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The Shrinking Merger Arbitrage Spread: Reasons and Implications

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The merger arbitrage spread has declined by more than 400 bps since 2002. This decline, which is both economically and statistically significant, corresponds to the decline in aggregate returns of merger arbitrage hedge funds, as well as increased inflows into merger arbitrage hedge funds. Part of the decline in the arbitrage spread may be explained by increased trading in the targets' stocks following the merger announcement, reduced transaction costs, and changes in risk related to merger arbitrage. These findings suggest that some of the decline is likely to be permanent; therefore, investors seeking to invest in merger arbitrage hedge funds should focus on returns since 2002.

Merger arbitrage, also known as risk arbitrage, is an investment strategy that involves buying shares of a company that is being acquired (i.e., the target); in the case of a merger[1] that entails payment in shares, it also involves shorting the shares of the acquiring company. The objective of the strategy is to capture the arbitrage spread—the difference between the acquisition price and the price at which the target's stock trades before the consummation of the merger. The arbitrage spread is realized over the period between the merger's announcement and its consummation. For example, on 10 July 2008, the Dow Chemical Company announced the acquisition of Rohm and Haas Company (ROH) for $78.00 a share in cash;[2] in response to the announcement, ROH's stock price increased by more than 60 percent to close at $73.62.[3] Thus, the arbitrage spread at the close of the NYSE on 10 July 2008 was $4.38, or 5.9 percent ($4.38 as a percentage of $73.62).

Merger arbitrage involves risk because the arbitrageur will incur a loss if the merger fails. Several studies, however, have reported large excess returns (i.e., risk-adjusted returns) related to the merger arbitrage investment strategy. For example, Larcker and Lys (1987), Mitchell and Pulvino (2001), Baker and Savasoglu (2002), and Jindra and Walkling (2004) found economically and statistically significant excess returns related to merger arbitrage.

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Note: The views expressed in this article do not necessarily represent those of the Analysis Group.

Several reasons have been suggested to explain excess returns related to merger arbitrage. Larcker and Lys (1987) posited that the excess return represents compensation for acquiring costly private information. Shleifer and Vishny (1997) stated that arbitrageurs risk running out of capital when the best opportunities exist, and thus, they become more cautious when they make their initial trades; this action, in turn, limits their ability to price away any inefficiencies. Similarly, Mitchell and Pulvino (2001) found that excess returns represent compensation for providing liquidity, especially in down markets.

The popularity of merger arbitrage as an investment strategy has grown over the years, and a number of merger arbitrage hedge funds follow this strategy.[4] According to Hedge Fund Research (HFR), the assets under management of merger arbitrage hedge funds grew from $233 million at the end of 1990 to $28 billion by the end of 2007 (HFR 2008). Further, a number of studies have reported that merger arbitrage hedge funds have generally been able to realize positive alphas. For example, Agarwal and Naik (2000) found that event-driven arbitrage funds were able to generate positive alphas of about 1 percent a month. Ackermann, McEnally, and Ravenscraft (1999) concluded that risk arbitrage generates risk–return profiles that are superior to those of other hedge fund strategies. Block (2006) found that merger arbitrage hedge funds are able to earn strong returns in various types of market environments.

More recently, studies have documented the general decline in hedge fund alphas. Fung, Hsieh, Naik, and Ramadorai (FHNR 2007) found that capital inflows into hedge funds that produce alphas

adversely affect the ability of those funds to continue to generate alphas. FHNR concluded that the aggregate alpha of hedge funds may be heading toward zero. FHNR's conclusions are similar to those reached by Berk and Green (2004) vis-à-vis actively managed mutual funds. Moreover, Zhong (2008) found that, on average, the alpha of hedge funds has declined; Zhong attributed the decline in aggregate hedge fund alphas to capacity constraints, which are caused by the nonscalability of managers' abilities and by limited profitable opportunities in the market.

Evolution of the Arbitrage Spread

The purpose of our study was to examine the evolution of the arbitrage spread between 1990 and 2007. As stated previously, merger arbitrage involves taking a long position in the stock of the target company and, if applicable, a short position in the stock of the acquiring company. Thus, for mergers in which the target's shareholders receive cash, merger arbitrage involves buying the stock of the target after the merger has been announced. For mergers in which the target's shareholders receive shares of the acquiring company (e.g., x shares of the acquiring company for every share of the target company), merger arbitrage involves buying one share of the target and short selling x shares of the acquiring company. Similarly, for mergers in which the target receives both cash and stock of the acquiring company (e.g., y dollars in cash and z shares of the acquiring company for every share of the target company), merger arbitrage involves buying one share of the target and short selling z shares of the acquiring company.

We obtained the data for our study from the merger and acquisition database of Thomson ONE Banker (Thomson M&A database). We compiled a dataset of all mergers or acquisitions that were completed or failed between 1990 and 2007. For deals that were completed successfully, we included only those transactions in which acquirers gained majority control of target companies after consummation. We further limited our sample to transactions involving U.S. companies because transactions involving foreign companies are likely to have risks and transaction costs that are different from those in transactions involving U.S. companies. We also limited our dataset to transactions involving a publicly traded target because merger arbitrage is impossible in transactions involving closely held target companies. Furthermore, we included only those transactions in which the consideration offered was cash or common stock or any combination of the two. This constraint effectively excluded any deals that involved such considerations as preferred stock, convertible debt, or earnout because the market values of those forms of consideration are generally unavailable.[5] We further excluded any deals that involved multiple bids.[6] Finally, we limited our sample to transactions for which the Thomson M&A database provided the information required to compute arbitrage spreads.[7]

Table 1 presents a summary of the mergers in the dataset. The table shows that for the 2,182 deals in our study, the deal success rate was relatively stable over time. Table 1 also shows that the percentage of transactions that used cash as the sole form of consideration decreased in the late 1990s but increased in recent years. The more recent years have seen a decline in the percentage of deals with stock as the only form of consideration and an increase in the percentage of transactions using a combination of cash and stock. In contrast, the percentage of tender offers exhibits no apparent pattern over time. In our sample, the average time from bid announcement to transaction resolution was 129 calendar days; for deals that ultimately succeeded, the average transaction duration was 130 calendar days, versus 112 calendar days for deals that ultimately failed. One last point worth noting is that target companies were significantly smaller than acquiring companies. From 50 to 25 calendar days before the bid announcement, the average market capitalization of target companies was $779 million and the average market capitalization of acquiring companies was approximately $12.7 billion.

