 140) positively revised offers. Moreover, the percentage of unrevised and positively revised offers taking greater than 180 days are less than 1% (2 of 207) and greater than 12% (17 of 140), respectively.

4. Multivariate results

4.1. The interaction of speculation spread, duration, and revision return

In this section, we compare speculation spreads across categories of revision return and offer duration. Obviously, offer duration and revision returns interact. Revised offers, generally offering higher post-announcement returns, take longer to complete. We partially control for this interaction by analyzing a 3×3 table showing average speculation spreads across treciles of offer duration and the categories of revision. Break points for short and medium treciles of duration are less than 37 days and less than 66 days, respectively. Durations 66 days and above are in the trecile labeled "long". Table 5 presents the results.

Hypothesis 1 asserts that speculation spreads are inversely related to revision returns. The marginal values in the far right column are consistent with this hypothesis: average speculation spreads are smallest (in fact negative) for positively revised offers, highest for negatively revised offers and in between for unrevised offers. We also observe this pattern across the medians of this column.

Hypothesis 2 asserts that speculation spreads increase with offer duration. Examining the marginal values of the last row reveals that speculation spreads do not increase monotonically across treciles of offer duration. Speculation spreads are 2.0% for short

Table 5
Average speculation spreads across direction of revision and treciles of duration

	Revised		Duration: Short (< 37 days)	Medium (37 to 66 days)	Long (> 66 days)	Total
362 Cash Tender Offers (1981–95)	Up	Mean	–2.8%	–3.3%	1.0%	–0.7%
		Median	–2.4%	–2.4%	–0.7%	–1.6%
		N	11	45	84	140
	No	Mean	2.3%	3.6%	5.1%	3.2%
		Median	2.0%	2.4%	4.4%	2.1%
		N	101	77	29	207
	Down	Mean	9.3%	6.1%	7.3%	7.3%
		Median	9.3%	4.3%	3.4%	4.3%
		N	2	3	10	15
	Total	Mean	2.0%	1.1%	2.5%	1.86%
		Median	2.0%	2.0%	1.8%	1.96%
		N	114	125	123	362

Speculation spread is defined as (BP − P_1) divided by P_1 where BP is the announced bid price by the first bidder, and P_1 is market price 1 day after the first announcement of the tender offer. Offer durations are measured as the length of time between the first formal announcement of an acquisition bid and the announced resolution of the offer.

duration offers, drop to 1.1% for medium duration offers and rise to 2.5% for offers of the longest duration. However, since speculation spreads, revision returns and offer duration interact, the relation of offer duration to speculation spreads is more subtle. Longer offers are more likely to be revised. To the extent that this increases revision returns it reduces speculation spreads. Consequently, this effect works against us finding a positive relation between offer duration and speculation spread.

To partially control for this effect, we examine speculation spreads across the three categories of offer revision. A pattern of increasing speculation spreads is noted across medians of duration treciles of unrevised offers and upwardly revised offers. This pattern is also noted in the means of the unrevised (but not the upwardly revised) offers. The downwardly revised offers, containing very small cell sizes, deviate from a strict monotonic pattern. With the exception of the downwardly revised offers, the univariate results are generally supportive of a positive relation between speculation spread and offer duration.[24]

[24] In multivariate tests (available upon request) regressing offer duration on offer characteristics and the speculation spread we find that the latter is significantly positive, a result consistent with Hypothesis 2: the market appears to correctly anticipate the actual duration of the offer in the initial post bid pricing of the target. From other results we note that bid premiums are significantly negatively related to offer duration: higher bid premia results in shorter offers. Friendly offers are significantly shorter in duration. On the other hand, durations increase with the size of the toehold. While initially surprising to us, our analysis indicates that the probability of revision increases with the size of the toehold.

The importance of managerial attitude is evident in its impact on explanatory power. The adjusted R^2 rises to 14% with the inclusion of managerial attitude; adding toeholds and managerial attitude does not increase its value.

