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Financial Media, Price Discovery, and Merger Arbitrage

Matthias M. M. Buehlmaier and Josef Zechner*

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Abstract

Using merger announcements and applying methods from computational linguistics we find strong evidence that stock prices underreact to information in financial media. A one standard deviation increase in the media-implied probability of merger completion increases the subsequent 12-day return of a long-short merger strategy by 1.2 percentage points. Filtering out the 28% of announced deals with the lowest media-implied completion probability increases the annualized alpha from merger arbitrage by 9.3 percentage points. Our results are particularly pronounced when high-yield spreads are large and on days when only few merger deals are announced. We also document that financial media information is orthogonal to announcement day returns.

Keywords: Financial media, merger arbitrage, hedge funds, market efficiency, mergers and acquisitions.

JEL Codes: G11, G14, G34

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Whether competitive financial markets can efficiently aggregate information is one of the central questions in finance. Since a consensus seems to have been reached both in theory and in the empirical literature that prices of financial assets are not fully informationally efficient, recent research focusses on understanding the limits of arbitrage and the resulting dynamics of the price discovery. This paper contributes to this literature by applying methods of textual analysis in the context of a well defined corporate event: corporate mergers. Specifically, we analyze whether texts in financial media provide information about the probability of merger completion which is not already contained in the target stock price.

Analyzing price discovery in a merger context has several advantages. First, in contrast to many other corporate events such as earnings announcements, a *merger* announcement is largely unanticipated by the market and thus the time of information release is well defined. This is so because without inside information, it is almost impossible ex-ante to predict the exact pairing of firms involved and the exact timing of the announcement (see, e.g., Palepu (1986)). Second, the relevant information for the short-term price dynamics of the target is also well defined, namely information about the probability of merger completion. Thus, this information is unambiguously observable ex post since there are only two possible outcomes, observable ex post without measurement error: either the merger is withdrawn or the two companies complete the merger. Furthermore this final outcome is known relatively quickly, on average within three to four months after the merger announcement. This greatly simplifies our research design compared to other studies that focus on merger synergies, which are difficult to measure and may take years to materialize.

To measure the stock market reaction to new information from the merger announcement, we use a variant of the common merger arbitrage strategy described in

Mitchell and Pulvino (2001). Specifically, the merger arbitrage strategy is a risky bet, initiated on the merger announcement date by a deal outsider (the merger arbitrageur), who bets that the merger will complete. In the simplest case, illustrated in Figure 1, the arbitrageur buys the stock of the target company if he believes that the merger is going to complete. If later this belief turns out to be true and the merger indeed completes, the profit is the positive difference between the bid price and the target's stock price (the so-called arbitrage spread). On the other hand, if the merger fails and the companies do not merge, the arbitrageur typically loses money, since he has to sell the target company's stock at a loss. The distinguishing feature of this strategy is that it is a simple bet on merger completion.

To estimate the probability of merger completion, we use a model from computational linguistics and apply it to textual media content from press articles and newswire articles. Specifically, we analyze the words in each press article to calculate a media content measure, which relates this textual information to the probability of merger completion. In symbols, $P(\text{completion}) = f(\text{media content})$, i.e., we model the probability of merger completion as a function of textual media content.

We find strong evidence that stock prices underreact to information in financial media both in event time as well as in calendar time tests. Our cross-sectional regressions show that a one standard deviation increase in the media-implied probability of merger completion results in an increase of 1.2 percentage points in the subsequent twelve-day stock return (2.2 percentage points per month) of the target firm. Furthermore, we find that when we vary the holding period after the announcement day from one to twelve days, the return effects of a given increment in media-implied merger completion probability increase monotonically, implying that information indeed is slow-moving.

We find that merger arbitrage becomes significantly more profitable if one uses me-

dia information to filter out those announced deals with low completion probability. If one uses media information to eliminate those deals with a media-implied completion probability of less than or equal to 85%, which is equivalent to filtering out approximately 28% of all announced deals, then this increases the annualized risk-adjusted return of the trading strategy (i.e., the "alpha" of the Fama and French (1993) three-factor model) by 9.3 percentage points.

We find that price efficiency relative to media information varies with financial market conditions. Following Axelson et al. (2013) we use the Merrill Lynch US High Yield Master II Option-Adjusted Spread to proxy for market conditions and find that media-based profits are particularly large and significant when it is hard for institutional investors to lever up, as indicated by a large high-yield spread. In this case, annualized risk-adjusted returns increase by 11.3% when filtering out deals with low ex-ante media-implied completion probability. By contrast, such profits decrease significantly or vanish completely when high-yield spreads are small.

We also explore whether price efficiency is related to the ownership structure of the target firm. The hypothesis is that media-related information may get more quickly into prices when institutions make up a larger proportion of the target's investors. When we include an interaction term of lagged media content and an institutional ownership dummy, we find that the sign of the coefficients support the above hypothesis, but that the result lacks statistical significance.

Finally, we analyze whether our findings are systematically related to the number of merger announcements made on a particular day. This would be the case if, for example, market participants are subject to limited attention. We therefore distinguish between Mondays when usually more mergers are announced, and other days of the week. On Mondays on average seven mergers are announced, whereas this number is

less than four on other days of the week. We find that on Mondays media information does not help to predict merger arbitrage returns, consistent with capacity limits for financial media to process useful information.

The media measure for merger completion discussed so far is based on textual media *content*, but we also examine an alternative media measure based on media *coverage*. Coverage, which counts the number of press articles being released, is fundamentally different to content because it ignores the textual information contained in each press article. As such, it may be easier to manipulate, and prior studies have shown that media coverage may be biased by firms seeking to manipulate their stock price (Ohl et al. (1995) and Ahern and Sosyura (2014)), e.g., by hiring public relations firms and running media campaigns, or through advertising (Bushee and Miller (2012) and Gurun and Butler (2012)). In this sense, coverage complements our content measure. *Coverage* may *capture* manipulation attempts, while our *content* measure is designed to *filter out* manipulation in order to extract fundamental information about merger completion.

We find weaker results for media *coverage*, consistent with the notion that coverage may be easier to manipulate. For example, our time series regressions show that a one standard deviation increase in media *coverage* yields an increase in annualized merger arbitrage returns of only 3.6 percentage points, whereas the same change in lagged media *content* yields a larger increase in annualized returns of 11.2 percentage points. Furthermore, a trading strategy based on media *coverage* is statistically insignificant, while the same trading strategy based on media *content* significantly increases annualized alphas by 9.3 percentage points.

These results show that in order to extract slow-moving real information about merger completion from financial media, it is *not* sufficient to simply use media *coverage*. Instead, a deeper investigation is required and it is important to examine the *content*

of those press articles using textual analysis.

We also find weak evidence in favor of a certification role of the media. We restrict the construction of our media measures to the top newspapers and top newswires to separately investigate their information content. We find that often these top news sources contribute more novel information to the market, consistent with their certification role to stock market investors.

We find that media information released on the announcement day provides information not captured by announcement day returns. In fact, announcement day returns and media measures are orthogonal to each other, suggesting that they convey different kinds of information. Specifically, since the media content measure already captures the probability of merger completion, announcement day returns seem to reflect other information such as assessing whether the completed merger would create or destroy value in the long run.

To the best of our knowledge, this is the first paper to model the probability of an economic outcome as a *direct* function of textual media content. Unlike other studies in the finance literature, we do not take a detour by investigating whether a given word invokes "positive" or "negative" psychological associations, since this particular information is not of direct relevance for our research question. This is particularly important, since it has been shown by Loughran and McDonald (2011) that financial texts may be easily misclassified. We tackle this problem at its root by *directly* relating each word in a press article to merger completion, which is the central focus of this study. That is, we infer, directly from the data, the *meaning* of each word regarding *merger completion*. In contrast to prior studies, we do not impose meaning in a potentially subjective or ad hoc way, but instead we let the data speak by estimating meaning directly from the data. A consistency check of the most important words identified

by our algorithm confirms that these are *not* random words from data dredging and instead capture economically meaningful textual content about merger completion.

The remainder of the paper is organized as follows. Section 1 reviews the related literature. We then introduce the merger arbitrage investment strategy in Section 2 and explain how we quantify media information in Section 3. In the remaining sections we describe and analyze the data: Section 4 details our data and shows summary statistics, while Section 5 presents our regression results. Finally, Section 7 concludes.

1. Related Literature

Our paper is related to several strands of literature. First, it is connected to work on the profitability of merger arbitrage strategies. Examples for this literature are Larcker and Lys (1987), (Dukes et al. (1992), Karolyi and Shannon (1999), and Jindra and Walkling (2004)). Although the profitability of merger arbitrage has been decreasing over time (Jetley and Ji (2010)), these papers document that substantial risk premia can be realized from merger-related investment strategies, even when based solely on publicly available information.

Potential explanations for these findings include market inefficiencies such as limits to arbitrage (Baker and Savaşoglu (2002) and Officer (2007)) as well as trading costs and premia for providing liquidity during market downturns (Mitchell and Pulvino (2001) and Mitchell et al. (2007)). Another explanation proposed by Cornelli and Li (2002) is that merger arbitrageurs have an informational advantage relative to target shareholders because arbitrageurs, hiding among noise traders, know that they bought shares. The good performance of merger arbitrage has also been attributed to hedge funds' better management of downside risk (Cao et al. (2014)), to investors underre-

acting to the passage of time after the merger announcement (Giglio and Shue (2014)), or to probability weighting (Wang (2014)).