The arbitrage spread for cash deals (i.e., mergers in which target shareholders are paid in cash only) is given by

$$S_{cash,t} = \frac{P_{offer} - P_{target,t}}{P_{target,t}}, \quad (1)$$

where

$S_{cash,t}$ = the arbitrage spread for a cash deal on trading day t

P_{offer} = the price in cash that an acquiring company offers to pay for each share of the target company's common stock

$P_{target,t}$ = the closing price of the target company's common stock on trading day t

The arbitrage spread for stock deals (i.e., mergers in which the compensation to target shareholders is common stock of the acquiring company) is given by

Table 1. Summary of M&A Deals, 1990–2007

Year	No. of Deals in Sample	% of Successful Deals	% of Cash-Only Deals	% of Stock-Only Deals	% of Hybrid Deals	% of Tender Offers	Avg. Duration in Days—All Deals	Avg. Duration in Days—Successful Deals	Avg. Duration in Days—Failed Deals	Target's Avg. Market Cap. before M&A Announcement (millions)	Acquirer's Avg. Market Cap. before M&A Announcement (millions)
1990	41	85	100	0	0	37	164	167	149	$ 137	$ 2,988
1991	10	80	90	10	0	60	164	137	274	74	2,556
1992	50	82	28	66	6	2	183	208	71	95	1,640
1993	78	96	45	50	5	14	174	175	161	190	2,044
1994	108	86	47	49	4	26	148	159	75	304	2,677
1995	162	90	43	55	2	21	143	145	121	560	2,892
1996	111	91	44	55	1	18	125	128	95	328	4,371
1997	193	95	33	65	3	18	130	133	67	534	4,739
1998	216	93	37	59	4	19	134	135	118	723	8,056
1999	260	88	50	45	4	29	125	127	111	736	21,400
2000	220	93	46	46	7	30	105	105	99	800	20,304
2001	135	95	47	44	9	22	119	121	92	431	16,240
2002	74	93	59	27	14	39	116	115	133	1,085	12,445
2003	100	93	51	30	19	22	123	126	84	577	15,170
2004	106	92	50	28	22	8	139	135	188	1,650	10,633
2005	98	96	63	20	16	13	116	114	166	1,735	28,407
2006	117	98	79	9	12	8	121	120	167	1,409	23,005
2007	103	94	72	13	16	22	103	101	136	1,764	26,558
Sample	2,182	92	50	45	9	21	129	130	112	$ 779	$12,695

Sources: Thomson ONE Banker and CRSP.

$$S_{stock,t} = \frac{(P_{acquirer,t})(ER) - P_{target,t}}{P_{target,t}}, \quad (2)$$

where

$S_{stock,t}$ = the arbitrage spread for a stock deal on trading day t

$P_{acquirer,t}$ = the closing price of the acquiring company's common stock on trading day t

ER = the deal exchange ratio (i.e., the number of shares of the acquiring company's common stock offered to the target company's common shareholders in exchange for one share of the target company's common stock)

$P_{target,t}$ = the closing price of the target company's common stock on trading day t[8]

For all deals in the dataset, we computed the arbitrage spread from the day after the merger was announced to the date of resolution (i.e., the date on which the merger was completed or terminated). We began with the day after the announcement date to ensure that we did not include any preannouncement information for deals that were announced after the close of the markets.

Mitchell and Pulvino (2001), Baker and Savasoglu (2002), Jindra and Walkling (2004), and Walkling (1985) documented the evolution of the arbitrage spread over the period from the day after the merger announcement to the resolution date (the deal period).[9] These studies found that for successful deals, the arbitrage spread gradually declined over the deal period; for mergers that failed, the evolution of the arbitrage spread over the deal period was more erratic and the spread increased on the termination announcement (Mitchell and Pulvino 2001).

Table 2 shows the 5th, 25th, 50th, 75th, and 95th percentiles, by year, of the first-day arbitrage spread (i.e., measured the day after the merger announcement) of deals announced between 1990 and 2007. As documented by other studies, the table shows that the first-day arbitrage spread reveals high variability for all years. The table also shows that since 2001, first-day arbitrage spreads have declined. For example, the medians of the first-day arbitrage spreads for deals announced before 2001 range from 4.10 percent to 7.94 percent, whereas the medians for deals announced in or after 2001 range between 1.74 percent and 2.63 percent.

To investigate whether the differences in arbitrage spreads persist beyond the first day, we compared the arbitrage spreads throughout the deal period for mergers across years. In addition, to ascertain whether the differences in the first-day arbitrage spreads are driven by the increase in mergers with a particular outcome, we compared the arbitrage spreads of successful deals and failed deals separately.

Table 2. Summary of M&A Deals' Arbitrage Spreads, 1990–2007

Year	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
1990	–0.78	2.26	7.94	13.76	38.78
1991	–25.82	2.44	7.50	27.27	55.00
1992	–5.71	3.82	7.76	16.46	74.30
1993	–15.60	4.20	7.27	14.29	51.43
1994	–2.47	2.37	7.58	11.46	45.77
1995	–6.54	2.00	5.57	9.61	25.83
1996	–3.04	2.02	5.07	11.37	30.50
1997	–6.36	1.91	4.10	8.62	35.79
1998	–1.28	3.03	6.32	13.44	45.26
1999	0.08	3.21	5.90	12.37	39.06
2000	0.77	2.79	4.59	10.06	37.46
2001	–2.74	1.77	2.63	6.51	38.17
2002	–6.52	0.93	1.74	3.94	36.93
2003	–4.33	0.92	1.94	6.20	37.46
2004	–0.53	1.09	1.84	3.27	39.25
2005	–2.37	1.04	1.90	3.24	33.31
2006	–0.58	1.41	2.26	3.17	5.95
2007	–0.98	0.97	2.03	3.57	14.83

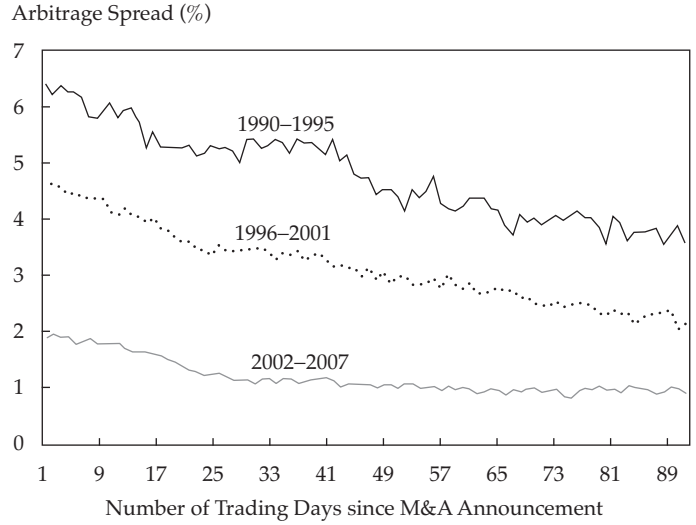
Sources: Thomson ONE Banker and CRSP.

