Risk Arbitrage and the Prediction of Successful Corporate Takeovers

Keith C. Brown and Michael V. Raymond

Keith C. Brown is Assistant Professor at the Graduate School of Business, University of Texas at Austin. Michael V. Raymond is a Financial Analyst at Electronic Data Systems, Dallas.

I. Introduction

Risk arbitrage, in its most common usage, refers to the purchase of the securities of a firm targeted for acquisition. By purchasing shares immediately after a definite cash tender or exchange offer is established, an investor is able to lock in the fixed spread that typically exists between the offer price and the post-announcement market price for the target firm. Of course, this price differential will only be guaranteed if the merger ultimately occurs. Thus, the primary function of the risk arbitrageur is to determine the likelihood that a proposed takeover will succeed, thereby substituting event risk for market risk in the process.

Until recently, risk arbitrage has been a game played almost exclusively by the institutional specialist. Welles [17] noted that although the strategy has been employed since the 1930s it was not until the merger wave of the last decade that the "shroud of mystery" surrounding takeover arbitrage was lifted for the general public. Perhaps the biggest reason for this prolonged lack of recognition was the perception in the financial press that gambling on mergers and acquisitions requires the skill and acumen of a Wall Street "insider" (see, for example, Much [12] and Laws [10]). As Ivan Boesky, one of its leading proponents, flatly stated, "the practice of risk arbitrage . . . is a craft that borders on an art" [1, p. 15]. Ironically, it is Boesky himself who is credited with bringing the technique into the open by forming one of the first risk arbitrage limited partnerships in 1975. Since then, competition in the market has steadily increased to the point where there are now a multitude of investment pools and mutual funds specializing in merger and acquisition arbitrage, offering smaller investors access to the field. The extent of this outside participation is such that by the middle of 1981 it was estimated that as much as $1.5 billion had been invested by nonprofessionals, with the professional arbitrage community investing a like amount.

Coincident with the rise in outside investor influence has been an increase in the amount of information that becomes available about a proposed merger. Most notably, Rosenberg [13] has observed that investment bankers will often consult with an arbitrage profession-

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al while the deal is still being structured. Thus, an assessment of the market's predisposition toward the merger can be embedded in the exchange or tender offer before any public announcement is made. This notion is fully consistent with the finding of Ruback [14], who reported that successful offer prices are indeed competitively set. Further, once the terms of the deal are announced, the arbitrageurs, many of whom represent large investment interests, must compete with one another in the open market to secure the best price spread possible. One result of this competition for information is that risk arbitrage is no longer a strategy yielding abnormally high returns, as indicated by Govoni [5]. Equally important, with an increase in the number of informed "outside" participants, the prevailing prices of the firms involved will reflect the consensus view of whether or not the deal will eventually be consummated. Of course, this is exactly the same reasoning used to suggest that the stock market in general sets prices so as to efficiently reflect all available information.

The purpose of this article is to argue that, while risk arbitrage may remain an arcane art on the individual level, competition among investors is such that the markets for merging companies are quite efficient. As a result, it is shown that an ongoing prediction as to the eventual success of the merger can be inferred from the prices set in the post-announcement period. This process, which is based on the investment strategies of the arbitrageur, complements the work of Lewellen and Ferri [11] who first considered the estimation of merger probabilities for acquisitions involving share exchange offers only. To demonstrate the technique, a sample of announced takeover attempts utilizing both cash tender offers and stock swaps is gathered, and empirical predictions of a successful merger are then generated. The major finding indicates that the market is able to discriminate, in a statistically meaningful way, between mergers that will eventually fail or succeed as far as three months in advance of the respective events. This evidence is interpreted as consistent with the notion that the prices in the post-announcement stage of a corporate takeover attempt are set in an efficient and competitive manner.

II. The Mechanics of Risk Arbitrage

The risk arbitrageur is a speculator. However, unlike a currency speculator concerned with overall economic trends, the investor in an attempted takeover cares only about the factors affecting the outcome of the proposed deal. Through their willingness to gamble on the terms of the merger, arbitrageurs provide liquidity to those stockholders in the target firm who are satisfied taking the smaller, but certain, profit that results from the announcement of the deal. In essence, then, the takeover arbitrage market is one in which less speculative investors can transfer any undesired merger-specific risk to a risk professional. This is a point that is missed by Hetherington [6], who apparently assumed that any investor selling shares of an acquisition candidate prior to the completion of a takeover was incapable of assessing the proposal efficiently.