4.2. Regression analysis of speculation spreads and ex ante variables

A multivariate analysis of speculation spreads and variables known at the time of the bid is shown in Table 6. As we have noted, arguments can be made for dual effects of these variables on the speculation spread. To recognize the importance of conditioning managerial ownership on managerial attitude, appropriate interaction variables are added to the regressions. (In results not reported, spreads are significantly positively related to managerial ownership itself, without conditioning it on managerial attitude.) In all specifications and subsamples of our regressions, speculation spreads increase with bid premia. Regression 1 reveals that speculation spreads also increase with both the existence of friendly and neutral offers and with the level of target managerial ownership in nonhostile offers. The significance of the friendly and neutral indicator variable is robust to all specifications except for regression 8, discussed below. This variable is insignificant in subperiods when the sample is divided in half chronologically.

These empirical results are consistent with the following interpretation. Offers involving higher bid premia are less likely to attract competing offers and subsequent bid revisions. Consequently, the initial post-announcement price adjusts less than would be expected if subsequent revisions in the offer price were anticipated. Similarly, friendly/neutral offers are also less likely to attract revised bids, an effect that translates into higher levels of speculation spread. Management with higher levels of shareholdings has increased power to repel unwanted acquisitions and less need for rescue by white knights. In the case of friendly acquisitions, where ownership is used to encourage acquisition, speculation spreads widen with managerial ownership, consistent with a reduced probability of offer revision.[25]

Regressions 2 through 9 also add dummy variables to control for the existence of rumors, stock price runups, microstructure effects (small priced stocks), hedging costs (an option indicator), previous acquisitions in the targets industry, and bidder experience. Spreads are significantly larger in offers preceded by a rumor and significantly negatively related to runup. Consistent with the univariate results, speculation spreads are significantly larger for small priced targets. None of the remaining dummy variables relating to the existence of options, activity in the target's industry or bidder experience, is significant.[26]

Arguably, not all offers attract speculative activity. Cornelli and Li (2001) argue that arbitrage activity will increase with stock liquidity, which we proxy by abnormal volume around an acquisition. If, as we hypothesize, speculative activity is driving our results, then mixing offers with and without such activity will confound our analysis. Our third hypothesis asserts that the implications of our model will be greater in offers with increased liquidity, measured here as abnormal volume. We calculate abnormal volume using two methods due to Lakonishok and Vermaelen (1990) and Schwert (1996). The Lakonishok and Vermaelen variable is the ratio of event volume relative to pre-announcement volume. Under

[25] It could be argued that higher target managerial ownership gives them greater bargaining power and produces higher premia. If this higher premia is obtained in the initial bid however, it would not necessarily affect the revision returns or influence the speculation spreads.

[26] An exception is that the dummy variable for the existence of options is significant in the last half of the sample (regression 6). Also, the dummy variable for the existence of an experienced bidder is significant in the first half of the sample.

Table 6
Regressions explaining the speculation spread with ex ante characteristics