Panel A of **Figure 1** compares the median arbitrage spreads over the first 90 trading days after the merger announcement[10] for successful deals in three six-year periods: 1990–1995, 1996–2001, and 2002–2007. Panel A shows that in all three six-year periods, the arbitrage spread for successful deals declined steadily after the deal announcement. Although the arbitrage spread in each six-year period exhibited a similar pattern, Panel A shows that the arbitrage spread for successful deals declined significantly in the most recent six-year period. The median first-day arbitrage spread for successful deals declined from 6.39 percent in 1990–1995 to 4.62 percent in 1996–2001 and, finally, to only 1.91 percent in the most recent period.

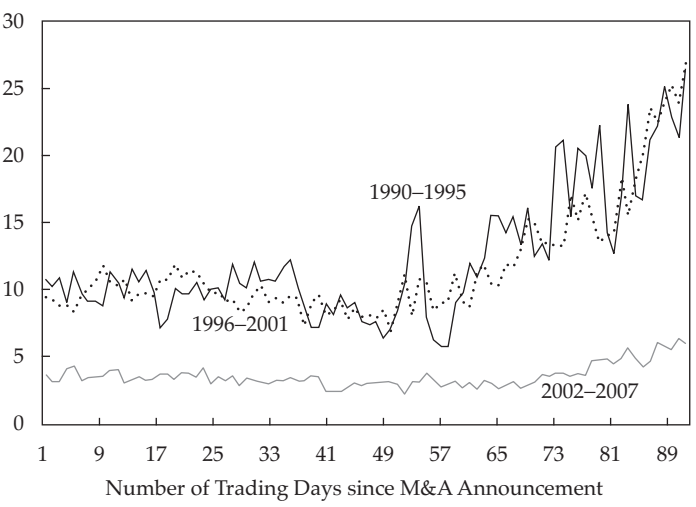
Panel B of Figure 1 presents the same comparison for failed mergers. The patterns of the arbitrage spreads for failed deals in the first two six-year periods are similar—both fluctuated around 10 percent in the first 60 or so trading days and then rose quickly. In contrast, the median daily arbitrage spread in the most recent six years fluctuated between 3 percent and 5 percent during most of the 90 trading days following the merger announcement. Similar to the results presented in Panel A, the arbitrage spread of deals that ultimately failed

Figure 1. Median Arbitrage Spreads for M&A Deals, 1990–2007

A. Successful M&A Deals, First 90 Trading Days after M&A Announcement



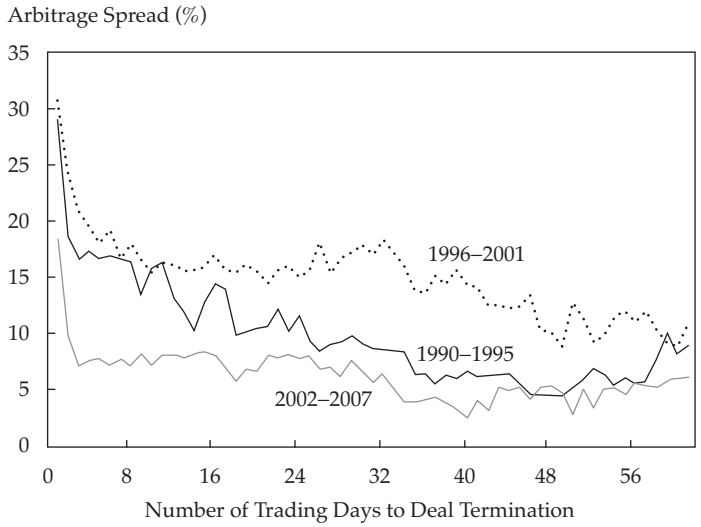
B. Failed M&A Deals, First 90 Trading Days after M&A Announcement



(continued)

Figure 1. Median Arbitrage Spreads for M&A Deals, 1990–2007 (continued)

C. Failed M&A Deals, 60 Trading Days Ending on Date of Deal Termination Announcement



Sources: Thomson ONE Banker and CRSP.

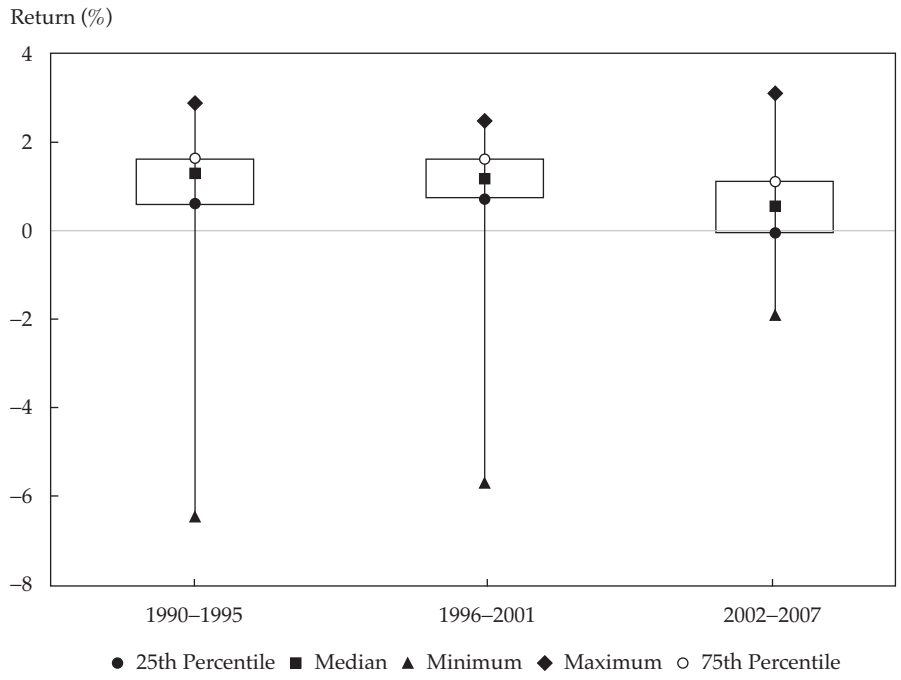
was lower in the most recent period than in the two earlier periods. Moreover, an intraperiod comparison of failed and successful deals shows that shortly after the merger was announced, the arbitrage spread of failed deals was higher than the spread of successful deals during each period. One possible explanation is that the deals that failed had higher risk than those that succeeded. As discussed later in the article, a couple of *ex ante* indicators of risk are the attitude of the bidder (i.e., hostile versus nonhostile)[11] and the bid premium (the percentage difference between the offer price for a deal and the target stock's pre-deal-announcement price).[12] In fact, we found that in all three periods, the percentage of hostile deals was higher for failed deals than for successful deals.[13]

We further reviewed the arbitrage spread of failed deals by comparing the arbitrage spreads over the 60-day period ending on the date that the deal's termination was announced (Panel C of Figure 1). As expected, the panel shows that in all three periods, the arbitrage spreads increased sharply starting a few days before the announcement. Again, even around the date of the announcement of the deal's termination, the arbitrage spread was lower for the most recent six-year period.