The basic mechanics of the risk arbitrage investment are fairly simple. Suppose that a firm targeted for acquisition receives an offer equivalent to $30 for each of its outstanding shares. For simplicity, suppose further that prior to the announcement of the deal the stock of both the target and acquiring firms sold for $20 a share. After the merger plans are publicly revealed, assume that the investors react to the announcement by bidding the price of the target firm's stock up to $28. At this time, the arbitrageur must judge whether the deal appears sufficiently likely to go through that purchasing the target firm's stock in order to capture the $2 price spread is justified. If it does appear so, the exact strategy employed depends upon the nature of the acquiring company's offer. With a cash tender offer, the arbitrageur has only to purchase the stock of the target firm in order to lock in the price differential. When shares are exchanged, however, the post-announcement value of the exchange offer will vary with the price of the acquiring firm's stock. Thus, in order to lock in a particular spread, the stock of the acquiring firm will have to be sold short in appropriate quantities at the same time that the target firm's stock is purchased. In the present example, as $28 is spent for a share of the target firm, one and a half shares of the suitor company will be shorted at the assumed price of $20. If the merger is then consummated, the investor can cover the short sale with the exchanged value of the target share.

The risk involved with such speculation is, of course, that the attempted merger may never be completed. If the deal proposed heretofore does indeed fall through, it is likely that the target stock will return to its pre-announcement level and $8 could be lost.[1] Con-

[1]The price to which the target firm's stock will fall in the event of an unsuccessful takeover attempt is a matter of considerable uncertainty. If the pre-announcement price of $20 already incorporated a degree of anticipation about the merger proposal, then the subsequent decline could be even more severe. However, if the takeover attempt, albeit flawed, has revealed new and positive information about the target firm, $20 may be the lower end of the post-failure price range. This issue will be considered in more detail in the empirical analysis that follows.

sequently, the time and money spent researching the takeover on the front end is most important. However, while considerable resources may be expended, the evaluation process is hardly a scientific endeavor. As Boesky [1] noted, assessment of the probability of a successful merger is essentially subjective, depending not only on whether the deal makes economic sense but also on the personalities involved in the negotiations. Once the arbitrageur makes this prediction, the decision to invest rests on two remaining questions. First, is the existing differential between market and offer prices sufficient compensation for the perceived risk? Second, will the merger occur soon enough for the available price spread to translate into an adequate return on the investment? To answer the first question, notice that if $20 is thought to be a reasonable estimate of the post-failure price of the target firm, then the arbitrageur is risking eight dollars to earn two. Thus, for the investment to make sense, it must be thought that the merger has at least a four-out-of-five chance of succeeding. On average, then, 80% can be viewed as the "breakeven" probability inferred from the price spread. The obvious implication here is that since individual investors are helping to set the same post-announcement prices on which they base their decisions, those prices must reflect the aggregate opinion of whether and when the merger will ultimately take place. This will be true even though the required rate of return is difficult to assess precisely since the risk in acquisition arbitrage is almost wholly unsystematic.

The significance of the preceding discussion is that as a result of the competition among arbitrageurs it is possible to infer an aggregate opinion about the likelihood that a merger will occur from observable market prices. Thus, it should be of considerable interest to see how accurate these forecasts are. In particular, is it possible for the market to consistently discriminate between proposed takeovers that will ultimately succeed and those that will fail well in advance of the actual event? It is to just this topic that the empirical experiment of the following sections is addressed.

III. The Prediction of Successful Corporate Takeovers

The purpose of this section is to use the information implicit in the arbitrageur's decision-making process to estimate the likelihood that a cash tender or exchange offer will eventually be accepted. Before this is accomplished, three things should be mentioned. First, as noted by Jensen and Ruback [8], most of the literature concerning itself with corporate takeovers has concentrated on the reaction of the stock market either around the time of the initial announcement or after the resolution of the deal. Thus, while these studies do offer excellent insights into the *ex post* returns realized by both the acquiring and target firms, they fail to give an adequate *ex ante* indication of the probability that a merger will be completed. This knowledge would seem to be particularly important given that Dodd and Ruback [4], as well as Bradley, Desai, and Kim [3], have shown that the shareholders of the target firm tend to earn positive (zero) abnormal returns if the merger succeeds (fails). Second, while Hoffmeister and Dyl [7] and Walkling [16] have adapted sophisticated statistical techniques for the purpose of predicting tender offer success, both models are designed to use only information available to a potential bidding firm *before* a formal proposal is made. Thus, neither of these methodologies provides an explicit means of evaluating the progress of an offer in the post-announcement period. Finally, the procedure developed hereafter exploits the market's ability to set prices for the target company in an efficient manner. In this sense, our methodology is in keeping with Lewellen and Ferri's [11] argument that the securities market should be considered the ultimate authority on the desirability of any corporate decision. However, while Lewellen and Ferri focused on measuring the synergistic benefits of two firms merging via an exchange of shares, the probability measure suggested hereafter allows for a greater variety of offers while concentrating on the price fluctuations of the target firm. In the case of cash tender offers, this segmentation is possible because the risk arbitrage investment occurs on only one side of the merger transaction.