Independent variables	1	2	3	4	5	6	7	8	9
					≤ 6/28/88	>6/28/88	High volume	Low volume	All
N	362	362	362	354	177	177	177	177	354
Intercept	**− 0.029**	**− 0.024**	**− 0.026**	− 0.007	0.007	0.006	**− 0.070**	**0.043**	− 0.000
	(0.035)	(0.085)	(0.066)	(0.631)	(0.073)	(0.775)	(0.000)	(0.061)	(0.996)
Premium	**0.030**	**0.035**	**0.027**	**0.052**	**0.071**	**0.030**	**0.041**	**0.054**	**0.055**
	(0.005)	(0.006)	(0.013)	(0.000)	(0.015)	(0.022)	(0.004)	(0.034)	(0.000)
Friendly/neutral?	**0.031**	**0.033**	**0.032**	**0.033**	0.129	0.028	**0.053**	− 0.013	**0.028**
	(0.045)	(0.031)	(0.038)	(0.020)	(0.132)	(0.174)	(0.001)	(0.646)	(0.045)
Blockholders	0.015	0.010	0.001	0.004	0.041	0.005	0.013	− 0.012	0.007
	(0.492)	(0.649)	(0.950)	(0.846)	(0.195)	(0.862)	(0.627)	(0.722)	(0.738)
Toehold	− 0.035	− 0.033	− 0.024	**− 0.049**	**0.062**	**− 0.050**	**− 0.068**	− 0.041	**− 0.052**
	(0.164)	(0.196)	(0.345)	(0.048)	(0.079)	(0.134)	(0.081)	(0.205)	(0.035)
O&D*	**0.028**	**0.034**	**0.029**	0.009	− 0.004	− 0.008	0.025	− 0.004	0.011
Friendly/neutral	(0.052)	(0.029)	(0.059)	(0.571)	(0.867)	(0.709)	(0.311)	(0.839)	(0.492)
O&D*Hostile	0.143	0.136	0.142	0.115	0.106	0.081	0.156	0.012	0.113
	(0.101)	(0.116)	(0.115)	(0.170)	(0.316)	(0.443)	(0.266)	(0.907)	(0.174)
Rumor?		**0.036**	**0.047**	**0.041**	**0.052**	**0.030**	**0.047**	0.021	**0.044**
		(0.029)	(0.009)	(0.010)	(0.024)	(0.152)	(0.032)	(0.497)	(0.006)
Runup		**− 0.050**	**− 0.069**	**− 0.053**	**− 0.057**	**− 0.031**	− 0.028	**− 0.058**	**− 0.053**
		(0.005)	(0.024)	(0.004)	(0.084)	(0.102)	(0.113)	(0.051)	(0.004)
Stock price < $5?		**0.034**	**0.034**	**0.025**	**0.012**	**0.027**	**0.025**	0.021	**0.023**
		(0.003)	(0.004)	(0.029)	**(0.064)**	**(0.036)**	(0.073)	(0.215)	**(0.053)**
Option on target?		− 0.001	0.002	− 0.002	0.020	**− 0.028**	0.006	− 0.014	− 0.003
		(0.964)	(0.841)	(0.847)	(0.386)	(0.009)	(0.563)	(0.452)	(0.783)
Previous acquisition?		− 0.010	− 0.007	− 0.009	**− 0.019**	0.009	− 0.008	− 0.003	− 0.011
		(0.279)	(0.451)	(0.319)	(0.064)	(0.493)	(0.553)	0.815)	(0.230)

Experienced bidder?		− 0.003	− 0.004	0.003	0.013	− 0.010	0.009	− 0.010	0.005
		(0.749)	(0.626)	(0.755)	(0.311)	(0.467)	(0.464)	(0.424)	(0.608)
HOT? Acquisition activity in upper quartile of sample									**− 0.014**
									(0.066)
COLD? Acquisition activity in lower quartile of sample									0.011
									(0.265)
Abnormal volume:									
Pre-announcement			**− 0.056**						
($t = -42, -2$)			(0.009)						
Announcement				**− 0.127**	**− 0.245**	**− 0.072**			**− 0.133**
($t = -1, 1$)				(0.000)	(0.000)	(0.011)			(0.000)
Adjusted R^2	0.047	0.097	0.093	0.159	0.199	0.146	0.192	0.057	0.168
F-value	3.96	4.24	4.03	6.13	4.369	3.315	4.48	1.88	5.751
p-value for F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.040	< 0.001

The speculation spread equals (BP − P_1) divided by P_1 where BP is bid price, P_1 is market price 1 day after announcement of the tender offer. O&D Ownership and Institutional Ownership are variables reflecting the share ownership of officers and directors and institutions as reported in a proxy statement and S&P Guide (institutions). Blockholders are defined as the sum of holdings of all outsiders (nonobvious insiders) who hold more than 5% as reported in a proxy statement. Number of shareholders is collected from proxy statements while number of institutional holders is from S&P Guide. The bid premium is calculated as the dollar premium (BP − P_b) divided by P_b (where P_b is the average pre-bid price from $t = -30$ to $t = -10$ relative to announcement date of the tender offer). Toehold represents the percentage of shares held by the bidder prior to the announcement of the tender offer. Abnormal volume is based on Lakonishok and Vermaelen (1990). The event window for measure (i) begins 42 days prior to the announcement date. The normal volume for measure (ii) is the average trading volume in the interval − 50 to − 25 days prior to the announcement. Attitude is coded with respect to the first bidder. All unsolicited tender offers are classified as friendly. Option is defined as traded when an option is listed on American, New York, Chicago, Pacific, Philadelphia, or Midwest option exchange around the announcement date. Runup measures return from 42 days prior to till the day of the announcement. Stock price < $5 is a dummy variable set to 1 if the average price of the target between days − 30 and − 10 is less than $5 and to 0 otherwise. Previous acquisition codes for the presence of takeover activity in target's three-digit SIC industry in a prior year (= 1 and 0 otherwise). Experienced bidder is a dichotomous variable equal to 1 if the first bidder in our sample attempted an acquisition in prior three years and 0 otherwise. High/low volume splits sample by abnormal share of company traded prior to the announcement of the tender offer (volume methodology follows Lakonishok and Vermaelen (1990)). p-values are reported in parentheses below each coefficient. Coefficients in bold are significant at better than 10% level.