At least three explanations can account for the difference in arbitrage spread around the deal termination date. One explanation is that the difference in the spread could be driven by the difference in the premium that the potential acquirer was willing to pay over and above the target's stock price. In fact, we found that, on average, the premiums of failed deals for 1990–1995 and 1996–2001 were 40.8 percent and 37.4 percent, respectively, whereas the premium for deals that failed during the most recent six-year period was 27.4 percent. The second possible explanation is that the targets involved in failed transactions from 2002 to 2007 were expected to have an increased probability of being involved in a subsequent transaction. Davidson, Dutia, and Cheng (1989) concluded that the stock prices of target companies do not revert to pre-merger-announcement levels if the target companies are involved in subsequent mergers. We did not test that hypothesis. Finally, the stock prices of targets in failed deals may not have reverted to pre-merger-announcement levels because of breakup fees or other termination payments that targets of failed deals in the most recent period were expected to receive.[14] Again, we did not test that hypothesis.

To evaluate the evolution of aggregate returns of merger arbitrage hedge funds, we used monthly return data from the HFRI Merger Arbitrage Index, a merger arbitrage hedge fund index constructed by HFR. Aggregate returns reported by HFR may be biased upward (Fung and Hsieh 2004). Because the focus of our study was the change in returns over time, however, the impact of an upward bias was likely to be second order at best. **Figure 2** is a box plot of monthly returns during the three six-year periods that shows that the distribution of monthly returns was similar for 1990–1995 and 1996–2001, whereas the returns seem to have declined in the last period. For example, the medians of monthly returns for 1990–1995, 1996–2001, and 2002–2007 are 96 bps, 99 bps, and 51 bps, respectively. The

Figure 2. Merger Arbitrage Hedge Fund Monthly Returns, 1990–2007



Source: HFR (2008).

difference-of-means test confirms that the decline in monthly returns of merger arbitrage hedge funds reported by HFR is statistically significant.[15]

Next, we examined the aggregate alpha of merger arbitrage hedge funds by using a modified version of the seven-factor model developed by Fung and Hsieh (2004). Our modifications included dropping the three variables suitable for trend-following hedge funds.[16] Equation 3 describes the model we used to evaluate the evolution of aggregate alpha:

$$MR_i = \alpha + \beta_1(S\&P_i) + \beta_2(SC - LC)_i + \beta_3(10Y_i) + \beta_4(Credit - SP)_i + \beta_5(Y96 - 01)_i + \beta_6(Y02 - 07)_i + \xi_i. \quad (3)$$

The dependent variable (MR_i) is the return of merger arbitrage hedge funds in month i as reported by HFR. *S&P* is the return of the S&P 500 Index, and *SC* − *LC* is the difference between the return on the S&P SmallCap 600 Index and the S&P 500; *S&P* and *SC* − *LC* measure the exposure of merger arbitrage hedge funds to equity risk. The 10*Y* is the change—measured from the beginning to the end of a month—in the 10-year constant maturity and Treasury rate (CMT), and *Credit* – *SP* is the change—measured from the beginning to the end of a month—in the difference between Moody's Investors Service Baa yield and the 10-year CMT. Even though the interest-rate-related variables seem better suited for fixed-income hedge funds, these variables are likely to capture the impact of the transaction costs related to the interest costs of margin trades and short positions.[17] To determine whether the alpha of merger arbitrage hedge funds has changed over the years, we included two indicator variables: *Y*96–01 represents 1996–2001, and *Y*02–07 represents 2002–2007. In addition, following the insight by Mitchell and Pulvino (2001) that the correlation of the returns of merger arbitrage hedge funds is likely to be higher during periods when the equity market experiences large declines, we ran the regression for the months in which the equity market experienced large declines. We defined a month with large declines as one in which the difference between the return on the S&P 500 and the risk-free rate was less than –3 percent.[18]

Table 3 presents the results. Column 1 shows the regression results for the full sample. The results are consistent with those reported in other studies (see, e.g., Block 2006). The regression shows that merger arbitrage hedge funds face some equity risk because the coefficients of the *S&P* and *SC* – *LC* variables are relatively small. The regression also shows that the return on merger arbitrage hedge funds is negatively related to interest rates and the credit spread because the costs of leverage and short positions are likely to be directly related to interest rates and credit spreads.

Table 3. Regression Results of Merger Arbitrage Hedge Fund Return Model, 1990–2007

Explanatory Variable	Estimate (*t*-statistic)[a]	Estimate (*t*-statistic)[b]
Constant	0.0080	0.0151
	(6.86)*	(1.91)
S&P 500 monthly return	0.1453	0.3900
	(8.52)*	(3.82)*
Difference between the monthly returns on the S&P 500 and the S&P SmallCap 600	0.1104	0.2017
	(5.41)*	(2.6)*
Monthly change of 10-year CMT yield	–0.7143	–0.8424
	(–1.8)	(–0.31)
Monthly change of the difference between Moody's Baa yield and the 10-year CMT yield	–0.9658	–1.2677
	(–1.32)	(–0.36)
Dummy variable for 1996–2001	0.0005	0.0109
	(0.28)	(1.53)
Dummy variable for 2002–2007	–0.0041	–0.0007
	(–2.5)*	(–0.07)
R^2	0.3646	0.4007
Number of observations	216	36

[a]Baseline regression model with monthly data from 1990 to 2007.
[b]Regression model for severe market declines (defined as S&P 500 return minus risk-free rate is less than –3 percent).

*Significant at the 5 percent level.

Sources: HFR (2008), the Federal Reserve Board website, and Bloomberg.

For 2002–2007, relative to the earlier periods, the aggregate alpha of the merger arbitrage hedge funds declined by about 41 bps. This decline is economically significant because a decline of 41 bps in monthly alpha translates to an annual decline of 4.81 percentage points.[19] Column 2 shows that for a subsample of periods of severe market declines, the dummy variable for 2001–2007 has a coefficient estimate with a negative but statistically insignificant sign.

Thus, an evaluation of arbitrage spreads and returns of merger arbitrage hedge funds shows that both experienced significant statistical and economic declines from 2002 through 2007.

Reasons for the Decline in the Arbitrage Spread

We next examined the reasons for the decline in the arbitrage spread and the consequent decline in the aggregate alpha of merger arbitrage hedge funds. As stated previously, the decline in the arbitrage spread has three possible explanations: a reduction in transaction costs related to risk arbitrage, capacity constraints over time (i.e., more money chasing a limited number of deals), and a reduction in risks associated with risk arbitrage. We also explored the impact of each of these factors on the arbitrage spread and the resulting impact on the returns and alphas of merger arbitrage hedge funds.