Returning to the earlier example, consider the period t decision of the arbitrageur who can acquire at the prevailing market price P_{mt} a share in a firm for which there is an outstanding tender offer at the price P_{Tt}.[2] This purchase will therefore yield a return of $[(P_{Tt} - P_{mt}) \div P_{mt}]$ if the merger is completed. However, since an announced tender offer is not necessarily an accepted one, there is also the chance that the merger will ultimately fall through. Assuming that the price to which the target's stock falls in the event of an unsuccessful merger can be written P_F, the arbitrageur also faces the possibility of realizing a potentially negative

[2]The period t subscript on the offer price reflects the fact that acquisition proposals involving stock swaps, while maintaining a fixed exchange ratio, can change drastically in dollar amount over time. In this context, the term "tender offer" is used to connote any definite form of merger proposal.

return of $[(P_F - P_{mt}) \div P_{mt}]$. While this latter expression cannot be set in advance (since P_F is not known with certainty at time t), the use of any of several pre-announcement prices as a proxy can still give the investor an indication of the overall risk-return tradeoff. Once established, these parameters can then be used to set the market's prediction of the likelihood (or, as will be discussed, the desirability) of the merger, which can in turn be compared with the arbitrageur's own subjective assessment.

To formalize this process, compute the period t merger probability (*i.e.*, x_t) such that the expected risk arbitrage payoff is zero.

$$\begin{aligned} E(\Pi_t) &= x_t[(P_{Tt} - P_{mt}) \div P_{mt}] + (1 - x_t)[(P_F - P_{mt}) \div P_{mt}] \\ &= x_t[(P_{Tt}/P_{mt}) - 1] + (1 - x_t)[(P_F/P_{mt}) - 1] \\ &= 0. \end{aligned}$$

Thus:

$$x_t = \frac{1 - (P_F/P_{mt})}{(P_{Tt}/P_{mt}) - (P_F/P_{mt})}, \qquad (1)$$

where (P_{Tt}/P_{mt}) and (P_F/P_{mt}) are defined as the tender and failure premiums, respectively. To see more clearly the intuition behind this probability measure, rewrite Equation (1) in the following form:

$$x_t = (P_{mt} - P_F) \div (P_{Tt} - P_F) \qquad (2)$$

From Equation (2) it is straightforward to see that the market as a whole sets the likelihood that the takeover will be successful as the percentage of the incremental tender offer that has already been assimilated into the market price as of period t.[3] To ensure that this measure can be strictly interpreted as a probability, rewrite Equation (2) so that it is restricted to remain within the [0,1] interval:

$$x_t = \text{Min}\{[\text{Max}\{(P_{mt} - P_F), 0\} \div (P_{Tt} - P_F)], 1\} \qquad (3)$$

By way of interpreting Equation (3), notice that in the absence of competing bids the market decides that a merger is certain when the period t market price is equal to or greater than the prevailing tender offer. Conversely, the takeover will be labeled a certain failure whenever the market allows the stock to fall below the estimated "failure" price.[4] One potential problem that arises from this latter definition is that if the market has anticipated the public announcement of the merger, it is possible that using a pre-announcement price as a proxy for P_F will bias x_t downward since $(\delta x_t/\delta P_F) < 0$ whenever $P_{mt} < P_{Tt}$, which is typically the case. Therefore, one consequence of such a bias might be an overprediction of merger failure. This is an empirical question and one that will be considered in subsequent sections.[5]

IV. Data and Methodology

In order to test the market's ability to predict the eventual outcome of an announced takeover attempt, a sample consisting of both successful and failed mergers was collected from the 1980–1984 period. With several hundred acquisition proposals per year to choose from, it was possible to refine the data base by imposing the following *a priori* constraints: (i) the proposed transaction must involve either a merger or an acquisition, *i.e.*, divestitures or other forms of reorganization were excluded; (ii) the announcement and completion or termination date of the deal, as well as the terms of the offer, must be publicly available information; and (iii) the stock of both firms involved must be exchange listed. As an additional means of establishing the predictive power of Equation (3), all the merger proposals selected were classified according to whether or not the target firms were involved in a competitive bidding process. These distinctions left three separate subsamples: completed mergers, non-competing; failed attempts, non-competing; and completed mergers where at least one other competing bid failed.

