

# Internet Appendix for “Financial Media, Price Discovery, and Merger Arbitrage”

This online appendix provides more details on mergers and acquisitions (Appendix A), merger arbitrage (Appendix B), transaction costs (Appendix C), additional summary statistics (Appendix D), and an investigation of institutional ownership (Appendix E). Numeric references to figures and tables (e.g., “Figure 1”) pertain to the main text of this paper. In contrast, figures and tables from this appendix use different labels, e.g. “Figure B.1” is the first figure in Appendix B.

## **A. Timeline of a Corporate Acquisition**

Although each corporate acquisition is different, a typical timeline can be described as follows (see also Figure 1). In the *pre-announcement phase*, the management and the boards of both the target and the acquirer are in private negotiations about the potential sale of the target to the acquirer and the conditions of this sale. This phase is often shrouded in secrecy, and even the employees of the target and the acquirer (with exception of the senior management) are not aware of the ongoing negotiations. The negotiations are usually facilitated by investment banks, who also treat any knowledge of the ongoing negotiations confidentially. The negotiations may break down at any point in time, or they may reach the next stage, at which point the planned merger is made public. The date when the deal is made public is called the *announcement date*. Its purpose is to inform regulators and the shareholders of the target and the acquirer

that a merger is in the making. The goal of the subsequent *post-announcement phase* is to obtain approval from both regulators and shareholders to complete the planned merger. If it is possible to obtain approval, the deal is *completed* and the firms merge. Otherwise the deal status is said to be *withdrawn* and the two companies continue to exist as two separate entities. The *resolution date* is the date when the merger either completes or is withdrawn.

Although most mergers fit into the timeline above, there are some deals where the pre-announcement phase is skipped and no negotiations take place prior to the announcement date. These deals are called *unsolicited* since there are no prior negotiations and the acquirer directly approaches the target's shareholders instead of the target's management or board. Most unsolicited deals end up being *hostile*, meaning that the target's management and board oppose the takeover. There are, however, also unsolicited deals that turn friendly, with the target's board and management supporting the planned acquisition.

## B. Profitability of Merger Arbitrage

Figure B.1 shows the number of merger deals in the portfolio over time. On average the portfolio consists of 30 mergers on any given trading day using the long-only investment strategy (i.e., buying the target) and of 19 mergers on average using the long-short investment strategy (i.e., additionally short-selling the acquirer if it is a stock deal). The latter number is lower because of missing exchange ratios or missing acquirer returns in stock deals.

The performance summaries of the merger arbitrage portfolios and for comparison the stock market are shown in Table B.1. Both the long-only and long-short portfolios

Figure B.1: Number of Invested Deals

This figure shows how many deals the merger arbitrage portfolio is invested in over time. The portfolio opens positions on the day after the merger announcement, and closes positions when the deal is either completed or withdrawn. The long-only portfolio buys the target stock, while the long-short portfolio additionally short-sells the acquirer stock in a stock deal, adjusted by the exchange ratio  $\delta$ . The long-short portfolio often invests in less deals than the long-only strategy because in some stock deals the exchange ratio or the acquirer return is not available, in which case this deal is skipped for the long-short portfolio.