Transaction Costs. Transaction costs can be separated into two categories: direct and indirect. Direct transaction costs cover expenses related to opening and maintaining a risk arbitrage position (Mitchell and Pulvino 2001).[20] Such costs include brokerage commissions, bid–ask spreads, and the costs of maintaining a position.[21] Indirect transaction costs are related to the price impact of trades. That the components of direct costs (e.g., brokerage commissions) and the price impact of trades have been declining since 1990 is well established. French (2008) reported that direct trading costs declined by more than 50 bps between 1990 and 2006, from 64 bps to 11 bps. Several studies have concluded that indirect transaction costs also declined because of increased liquidity and regulation, such as Regulation NMS (National Market System).[22]

Moreover, given that the arbitrage spread reflects transaction costs[23] and that investors must incur transaction costs, we do not expect changes in transaction costs to have any impact on the returns (and, therefore, alpha) associated with a merger arbitrage investment strategy.[24] A simple hypothetical example helps illustrate this point. Assume that on the day after a merger is announced, the arbitrage spread is equal to x bps. Of the x bps, assume that y bps represent transaction costs. Thus, given the transaction costs of y bps, a merger arbitrage hedge fund or any other investor that implements risk arbitrage will earn, on average, only $x - y$ bps if the merger is successfully completed. But if the first-day arbitrage spread declines from x to x' and if the decline is entirely attributable to a decline in transaction costs from y to y', then the return from merger arbitrage will not change.

Finally, to test whether the transaction costs related to mergers in our sample experienced similar declines, we compared the arbitrage spreads of successful deals on the date the deal completion was announced.[25] We posited that the arbitrage spreads of successful deals on the day that merger completion is announced are a good indicator of transaction costs because once deal completion is announced, the arbitrage spread reflects only the transaction costs of taking a long position in the target's stock and, if required, a short position in the stock of the acquiring company. Given that a few

days may elapse between the deal completion announcement and the effective date (the date on which the target's stock is delisted and the target shareholders receive cash and/or stock of the acquiring company), the arbitrage spread on the completion date also reflects the cost of maintaining the position. But given the relatively short period between the merger completion date and the effective date, the spread on the completion date, for all practical purposes, reflects the cost of trading only. The median completion-date arbitrage spreads for successful cash deals for 1990–1995, 1996–2001, and 2002–2007 are 62 bps, 41 bps, and 6 bps, respectively. Similarly, the median completion-date arbitrage spreads for successful stock deals for the same three periods are 107 bps, 82 bps, and 51 bps. These results confirm the conclusion of French (2008) concerning the amount by which trading costs have declined since 1990 on the basis of the evolution of direct trading costs.

Capacity Constraints. According to HFR (2008), between 1990 and 2007, net inflows into merger arbitrage hedge funds were equal to $18.3 billion, of which $14.8 billion was attributable to net inflows since 2000. HFR (2008) also reported that assets under management for merger arbitrage hedge funds increased sharply for 2000–2002.[26] To investigate whether increased investment in merger arbitrage contributed to the decline in the arbitrage spread, we analyzed trading volume in the target stock subsequent to the merger announcement.[27]

To assume that the increased trading in the target stock subsequent to the merger announcement is related to more money flowing into arbitrage funds is reasonable. Studies have documented that subsequent to a merger announcement, arbitrage funds own a significant fraction of the target's common equity. Hsieh and Walkling (2005) reported a 15 percent ownership by arbitrage funds, whereas Officer (2007) reported 35 percent. Officer (2007, p. 800, n. 9) also stated that "most merger arbitrageurs trade under the auspices of hedge funds." Moreover, industry insiders have estimated that, on average, arbitrage funds own as much as 50 percent of the target (Wasserstein 1998). Other studies have also suggested a link between trading and capital invested in arbitrage funds. Baker and Savasoglu (2002) reported a negative relationship between excess returns related to merger arbitrage and the amount of arbitrage capital; they also stated that to assume that individuals would invest in merger arbitrage is implausible.

Table 4 shows the 5th, 25th, 50th, 75th, and 95th percentiles, by year, of the relative trading volume (RV) of targets' stock the day after deal announcements for transactions between 1990 and 2007. The RV for any target for any given day during the deal period is equal to the trading volume on that day divided by the target's normal trading volume. We followed Lakonishok and Vermaelen (1990), who defined normal trading volume as the average trading volume between 50 and 25 days before the merger announcement. The table shows that first-day RV has increased since 2001.

Table 4. Summary of M&A Deals' Relative Volume, 1990–2007

Year	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
1990	0.17	4.20	9.11	17.58	46.94
1991	0.00	1.91	3.26	18.46	38.39
1992	0.44	3.55	9.44	27.44	120.00
1993	0.18	2.61	7.72	16.94	57.77
1994	0.73	5.21	10.69	20.85	71.32
1995	0.93	3.88	9.26	22.29	46.71
1996	0.91	4.87	9.12	20.40	69.83
1997	1.11	4.82	9.82	22.48	78.04
1998	1.04	4.15	7.97	17.93	44.13
1999	1.38	3.73	8.80	22.31	67.75
2000	0.67	3.58	7.51	18.52	99.03
2001	0.72	5.02	11.40	39.30	119.96
2002	1.56	4.80	14.22	41.96	191.93
2003	2.02	7.39	14.50	37.38	150.01
2004	2.11	5.75	11.54	33.78	108.55
2005	2.60	7.11	13.77	27.47	115.89
2006	3.08	7.54	14.50	29.35	116.31
2007	2.46	5.30	10.02	21.32	78.18

Sources: Thomson ONE Banker and CRSP.

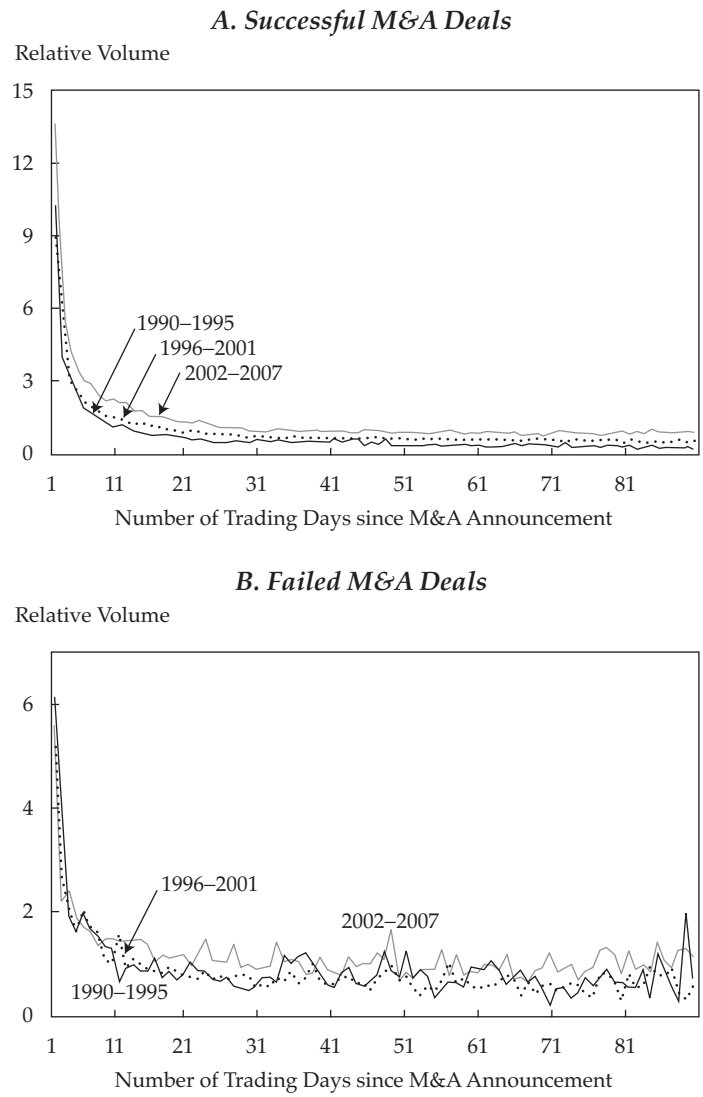
For example, the medians of the first-day RV for deals announced before 2001 range from 3.26 to 10.69, whereas the medians for deals announced in or after 2001 range between 10.02 and 14.50.