Two primary sources of information were used in

[3]Notice that the probability measure is calculated by taking a percentage of the *difference* between the failure and tender prices, rather than simply inverting the tender premium (*i.e.*, P_{mt}/P_{Tt}). To see why it is necessary to also account for the failure price, consider two target firms each receiving tender offers for $10 more than their initial share prices of $20 and $60. Assuming that the market subsequently reacts to these announcements by bidding the respective prices to $28 and $68, Equation (2) would correctly predict that each proposed merger has the same (0.8) chance of success. However, if the reciprocals of the tender premiums are used, the predictions would be (28/30) = 0.93 and (68/70) = 0.97, respectively.

[4]From the perspective of a shareholder of the target firm, an outstanding tender offer can be judged successful if it is accepted or, if it fails, it conveys enough new information about the company to lead to a subsequent offer. See Jensen and Ruback [8, pp. 14–16] for more on this point.

[5]It should be noted that a similar prediction method has been developed independently by Samuelson and Rosenthal [15]. However, the empirical application offered in [15] differs from that presented subsequently in three primary ways: (i) the sample period runs from 1976–1981, (ii) no non-cash exchange offers are considered, and (iii) all competitive tender offers are excluded from the sample. Nevertheless, the results of the two studies seem to be robust with respect to these differences.

Exhibit 1. Average Probabilities of Completed (Non-Competing and Competing) and Failed Merger Proposals, P_F = Four Weeks Prior to Announcement

	Weeks Prior to Resolution							
	0	1	2	3	4	5	6	7
Completed (Non-Competing):								
Average	0.984	0.964	0.951	0.932	0.913	0.882	0.849	0.842
Std. Deviation	0.023	0.044	0.050	0.047	0.066	0.111	0.105	0.106
Sample Size	36	36	36	36	36	36	36	36
t-statistic	257.7	131.5	114.1	119.0	83.0	47.7	48.5	47.7
Completed (Competing):								
Average	0.934	0.946	0.923	0.884	0.867	0.864	0.880	0.925
Std. Deviation	0.098	0.070	0.099	0.222	0.238	0.246	0.227	0.081
Sample Size	18	17	17	17	17	16	15	13
t-statistic	40.4	55.7	38.4	16.4	15.0	14.0	15.0	41.2
Failed:								
Average	0.209	0.413	0.421	0.454	0.489	0.435	0.436	0.420
Std. Deviation	0.284	0.303	0.323	0.311	0.310	0.282	0.265	0.244
Sample Size	35	34	33	29	26	23	20	20
t-statistic	4.35	7.95	7.49	7.86	8.04	7.40	7.36	7.70

All average probabilities are significant at the 0.05 level.

the selection process. For the non-competitive proposals, both the "Roster" and "Out the Window" sections in various issues of *Mergers and Acquisitions* were used to locate a total of 71 representative takeover attempts. Announcement dates as well as the initial and, if applicable, revised offer terms were gathered from *The Wall Street Journal*. Of these merger candidates, 36 were successful and 35 ultimately failed. Further, approximately half of the proposed non-competing deals were purely for cash while the other half involved stock swaps or combinations of stock and cash. The competitive subsample, on the other hand, was comprised solely of acquisition attempts relying on cash tender offers by all the bidding firms. Using the *Tender Offer Statistics* data base provided by Douglas Austin & Associates, a set of 18 target firms satisfying the preceding requirements was isolated. This data base, which collects information directly from tender offer forms (14D-1) filed with the SEC, provided all the necessary announcement and offer terms for the competing tender offers. Interestingly, the 18 target firms selected represent the full set of companies receiving multiple registered bids during the sample period. While this would seem to be a surprisingly small number of cases, two points should be kept in mind. First, as noted by Knoeber [9], tender offers accounted for only about 5–10% of all merger announcements during these years. Second, since only formally registered bids were considered, all rumors or speculations about proposed takeovers were ignored.[6]

The probability measure given by Equation (3) requires three pieces of information: the prevailing market price of the target firm, the offer price, and the price to which the target firm's stock will fall if the deal is cancelled. All but the latter are directly observable and so an estimate must be used for the value of P_F. For purposes of this investigation, four different proxies were selected. These are the actual market prices of the target firm one, two, three, and four weeks prior to the initial announcement of the attempted takeover. Thus, for each of the merger proposals in the sample, four separate sets of probabilities were calculated.