Other studies suggest that even prior to the announcement day, some inside information may leak into options markets (Jayaraman et al. (1991), Cao et al. (2005), Chan et al. (2013), and Augustin et al. (2014)). In contrast to this literature, our study does not focus on the profitability of merger arbitrage strategies per se, but instead analyzes how fast post-announcement information from financial media gets incorporated in stock prices and whether the results differ across time and/or cross-sectionally.

Our paper is also related to the literature on slow-moving information in financial markets. Several papers find that stock prices are sluggish to incorporate new information. One of the most salient findings is described in Huberman and Regev (2001), where a reprint of a more than five months old story causes stock prices to soar. While this case might have been an isolated incident, it has been shown using larger samples that indeed some information diffuses slowly into asset prices, with contributions including Klibanoff et al. (1998), Chan (2003), Mitchell et al. (2007), Duffie (2010), Tetlock (2010), Tetlock (2011), Mitchell and Pulvino (2012), Da et al. (2014), Manela (2014), Peress (2014), and Scherbina and Schlusche (2015). We also study potentially slow-moving information. Compared to most existing studies, mergers provide a more structured setting for such an analysis since they define a clear-cut timeline of information flow, namely the time window between the announcement date and the time of ultimate resolution of the merger outcome, i.e., the time when it becomes known that the merger will go through or not. This allows us to capture new information arriving at the market via financial media and to disentangle it from already stale information. In addition, we shed light on cross-sectional and time-series variation of the speed with which merger-related information from financial media gets reflected in stock prices.

Third, our paper is related to the literature on the role of media in mergers and acquisitions more generally. Liu and McConnell (2013) show that managers, who have reputational capital at risk, can be swayed by media attention to abandon value-reducing acquisition attempts. Another channel through which the media can influence merger outcomes is through costly signaling, with the media transmitting fundamental information on whether the merger creates or destroys value (Buehlmaier (2013)). On the other hand, instead of providing novel information, the media can also introduce noise to financial markets, with sensationalist merger rumors published about firms that interest the newspapers' readers (Ahern and Sosyura (2015)). There may also be attempts to manipulate the media in order to sway investors (Ahern and Sosyura (2014)). This is consistent with the notion that public relations and marketing campaigns are effective not only in non-financial contexts, but also when people make *financial* decisions (Ohl et al. (1995), Cook et al. (2006), Bushee and Miller (2012), Solomon (2012) and Lou (2014)). This study contributes to this literature by identifying a specific information transmission channel through textual media content about merger completion and by examining the information diffusion in the context of mergers.[1]

Finally, our paper is related to finance applications of textual analysis outside the area of financial media. For example, a growing literature analyzes the textual content of corporate filings such as 10-K statements (Hoberg and Phillips (2010), Li (2010), Loughran and McDonald (2011), Jegadeesh and Wu (2013), Buehlmaier and Whited (2016), Hoberg et al. (2014), and Loughran and McDonald (2014a)) or SB-2/S-1 filings

[1]In a broader context, financial media are receiving increasing attention in the literature. In addition to the papers cited above, recent contributions include Veldkamp (2006), Tetlock (2007), Dyck et al. (2008), Tetlock et al. (2008), Bhattacharya et al. (2009), Fang and Peress (2009), Dyck et al. (2010), Da et al. (2011), Engelberg and Parsons (2011), Griffin et al. (2011), Dougal et al. (2012), Engelberg et al. (2012), Gurun and Butler (2012), Kuhnen and Niessen (2012), García (2013), Fang et al. (2014), Liu et al. (2014), and Solomon et al. (2014).

(Hanley and Hoberg (2010) and Loughran and McDonald (2013)). Other sources of textual information that have been analyzed include stock message boards on the internet, assessing the impact of investor opinions on management announcements, stock market volatility, and trading volume (Das and Chen (2007) and Antweiler and Frank (2004)) or central bank announcements (Loughran and McDonald (2014b), Romer and Romer (2004), Rosa and Verga (2007), Rosa (2011), Lucca and Trebbi (2009), and Schmeling and Wagner (2015)). While our paper uses similar algorithms to capture textual information as some of these studies, it differs by focusing on the information content of financial media during merger events and on the speed at which this information gets incorporated in stock prices.

2. Introducing Merger Arbitrage

As discussed above, the central question that this paper analyzes is how quickly information contained in financial media published prior and up to the merger announcement date gets reflected in stock prices. This is equivalent to asking whether information from financial media can explain the cross-section and/or the time-series of post-announcement date stock returns of the companies involved. This section sets the stage for our analysis by briefly defining merger arbitrage investment strategies and clarifying the terminology surrounding it.

There are two types of merger deals. In a *cash deal*, the acquirer pays in cash for the target. On the other hand, in a *stock deal* the acquirer issues new (acquirer) stock and uses this stock to pay for the target. (Some stock deals may also have a cash component; following the literature we treat those deals as all-stock deals, i.e., we ignore the cash component.) A typical timeline of a merger is shown in Figure 1 and

more background information on a merger's timeline is given in the Internet Appendix (available at www.buehlmaier.net).

In a cash deal, the merger arbitrageur buys the target stock on the stock market immediately after the public announcement of the merger. If the merger completes, the arbitrageur makes a profit equal to the difference between the (cash) bid price and the price of the target stock when he bought it. If the merger is withdrawn, the arbitrageur sells his target stock, usually at a loss. This investment strategy illustrates that merger arbitrage is a bet on merger completion, since the arbitrageur only makes a profit if the merger completes.

If part of the merger payment consists of acquirer stock, the merger arbitrageur buys the target stock, and additionally shorts the acquirer stock. This is done to lock in a profit in case the merger completes. Suppose for example that the exchange ratio, usually fixed at the announcement of the merger, is $\delta = 0.6$, which means that upon merger completion, each target stock will be converted into $\delta = 0.6$ newly-issued acquirer stocks. Given the target's and acquirer's stock prices, this exchange ratio reflects the premium paid to target shareholders. For example if the target's stock price is \$50 and the acquirer's stock price is \$100, then $\delta = 0.6$ corresponds to a premium of $0.6 \times \$100 - \$50 = \$10$ above the target's stock price of \$50, i.e., a premium of 20%. To capture this premium, the merger arbitrageur buys a target stock and short-sells $\delta = 0.6$ acquirer stocks, thus obtaining a positive net cash flow of \$10 at the announcement of the merger. When the merger later completes, he unwinds his positions at a net cash flow of zero by converting the target stock to $\delta = 0.6$ acquirer stocks and using these stocks to cover his short position. This means his total profit is positive if the merger completes. On the other hand, if the merger is withdrawn, the arbitrageur suffers a loss because the spread between the target stock and acquirer stock typically widens as

a result of the failed merger. Again, this strategy shows that merger arbitrage is a bet on merger completion, since the arbitrageur profits only if the merger completes.

We therefore define *long-short* merger arbitrage returns as

$$r_{LS} = r_{Tar} - \delta r_{Acq}, \tag{1}$$

where r_{Tar}, r_{Acq} denote the target stock return and the acquirer stock return, respectively. For stock deals, the exchange ratio δ is positive so that r_{LS} is long the target and short the acquirer. For cash deals, the exchange ratio δ is zero so that the return r_{LS} is given by the target's return, and is thus in this case a long-"short" return only in a degenerate sense.

In addition to this long-short merger arbitrage strategy, we also consider a simplified investment strategy that always invests in the target stock, independent of whether the acquisition is a cash deal or a stock deal. The return of this strategy is simply

$$r_L = r_{Tar}. \tag{2}$$

To ensure that there is no look-ahead bias in our analysis, we follow the common practice in the literature and start the analysis with the first trading day *after* the merger's announcement day.

3. Quantifying Information in Financial Media

This section describes how we capture information about merger completion from financial media. We first identify press articles and newswire articles which mention the names of both the acquirer firm and the target firm in the first 100 words of the

article and which have been published in a period that starts with the week prior to the announcement date and ends with the resolution date. While the universe of articles thus covers the whole merger period, our analysis will avoid any look-ahead bias. For example, in cross-sectional regressions where we use returns consisting of the first few trading days after the announcement, we only use media information released up to the announcement day, but not thereafter.

Our main media measure captures the probability of merger completion, calculated from media *content*. We thereby analyze *all* the words in a press or newswire article, thus analyzing media content. We then relate media content directly to the probability of merger completion, since this is the central determinant of the ultimate profitability of the merger arbitrage strategy, defined in equations (1) and (2). In symbols, we model the ex-ante probability of merger completion as a function f of media content as follows:

$$P(\text{merger completion}) = f(w_1, w_2, \ldots, w_n), \tag{3}$$

where $(w_1, w_2, \ldots, w_n)$ is the word count vector. Thus w_i, $i = 1, \ldots, n$, is the count of word i in the given media article. For example, if $w_i = 8$ then word i appears eight times in the press article. Importantly, we do *not* restrict the words to a potentially subjective set of keywords. Instead, we keep all words that appear in all press articles in order to "let the data speak" and to allow for a more precise estimation of our statistical model in Equation (3).

Following the literature on computational linguistics, the word count vector $(w_1, w_2, \ldots, w_n)$ is a simplified representation of a given press article, disregarding word order or grammar and keeping the count of each word. While some information such as word order is lost, it is a standard way of representing text documents in computational

linguistics, because it retains important information about media content (Bird et al. (2009)).

To relate the word count vector $(w_1, w_2, \ldots, w_n)$ to the probability of merger completion, we employ one of the best-established models used in computational linguistics for text classification (Lewis (1998) and Zhang (2005)). In particular, we use the naïve Bayes model to represent the function f in Equation (3). As the name suggests, this model is simply based on an application of Bayes' theorem to obtain conditional probabilities. To avoid any look-ahead bias, we use a rolling estimation, using press articles from the previous quarter to estimate the model, before applying it to press articles in the current quarter. This methodology is robust to using different time window lengths.