the null hypothesis, the mean ratio is 1. Schwert's model assumes that daily trading volume growth rate is a function of its own lagged volume growth rate and concurrent and lagged market volume growth rates. Under the null hypothesis of no abnormal trading, this measure is zero. Complete details and additional statistics are contained in Appendix A. In general, both methods show significant abnormal volume around acquisition bids.

We first examine the importance of this issue by including abnormal volume for the pre-announcement period ($t=-42,2$) in regression 3, and abnormal volume for the announcement period ($t=-1,1$) in regressions 4, 5, 6 and 9. Throughout all regressions, these variables are significantly negatively related to speculation spread. That is, an increase in abnormal volume signifying increased speculative activity is associated with smaller spreads. The results for pre-announcement abnormal volume occur in spite of the fact that it is measured over the same time period, and is correlated with, price runup. The Pearson, product moment correlation between these variables is 0.33.[27]

4.3. Time, industry and activity effects

Given the evolving nature of corporate acquisitions, it would not be surprising to see the importance of various bid and offer characteristics changing over time (see, for example, Holmstrom and Kaplan, 2001). Consequently, we examine several measures of time, industry and activity effects. We start by splitting the sample chronologically, reporting results for acquisitions announced before and after June 28, 1988, in columns 5 and 6, respectively. In both periods, speculation spreads are significantly positively related to bid premia and the existence of rumors. Spreads are significantly negatively related to runup and abnormal announcement period volume in both periods. The dummy variable for friendly and neutral offers is not significant at conventional levels, having p values of 0.13 and 0.17 in the two periods, respectively. Toeholds are significantly negatively related to spreads in the first period, but only marginally related (p-value = 0.13) in the second period. In general, the results are fairly consistent across time. One exception is that the coefficient for the existence of options on the target firm's shares, which is insignificant in every other regression, is significantly negatively related in the second period. In theory, we would have expected a negative relationship since the existence of options could reduce hedging costs to traders.

Finally, in results not reported, we include dummy variables set equal to 1 for each year other than the first year of the sample. Although the time dummies increase the adjusted R^2 by a few percent, our general results and conclusions are unaltered.

As another test for the effects of increased volume (and arguably increased speculative activity), we split the sample at the median of abnormal trading, first using the Lakonishok–Vermaelen measure. Regression 7 examines the 177 cases with higher than median abnormal trading in the announcement period ($t=-1,1$); regression 8 examines the

[27] Intuitively, we might expect that runups and the existence of rumors are related. Indeed, the median value of runup for the 38 cases with rumors is 0.15 as compared to a median of 0.12 for the remaining cases. Nevertheless, in sensitivity tests we find that the significance of the coefficients on these variables is unaffected by the presence or absence of the other variable.

remaining cases. Supporting our claim that speculative activity is pricing offer characteristics in the spread, we find increased explanatory power in the high volume firms. The adjusted R^2 is over 19% in the high volume cases but only 6% in the low volume cases. Moreover, several variables lose their significance in the low volume cases. Not including the intercept, five variables are significant in the high volume cases; only two variables are significant in the low volume cases. In results not shown, similar results are found when abnormal volume is defined using the Schwert measure: the adjusted R^2 is 12.9% in the abnormally high volume cases compared to 4.5% for the abnormally low volume cases. Not counting the intercept, five variables are significant at the 10% level or less in the high volume cases compared to two variables in the low volume set.