As discussed earlier, the risk arbitrage process takes place in the period between the announcement and resolution of the takeover attempt. Using these two dates as endpoints, weekly price information was obtained from *The Wall Street Journal* and probabilities were computed over the entire investment interval. In other words, starting with the day on which the proposed deal was either completed or terminated, a prediction was made according to Equation (3) for each prior week all the way back to the announcement date.[7]

[6]It also should be mentioned that none of the merger proposals sampled involved "two-tiered" bids, wherein the bidding firm makes its initial offer for only a portion of the target company's shares. To evaluate this kind of deal, the risk arbitrageur must estimate a "blended" tender offer as the weighted average of all prices received by the shareholders of the target firm. For more on both the practical and technical aspects of this process, see Boesky [1] and Bradley [2].

[7]For notational convenience in the work that follows, a "week" is defined to be a unit consisting of any number up to five business days. For instance, a proposed merger announced on Tuesday, May 1 and terminated on Friday, May 25 would be considered four weeks long.

Exhibit 1. (Continued)

Weeks Prior to Resolution				
8	9	10	11	12
0.830	0.798	0.785	0.767	0.743
0.121	0.190	0.172	0.171	0.158
36	35	32	30	28
41.1	24.8	25.8	24.6	24.9
0.914	0.846	0.774	0.750	0.705
0.095	0.273	0.360	0.377	0.295
11	7	6	6	4
31.9	8.20	5.27	4.87	4.78
0.438	0.423	0.375	0.391	0.442
0.235	0.290	0.274	0.256	0.265
18	17	13	11	10
7.91	6.01	4.93	5.07	5.27

Since this period of time lasted anywhere from three to forty-six weeks, some method of standardizing the results was necessary. Given the stated purpose of the empirical analysis, the probability estimates were averaged on a weekly basis for all three subsamples. Each set of average probabilities was initially calculated from the point at which the uncertainty was finally resolved (*i.e.*, the ultimate failure or completion date). Consequently, each partition of the sample contains its maximum number of observations as of the last day in the investment interval. It will be the difference between these weekly averages that indicates the stock market's ability to accurately anticipate the outcome of a proposed takeover.

V. Empirical Results

As a starting point, the prediction measure of Equation (3) was calculated on a weekly basis for all 89 proposed deals using the price of the target firm four weeks prior to the announcement date as a proxy for the "failure" price, P_F. The probabilities for a given week relative to the resolution date were then averaged over both of the subsamples. These cross-sectional averages, along with the associated standard deviations, are reported for the three months preceding the completion or failure of the merger in Exhibit 1. The results are presented in a graphical form in Exhibit 2.[8]

The first fact to emerge from an examination of Exhibit 1 is that for every subsample all the weekly average probabilities are significantly different from zero. If nothing else, this serves as an indication that the prediction technique used produces results of con-

[8]As mentioned, all of the empirical tests summarized below were conducted with four different proxies for P_F. However, given that identical inferences were generated by each of the various "failure" prices, only a representative set of results will be listed.

Exhibit 2. Average Probabilities of Completed (Non-Competing and Competing) and Failed Merger Proposals, P_F = Four Weeks Prior to Announcement