While Equation (3) analyzes media content for a single media article, we aggregate this media content measure for a given deal-day when *several* press articles are released on that day. To this end, we average the merger completion probabilities of all press articles that pertain to a given merger deal on a given day. Specifically, since we aggregate press articles for a single merger deal (and not for several deals, which could have different firm sizes), we *equal*-weight the completion probabilities. Since each probability is between one and zero, the averaged aggregate media content measure is also between one and zero. Its interpretation thus remains unchanged, so the aggregate media content measure captures the probability of merger completion for a given merger deal on a given day.

In addition to media *content*, we also employ an alternative media measure, media *coverage*, that captures the arrival intensity at which new information is provided by financial media. Media coverage is a much simpler measure than content, since coverage ignores the words in each article and instead counts how many press articles are released on a given day about a given merger. For example, if coverage is equal to eight on a

given day, it means that eight press articles were published about the merger on that day. To capture the surprises in coverage, we additionally consider an adjusted version of media coverage by subtracting its exponentially-weighted moving average (EWMA).

While being simpler than media content, media coverage may also be easier to manipulate (Ahern and Sosyura (2014)). Furthermore, media coverage may be less clearly related to the probability of merger completion than media content, as it will be mostly driven by the intensity at which new information becomes available to financial media.

4. Data, Summary Statistics, and First Results

The following Section 4.1 describes our data sources, Section 4.2 provides summary statistics, and Section 4.3 shows preliminary results.

4.1. Data

We obtain merger-related information from Thomson Reuters SDC Platinum. Since we want to analyze whether price relevant information about mergers is contained in financial media and how fast this information is impounded in stock prices, it is crucial to obtain accurate announcement dates. While problems with SDC announcement dates have been reported, especially for years before 1984, it is well-known that SDC is accurate for the time period of our sample (Barnes et al. (2014)).

We include the SDC categories "disclosed value mergers & acquisitions", "tender offers", and "exchange offers", while we exclude "undisclosed value mergers & acquisitions" since the value of the merger deal should be known. We apply the following screens to the merger data. The merger's announcement date must be in the eleven

years between January 1, 1999 and December 31, 2009, which ensures that we include both the dot-com bubble and the financial crisis of 2007–2008. Both the target and the acquirer have to be public companies to ensure that stock market data are available. We remove all non-US companies to avoid cross-border mergers, since national interests instead of economic forces often dominate the discussion in those deals (Dinc and Erel (2013)). We also exclude challenged deals, where a second bidder makes an offer to buy the target *after* the merger announcement has been made. Challenged deals make up less than 2% of the sample. We exclude them because the competitive nature of auctions can lead to fundamentally different media dynamics that are not the focus of this study. (This is not to say that unchallenged deals have no competition; auctions do take place *before* the announcement of a deal, i.e., before a firm enters our sample, but there is no data available on these auctions because they are conducted in strict confidentiality by the participating investment banks.) Following common practice in the literature, we also exclude industries that are subject to strong regulation where market forces often have less influence on outcomes, i.e., energy and power, financials, and government and agencies. Deals where the acquirer CUSIP and target CUSIP are identical are removed to avoid contaminating the sample with self-tenders or recapitalizations. We only keep deals where the deal status is completed or withdrawn, where the acquirer owns more than 50% of the target shares after a merger, and where the acquirer purchases at least 20% of the outstanding shares. Of the merger deals that survive these screens, we keep the largest 1200 deals, as measured by deal value (i.e., the value of the target).

After having created our sample containing the mergers, we add data from the financial press from Dow Jones Factiva, stock market data from the Center for Research in Security Prices (CRSP), and accounting data from Compustat. A key challenge is

to match our merger data from SDC with data from Factiva. To ensure the highest possible data quality, we manually construct text strings that can be used as search terms in Factiva. We do this separately for the target and acquirer, leaving us with 2400 manually constructed search terms. For example, we search for "IBM or International Business Machines" to capture several variations by which this company is referred to in the press. We then recombine those search terms by requiring that both the search term for the target and the acquirer occur in the first 100 words of a press article. Downloading articles that appear later than the seven days preceding a merger's announcement date and before a merger's resolution date leaves us with a sample of 130,589 press articles from Factiva. After merging all databases we are left with 1107 mergers.

To be able to separately investigate the information content of newspapers containing the largest number of articles, we define a group called *top newspapers* that contains the union of the top four newspapers and the top four domestic newspapers, as measured by the number of merger-related articles. This set is given by The Wall Street Journal (2,873 articles), The New York Times (1,621 articles), Financial Times (1,613 articles), The Globe and Mail (956 articles), The Washington Post (757 articles), and eWeek (743 articles). For comparison, we also consider newswires. Since the top newswire, Dow Jones News Service (15,298 articles), already contributes more articles than the top newspapers combined, we only focus on the Dow Jones News Service when analyzing top newswires.

4.2. Summary Statistics

The most important variable for the return of merger arbitrage strategies, deal status, is shown in Table 1. Almost 90% of all mergers complete. However, there is still a

10.1% chance that the merger gets withdrawn, in which case a merger arbitrage strategy typically incurs substantial losses. It is therefore of great economic importance to have an ex-ante information of the likelihood of merger completion.

The following Table 2 shows that the unconditional media content measure, which is supposed to measure the probability of merger completion based on media information, closely matches the unconditional probability of merger completion from the previous Table 1. The former's mean is 87.0%, while the latter is 89.9%, which shows that the media's ex-ante estimate of merger completion is *on average* consistent with the fact that ex-post 89.9% of mergers complete. This does not imply, however, that media correctly predict *individual* merger outcomes, which is a separate question investigated later.

The remaining contents of the table are as expected, with targets holding more cash and having a higher book to market ratio than acquirers (Jensen (1986)), a positive stock market reaction on the announcement date for the target and a negative reaction for the acquirer, an average premium of 33% paid by the acquirer over the target's stock price, and the median duration of each merger of approximately three months.

Table 3 investigates media content and media coverage in event-time of a typical merger—before, during, and after the merger announcement. It is important to keep in mind that the media data *before* the announcement is determined with hindsight and can at the earliest be calculated on the announcement day. The probability of merger completion, calculated from textual media content, increases to 0.87 on the announcement date from 0.82 in the preceding week. The standard deviation decreases to 0.21 from 0.32 in the preceding week, implying that media content becomes more precise on the announcement date, consistent with more information being released on the announcement. Media coverage shows that although no public announcement

about the merger has been made, on average seven articles per day are published in the week before the announcement, mentioning both the target firm and the acquirer firm. There could already be some rumors in the press about the impending merger, but a simpler explanation is that both the acquirer and the target do business in related areas or industries. Even if there is a latent rumor about a potential merger, it is certainly not hot, since media coverage increases by over 170% to 19 articles on the announcement date. Consistent with the smaller standard deviation of media content on the announcement date, the sudden spike in coverage indicates that more merger-related information is released on the announcement date. The Internet Appendix provides additional summary statistics.

4.3. First Results

4.3.1. Evidence on the Profitability of Merger Arbitrage Strategies

We now present first evidence on the profitability of merger arbitrage strategies, without conditioning on media-based information. This analysis constitutes a benchmark which allows us to measure the unpriced news content in financial media.

Figure 2 shows the event-time merger arbitrage returns for the target, the acquirer, and the long-short merger arbitrage strategy starting on the first trading day *after* the announcement. The solid lines represent completed mergers, while the dashed lines represent withdrawn mergers. The plots illustrate that it makes a fundamental difference for the merger arbitrageur whether he invests in a deal that will be completed or in a deal that will be withdrawn. While merger completion/withdrawal becomes only known with certainty at the very end of a merger (on average about three to four months after the announcement), Figure 2 shows that prices seem to incorporate this

information gradually. We will analyze below whether these price dynamics already reflect the information about deal completion contained in financial media.

In Figure 3 we show the calendar-time performance of the classical merger arbitrage portfolio that invests in a deal on the day after the announcement and exits on the resolution day when the merger is either completed or withdrawn. At this stage, we do not condition on information in financial media and instead follow the literature in only conditioning on the fact that a merger has been announced. Consistent with previous findings in the literature, we document that the merger arbitrage portfolio has high returns compared to the market even when not conditioning on additional information except the announcement. Additional information on the profitability of merger arbitrage and the impact of transaction costs can be found in the Internet Appendix.

4.3.2. Evidence on Media Content and Media Coverage

This section provides a first set of findings related to the two media information measures.[2] Figure 4 shows time series plots for both media content and media coverage. Recall that the media content measure captures the media-implied probability of merger completion. The plot shows clearly that media content differs depending on whether the merger is going to complete at the end, with ex-post completed mergers having an ex-ante media-based completion probability consistently above 75%, with a slightly rising trend over time. On the other hand, merger arbitrageurs would like to avoid deals that will not complete, and media content already picks up this information ex-ante. For withdrawn deals, the probability of completion continually drops as time goes on,

[2]The Internet Appendix contains additional results, such as the most important words picked up by the linguistic model.

providing a clear signal that the merger is less likely to complete. While this plot does not tell us how quickly this information is revealed *relative to the stock market reaction*, it does tell us that already on the announcement day, media content provides an informative signal about merger completion because the solid line is above the dashed line on this day. Media content is thus an informative signal on the announcement day about whether the merger will complete. Also later it picks up information about merger completion, potentially faster than the stock market.