Industry effects can impact the characteristics of an acquisition as well as the probability of its completion. We perform (but for brevity do not show) several separate tests to evaluate these impacts. First, we include dummy variables set equal to 1 if the proposed acquisition was nonhorizontal. A nonhorizontal acquisition is defined as one where the primary SIC codes of the bidder and target, obtained from SDC, differ at the two-digit level. We also test the impact of this variable defined at the three-digit level. Second, acquisitions in highly concentrated industries are more likely to be contested by regulatory authorities. To recognize this, we included the several specifications of the Herfindahl index of the target firm's industry. These specifications include defining industry at the two-digit SIC code level and separately at the three-digit SIC level (source: SDC). It could be the case that acquisitions in the most concentrated industries are more likely to be contested but that all others are unlikely to be contested. We recognize this possibility by including a dummy variable set equal to 1 for firms with Herfindahl indices falling in the largest quintile. Finally, Weston et al. (2001) report that a critical level for the Herfindahl index is 1800; firms in industries with Herfindahl indices greater than this critical value are more likely to face regulatory challenge. Consequently, we also define a dummy variable equal to 1 if the Herfindahl of the target's industry (at the two-digit SIC level obtained from SDC) exceeds 1800. Eighteen firms (5.4% of the 350 firms for which we could calculate this value) meet this criteria. None of the additional variables added to recognize horizontal effects or industry concentration is significant, nor do they materially alter our results.

Finally, we depart from our strict requirement of ex ante variables to perform another sensitivity test regarding time. We report results in column 9, including dummy variables set equal to 1 for periods of intense or inactive acquisition activity. A "hot" ("cold") period is defined as a month in which the number of takeovers is in the upper (lower) quartile of our sample distribution. If an observation falls in these months the appropriate dummy variable is set equal to 1. Spreads are significantly lower in periods of intense activity; the significance of the remaining variables is unaffected.

4.4. Additional tests of robustness

In results, not reported, we test for interaction effects between managerial attitude and the other independent variables, splitting the sample according to attitude and reestimating

Table 7
Regressions comparing the initial speculation spread with actual offer outcomes and results

Independent variables	1	2	3	4	5	6	7
					All	High abnormal volume	Low abnormal volume
N	362	362	362	362	354	177	177
Intercept	**0.026** (0.000)	**0.055** (0.001)	**0.056** (0.001)	**0.025** (0.285)	0.003 (0.896)	− **0.06** (0.028)	0.025 (0.529)
Revision return	− **0.103** (0.001)	− **0.122** (0.002)	− **0.120** (0.000)	− **0.141** (0.000)	− **0.133** (0.001)	− **0.246** (0.001)	− **0.110** (0.046)
Offer duration (log years)		**0.015** (0.039)	**0.015** (0.036)	**0.017** (0.020)	**0.017** (0.015)	− 0.007 (0.36)	**0.023** (0.039)
Multibidder = 1			− 0.002 (0.906)	0.023 (0.111)	0.007 (0.559)	0.01 (0.482)	0.019 (0.366)
Successfully completed = 1				0.001 (0.929)	0.034 (0.175)	0.012 (0.684)	**0.060** (0.076)
Premium					**0.052** (0.001)	**0.040** (0.003)	**0.054** (0.035)
Friendly/neutral?					**0.029** (0.06)	**0.029** (0.093)	− 0.011 (0.713)
Blockholders					0.008 (0.706)	0.020 (0.411)	− 0.005 (0.874)
Toehold					− **0.053** (0.042)	− 0.034 (0.401)	− 0.049 (0.142)
O&D* Friendly/neutral					0.000 (0.98)	0.012 (0.574)	− 0.008 (0.722)
O&D* Hostile					0.117 (0.161)	0.189 (0.155)	0.04 (0.703)
Rumor?					**0.039** (0.018)	**0.045** (0.036)	0.017 (0.504)