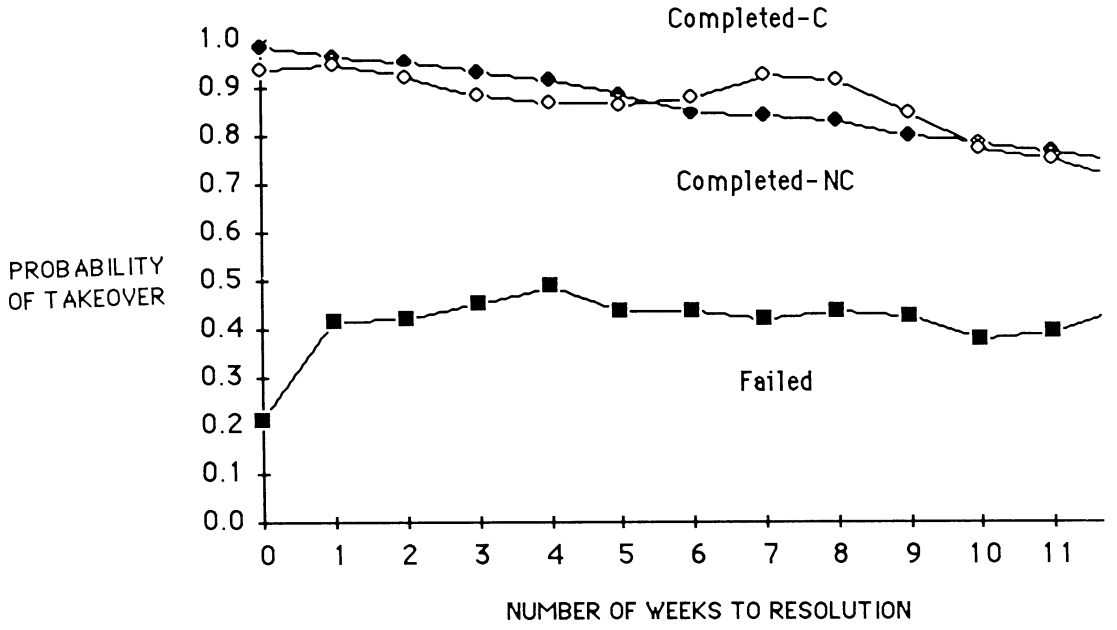

Exhibit 3. Difference in Average Probabilities between (i) Completed (Non-Competing) vs. Failed and (ii) Completed (Competing) vs. Failed Merger Proposals, P_F = Four Weeks Prior to Announcement

	Weeks Prior to Resolution							
	0	1	2	3	4	5	6	7
Completed-NC vs. Failed:								
Avg. Difference (D_t)	0.775	0.551	0.530	0.478	0.424	0.447	0.413	0.422
Pooled Std. Dev. (s_{pt})	0.200	0.213	0.226	0.210	0.206	0.196	0.178	0.168
t-statistic	16.3	10.8	9.73	9.11	7.98	8.56	8.30	9.01
Completed-C vs. Failed:								
Avg. Difference (D_t)	0.725	0.553	0.502	0.430	0.378	0.429	0.444	0.460
Pooled Std. Dev. (s_{pt})	0.239	0.252	0.270	0.282	0.284	0.268	0.250	0.237
t-statistic	10.5	7.13	6.23	4.99	4.27	4.92	5.21	5.68

All differences in average probabilities are significant at the 0.05 level (except where denoted by an asterisk).

sistent quality. Beyond this point, however, the probabilities generated by the failed and completed merger cases are apparently quite different. For instance, notice that over the 12-week period leading up to the completion of either a competitive (C) or a non-competitive (NC) merger, the market never forecasts less than a 70% chance that the proposed target will be acquired. This is particularly impressive in the case of the competitive takeovers since the market was able to correctly evaluate the target firm's acquisition, despite the fact that at least one of the competing bids failed. Conversely, at no time during the reported sample period does the average probability for the failed merger candidates ever exceed 0.5. From the outset, then, investors in the arbitrage market set prices that indicate that it is far more likely that these takeover attempts will eventually be terminated. This fact is notable since, for the 35 failed mergers studied, the average length of time between the announcement and resolution dates was only 9.20 weeks. Therefore, from the inception of the typical failed takeover, the market provided ample indication of the tenuous nature of the deal. On the other hand, the mean length of time it took to complete the 36 non-competitive and 18 competitive successful mergers was 17.31 and 9.83 weeks, respectively. Thus, as with the failed subsample, the average length of time that it takes to acquire a target firm with multiple bidders is shorter than the three months of data reported. Further, although not shown on the displays, even 18 weeks prior to resolution the average probability of the 13 non-competing mergers that took this long to complete is 0.671 with a standard deviation of 0.142. The t-statistic of 17.04 implied by these figures is also significant at the 5% level. These findings might therefore be interpreted as an initial demonstration of the market's ability to discriminate between the various types of acquisition proposals.

Another difference in the weekly mean probabilities is the manner in which the market revises its predictions as the resolution date draws closer. As seen most clearly from Exhibit 2, the average probability for the successful merger subsamples steadily increases up to the time of completion. Conversely, while it was noted heretofore that the unsuccessful merger attempts are never considered to be very promising, there appears to be no substantial downward reassessment as the failure date approaches. To formalize this, consider regressing the average probability for the completed (CMPRB-NC and CMPRB-C) and failed (FLPRB) takeovers against the number of weeks to resolution (WTR). The results of these equations, with the t-statistics listed parenthetically, are as follows:

$$(\text{CMPRB-NC})_t = \underset{(284.4)}{0.9867} - \underset{(-41.5)}{0.0203}\ (\text{WTR})_t;\ R^2 = 0.99$$

$$(\text{CMPRB-C})_t = \underset{(40.7)}{0.9584} - \underset{(-4.80)}{0.0160}\ (\text{WTR})_t;\ R^2 = 0.68 \quad t = 0,1,\ldots,12$$

$$(\text{FLPRB})_t = \underset{(10.9)}{0.3818} + \underset{(0.99)}{0.0049}\ (\text{WTR})_t;\ R^2 = 0.08$$

As the disparity between the coefficients of determination rather clearly reveals, only the predictions for the completed mergers are revised with any consistency. By directly comparing the t-statistics for the respective parameter estimates on the independent variable it is seen that only the failing acquisitions yield an insignificant temporal relationship. Consequently, it can be argued that the two completed subsamples are also differentiated from the failed grouping according to the process by which the weekly probabilities are generated.