The second plot in this figure shows media coverage, split up by completed and withdrawn merger deals. A clear spike is visible at time zero for both types of deals, showing that the announcement day is particularly important as more press articles and newswire articles get released. After the announcement day, media activity decreases as the surprise of the announcement wanes off. It appears that completed deals receive slightly less media coverage than withdrawn deals, consistent with potential media manipulation attempts of "bad" deals that will later be withdrawn (Ahern and Sosyura (2014)), or alternatively, because withdrawn deals have higher information intensity due to negative news coming out over time, correcting the initially upbeat merger announcement.

Before investigating its relation to stock prices, we provide evidence that the media content measure in fact predicts actual ex-post merger completion and thus captures the information it is supposed to measure.

To this end, we use a probit model to regress an ex-post merger completion dummy on the media content measure, using only press articles released on the announcement day and discarding articles released thereafter. The timing is important because the media measure on the announcement day uses information released on average more than one hundred days *before* the actual merger completion takes place. Furthermore,

as in the rest of this paper, to estimate the media measure itself, we use a rolling window (instead of the whole sample consisting of all mergers) to ensure that this is an out-of-sample test and that no look-ahead bias occurs.

Specifically, we use a probit regression of the standard form

$$P(\text{ex-post completion}) = \Phi(\beta_1 + \beta_2 \times (\text{ex-ante media content})),$$

where P denotes probability, Φ is the standard normal distribution, and β_1 and β_2 are the regression coefficients shown in Table 4. We find that the media content estimate is significantly positive, confirming that media indeed pick up information about actual ex-post merger completion, even when we restrict media to the announcement date and discard media articles from thereafter.

We then visualize the estimated probit model in Figure 5, showing the fitted probit line and confidence intervals. The average sample marginal effect (i.e., the average slope) is 0.18. This positive marginal effect underlines the importance of the media content measure in identifying mergers that will later be withdrawn (i.e., not completed). Importantly, the slope is steeper for deals with lower probabilities of completion, showing that for those deals to be avoided by the merger arbitrageur, the media measure has more information content.

5. Merger Arbitrage and Information in Financial Media

In this section we investigate the central question of this study: Do financial media contain fundamental information not yet incorporated in stock prices? As discussed

above, our main variable of interest is the probability of merger completion, calculated from textual media content, to which we refer to as "media content."

5.1. Media and Announcement Day Returns

We first provide evidence on how media content and media coverage are related to firm and deal characteristics and to each other. The regressions in the first two columns of Table 5 show that media coverage and media content are negatively related to each other, implying that more press articles are released for mergers that have a low probability of merger completion. This is not caused by a size effect, since the regressions control for various deal characteristics and firm characteristics, including size. Except for the acquirer's book to market ratio, media content is unrelated to firm characteristics of acquirer or target, indicating that media content contains information not captured by firm features. Regarding deal characteristics, the negative correlation of the unsolicited dummy with media content is consistent with unsolicited mergers being mostly hostile, which means they have a lower probability of merger completion.

Media coverage, on the other hand, correlates positively with target size, acquirer size, and the acquirer's cash. The first two results are consistent with the notion that larger mergers generate more media attention. The correlation of media coverage with acquirer's cash may be interpreted as suggestive evidence consistent with the acquirer trying to manipulate media coverage in his favor, e.g., by hiring PR firms to spin the news (Ohl et al. (1995), Bushee and Miller (2012), Gurun and Butler (2012), Buehlmaier (2013), and Ahern and Sosyura (2014)). However, in case the acquirer indeed tries to spin the news, he is not very successful in influencing the media-implied probability of merger completion, calculated from media content, since acquirer cash is insignificant in the first regression in Table 5. This is consistent with the media content measure

filtering out potential manipulation attempts.

The second and third columns of Table 5 display results from regressing announcement day returns of the target and the acquirer on various explanatory variables. Not surprisingly, they are positively related to each other, but they are unrelated to both media coverage and media content. Media coverage and the probability of merger completion, calculated from textual media content, are therefore not reflected in the stock market's assessment of the merger announcement. In this sense, media information is orthogonal to announcement day returns and contributes novel information to financial markets. It also means that announcement day returns capture additional information that is not directly related to merger completion, for example an assessment of whether the merger creates or destroys long-term value.

5.2. Cross-sectional Merger Arbitrage Results

In Table 6 we relate merger arbitrage returns to the probability of merger completion, constructed from textual media content, and media coverage, adjusted for coverage surprises. The cross-sectional regressions in this table are predictive in the sense that all independent variables are known before the dependent variables. In particular, the media variables are constructed using data from the announcement day, while dependent variables are cumulative merger arbitrage returns from the first trading day *after* the announcement day until twelve trading days later (Baker and Savaşoglu (2002)). While twelve trading days are *short* compared to the standard merger arbitrage strategy that holds until merger resolution, it is *long* for our purpose, since we only focus on media information released on the announcement day and do not include any press articles released thereafter. In an efficient market, this information should be *immediately* incorporated into asset prices on the day after the announcement day. However, we will

report results for holding periods shorter and longer than twelve trading days below and also in Section 5.3.

We consider target stock returns, excess target stock returns (over the risk-free interest rate and over the stock market's return) and returns from the long-short investment strategy described earlier in Section 2. We find that the probability of merger completion, constructed from media content, strongly predicts target stock returns over the following twelve days, while media coverage strongly predicts the long-short investment strategy. In particular, a one standard deviation increase in the media-implied probability of merger completion yields an increase in the target stock return of 1.2 percentage points over the subsequent twelve days. Assuming 22 trading days per month, this corresponds to an increase in monthly returns by 2.2 percentage points, an economically as well as statistically meaningful number. Similarly, a one standard deviation decrease in media coverage yields a long-short return that is 1.3 percentage points larger over the subsequent twelve days, corresponding to 2.3 percentage points on a monthly basis.

While these are event-date returns and it is not possible to earn them on a continuous basis, there are approximately eight merger announcements per month in our sample. Merger events thus occur frequently enough to make the increase in event-time returns economically relevant.

In Table 7 we repeat the analysis from the previous Table 6, with the difference that media data is restricted to be from top news sources. For the top newswire Dow Jones News Service in columns one and two, the coefficients of media content and media coverage increase in absolute value compared to Table 6, where all news sources were used. Likewise, the goodness of fit of the regressions increases, as measured by R^2. These results show that the media-implied probability of merger completion is driven by the top newswires. On the other hand, restricting attention to the top newspapers

in columns three and four does not yield significant media coefficients. This might be due to the fact that the top newspapers only publish relatively few press articles, which implies that the number of cross-sectional observations drops to less than 200 in Table 7 from over 900 in Table 6. Despite the small number of observations, however, the goodness of fit of the newspaper regressions are highest among all cross-sectional merger arbitrage return regressions, with R^2's of up to 11.5%, showing that the top newspapers improve the overall fit of the model considerably.

After establishing that media information has predictive power for merger arbitrage returns, we investigate how quickly media information is absorbed in stock prices. To this end, we repeat the baseline regression from Table 6 with different holding periods for the left-hand side return. While previously in Table 6, the holding period was twelve days starting from the first trading day *after* the merger's announcement day, we now vary the holding period from one day to sixteen days and plot the resulting media content coefficients in Figure 6. If markets are efficient, the holding period beyond the first day should not matter since the media information should already be reflected in prices and Figure 6 should plot horizontally. However, we find that the plot increases steadily until it peaks at a twelve-day holding period, confirming that it takes approximately 2.5 trading weeks before stock prices fully react to the media content measure. Importantly, independent of the holding period, the media content measure only uses information from the merger's announcement day and no information afterwards, so the media's information content is held constant as we increase the return's holding period. Thus the higher return is not due to more information, but it is the *same* information that takes longer to get absorbed into prices. In summary, we find that information provided by financial media only gradually gets reflected in stock prices over a period of approximately 12 trading days.

5.3. Time Series Tests of Media-based Merger Arbitrage

After establishing in the previous section that information in financial media has cross-sectional predictive power for merger arbitrage returns, we investigate next its time series properties in calendar-time from several angles. We begin by examining a simple trading strategy. If the ex-ante probability of merger completion, calculated from textual media content on the announcement day, correctly predicts subsequent arbitrage returns, one should invest in mergers with a high probability of completion and stay away from the remaining mergers. One way to do this is to choose a media content threshold and invest in a deal if announcement day media content is above this threshold, while staying away from deals below the threshold. For each given threshold, we can thus identify a subset of mergers to invest in. For the identified mergers we then form a merger arbitrage portfolio and calculate risk-adjusted returns in calendar time.

While being simple, this investment strategy allows us to test whether risk-adjusted arbitrage returns depend on announcement date media information. In particular, if the media content threshold is larger on the announcement date, we exclude more mergers with low probability of completion, and should therefore have higher arbitrage returns, because arbitrage returns are a bet on merger completion. So if merger arbitrage returns are a function of media content, we should observe higher risk-adjusted arbitrage returns for higher media content threshold levels.

Specifically, to formally test this hypothesis, we calculate risk-adjusted arbitrage returns for a range of media content threshold levels and plot them and their p-values in Figure 7. We calculate risk-adjusted arbitrage returns from the time series of long-short arbitrage portfolio returns starting on the day after the announcement day until twelve trading days later to investigate how the media information released on the

announcement day (while excluding media thereafter) is absorbed in stock prices in the following trading days. If several deals are open in the twelve day range, we average them in calendar-time to form the arbitrage portfolio. We then regress these arbitrage returns on the stock market return and the Fama/French factors to control for risk (Fama and French (1993)). The risk-adjusted arbitrage return, or "Jensen's alpha," is the intercept of this regression and the p-value comes from the intercept as well. The terms "risk-adjusted returns" and "alphas" are used interchangeably.