Runup					**− 0.054** (0.004)	**− 0.031** (0.064)	− 0.065 (0.592)
Stock price < $5 = 1					**0.021** (0.049)	0.012 (0.37)	0.023 (0.140)
Option on target = 1					− 0.003 (0.744)	0.009 (0.383)	− 0.013 (0.468)
Previous acquisition = 1					− 0.01 (0.281)	− 0.006 (0.695)	− 0.006 (0.685)
Experienced bidder = 1					0.004 (0.706)	0.001 (0.919)	− 0.004 (0.779)
Abnormal volume: Announcement ($t = -1, 1$)					**− 0.127** (0.000)		
Adjusted R^2	0.046	0.059	0.056	0.061	0.203	0.331	0.105
F-value	18.53	12.30	8.19	6.85	6.30	6.44	2.29
p-value for F	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005

The sample consists of 362 tender offers filed between January 1, 1981, and December 31, 1995. The dependent variable is the percentage spread calculated as $(BP - P_1)$ divided by P_1 where BP is bid price, P_1 is market price 1 day after announcement of the tender offer. "Did the first bidder win?" is a dummy variable set to 1 if the bidder that acquired the target in question made the first offer (1 otherwise). Was the offer successful is a dummy variable equal to 1 if target gets acquired and to 0 if it remains independent for at least three months after the withdrawal of tender offer. Revision return equals $(P_F - BP)/P_1$, where P_F is the final bid price in a successful offer or market price at the announcement of a failed offer. Duration of tender offer reports the number of days between the announcement of the tender offer and either the announced date of purchase of tendered shares or date of the first newspaper article indicating withdrawal of the offer. It is measured here in logs of fraction of a year. p-values are reported in parentheses below each coefficient. Coefficients in bold are significant at better than 10% level.

regression 3. Coefficients for bid premia, runup, and abnormal announcement volume remain significant (with the same sign as before) in both regressions. The coefficient for rumors is significantly negatively related to spreads in the hostile offers, and marginally related (p-value = 0.13) in the friendly and neutral cases. Offers with prices below $5 have significantly higher spreads in the friendly and neutral cases. Toeholds are insignificant in both regressions.

Cornelli and Li (2001) argue that stocks with smaller capitalization are likely to be less liquid, which would also increase the cost of taking positions in the target firm. Adding the size of the target firm (log of market capitalization at the pre-offer year-end) to our regressions does not alter our conclusions. Results adding bidder size, produce a negative, but insignificant coefficient.

4.5. Does the spread anticipate offer outcomes?

A preceding section demonstrates significant abnormal returns from trading strategies surrounding the post-acquisition period. We also demonstrate that the considerable cross-sectional variation in speculation spreads is related to target and offer characteristics known at the time of the bid. In this section, we examine the initial market pricing of information known only after the fact. Specifically, how does the speculation spread relate to dimensions describing the outcome of the bid: bid success and the existence of multiple bidders? Finally, does the speculation spread relate to realized revision returns and offer duration in the manner predicted by our hypotheses?

Table 7 presents multivariate results relating speculation spreads with subsequently revealed characteristics. The first hypothesis of our initial model is that the magnitude of the initial speculation spread is negatively related to subsequent revision returns. All of the regressions of Table 7 are consistent with this hypothesis. There is a significant link between the initial speculation spread and subsequent returns. The coefficient of regression 1 suggests that an additional 1% increase in the revision ratio is associated with a decrease in the spread of 0.10%. That is, an additional 1% return resulting from a bid price revision costs the speculator 0.10% today due to the higher price for target's shares (smaller spread). Note that in this and the remaining regressions, the coefficient on revision returns is significantly different from zero, but also significantly different from the stronger implication of Hypothesis 1—that the coefficient of revision returns would be -1.[28] The realized magnitude of this coefficient is undoubtedly driven by uncertainty surrounding revisions.

The results of regressions 2 and 3 are also consistent with our second hypothesis: that speculation spreads are significantly positively related to the duration of the offer. Positive coefficients on the duration of an offer are consistent with longer offers being more costly to speculators. Note that these results even hold when including dummy variables signifying the existence of a completed offer and a dummy variable signifying multiple bidders. The strength of the relationship between spreads, offer duration and revision return is signified by the significance of the latter two variables in the presence of other

[28] This is also true of regressions involving annualized spreads and revision returns.

variables that must be collinear. That is, offer durations and revision returns are undoubtedly related to the existence of multiple bidders and successful offers.