A closer inspection of Exhibit 1 reveals that even after the termination of a takeover attempt (*i.e.*, week zero) the market prediction of success is still about 20%. Further, the week zero standard deviations indi-

Exhibit 3. (Continued)

Weeks Prior to Resolution				
8	9	10	11	12
0.392	0.375	0.410	0.376	0.301
0.167	0.227	0.206	0.196	0.190
8.13	5.59	6.06	5.43	4.29
0.487	0.491	0.471	0.383	0.308
0.187	0.235	0.274	0.295	0.310
7.14	5.40	3.67	2.57	1.93*

cate that the market has more trouble coming to a definitive conclusion about the failed merger subsample. Both of these results are caused by the fact that the actual post-failure price for the target firm is above its estimated level. The most plausible explanation for this occurrence is that, although a particular merger may fall through, the market recognizes that the target firm is still an attractive acquisition, even if no other offer is currently available. In the present sample this is exemplified by Flagship Banks, which was successfully merged with Sun Banks in 1983 after an effort by Royal Trustco two years prior had failed. If this is indeed the case, the probability measure summarized by Equation (3) must be considered to be not only a prediction about a current takeover attempt but also an expression of the perceived likelihood that the target firm will be involved in a future deal. In theory, this interpretation clearly makes it more difficult to separate failed from completed mergers, particularly in situations involving competing tender offers. From a practical standpoint, however, it merely raises an empirical issue which requires an alteration in the test methodology. Specifically, a modification will be made so as to directly test the ability of the prediction measure to differentiate the two completed groupings from the failed subsample. This can be accomplished by defining D_t as the week t difference in the values of the average probabilities for one of the completed and the failed merger samples. A t-statistic for the significance of this measure is given by the ratio:

$$T = D_t \div \{s_{pt} \cdot \sqrt{[(1/N_{Ft}) + (1/N_{ct})]}\}, \quad (4)$$

where s_{pt} represents the pooled, cross-sectional standard deviation for the respective subgroups, *i.e.*:

$$s_{pt}^2 = \{[(s_{Ft}^2 \cdot N_{Ft}) \div (N_{Ft} + N_{ct})] + [(s_{ct}^2 \cdot N_{ct}) \div (N_{Ft} + N_{ct})]\}. \quad (5)$$

Here, N_{Ft} and N_{ct} represent the week t number of failed and completed takeovers, respectively. The results of comparing each of the successful merger subsamples with the unsuccessful merger group are in Exhibit 3.

To be conservative, specify the degrees of freedom for a particular value of D_t to be the minimum of $\{N_{Ft} - 1, N_{ct} - 1\}$. Also, the significance tests will be conducted against a two-sided alternative even though a one-sided alternative would be appropriate since there is no *a priori* reason to believe that D_t will ever be negative. The t-statistics for each of twelve weeks preceding the resolution of the attempted takeover are displayed by comparison grouping. Finally, it should again be noted that all of the tests described in this section were replicated using three other proxies for P_F. In every case, inferences were identical to those reported subsequently and therefore were omitted.

Perhaps the most striking result found in Exhibit 3 is the remarkable similarity in the probabilities generated by both competing and non-competing acquisition attempts. With a single exception, the average probabilities for each of the completed sample partitions are significantly different from those of the failed merger proposals as far as three months in advance of the respective events. This is particularly noteworthy when it is recalled that the average length of both an unsuccessful acquisition and a competitive tender offer is less than ten weeks. Since this finding is consistent over a wide range of estimated values it must be concluded that prices set in the risk arbitrage stage of a merger can significantly discriminate between eventual outcomes. Thus, there is strong evidence to suggest that the average probabilities generated by failing takeover attempts are significantly lower than those generated by successful ones.

Before concluding, two final points merit some attention. First, it may be of some interest to consider how accurately the estimated values of P_F forecast the actual post-failure prices. To do this, for each of the 35 failed mergers compute the cross-sectional average ratio of the actual price of the target firm j weeks after the termination date (P_{N+j}) and the price j weeks prior to the announcement date (P_{A-j}). That is, for each of the failed takeovers, calculate $(P_{N+j}) \div (P_{A-j})$ and compute the average for all for proxy weeks j. The resulting mean ratios for j = 1,2,3,4 are 1.04, 1.09, 1.10, and 1.11, respectively, none of which is significantly different from one at the 0.05 level.[9] Thus, it appears

[9]The respective cross-sectional standard deviations for the four cases are 0.28, 0.35, 0.35 and 0.46 with t-statistics of 0.85, 1.60, 1.67 and 1.49.