We find that, consistent with our hypothesis, risk-adjusted arbitrage returns of this trading strategy are an increasing function of the media content threshold, which represents the ex-ante probability of merger completion based on textual media content. Except for the largest threshold levels, where fewer observations are available, an increase in ex-ante media content yields a higher arbitrage return, consistent with the notion that merger arbitrage is a bet on merger completion.

The risk-adjusted arbitrage returns are statistically and economically significant. For all threshold levels, the strategy outperforms the benchmark strategy with threshold zero that blindly invests in all mergers, independent of media content. On an annualized basis, the alpha increases from 8.8% when investing in all deals (i.e., the media content threshold is zero) to a maximum of 18.1% when screening out deals that lie below the media content threshold of 0.85. (This threshold is equivalent to filtering out 28% of all announced deals.) This change in alpha corresponds to an increase of 9.3 percentage points in annualized risk-adjusted returns when following a simple trading strategy based on media content.

Our results also show that the alpha is 8.8% when investing in *all* deals independent of media (i.e., the media threshold is zero). This is consistent with earlier findings (see, for example, (Baker and Savaşoglu (2002))and a number of possible explanations have

been discussed in the literature. We show that these naive merger strategies do not reflect media information and that novel media information takes several days to be absorbed in stock prices, as shown by the increase in calendar-time merger arbitrage returns to 18.1% when trading on financial media information.

Importantly, this increase in returns is accomplished by trading *less*. Because we screen out mergers with a low probability of completion, we obtain a higher return by investing in fewer mergers, which should lower trading costs.

For media coverage, we find that consistent with earlier cross-sectional results, the risk-adjusted arbitrage returns are a decreasing function of announcement day media coverage. However, the alphas are statistically insignificant, thus contrasting with the stronger results for media coverage.

After investigating the time series properties of a simple trading strategy based on announcement day media content and coverage, we next look into the time series properties of media *after* the announcement date as well. The timing is now different, since we no longer restrict media to articles published on the announcement day, and instead construct a time series that averages *all* media content across deals in calendar time from announcement to the merger's resolution. Furthermore, we no longer restrict the portfolio holding period to the first twelve trading days after the announcement and instead include the whole deal duration in the portfolio.

Specifically, in the spirit of Mitchell and Pulvino (2001), we regress time series of arbitrage returns on lagged time series of media measures and controls in Table 8 according to the following specification in calendar-time:

$$r_t = \beta_0 + \beta_1 \times \text{content}_{t-1} + \beta_2 \times \text{coverage}_{t-1} + \beta_3^{'} \times \text{controls}_t$$

Here r_t is either the aggregate target excess return or the aggregate long-short merger arbitrage return, media content and coverage are aggregated and lagged by one trading day, and controls include the market and the Fama-French factors. For each calendar day t, aggregation is done across all open deals. Because we are focusing only on the largest deals to begin with, and because the portfolio only holds a small number of stocks (30 stocks on average for the long-only portfolio and 38 for the long-short portfolio), we aggregate across deals by equal-weighting the arbitrage returns and the media measures on each day.

For all specifications, we find a positive and significant coefficient for the lagged media content measure, capturing the probability of merger completion from textual information. For example, for the long-short merger arbitrage investment strategy, an increase of one standard deviation in lagged media content yields an increase in annualized returns of 11.2 percentage points. As in previous tests in this paper, this is an economically and statistically significant number. The time series variation for media coverage is different compared to earlier tests. While media coverage has a significantly negative sign in the cross-sectional regressions, it now is insignificant for the long-only portfolio and significantly positive for the long-short portfolio, due to the inclusion of the whole duration of the merger. The economic magnitude of this effect is smaller than for lagged media content: a one standard deviation increase in lagged media coverage increases the long-short annualized return by 3.6 percentage points.

Table 9 repeats the regressions from Table 8 using media information from only the top news sources. With the exception of top newspapers for the long-short portfolio, all lagged media content variables are significantly positive, thus predicting merger arbitrage returns as expected. For the long-only portfolio, the top newspapers yield an increase in annualized returns of 10.0 percentage points for a one standard deviation

increase, while the top newswire yields an increase of 14.4 percentage points. Furthermore, despite fewer observations, the R-squared measures are higher, indicating a better model fit using only a subset of the media data. This shows that information from the top news sources matters more due to better quality or due to a certification effect of the top news sources. In contrast to media *content*, the media *coverage* coefficients are all insignificant. This finding again underlines the importance of using standard yet sophisticated textual analysis on press and newswire articles, instead of simply counting the number of articles.

6. Determinants of Price Efficiency

In this section we explore potential factors that may influence the extent to which financial media contains information not reflected in stock prices and the speed at which this information gets into prices. We first focus on financial market conditions that may influence the degree to which arbitrageurs are active. Then we analyze effects of the number of merger deals announced on a particular day. Finally, we ask if the ownership structure of the target firm is associated with its price efficiency with respect to financial media information.

6.1. Capital Market Conditions, Financial Media, and Stock Prices

In this subsection we explore whether financial and economy-wide credit conditions may play an important role because they determine the availability of leverage (Axelson et al. (2013)). If credit conditions are favorable, it may be easier for merger arbitrageurs to leverage their bets on merger completion and to trade more aggressively on available ex-ante information about merger completion, including information from financial media.

On the other hand, if credit conditions worsen, then trading on information in financial media becomes more difficult and media-based information is therefore arbitraged away more slowly, yielding higher predictive power of media content.

We test this hypothesis by investigating the interaction between lagged media content and a variable capturing debt market condition. Building on Axelson et al. (2013), we use the Merrill Lynch US High Yield Master II Option-Adjusted Spread, obtained from the Federal Reserve Bank of St. Louis, to capture economy-wide credit conditions. If this high yield spread is large, credit conditions are unfavorable for arbitrageurs. As a consequence it may be more difficult to take arbitrage positions based on media information, leading to higher predictive power of media content.

To this end, we regress the time series of the merger arbitrage portfolio's returns on an interaction term between the time series of lagged media content an the high yield spread, as well as controls. Consistent with the above hypothesis, Table 10 shows that the interaction term between the high yield spread and lagged media content is significantly positive. A one standard deviation increase in the high yield spread makes *daily* returns by 0.35 percentage points more responsive to changes in lagged media content, corresponding to 7.6 percentage points per month. This number is economically large, and indicates a strong effect of market conditions on the media-return relationship.

To further investigate how our simple trading strategy from the beginning of Section 5.3 depends on economy-wide credit conditions, we update our previous results by splitting up the trades depending on whether the high yield spread is large or small. In this test, we collect media content on the announcement day (but not thereafter). We then invest in a deal starting on the next day if media content and its captured probability of merger completion is above a given threshold. Deals below that threshold

are excluded. We then repeat this strategy for all threshold levels and plot the results separately for both small and large levels of the high yield spread.

Consistent with our hypothesis, Figure 8 shows that the media-based trading strategy works very well when the high yield spread is above its median. For example, in this case, the annualized risk-adjusted return increases by 11.3 percentage points when filtering out deals with an ex-ante merger completion probability below 90% (which is equivalent to filtering out 39.5% of all announced deals). Thus, when the high yield spread is large, media-based information does not get arbitraged away by investors, possibly due to the unavailability of leverage. If, on the other hand, the spread is below its median, media content on the announcement day loses its predictive power. In these periods markets seem to react very quickly and stock prices seem to be efficient with regard to information in financial media.

6.2. Merger Monday

Next we investigate whether the media-return relationship is affected by the amount of new information released on a particular day. We see two possible channels through which the amount of information could have an effect. First, there is a literature that documents that investors are subject to limits of attention (see e.g., Kahneman (1973), Hirshleifer and Teoh (2003), Barber and Odean (2008), and Da et al. (2011)). Thus, if many mergers are announced simultaneously, investors are not able to spend as much attention on each one, thus leading to less efficient prices. If this is true, then we should see a stronger media-return relationship on such days. Alternatively, limits of attention may be affecting the quality of the news media reports on each merger. Here the premise is that the analysis and evaluation of new corporate information by media journalists takes time and effort. Thus, when many mergers are announced simultaneously, the

precision of information reflected in news media may be lower, and therefore the media-return relation becomes weaker or should even temporarily reverse.

To explore these alternative hypotheses, we investigate the effects of Merger Mondays, which are characterized by a larger number of mergers being announced and more news articles released. Figure 9 shows that on Mondays, on average seven mergers are announced, while this number is less than four on all remaining days of the week, on Fridays even dropping to two. New announcements are also reflected in increased media activity with a distinctive spike of press articles released on Monday. The reasons are that the details of mergers are often finalized over the weekend and announced on Monday morning, or that merger announcements are held on purpose until Monday morning, hoping for a full week of positive press following the announcement. In any case, more mergers accumulate over the weekend and are released on Mondays, resulting in a burst of new activity due to more information coming out.

While it is well-known that Merger Mondays exist and therefore more mergers are announced, it is important to keep in mind that it is *not* known which mergers are going to be announced, i.e., who merges with whom. This means that merger arbitrageurs know in advance that more information will be coming out on Monday, but they do not know in advance which information it is going to be. In this sense, as in the rest of this paper, merger announcements can be treated as unanticipated and exogenous, as it is well known that without inside information it is almost impossible to exactly predict the pairing of firms and the timing of the announcement (see, e.g., Palepu (1986)).

We use the fact that more mergers are announced as a proxy for either less precise media information or fewer active arbitrageurs per deal. Table 11 investigates whether the media information released on Mondays has weaker predictive power for merger arbitrage returns. We run two sets of analyses as follows.