To see whether the differences in RV persist beyond the first day, we compared the differences in RV throughout the deal period. Similar to the comparison of the arbitrage spreads, we compared the RVs of successful deals and failed deals separately. Panel A of **Figure 3** compares the RVs of successful deals over the first 90 trading days after the merger announcement for the three six-year periods (1990–1995, 1996–2001, and 2002–2007).

Panel A shows that for all three six-year periods, the RVs of successful deals declined sharply right after the deal announcement and then remained relatively stable after approximately 20 trading days following the merger announcement. Although the RVs for the three six-year periods exhibit a similar pattern, Panel A shows that the relative volume for successful deals increased significantly for the most recent six-year period. The median first-day RV of successful deals changed from 10.24 for 1990–1995 to 9.21 for the next six years and, finally, to 13.55 for the most recent period.

Panel B of Figure 3 presents the same comparison for failed mergers. It shows that the RVs during the deal period are very close to each other for all three six-year periods, with the RV for the most recent six years being occasionally slightly higher

Figure 3. Median Relative Trading Volume for M&A Deals, 1990–2007



Sources: Thomson ONE Banker and CRSP.

than the RV for the earlier periods. Another interesting pattern associated with failed deals is that their RVs during the first several trading days are generally lower than the RVs of successful deals.

A comparison of Figures 3 and 1 suggests that the decline in arbitrage spread coincides with the increase in RV. This finding, in turn, suggests that the decline in both arbitrage spread and aggregate alpha of merger arbitrage hedge funds may be explained by increased capital devoted to merger arbitrage.

Capital invested in merger arbitrage can also be affected by changes in leverage used by merger arbitrage funds. All else being equal, an increase in leverage, such as margin borrowing, will also raise the amount of funds invested in merger arbitrage. A number of industry publications have suggested that leverage has facilitated the growth in capital flows into hedge funds over the past several years.[28] In this article, we have not attempted to separate the effects of leverage on arbitrage spreads from the effects of new capital flowing into merger arbitrage. Similarly, we have not evaluated the impact of the use of derivatives and changes in leverage on the returns of risk arbitrage funds.

Risk. Completion risk is the main risk in merger arbitrage, together with uncertainty as to the loss in the event of failure. Mergers are also subject to uncertainty concerning the deal terms and the time to consummate the deal. Given that merger arbitrage profits can be considered compensation for assuming these risks, any change in the risks will also affect the arbitrage spread (Baker and Savasoglu 2002).

To ascertain whether completion risk has changed, we compared the success rates of mergers since 1990. We defined the success rate for any period as the ratio of successful deals announced in that period to total deals announced in that period. Table 1 shows that the success rate has remained relatively stable since 1993, within the percentage range of mid-80s to mid-90s. Thus, that observed declines in the arbitrage spread are the result of reduced completion risk is unlikely.

To measure any change in the percentage loss an arbitrageur suffers upon deal failure, we computed the loss associated with failed mergers announced between 1990 and 2007. We found that the loss resulting from deal failure has declined since 1990.[29] One reason for the decline in potential loss from deal failure is that bid premiums may have declined.[30] If the probability of deal failure is held constant—which is reasonable, given Table 1—the bid premium may be used as a crude indicator of the loss suffered if a deal fails (Officer 2007). Thus, lower bid premiums may be responsible for lower losses from deal failure. In fact, the average bid premium declined from 45 percent for 1996–2001 to 36 percent for the most recent six years, and the difference between the means is statistically significant.

In addition, the probability that targets in failed transactions may be involved in subsequent transactions increased for 2002–2007, such that the targets' stock prices did not revert to pre-merger levels (see Davidson, Dutia, and Cheng 1989). Expected payments related to deal failure may explain why a target's price fails to revert to pre-merger levels. As stated previously, however, we did not test those hypotheses.

Model and Estimation. Surely, a nontrivial part of the decline in the arbitrage spread is the result of a decline in trading costs. Trading cost data reported by French (2008) showed that average trading costs declined from 61 bps for 1990–1995 to 17 bps for 2002–2006. Thus, potentially 40–50 bps of the observed decline in arbitrage spread of approximately 400 bps between 1990–1995 and 2002–2007 may be attributable to trading costs.

Our model does not account for transaction costs directly for two reasons. First, that changes in transaction costs affect aggregate returns and alphas of merger arbitrage hedge funds (which is what investors care about) is unlikely. Second, we are unaware of any deal-level variable that could capture the impact of transaction costs on arbitrage spreads. We posited, however, that the market capitalization of the target should capture differences in transaction costs for at least two reasons. First, that transaction costs related to trading equity of large companies are lower than such costs for small companies is well established.[31] Second, costs associated with collecting information are also likely to be lower for large companies because they are followed by more analysts and other market commentators than are small companies.[32]

To test whether capacity constraints and changes in risk can explain the observed decline in the arbitrage spread, we used the following equation:

$$\begin{aligned} AS_i = {} & \alpha + \beta_1(LRV_i) + \beta_2(BIDPREMIUM_i) \\ & + \beta_3(LMKTCAP_i) + \beta_4(HOSTILE_i) \\ & + \beta_5(COLLAR_i) + \beta_6(CASH_i) + \xi_i, \end{aligned} \tag{4}$$

where

AS_i = the first-day arbitrage spread for any given deal i in the sample[33]

LRV = the natural logarithm of the target stock's relative trading volume the day after the merger announcement

BIDPREMIUM = the bid premium computed as the percentage difference between the offer price for a deal and the target stock's average closing price from 50 to 25 days before the merger announcement

LMKTCAP = the target company's average market capitalization from 50 to 25 days before the merger announcement

HOSTILE = an indicator variable for deals classified as hostile by the Thomson M&A database

COLLAR = an indicator variable for deals that include a collar[34]

CASH = an indicator variable when the form of consideration is cash only

The correlation matrix presented in **Table 5** shows that our model is not affected by multicollinearity.