Exhibit 4. Average Probabilities of Failed (Competing and Non-Competing) Merger Proposals, P_F = Four Weeks Prior to Announcement

	Weeks Prior to Resolution				
	0	1	2	3	4
Failed (Competing):					
Average	0.887	0.951	0.904	0.819	0.641
Std. Deviation	0.112	0.096	0.286	0.337	0.447
Sample Size	18	17	12	8	6
t-statistic	33.60	40.79	10.94	6.87	3.51
Failed (Non-Competing):					
Average	0.209	0.413	0.421	0.454	0.489
Std. Deviation	0.284	0.303	0.323	0.311	0.310
Sample Size	35	34	33	29	26
t-statistic	4.35	7.95	7.49	7.86	8.04

All average probabilities are significant at the 0.05 level.

that all of the estimated "failure" prices used are reasonable forecasts of the actual values.

The second point worth considering is how the market evaluates tender offers which will eventually be outbid. For the competing tender offers examined, the average time between the initial and second registered offers was 2.39 weeks. Since the mean length from the first offer to the eventual acquisition was about two and half months, it is apparent that competitors for a target firm formally reveal themselves relatively early in the bidding process. The more important issue, however, is how the price of the target firm reacts during the time between when a proposal is initiated and when it is rejected. Specifically, are the probabilities set by the market similar for all unsuccessful offers, regardless of whether they failed for competitive or non-competitive reasons? To consider this question more carefully, Exhibit 4 lists the average probabilities for both of the relevant subsamples in the four weeks prior to the respective failure dates. For the competitive grouping, these four weeks correspond to the time immediately prior to the registration of the eventually successful bid while the non-competitive probabilities are replicated from Exhibit 1. Not surprisingly, the results indicate that the probabilities are substantially higher in the competitive subsample. Since the only apparent difference between the two groups is the presence or absence of alternative bidders, these findings undoubtedly reflect the market's ability to anticipate larger (or more attractive) subsequent offers. Interestingly, the results of Exhibit 4 may actually understate this disparity due to the fact that Equation (3) restricts the probability measure to equal one whenever the current market price of the target firm exceeds the existing tender offer. For the competitive sample, however, the price of the target firm in the week before the successful bid is issued was already an average of 0.4% *higher* than the level of the initial offer. Thus, even when a particular merger proposal fails to achieve the desired result, participants in the risk arbitrage market are able to accurately evaluate the nature of the failure and arrive at the correct conclusion about the ultimate fate of the target firm.

By way of summarizing the results of this section, it should be recalled that the question to be addressed was whether or not the prices set in the post-announcement stage of a corporate takeover reflect enough information to differentiate between eventual outcomes. According to findings contained in Exhibit 3, the answer to this question is clearly yes. As indicated by both the competitive and non-competitive subsamples, successful and unsuccessful takeover attempts do imply significantly different estimated probabilities.

VI. Conclusion

Speculating in merger and acquisition arbitrage, once the domain of a few well connected insiders, has recently become an increasingly competitive endeavor. The purpose of this paper has been to demonstrate that an important implication of this speculative activity is that the market prices of the firms involved in a takeover attempt will necessarily reflect the attitudes of the investing public. In particular, it was argued that through the actions of the arbitrageur it is possible to use the post-announcement price of the target firm to infer the probability that an acquisition will ultimately take place. To demonstrate this point, it has been shown that successful and unsuccessful merger proposals do in fact imply significantly different probabilities well in advance of the eventual outcome. Further,

it was indicated that this prediction process is robust with respect to the only piece of information that is not directly observable; that is, the post-failure price of the target firm. Thus, it was concluded that the arbitrage market does effectively differentiate between the two types of corporate takeover attempts.

The direct suggestion of the results in this study is that even though the risk associated with the arbitrage process is largely unsystematic, the market can nonetheless be useful in helping to assess the resolution of an uncertain acquisition. It should be quite reassuring to both the private investor and management of the merging firms that the prices set in the post-announcement period reflect prevailing attitudes and that these attitudes are discriminating predictors of future events. While professional arbitrageurs may still be "artists" at forming subjective merger probabilities, their work may appropriately be likened to that of the fundamental analyst in an efficient stock market. At the very least, it now appears that the aggregate product of the risk arbitrage community is less mysterious than the method itself.

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