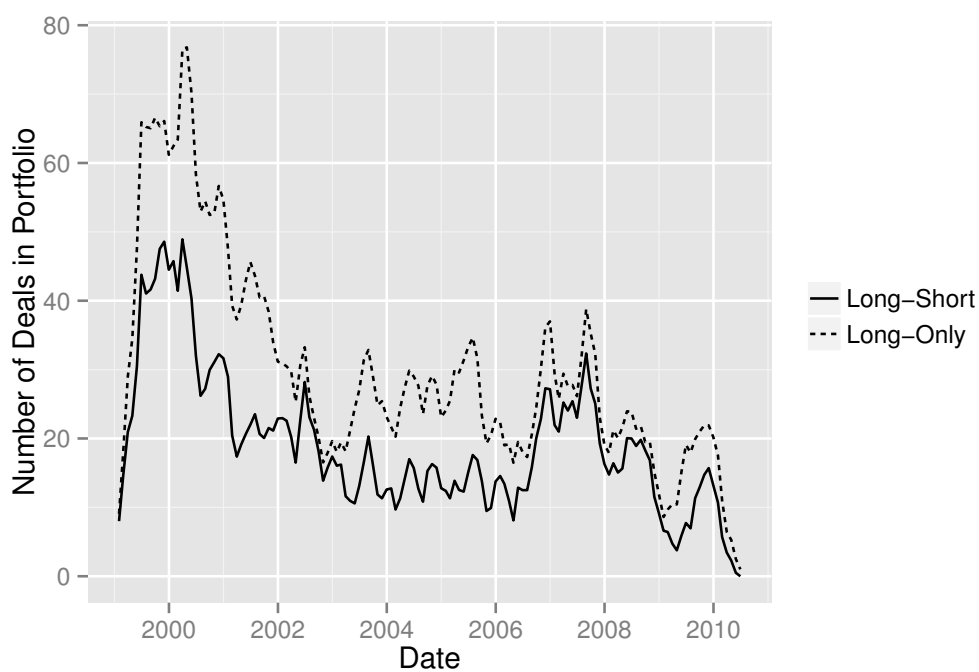


Table B.1: Performance Summary of Merger Arbitrage Portfolio

This table shows summary statistics for the return time series of the classic merger arbitrage portfolio in calendar time that only conditions on deal announcement, but not on financial media. We consider two portfolios representing the standard merger arbitrage strategy, and additionally the stock market for comparison. The first is a long-only portfolio that, for each announced merger deal, buys the target stock. The second is a long-short portfolio that buys the target stock and short-sells the acquirer stock in a stock deal, adjusted by the merger’s exchange ratio  $\delta$ . For skewness, \*, \*\*, and \*\*\* indicate significance at 10%, 5% and 1% respectively, according to the D’Agostino skewness test.

	Long-Only	Long-Short	Market
Annualized Return	16.2%	14%	1.98%
Annualized Volatility	21.9%	14.3%	21.8%
Sharpe Ratio	59.4%	75.8%	-3.75%
Max. Drawdown	-43.1%	-32.9%	-55.6%
Skewness	2.7***	1.8***	-0.01

outperform the market in terms of return, Sharpe ratio, and maximum drawdown. For example, the long-short merger arbitrage portfolio returns on average 14% per year, while the market returns 2% in our sample period. Skewness is positive for the merger arbitrage returns while it is approximately zero for the market. Thus, there is at least no obvious hint that skewness can explain the higher arbitrage returns. In any case, the higher merger arbitrage returns are in line with previous findings in the literature. For example Mitchell and Pulvino (2001) report an annualized merger arbitrage return of 16% for their sample period, while in our sample period we obtain with 14% slightly less, which is possibly due to our focus on larger stocks with more media coverage.

## C. Transaction Costs

While the merger arbitrage portfolios in Figure 3 and Table B.1 have returns significantly higher than the market, they also have a high turnover due to moving into newly announced mergers and moving out of closed mergers, meaning that direct and indirect transaction cost matter. It is therefore important to discuss the limitations imposed by transaction costs such as broker commissions and market impact. Mitchell and Pulvino (2001) present such results for the same merger arbitrage strategy as the one used in this paper, showing that their annualized portfolio return of 16.05% before transaction costs decreases to 10.64% after costs. This decrease provides an *upper bound* on transaction costs because their sample period ends before ours start, and it is well known that both direct and indirect transaction costs have decreased significantly since then. For example, per-share transaction costs at the end of their sample period in 1998 were \$0.04 per share, while today they are an order of magnitude lower at \$0.005 per share.

The results in Mitchell and Pulvino (2001) therefore suggest that a decrease of 34% ( $= 1 - 10.64/16.05$ ) in merger arbitrage returns is a conservative number to use for our sample period, which starts after theirs ends. Applying this estimate to the returns from Table B.1 shows that the long-only portfolio return is 10.7% ( $= 16.2\% \times 10.64/16.05$ ) while the long-short portfolio return is 9.3% ( $= 14\% \times 10.64/16.05$ ), *after* transaction costs. For comparison, the market *before* transaction costs has an annualized return of less than two percent during the sample period.