Table 6 presents the results of the regression. The coefficients of all the variables are statistically significant and have the expected sign. Similar to the results reported in Jindra and Walkling (2004), Walkling (1985), and Officer (2007), the target's market capitalization is negatively related to the arbitrage spread, which suggests that the arbitrage spread is smaller for larger target companies because of lower transaction costs related, in part, to higher liquidity and more readily available information.

The results also suggest that characteristics of a transaction (e.g., bidder attitude, bid premium, and type of compensation) also affect the arbitrage spread. As expected, *HOSTILE* deals have higher arbitrage spreads than do friendly stock mergers, and *CASH* mergers have lower arbitrage spreads than do stock mergers. Cash transactions might be associated with higher certainty in the offer price and thus result in a lower arbitrage spread. The coefficient for *COLLAR* is 0.0262 (statistically significant at the 1 percent level), which suggests that the arbitrage spread for deals with a collar is about 262 bps higher than for deals without a collar. This finding is not surprising because risk arbitrage in mergers with collars involves higher transaction costs and may involve risk related to uncovered short positions in the acquirer's stock. In fact, Table 1 shows that the popularity of cash deals increased during the most recent six-year period, whereas *BIDPREMIUM* declined for deals during the same period. Furthermore, *HOSTILE* deals have also declined over time; *HOSTILE* deals as a percentage of all deals for 1990–1995, 1996–2001, and 2002–2007 were 7.1 percent, 2.3 percent, and 3.2 percent, respectively. The regression results indicate that the increased popularity of cash deals, lower bid

Table 5. Correlation Matrix, 1990–2007

Variable	*AS*	*LRV*	*BIDPREMIUM*	*LMKTCAP*	*HOSTILE*	*COLLAR*	*CASH*
AS	1.0000						
LRV	–0.0928*	1.0000					
	(0.0000)						
BIDPREMIUM	0.3616*	0.2069*	1.0000				
	(0.0000)	(0.0000)					
LMKTCAP	–0.1677*	–0.1071*	–0.2499*	1.0000			
	(0.0000)	(0.0000)	(0.0000)				
HOSTILE	0.1372*	–0.1022*	0.0013	0.0277	1.0000		
	(0.0000)	(0.0000)	(0.9508)	(0.2033)			
COLLAR	0.1263*	0.0324	0.0467*	–0.0561*	–0.0423	1.0000	
	(0.0000)	(0.1358)	(0.0315)	(0.0099)	(0.0517)		
CASH	–0.1903*	0.1247*	0.0541*	–0.0861*	0.1353*	–0.2793*	1.0000
	(0.0000)	(0.0000)	(0.0127)	(0.0001)	(0.0000)	(0.0000)	

Note: *P*-values are in parentheses.

*Significant at the 5 percent level.

Sources: Thomson ONE Banker and CRSP.

Table 6. Predictors of Arbitrage Spread, 1990–2007

Explanatory Variable	Estimate (*t*-statistic)
Constant	0.1182
	(11.87)*
Log of target stock's relative trading volume first day after merger announcement	–0.0135
	(–7.14)*
Bid premium first day after merger announcement	0.1188
	(18.56)*
Log of target's average market capitalization from 50 to 25 days before merger announcement	–0.0078
	(–5.5)*
Indicator: hostile attitude of acquirer	0.1041
	(8.03)*
Indicator: deal involves a collar	0.0262
	(2.8)*
Indicator: cash is the only form of deal consideration	–0.0503
	(–10.2)*
R^2	0.2339
Number of observations	2,118

*Significant at the 5 percent level.

Sources: Thomson ONE Banker and CRSP.

premiums, and the decreased popularity of hostile deals reduced the arbitrage spread for the most recent six-year period by 194 bps[35] and 201 bps[36] vis-à-vis 1990–1995 and 1996–2001, respectively.

Our model also confirms that relative volume has a statistically and economically significant impact on the arbitrage spread. Given that the difference between the average first-day RVs of deals announced during 1990–1995 and 2002–2007 is about 13, the regression results suggest that the increase in volume can explain about 66 bps of the decline in the average arbitrage spread for 2002–2007 vis-à-vis 1990–1995.[37]

The regression results demonstrate that part of the decline in the arbitrage spreads and, as a result, in the aggregate alphas of merger arbitrage hedge funds is attributable to reduced risk associated with the mergers in the most recent period and to the devotion of increased amounts of money to merger arbitrage. There is no reason to believe, however, that future deals will continue to have less risk than deals announced in the 1990s. The popularity of cash deals could decline and hostile acquisitions could increase, resulting in both higher arbitrage spreads and higher merger arbitrage hedge fund alphas. But the increase in volume seems to be more permanent. Furthermore, given that merger arbitrage hedge funds outperformed most other hedge fund strategies in 2008,[38] more money is likely to be dedicated to risk arbitrage. Hence, all else being equal, one should expect arbitrage spreads and aggregate alphas of merger arbitrage hedge funds to remain below the levels realized before the early part of this decade. Thus, to the extent that reviewing historical returns associated with an investment strategy is useful, investors should focus on the performance of returns since 2002 because, on average, the performance of the 1990s and earlier is unlikely to be repeated.

Conclusion

We documented a substantial decline in the arbitrage spread since the 1990s. We found that for mergers announced since 2001, the first-day arbitrage spread is 520 bps lower than the spread for deals announced between 1990 and 1995 and 290 bps lower than the spread for deals announced between 1996 and 2001. Not surprisingly, the decline in arbitrage spread coincides with the decline in the aggregate returns and alphas of merger arbitrage hedge funds. For 2002–2007, we estimated that the annual aggregate alphas of merger arbitrage hedge funds declined by 481 bps.

In addition, we showed that the decline in the arbitrage spread and, as a result, the decline in aggregate returns and alphas of merger arbitrage hedge funds may be attributed to increased interest in the merger arbitrage investment strategy, as well as to a reduction in risk associated with mergers. In particular, we found that the decline in arbitrage spread may be explained by changes in the characteristics of a deal—increased popularity of cash deals, lower bid premiums, and fewer hostile deals—and by increased trading in the target's stock following the merger announcement. Our findings support the conclusion of earlier researchers that hedge fund alphas are adversely affected by capacity constraints.

Our findings suggest that some of the decline in the arbitrage spread is likely to be permanent; therefore, investors seeking to invest in merger arbitrage hedge funds should focus on returns since 2002 rather than over a longer period. Furthermore, if more money continues to be devoted to merger arbitrage, the returns and alphas related to this strategy are likely to continue to decline.

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This article qualifies for 1 CE credit.