Regression 4 includes the target and bid characteristics analyzed in Table 6. Our purpose is to ascertain whether the results suggested by our hypotheses (i.e., speculation spreads will have a negative relation with revision returns and a positive relation with offer duration) still hold after controlling for the other bid and offer characteristics. Both revision returns and offer durations remain positive with the specified sign.

Our third hypothesis asserts that stronger results will be found in cases with abnormally high volume. We test this hypothesis by splitting the sample at the median of the residuals from both the Lakonishok–Vermaelen and Schwert models of volume. Results for the Lakonishok–Vermaelen measure are shown in regressions 6 and 7. Except where noted, similar results are obtained with the Schwert model of volume. Consistent with Hypothesis 3, we note that the R^2 for our regressions in the high abnormal volume cases ($R^2 = 33\%$) is over three times higher than the comparable regressions for the low volume cases ($R^2 = 10\%$). Interestingly, offer duration is insignificantly different from zero in the high volume cases but significantly positive for the low volume cases. If high abnormal volume cases signify increased speculative activity, we might expect these offers to be those with shorter expected duration. The data are consistent with this idea. The mean offer duration for the high volume cases is 62 days. The comparable value for the low volume cases is 79 days. Thus, cases with increased volume have subsequently shorter durations. This observation is also consistent with the theoretical literature (Cornelli and Li, 2001) that links increased speculative activity to offer success.

In summary, the results of Table 7 indicate that consistent with our hypotheses, the initial speculation spread anticipates both subsequent price activity for the target firm and the length of time the offer is outstanding. The stronger implication of a hypothesized coefficient of -1 for revision returns is not supported. In sensitivity tests, we find that adding the bid and offer characteristics from Table 6 regressions does not change the significance of revision returns or offer duration. None of the analyses including bid characteristics, microstructure effects, size, the existence of options, time periods, or "hot and cold markets" materially alters our conclusions. In all of these regressions, speculation spreads are significantly negatively related to revision returns and significantly positively related to offer duration. Results are stronger in cases with high abnormal volume.

5. Summary and conclusions

In spite of over two decades of active research on acquisitions, much remains unknown about speculative activity around acquisition announcements and its effect on pricing of a target firm's stock. This paper analyzes speculation spreads, defined as the percentage difference between the initial bid price and the subsequent market price 1 day after an initial announcement. We develop a simple model that separates total returns into two components: the speculation spread, which is immediately observable, and any subsequent revision returns. In our model, the speculation spread is determined conditional on the terms of the offer and anticipating the subsequent price resolution. This implies an inverse relation between speculation spread and revision returns and a positive relation between speculation

spreads and offer duration. Intuitively, prices will increase (speculation spreads will narrow) with the increased probability of higher subsequent returns; prices will decrease (speculation spreads will widen) with the anticipated increase in holding costs of an offer.

To test our model, we examine 362 cash tender offers (for 100% of a firm's shares) announced between 1981 and 1995. While speculation spreads are, on average, positive, they exhibit considerable cross-sectional variation. In fact, over 23% of the speculation spreads are actually negative, indicating post-announcement prices higher than the bid price.

In order to understand the post-announcement pricing of the target's stock, we compare speculation spreads to bid and target characteristics. We also document the extent of abnormal volume around acquisition announcements and reveal the distribution of offer duration. Spreads are found to be significantly related to bid premiums, pre-offer runup, managerial attitude about the offer, and the existence of rumors about the offer. These variables have enhanced explanatory power in the subset of offers with increased liquidity and likely to experience increased arbitrage activity—those with high abnormal volume.

In the final section, we compare speculation spreads to characteristics unknown at the time of the bid. Spreads are significantly, positively related to the duration of an offer and significantly negatively related to the actual revision ratio that materializes. These results also hold after controlling for bid and offer characteristics both known and unknown at the time of the initial offer. Our results are consistent with market anticipation of the duration and price resolution of the offer.