Besides the more recent sample period, there are a few other reasons why transaction costs are likely to be lower. First, while Mitchell and Pulvino (2001) have 4,750 merger deals in their sample, we restrict the sample to the largest 1,200 deals to begin with, to ensure sufficient media coverage (i.e., the number of press articles per deal-day),

which is essential for analyzing textual media content. This further puts downward pressure on transaction costs since bid-ask spreads as well as market impact are smaller for larger companies. Second, on average there are 30 deals in the long-only portfolio and 19 deals in our long-short portfolio (see also Figure B.1), and the holding period is three to four months on average, which means the portfolio does not frequently trade in and out of deals.

Finally, while the portfolios presented in Figure 3 and Table B.1 only condition on the announcement, but not on information in financial media, the main focus of this paper is on strategies that condition on media information. Specifically, the strategies invest in deals with high ex-ante merger completion probability and, importantly, skip deals with low ex-ante completion probability (because the merger arbitrageur prefers only deals that complete in the end). Compared to the classical merger arbitrage strategy, which invests in *all* announced deals, the strategies explored in this paper therefore invest in *fewer* deals by screening out the deals with high ex-ante likelihood of failure. The resulting transaction costs are therefore lower due to less frequent trading.

## D. Summary Statistics by Year

Summary statistics broken down by year are displayed in Table D.2. Two salient features are of particular importance. First, the probability of merger completion, calculated from media content, closely matches the ups and downs of overall merger activity. For example, in the late 1990s, with merger activity at its peak, the probability of merger completion was as high as 89%. In contrast, during the financial crisis of 2008, the probability dropped to 74%. Second, media coverage, i.e., the number of press arti-

Table D.2: Summary Statistics Year by Year

This table breaks down merger data and media data by years. The column *percentage of cash deals* refers to mergers where target shareholders got paid in cash only. The column *content* is the probability of merger completion, calculated from textual media content. *Coverage* is the average number of press articles per deal. Numbers in brackets are standard deviations. More details about the construction of the media measures are available in Section 3.

Year	Number of Mergers	Percentage of Cash Deals		Average Deal Duration		Target Market Value (\$ Billions)		Acquirer Market Value (\$ Billions)		Coverage During Deal		Content During Deal	
		Deals	Deals	Deal	Duration	Market Value	Market Value	Market Value	Market Value	During	Deal	During	Deal
1999	212	36%	36%	117 (96)	1.3 (3.6)	29.7 (63.3)	45.8 (66.0)	0.89 (0.14)					
2000	188	31%	31%	111 (71)	2.2 (8.7)	27.6 (76.1)	67.4 (297.1)	0.86 (0.21)					
2001	110	28%	28%	113 (57)	1.1 (2.6)	21.1 (44.1)	64.2 (98.6)	0.85 (0.15)					
2002	72	47%	47%	122 (120)	1.2 (6.0)	12.4 (33.6)	95.6 (237.5)	0.76 (0.23)					
2003	83	48%	48%	113 (79)	0.8 (1.8)	15.8 (42.2)	107.3 (305.1)	0.86 (0.18)					
2004	74	47%	47%	127 (80)	2.2 (7.6)	10.7 (22.1)	97.4 (175.2)	0.86 (0.20)					
2005	85	56%	56%	111 (63)	2.1 (6.0)	27.8 (48.8)	137.8 (275.1)	0.95 (0.08)					
2006	81	73%	73%	112 (64)	2.2 (7.4)	23.8 (38.7)	123.9 (370.2)	0.85 (0.16)					
2007	91	79%	79%	111 (81)	1.3 (1.6)	24.6 (51.8)	109.7 (250.6)	0.90 (0.13)					
2008	64	75%	75%	105 (94)	1.8 (5.2)	23.8 (53.4)	149.7 (507.9)	0.74 (0.27)					
2009	47	57%	57%	130 (87)	3.1 (9.5)	31.0 (45.8)	171.3 (270.0)	0.75 (0.20)					
Complete Sample	1107	48%	48%	115 (82)	1.7 (5.9)	23.7 (54.3)	92.0 (262.9)	0.86 (0.19)					

cles published, increases significantly over time. While in 1999 only 45.8 press articles were released for a given merger, this number went up to 171.3 in 2009. This could be due to increased investor attention, but also due to better data availability in later years.

## **E. Institutional Ownership**

Institutions are frequently considered to be more sophisticated investors and less subject to behavioral biases. Consequently, institutional ownership may correlate with more efficient stock prices. Thus, if a firm exhibits large institutional ownership, information may be reflected more quickly in its stock price. This is of particular importance in our research setting, where especially *media*-based information could be absorbed more quickly. If this is the case, it follows that the lagged media information-return relationship should become stronger when institutional ownership of the target is low, because media-based information is not arbitrated away so quickly by institutional investors.