Notes

1. We use the term merger to include acquisitions.
2. See "Dow Acquires Rohm and Haas, Creating World's Leading Specialty Chemicals and Advanced Materials Company; $18.8 Billion Transaction Marks Pivotal Point in Dow's Transformation," press release, Dow Chemical (10 July 2008).
3. ROH common stock closing price quotes are from Bloomberg.
4. This strategy calls for investing simultaneously in long and short positions in both companies involved in a merger or acquisition. Merger arbitrage hedge funds typically take a long position in the stock of the target company and a short position in the stock of the acquiring company. The primary risk is the risk that the merger may fail.
5. Earnout is an amount to be paid in the future, over time, if the target company meets certain financial performance criteria.
6. Including the deals with multiple bids did not change the main conclusions of our study.
7. In the early years of the study sample (i.e., 1990 and especially 1991), a disproportionately large number of stock exchange deals had a missing value in the Thomson M&A database for the exchange ratio, a necessary variable for computing arbitrage spreads for transactions involving a stock swap. Therefore, we considered a smaller percentage of deals for 1990 and 1991 than for later years.
8. For deals in which the target's shareholders are offered both cash and shares of the acquirer's stock, the arbitrage spread is given by $S_{hybrid,t} = [(P_{acquirer,t})(ER) + P_{cash\ offer} - P_{target,t}]/P_{target,t}$, where $P_{cash\ offer}$ is the amount of cash per share that is offered to the target's shareholders.
9. Mitchell and Pulvino (2001) focused on cash mergers, cash tenders, and simple stock swap transactions. The final sample in Baker and Savasoglu (2002) consisted of both pure cash deals and pure stock deals. Jindra and Walkling (2004) studied cash tender offers.
10. We chose this time frame because the average deal duration was 129 calendar days, as shown in Table 1. This duration corresponds to approximately 90 trading days.
11. We used an indicator variable in the Thomson M&A database to identify hostile deals.
12. We computed the bid premium as the percentage difference between the offer price for a deal and the target stock's average closing price from 50 to 25 days before the merger announcement.
13. For 1990–1995, the percentages of failed and successful deals that were classified as hostile were 43.1 percent and 2.2 percent, respectively. For 1996–2001, the percentages of failed and successful deals that were classified as hostile were 17.9 percent and 0.9 percent, whereas for 2002–2007, the percentages of failed and successful deals that were classified as hostile were 34.4 percent and 1.3 percent. In all instances, the differences are statistically significant at the 5 percent level.
14. Bates and Lemmon (2003) and Officer (2003) examined the impact of termination fees on mergers and acquisitions.
15. A statistically significant difference exists between the average monthly returns for 2002–2007 and 1990–1995, with the *t*-value of the difference equal to –2.23. Similarly, a statistically significant difference exists between the average monthly returns for 2002–2007 and 1996–2001, with the *t*-value equal to –2.69.
16. The variables we omitted are the return on a portfolio of lookback options on bond futures, the return on a portfolio of lookback options on currency futures, and the return on a portfolio of lookback options on commodity futures.
17. More specifically, higher interest rates or higher credit spreads are likely to increase the cost of margin trading.
18. The –3 percent threshold is based on Mitchell and Pulvino (2001). When the threshold is changed to –4 percent or –5 percent, the results remain unchanged.
19. This decline is calculated by compounding the monthly loss of 0.41 percent.
20. For example, according to Mitchell and Pulvino (2001), substantial direct trading costs existed before 1975. During that period, per-share trading costs were regulated by the NYSE. The regulated direct trading costs consisted of three main components: (1) brokerage commissions, (2) round-lot surcharges for orders of 200 shares or more, and (3) transfer taxes based on the price of the stock being bought or sold.
21. The costs of maintaining a position include interest costs related to leverage and short sales. Even though institutional investors do receive interest on the proceeds of a short sale (i.e., a rebate) because of margin requirements, the rebate is paid on only a fraction of the proceeds of the short sale (Pontiff 1996).
22. See, for example, Barclay, Christie, Harris, Kandel, and Schultz (1999).
23. Unless otherwise stated, transaction costs include both direct and indirect costs.
24. Individual hedge fund alphas may be determined, in part, by a transaction cost advantage, but this possibility cannot be true of funds in aggregate.
25. We used the effective date from the Thomson M&A database to represent the date of deal completion. According to the database definition, the effective date is the date when the entire transaction is completed and effective.
26. For example, merger arbitrage hedge fund assets under management reached $9.9 billion in 2000, more than double the year before. By the end of 2002, merger arbitrage hedge funds had more than $12.6 billion in assets under management. See HFR (2008).
27. We assumed that the growth in assets of merger arbitrage hedge funds was a reasonable indicator of the increase in investor interest in merger arbitrage.
28. See, for example, Jansen, Yechiely, and Srivastava (2007).
29. We computed loss from deal failure in two ways. One way was to assume that the arbitrageur invests in the merger the day after it is announced and unwinds the position the day after the deal is terminated. For deals that fail, the market becomes aware of the imminent failure long before the official deal termination. Therefore, we also computed losses under the assumption that the position is held for only half the deal period. Both analyses indicated that losses have declined since 1990.
30. The bid premium is the percentage by which the offer price exceeds the target's stock price. We calculated the bid premium as the ratio of the offer price to the target stock's average closing price from 50 to 25 days before the merger announcement day minus one.
31. See Bessembinder and Kaufman (1997) and Bessembinder (1999).
32. See, for example, Atiase (1985) and Dempsey (1989).

33. To remove outliers, we eliminated observations with arbitrage spreads in the top and bottom 1 percentiles.
34. Collars are bids in which the exchange ratio is contingent on the acquirer's stock price around the date of completion. Although collars may help reduce renegotiation risk, they make taking a position more difficult for arbitrageurs (Jaeger 2003). Thus, risk arbitrage transaction costs in mergers with collars are likely to be higher because arbitrageurs incur the additional cost of hedging the risk associated with a nonfixed exchange ratio.
35. To compute the decline in arbitrage spread, we proceeded as follows. First, for the *CASH*, *BIDPREMIUM*, and *HOSTILE* variables, we multiplied a change in a variable between 2002–2007 and 1990–1995 by its regression coefficient. Second, we added those products to obtain (0.1431 × −0.0503) + (−0.0672 × 0.1188) + (−0.0405 × 0.1041) = −0.0194.
36. Following the methodology outlined in Note 35, we obtained (0.1940 × −0.0503) + (−0.0949 × 0.1188) + (0.0086 × 0.1041) = −0.0201.
37. The difference between the log of the average RV for 1990–1995 and the log of the average RV for 2002–2007 is 0.53. The difference in the arbitrage spread related to volume is 0.53 × −1.347 percent = −0.72 percent.
38. See "The Incredible Shrinking Funds," *Economist* (23 October 2008):83–85.

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