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Appendix A

Cornelli and Li (2001) argue that arbitrage activity will increase with stock liquidity, which we proxy by abnormal volume around an acquisition. We calculate abnormal volume following Lakonishok and Vermaelen (1990) and Schwert (1996). We use three measures of abnormal volume, the mean and median of the Lakonishok–Vermaelen measure and the mean volume growth measure of Schwert. (Means and medians are similar for the Schwert measure.) The Lakonishok and Vermaelen variable is the ratio of event volume relative to pre-announcement volume. Under the null hypothesis, the mean ratio is 1. Normal trading volume is calculated as the average daily volume computed from days -52 to day -25 relative to the announcement. Due to large skewness, we report sample mean and median values of this ratio. We also calculate an

Table A1
Abnormal trading volume around tender offer announcements

Day	Average abnormal volume ratio (LV)	*t*-Statistic	Median abnormal volume ratio (LV)	$\Pr \geq \lvert S \rvert$	%>1	Abnormal volume growth measure (Schwert)	*t*-Statistics
−24	1.00	0.05	0.64	0.99	29	−0.079	−0.31
−23	1.19	1.78	0.63	0.99	35	−0.176	−0.63
−10	1.71	4.32	0.83	0.65	43	0.113	0.33
−9	1.92	3.71	0.85	0.03	44	0.214	0.59
−8	1.72	3.21	0.77	0.70	40	0.160	0.48
−7	1.81	3.66	0.89	0.19	44	0.203	0.61
−6	1.96	4.65	0.89	0.04	46	0.319	1.00
−5	2.13	5.22	0.94	<0.001	47	0.416	1.23
−4	2.08	6.02	0.94	<0.001	48	0.432	1.20
−3	2.24	6.06	1.00	<0.001	49	0.588	1.61
−2	2.40	6.74	1.11	<0.001	52	0.675	1.86
−1	4.12	6.00	1.58	<0.001	58	1.018	2.86
0	32.77	9.66	18.18	<0.001	88	3.507	7.75
1	24.22	10.77	13.59	<0.001	93	4.130	10.39
2	12.74	10.96	7.05	<0.001	88	3.161	6.97
3	8.93	10.25	4.46	<0.001	87	2.555	6.02
4	8.83	9.16	3.80	<0.001	84	2.257	5.43
5	7.27	9.46	3.24	<0.001	76	1.987	4.75
6	5.85	5.61	2.32	<0.001	73	1.479	3.88
7	6.05	5.67	2.02	<0.001	70	1.226	3.11
8	4.64	9.23	1.91	<0.001	69	1.130	2.85
9	4.85	9.18	2.18	<0.001	65	1.050	2.58
10	4.82	5.33	1.74	<0.001	63	0.885	2.13

Trading volume around the announcement of tender offers relative to normal trading volume. Normal trading volume is the average daily volume computed from days −50 to −25 relative to the announcement (Lakonishok and Vermaelen, 1990). Under the null hypothesis of no abnormal trading, the mean ratio is 1. $\Pr \geq \lvert S \rvert$ is based on a Signed Rank Statistic. Abnormal volume growth measure is based on Schwert (1996). The event window for this measure begins 42 days prior to the announcement date. ($N = 354$.)

abnormal volume growth measure based on Schwert. Schwert's model assumes that daily trading volume growth rate is a function of its own lagged volume growth rate and concurrent and lagged market volume growth rates. The parameters of the model are estimated over a window from −379 to −127 days prior to the first bid. The abnormal volume measure is a sum of daily prediction errors from day −42 till day −1, relative to the takeover bid.[29] Under the null hypothesis of no abnormal trading, this measure is zero.

Table A1 presents the analysis of abnormal volume. The ratio of event period volume to normal volume, averaged across all firms in the sample, is significantly greater than 1 as many as 23 days before the acquisition announcement. The high-level abnormal volume continues through and past the announcement day. The mean value, however, is distorted by the existence of extreme outliers. Indeed, the median abnormal volume ratio is less than 1 up until 4 days prior to the acquisition announcement. Median values substantially larger

[29] We also test event window −1 to 2 to measure abnormal trading volume. There is no qualitative impact on the results.

than 1 are noted on date −1 and continuing throughout the post announcement. The abnormal volume growth measure of Schwert (1996) also indicates significant abnormal volume beginning with day −1. All three measures of abnormal volume indicate significant trading activity just before and continuing after the announcement of the tender offer.

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