To formally test this hypothesis, we add an interaction term between lagged media content and an institutional ownership dummy that is one if institutional ownership is below its median. Specifically, we consider a dummy based on the institutional ownership ratio, defined as the number of shares held by institutional investors, obtained from Thomson Reuters Institutional (13F) Holdings, divided by common shares outstanding from CRSP. If this ratio is lower, it means that ownership structure is tilted away from institutional investors, which means information may get incorporated more slowly into prices, making lagged media content more powerful in explaining merger arbitrage portfolio returns.



While we do find weak evidence for this hypothesis in Table E.3 in the sense that the interaction coefficient is positive, it is not significantly so. This means we cannot reject the hypothesis that media content differs in its effect on arbitrage returns depending on institutional ownership levels. The results stay insignificant if we interact with other variables, e.g., directly with the institutional ownership ratio instead of the dummy, or with percentage changes in institutional ownership (untabulated).

There are several reasons for the absence of an institutional ownership effect in our sample. First, merger arbitrage is run almost exclusively by institutional investors. This means that institutional ownership after the announcement, when merger arbitrageurs enter the market, is more evenly distributed. Since we consider exactly this time period after the announcement, it is not surprising that due to more evenly distributed institutional ownership, we fail to find a significant ownership effect. Second, we restrict our sample to the largest deals to begin with to ensure sufficient media coverage. It is important for our study to ensure that each merger deal receives enough media attention for the textual analysis to obtain statistical power, and only the largest deals command sufficient media coverage. However, the largest deals are those with more institutional ownership to begin with, due to smaller stocks being more illiquid and more difficult to trade for institutional investors who have more assets under management. As a consequence of the larger institutional ownership in our sample, institutional ownership is more evenly distributed and we fail to find a significant institutional ownership effect.

In total, while the interaction term between media content and institutional ownership has the right sign, consistent with media-based merger arbitrage becoming more easy when institutional ownership is low, it is not statistically significant, due to the higher concentration of institutional ownership in our sample.

Table E.3: Institutional Ownership

This table shows tests investigating how the media-return relationship varies with changes in institutional ownership. The dependent variables are portfolio returns of the merger arbitrage strategy, both for the long-only portfolio that buys the target and the long-short portfolio that buys the target and additionally short-sells the acquirer in stock deals, adjusted by the merger's exchange ratio  $\delta$ . The independent variables are lagged media content and coverage, as well as an interaction term between lagged media content and a dummy that is one if the target's institutional ownership ratio is below its median. The institutional ownership ratio is defined as shares held by institutional investors divided by common shares outstanding. Coefficients are multiplied by 100 for readability. Numbers in brackets show  $t$ -statistics. Stars indicate significance at 10%, 5%, and 1%.

	$r_{\text{Tar}} - r_f$	$r_{\text{Tar}} - \delta r_{\text{Acq}}$	$r_{\text{Tar}} - r_f$	$r_{\text{Tar}} - \delta r_{\text{Acq}}$
Intercept	-0.22** (-2.24)	-0.26*** (-2.75)	-0.12 (-1.00)	-0.19 (-1.59)
$r_{\text{Mkt}} - r_f$	74.17*** (61.77)	24.69*** (21.52)	74.18*** (61.79)	24.70*** (21.53)
SMB	31.97*** (12.36)	13.71*** (5.54)	31.94*** (12.35)	13.69*** (5.53)
HML	-22.79*** (-9.94)	10.92*** (4.98)	-22.79*** (-9.94)	10.92*** (4.98)
Content Lagged	0.32*** (2.83)	0.31*** (2.89)	0.20 (1.39)	0.23 (1.64)
Coverage Lagged	-0.00 (-0.03)	0.01** (2.50)	-0.00 (-0.02)	0.01** (2.51)
Low Inst. Ownership	0.03 (0.77)	0.03 (1.03)	-0.22 (-1.18)	-0.15 (-0.81)
Content Lagged * Low Inst. Ownership			0.31 (1.33)	0.22 (1.00)
R <sup>2</sup>	0.60	0.15	0.60	0.15
Num. obs.	2820	2820	2820	2820