First we restrict the sample to the day following Monday (i.e., Tuesday) because we are interested in how *lagged* media variables are related to returns. In other words, we use the subset of data that corresponds to media information from Monday and returns from Tuesday. We find that media content coefficients switch sign and become negative, consistent with the hypothesis that more and potentially less precise information released makes it more difficult to generate arbitrage profits based on information published in financial media on that day. As a matter of fact, using media information on this day actually hurts performance. Second, we use the whole sample but add an interaction term that captures media information released on Monday. Again, because we use *lagged* media variables, this dummy is for Tuesday's returns. Consistent with our hypothesis, we find that a one standard deviation increase in media content on a Monday significantly lowers annualized long-short returns by 4.8 percentage points.

Taken together, the evidence in this subsection suggests that financial media information is getting noisier when a large number of different merger deals are reported. Thus, the results are more supportive for the second hypothesis laid out above, namely that limits of attention lead to less accurate information in financial media on such days.

6.3. 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 arbitraged 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 12 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 im-

portant 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.

7. Conclusion

Using merger announcements and applying methods from computational linguistics we provide strong evidence that stock prices underreact to information in financial media. A one standard deviation increase in the media-implied probability of merger completion on the day of the announcement raises the return of a long-short merger strategy over the 12 post-announcement days by 1.2 percentage points. We find that the effect of a given increment in media-implied merger completion probability increases monotonically when we extend the holding period from one to 12 days after the announcement. Thus, media information takes several days before it is fully reflected in stock prices. In time-series analyses we find that filtering out those deals with media-implied completion probabilities of 85% or less, which corresponds to 28% of the total sample, increases the annualized alpha from merger arbitrage by 9.3 percentage points.

The above findings vary significantly with financial market conditions. Following Axelson et al. (2013) we use the Merrill Lynch US High Yield Master II Option-Adjusted Spread to proxy for market conditions and find that media-based excess returns are particularly large and significant when it is hard for institutional investors to lever up, as indicated by a large high-yield spread. Specifically, annualized risk-adjusted returns increase by 11.3% when filtering out merger deals with low ex-ante media-implied probability of merger completion. By contrast, such profits vanish when high-yield spreads are small.

We also analyze whether our findings are systematically related to the number of merger deals announced on a particular day. To this end we distinguish between Mondays when the number of announcements is typically large, and other days of the week. Indeed we find that media information is only useful on days other than Mondays. Possibly the information processing by financial media becomes noisier on days with many announcements.

Interestingly, we show that media information is unrelated to announcement day returns. Thus, the cross-section of announcement returns seems to be less driven by differences in completion probabilities but instead by differences in longer-run value creation by the merger deals.

While the main focus of the paper is the analysis of media content, i.e., the particular words used in media and their information content for the completion probability, we also explore an alternative media measure based on media coverage. This measure only counts the number of press articles being released. While this is much simpler to measure, it may also be easier to manipulate (Ohl et al. (1995) and Ahern and Sosyura (2014)). Indeed we find that the results based on this measure are much weaker. In fact, a trading strategy based on media coverage is statistically insignificant. Thus, to

extract information about merger completion from financial media, it is important to analyze the content of those articles using textual analysis.

Taken together, our findings document that financial media contain fundamental information about the real economy that is not already reflected in stock prices. This study thereby contributes to our understanding of the limits and determinants of market efficiency, since our research design allows us to clearly identify the timing of information release and the subsequent market reactions. To this end, we provide a novel perspective on a specific channel of information transmission in financial markets and on the conditions which influence the speed at which this transmission takes place.

Table 1: Summary Statistics of Deal Characteristics

The variable *Deal Status* indicates whether the acquirer merged with the target. *Stock Deal* indicates whether the acquirer paid for the merger using its own stock or cash only. If *Stock Deal* is *yes*, at least 50% of the merger consideration offered is in the form of acquirer equity. The variable *Unsolicited* denotes whether the acquirer made an offer without prior negotiation with the target.

Variable	Levels	Observations	%
Deal Status	withdrawn	112	10.1
	completed	995	89.9
Stock Deal	no	529	47.8
	yes	578	52.2
Unsolicited	no	1037	93.7
	yes	70	6.3

Table 2: Summary Statistics of Continuous Variables

The variable $Content_{DA}$ denotes the probability of merger completion, calculated from textual media content on the announcement day. $Coverage_{DA}$ is the media coverage surprise on the announcement day. Section 3 details the construction of these media measures. The number δ denotes the merger's exchange ratio, and r_{Tar}, r_{Acq}, r_{Mkt}, and r_f are the target's return, the acquirer's return, the stock market's return, and the return on the risk-free rate starting on the first trading day after the announcement day until twelve days afterwards. These returns capture the returns to merger arbitrageurs. Following the literature, the announcement date is excluded from the return calculation since merger arbitrageurs are assumed to open their stock trading positions after the announcement day. The remaining variables are firm characteristics such as cash to total assets, book to market, and size ($ millions), followed by announcement day returns, the merger's duration in days, and the premium paid by the acquirer. All returns are log-returns, and the premium is also expressed using logarithms.

Variable	Min	P_{25}	Mean	Median	P_{75}	Max	Std. Dev.
Content_{DA}	0.00	0.83	0.87	0.99	1.00	1.00	0.21
Coverage_{DA}	-0.42	4.86	17.73	9.68	19.08	649.56	34.51
r_{Tar}	-0.97	-0.02	-0.01	0.00	0.02	0.75	0.12
$r_{\text{Tar}} - r_f$	-0.97	-0.02	-0.01	0.00	0.02	0.75	0.12
$r_{\text{Tar}} - r_{\text{Mkt}}$	-0.98	-0.04	-0.01	0.00	0.04	0.69	0.12
$r_{\text{Tar}} - \delta r_{\text{Acq}}$	-0.97	0.00	0.01	0.00	0.02	0.70	0.09
Tar. Cash/Total Assets	0.00	0.04	0.28	0.20	0.47	0.99	0.26
Acq. Cash/Total Assets	0.00	0.04	0.21	0.13	0.32	0.93	0.22
Tar. B/M	0.00	0.22	0.52	0.42	0.69	5.52	0.45
Acq. B/M	0.01	0.17	0.40	0.31	0.54	3.28	0.34
Tar. Size	2965.04	126593.50	1666167.28	376215.75	1125051.18	106213318.06	5895458.97
Acq. Size	23700.25	886775.22	23736267.96	3292817.12	16451593.36	531153308.38	54332026.58
$r_{DA,Tar}$	-1.02	-0.02	0.01	0.00	0.03	0.55	0.08
$r_{DA,Acq}$	-0.40	-0.03	-0.01	0.00	0.02	0.31	0.06
Deal Duration	0.00	65.50	114.81	92.00	138.00	1063.00	82.03
Premium	-1.93	0.17	0.33	0.32	0.49	1.30	0.28

Table 3: Summary Statistics of Media Content and Media Coverage
This table splits up the timeline of a merger into three periods: the pre-announcement period (Panel A), the announcement date (Panel B), and the post-announcement period (Panel C). The pre-announcement period is the week before the merger announcement, while the post-announcement period ends on the merger's resolution date, when the merger either completes or is withdrawn. *Media content* is the probability of merger completion, calculated from textual analysis of press articles. In all panels, media content and media coverage are further divided into all news sources, the top newspapers, and the top newswire. The top newspapers consist of The Wall Street Journal, The New York Times, Financial Times, The Globe and Mail, The Washington Post, and eWeek. The top newswire is Dow Jones News Service. More details about the construction of the media measures are available in Section 3.

			Percentile			
	Mean	Std. Dev.	25th	50th	75th	Obs.
Panel A: Media Information Before Announcement Date						
Number of articles per deal-day	6.55	12.17	1	2	6	265
Number of top newspaper articles per deal-day	2.48	2.14	1	2	3	67
Number of top newswire articles per deal-day	2.75	2.71	1	1	4	71
Average media content per deal-day	0.823	0.319	0.83	1.00	1.00	265
Average media content in top newspapers per deal-day	0.720	0.427	0.28	1.00	1.00	67
Average media content in top newswire per deal-day	0.773	0.364	0.64	1.00	1.00	71
Panel B: Media Information During Announcement Date						
Number of articles per deal-day	19.42	31.15	6	11	21	958
Number of top newspaper articles per deal-day	2.29	2.08	1	1	3	159
Number of top newswire articles per deal-day	3.86	5.47	1	2	4	898
Average media content per deal-day	0.873	0.210	0.83	0.99	1.00	958
Average media content in top newspapers per deal-day	0.859	0.310	1.00	1.00	1.00	159
Average media content in top newswire per deal-day	0.890	0.250	0.98	1.00	1.00	898
Panel C: Media Information After Announcement Date						
Number of articles per deal-day	4.17	9.33	1	2	4	25426
Number of top newspaper articles per deal-day	2.01	2.19	1	1	2	3807
Number of top newswire articles per deal-day	1.50	1.47	1	1	1	7211
Average media content per deal-day	0.821	0.330	0.82	1.00	1.00	25426
Average media content in top newspapers per deal-day	0.757	0.393	0.51	1.00	1.00	3807
Average media content in top newswire per deal-day	0.812	0.357	0.92	1.00	1.00	7211

Table 4: Ex-ante Media Content and Ex-post Merger Completion

This table shows a probit regression of an ex-post merger completion dummy on ex-ante media content. The probit model is of the standard form

$$P(\text{ex-post completion}) = \Phi(\beta_1 + \beta_2 \times (\text{ex-ante media content})),$$

where P denotes probability, Φ is the standard normal distribution, and β_1 and β_2 are the regression coefficients shown in the table below. The media content measure captures the media-implied probability of merger completion, estimated from textual analysis of press and newswire articles. For this regression, we only keep articles released on the merger's announcement date, and discard all later articles. It is therefore a highly predictive regression because merger completion (or withdrawal) on average takes place three to four months after the announcement. This regression is a consistency check to verify that the (ex-ante) media content measure captures information about actual (ex-post) merger completion. Numbers in brackets show z-statistics. Stars indicate significance at 10%, 5%, and 1%.

	Ex-Post Merger Completion
Intercept (β_1)	0.41^{**}
	(2.07)
Ex-Ante Media Content (β_2)	1.02^{***}
	(4.42)
McFadden R^2	0.03
Nagelkerke R^2	0.04
Num. obs.	960

Table 5: Media Measures and Announcement Day Returns

The first two regressions' dependent variables are the probability of merger completion, calculated from textual media *content*, and EWMA-adjusted media *coverage* surprises. Both media measures only use press articles appearing on the announcement day but not thereafter. The dependent variables of the last two columns are the announcement day returns of the target and the acquirer. The regression coefficients ">0" or "<0" denote positive or negative numbers that are too small to print, given the number of digits after the decimal mark. Numbers in brackets show t-statistics. The symbols *, **, and *** indicate significance at 10%, 5%, and 1%, respectively, based on robust standard errors.

Dependent Variable:	Content_{DA}	Coverage_{DA}	$r_{DA,Tar}$	$r_{DA,Acq}$
Intercept	0.933***	-123.777***	0.020	-0.054**
	(12.025)	(-6.524)	(0.563)	(-2.243)
Content_{DA}		-16.114**	0.007	-0.003
		(-2.283)	(0.402)	(-0.319)
Coverage_{DA}	-0.001***		<0	>0
	(-2.962)		(-0.927)	(0.085)
log(Tar. Cash/Total Assets)	-0.003	-0.116	-0.002	-0.002
	(-0.656)	(-0.243)	(-1.112)	(-1.334)
log(Acq. Cash/Total Assets)	0.009	2.409***	>0	-0.001
	(1.378)	(2.842)	(0.082)	(-0.348)
log(Tar. B/M)	-0.012	2.204**	-0.002	-0.001
	(-1.603)	(2.238)	(-0.688)	(-0.793)
log(Acq. B/M)	-0.019*	1.224	0.003	0.003
	(-1.777)	(1.235)	(0.917)	(1.158)
log(Tar. Size)	-0.009	10.874***	-0.003	-0.001
	(-1.255)	(7.947)	(-1.593)	(-0.338)
log(Acq. Size)	0.004	1.438**	0.001	0.004***
	(0.821)	(2.282)	(0.455)	(3.127)
$r_{DA,Tar}$	0.056	-9.202		0.232***
	(0.400)	(-0.890)		(4.677)
$r_{DA,Acq}$	-0.046	1.057	0.390***	
	(-0.319)	(0.085)	(6.823)	
Unsolicited=Yes	-0.196***	7.330	0.030**	-0.004
	(-5.338)	(0.804)	(2.175)	(-0.581)
Stock Deal=Yes	0.008	2.795	0.007	-0.019***
	(0.534)	(1.294)	(1.374)	(-5.478)
Premium	-0.010	-0.444	0.025***	-0.004
	(-0.447)	(-0.232)	(2.759)	(-0.644)
R^2	0.108	0.281	0.119	0.155
Observations	910	910	910	910

Table 6: Predicting Merger Arbitrage Returns Cross-sectionally

This table shows predictive regressions of merger arbitrage returns on the probability of merger completion (calculated from textual media *content*), EWMA-adjusted media *coverage* surprises, and control variables. The media measures are constructed using data from the announcement day, while dependent variables are cumulative stock returns from the first trading day *after* the announcement day until twelve trading days later. The regressions are predictive in the sense that independent variables are known before the dependent variables. The regression coefficients ">0" or "<0" denote positive or negative numbers that are too small to print, given the number of digits after the decimal mark. Numbers in brackets show t-statistics. The symbols *, **, and *** indicate significance at 10%, 5%, and 1%, respectively, based on robust standard errors.

Dependent Variable:	r_{Tar}	$r_{\text{Tar}} - r_f$	$r_{\text{Tar}} - r_{\text{Mkt}}$	$r_{\text{Tar}} - \delta r_{\text{Acq}}$
Intercept	-0.088	-0.088	-0.064	0.066
	(-1.512)	(-1.514)	(-1.257)	(0.938)
Content_{DA}	$0.056^{\star\star\star}$	$0.056^{\star\star\star}$	$0.045^{\star\star}$	-0.009
	(2.857)	(2.838)	(2.492)	(-0.335)
Coverage_{DA}	>0	>0	>0	$<0^{\star\star}$
	(0.524)	(0.578)	(0.885)	(-2.165)
log(Tar. Cash/Total Assets)	$-0.006^{\star\star}$	$-0.006^{\star\star}$	$-0.006^{\star\star}$	<0
	(-2.492)	(-2.460)	(-2.282)	(-0.141)
log(Acq. Cash/Total Assets)	<0	<0	-0.001	0.002
	(-0.030)	(-0.007)	(-0.527)	(1.079)
log(Tar. B/M)	0.001	0.001	0.002	>0
	(0.242)	(0.242)	(0.434)	(0.130)
log(Acq. B/M)	0.002	0.002	-0.001	-0.003
	(0.261)	(0.303)	(-0.180)	(-0.569)
log(Tar. Size)	-0.001	-0.001	-0.001	-0.002
	(-0.160)	(-0.178)	(-0.301)	(-0.585)
log(Acq. Size)	0.002	0.002	0.001	-0.001
	(0.888)	(0.892)	(0.549)	(-0.357)
$r_{DA,Tar}$	-0.070	-0.071	-0.049	0.022
	(-0.639)	(-0.644)	(-0.479)	(0.240)
$r_{DA,Acq}$	$0.228^{\star}$	$0.229^{\star}$	$0.205^{\star}$	-0.057
	(1.913)	(1.922)	(1.810)	(-0.595)
Unsolicited=Yes	$0.022^{\star}$	$0.023^{\star}$	0.013	0.002
	(1.813)	(1.837)	(1.196)	(0.163)
Stock Deal=Yes	-0.010	-0.010	$-0.011^{\star}$	$0.018^{\star}$
	(-1.391)	(-1.396)	(-1.682)	(1.706)
Premium	0.017	0.017	0.011	-0.009
	(0.800)	(0.796)	(0.554)	(-0.503)
R^2	0.036	0.036	0.033	0.034
Observations	910	910	910	624

Table 7: Merger Arbitrage Returns and Top News Sources

This table runs the same predictive regressions as in Table 6, with the difference that only top news sources are used for the construction of the media measures. The top newswire is Dow Jones News Service (columns one and two), while the top newspapers (columns three and four) consist of The Wall Street Journal, The New York Times, Financial Times, The Globe and Mail, The Washington Post, and eWeek. We only focus on a single newswire for comparison since it alone produces more articles than the top newspapers combined. The regression coefficients ">0" or "<0" denote positive or negative numbers that are too small to print, given the number of digits after the decimal mark. Numbers in brackets show t-statistics. The symbols *, **, and *** indicate significance at 10%, 5%, and 1%, respectively, based on robust standard errors.

	Dow Jones	Dow Jones	Top Newspapers	Top Newspapers
Dependent Variable:	$r_{\text{Tar}} - r_f$	$r_{\text{Tar}} - \delta r_{\text{Acq}}$	$r_{\text{Tar}} - r_f$	$r_{\text{Tar}} - \delta r_{\text{Acq}}$
Intercept	-0.101*	0.037	-0.046	0.140**
	(-1.723)	(0.626)	(-0.403)	(2.184)
Content$_{DA}$	0.069***	0.012	0.028	0.004
	(3.896)	(0.649)	(1.447)	(0.234)
Coverage$_{DA}$	0.001	-0.003*	0.001	0.001
	(0.672)	(-1.773)	(0.788)	(0.200)
log(Tar. Cash/Total Assets)	-0.006**	<0	-0.008*	-0.002
	(-2.502)	(-0.190)	(-1.660)	(-0.608)
log(Acq. Cash/Total Assets)	0.001	0.003	-0.003	0.001
	(0.253)	(1.267)	(-0.696)	(0.365)
log(Tar. B/M)	0.001	0.001	-0.004	-0.006
	(0.291)	(0.348)	(-0.623)	(-1.107)
log(Acq. B/M)	0.003	-0.004	0.001	<0
	(0.409)	(-0.567)	(0.036)	(-0.019)
log(Tar. Size)	-0.001	-0.001	-0.005	-0.011***
	(-0.251)	(-0.223)	(-0.707)	(-2.808)
log(Acq. Size)	0.003	-0.001	0.005	0.001
	(1.007)	(-0.550)	(0.820)	(0.314)
$r_{DA,Tar}$	-0.066	0.009	-0.267	-0.063
	(-0.622)	(0.093)	(-0.955)	(-0.475)
$r_{DA,Acq}$	0.193	-0.090	0.728**	-0.004
	(1.532)	(-0.877)	(2.174)	(-0.033)
Unsolicited=Yes	0.031**	0.011	0.006	0.011
	(2.238)	(0.868)	(0.248)	(0.512)
Stock Deal=Yes	-0.009	0.019*	-0.023	0.007
	(-1.207)	(1.790)	(-1.455)	(0.572)
Premium	0.015	-0.012	-0.043	-0.043
	(0.680)	(-0.656)	(-0.761)	(-1.345)
R^2	0.040	0.043	0.115	0.086
Observations	853	584	195	129

Table 8: Time Series Tests of Merger Arbitrage Returns

This table shows time series regressions of merger arbitrage portfolio returns on media measures. The dependent variables are portfolio returns of either the long-only merger arbitrage strategy that buys the target stock after the announcement, or the long-short strategy that in addition to buying the target also short-sells the acquirer in stock deals, adjusted by the exchange ratio δ. The dependent variables include media measures consisting of lagged textual media *content*, capturing the media-implied probability of merger completion, as well as lagged media *coverage*, capturing how many press/newswire articles are released per deal-day. In case more than one merger deal is open at any given date, the returns and the media measures are averaged across all open deals. 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	-0.21^{**}	-0.19^{**}	-0.20^{**}	-0.24^{***}
	(-2.20)	(-2.10)	(-2.13)	(-2.59)
$r_{\text{Mkt}} - r_f$	74.17^{***}	24.72^{***}	74.17^{***}	24.69^{***}
	(61.79)	(21.52)	(61.78)	(21.52)
SMB	32.01^{***}	13.89^{***}	32.02^{***}	13.77^{***}
	(12.38)	(5.61)	(12.38)	(5.57)
HML	-22.77^{***}	11.10^{***}	-22.77^{***}	10.95^{***}
	(-9.94)	(5.06)	(-9.93)	(5.00)
Content Lagged	0.32^{***}	0.29^{***}	0.32^{***}	0.31^{***}
	(2.82)	(2.69)	(2.81)	(2.86)
Coverage Lagged			-0.00	0.01^{**}
			(-0.09)	(2.43)
R^2	0.60	0.15	0.60	0.15
Num. obs.	2820	2820	2820	2820

Table 9: Time Series Tests of Arbitrage Returns: Top News Sources
This table shows the same regressions as in Table 8, with the difference that only top news sources are used in constructing the media measures. "TNP" refers to the top newspapers, "TNW" refers to the top newswire, "LO" refers to the long-only merger arbitrage portfolio that buys the target stock after each announcement, while "LS" refers to the long-short arbitrage portfolio that buys the target and additionally short-sells the acquirer in a stock deal, adjusted by the exchange ratio δ. Coefficients are multiplied by 100 for readability. Numbers in brackets show t-statistics. Stars indicate significance at 10%, 5%, and 1%.

	TNP LO	TNP LS	TNW LO	TNW LS
Intercept	-0.03	-0.01	-0.13^{***}	-0.15^{**}
	(-0.69)	(-0.13)	(-2.59)	(-2.56)
$r_{\text{Mkt}} - r_f$	73.22^{***}	23.13^{***}	73.68^{***}	25.81^{***}
	(50.75)	(14.28)	(67.73)	(20.79)
SMB	35.20^{***}	18.82^{***}	31.70^{***}	12.44^{***}
	(12.06)	(5.74)	(13.60)	(4.67)
HML	-21.41^{***}	16.82^{***}	-23.74^{***}	11.80^{***}
	(-8.36)	(5.85)	(-11.44)	(4.98)
Content Lagged	0.11^{**}	0.07	0.21^{***}	0.21^{***}
	(2.20)	(1.18)	(3.85)	(3.38)
Coverage Lagged	0.00	0.01	-0.00	0.01
	(0.05)	(0.92)	(-0.10)	(1.21)
R^2	0.64	0.12	0.68	0.16
Num. obs.	1767	1767	2469	2469

Table 10: Availability of Leverage to the Arbitrageur

This table shows tests investigating how the media-return relationship varies with changes to the availability of leverage to the merger arbitrageur. The dependent variables are the returns of the merger arbitrage portfolios, both 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 δ. The independent variables include lagged media content, coverage, and controls, as well as an interaction term between lagged content and a standard variable capturing conditions in the credit markets, the Merrill Lynch High Yield Spread. 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	-0.27^{**}	-0.30^{***}	0.21	0.29
	(-2.49)	(-2.95)	(1.01)	(1.46)
$r_{\text{Mkt}} - r_f$	74.17^{***}	24.69^{***}	74.14^{***}	24.65^{***}
	(61.78)	(21.52)	(61.82)	(21.53)
SMB	32.01^{***}	13.76^{***}	31.94^{***}	13.67^{***}
	(12.38)	(5.57)	(12.36)	(5.54)
HML	-22.73^{***}	10.99^{***}	-22.77^{***}	10.95^{***}
	(-9.92)	(5.02)	(-9.94)	(5.01)
Content Lagged	0.34^{***}	0.33^{***}	-0.24	-0.39^{*}
	(2.99)	(3.07)	(-0.98)	(-1.65)
Coverage Lagged	-0.00	0.01^{**}	-0.00	0.01^{**}
	(-0.03)	(2.49)	(-0.17)	(2.31)
High Yield Spread	0.01	0.01	-0.06^{**}	-0.08^{***}
	(1.31)	(1.43)	(-2.37)	(-3.13)
Content Lagged * High Yield Spread			0.08^{***}	0.10^{***}
			(2.68)	(3.48)
R^2	0.60	0.15	0.60	0.16
Num. obs.	2820	2820	2820	2820

Table 11: Media During Merger Mondays

This table shows the effect of Merger Mondays on the strength of the media-return relationship. Merger Mondays have more mergers announced and more press articles printed (Figure 9), releasing more information in limited time. Since we are interested in *lagged* media content for trading purposes, we focus on the *Tuesday* portfolio returns, because these are the relevant returns if we are interested in the information published by financial media on *Monday*, captured as *lagged* media content. The first two columns therefore show the subsample of merger arbitrage returns on Tuesdays for both the long-only and the long-short strategy (with lagged media content corresponding to Monday). The third and fourth columns show the whole sample with an interaction term added for returns on Tuesdays (i.e., when lagged content is from Monday). 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	0.44^{**}	0.25	-0.36^{***}	-0.35^{***}
	(2.15)	(1.13)	(−3.40)	(−3.42)
$r_{\text{Mkt}} - r_f$	73.91^{***}	24.50^{***}	74.09^{***}	24.65^{***}
	(30.26)	(9.42)	(61.81)	(21.51)
SMB	39.66^{***}	10.04^{*}	31.99^{***}	13.66^{***}
	(6.96)	(1.65)	(12.39)	(5.53)
HML	-20.17^{***}	9.10^{*}	-23.04^{***}	10.72^{***}
	(−4.43)	(1.88)	(−10.06)	(4.90)
Content Lagged	-0.46^{*}	−0.20	0.51^{***}	0.43^{***}
	(−1.87)	(−0.79)	(4.03)	(3.59)
Coverage Lagged	−0.00	0.01	−0.00	0.01^{*}
	(−0.36)	(1.45)	(−0.36)	(1.90)
Tuesday			0.81^{***}	0.60^{***}
			(3.45)	(2.67)
Content Lagged * Tuesday			-0.96^{***}	-0.64^{**}
			(−3.43)	(−2.36)
R^2	0.64	0.14	0.60	0.16
Num. obs.	577	577	2820	2820

Table 12: 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 δ. 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^{**}	-0.26^{***}	-0.12	-0.19
	(-2.24)	(-2.75)	(-1.00)	(-1.59)
$r_{\text{Mkt}} - r_f$	74.17^{***}	24.69^{***}	74.18^{***}	24.70^{***}
	(61.77)	(21.52)	(61.79)	(21.53)
SMB	31.97^{***}	13.71^{***}	31.94^{***}	13.69^{***}
	(12.36)	(5.54)	(12.35)	(5.53)
HML	-22.79^{***}	10.92^{***}	-22.79^{***}	10.92^{***}
	(-9.94)	(4.98)	(-9.94)	(4.98)
Content Lagged	0.32^{***}	0.31^{***}	0.20	0.23
	(2.83)	(2.89)	(1.39)	(1.64)
Coverage Lagged	-0.00	0.01^{**}	-0.00	0.01^{**}
	(-0.03)	(2.50)	(-0.02)	(2.51)
Low Inst. Ownership	0.03	0.03	-0.22	-0.15
	(0.77)	(1.03)	(-1.18)	(-0.81)
Content Lagged * Low Inst. Ownership			0.31	0.22
			(1.33)	(1.00)
R^2	0.60	0.15	0.60	0.15
Num. obs.	2820	2820	2820	2820

Figure 1: Merger Arbitrage Timeline

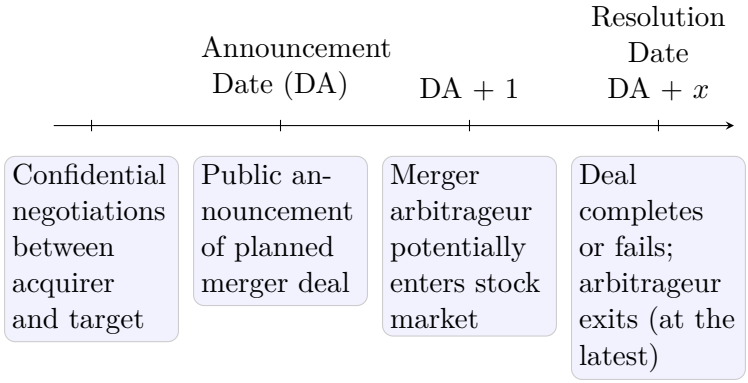


Figure 2: Event-time Merger Arbitrage Returns

This figure shows event-time returns of the target, the acquirer, and the long-short merger arbitrage strategy, all split up by whether the merger completes in the end. The long-short strategy always buys the target and additionally short-sells the acquirer in a stock deal, adjusted by the exchange ratio δ, as explained in Section 2.

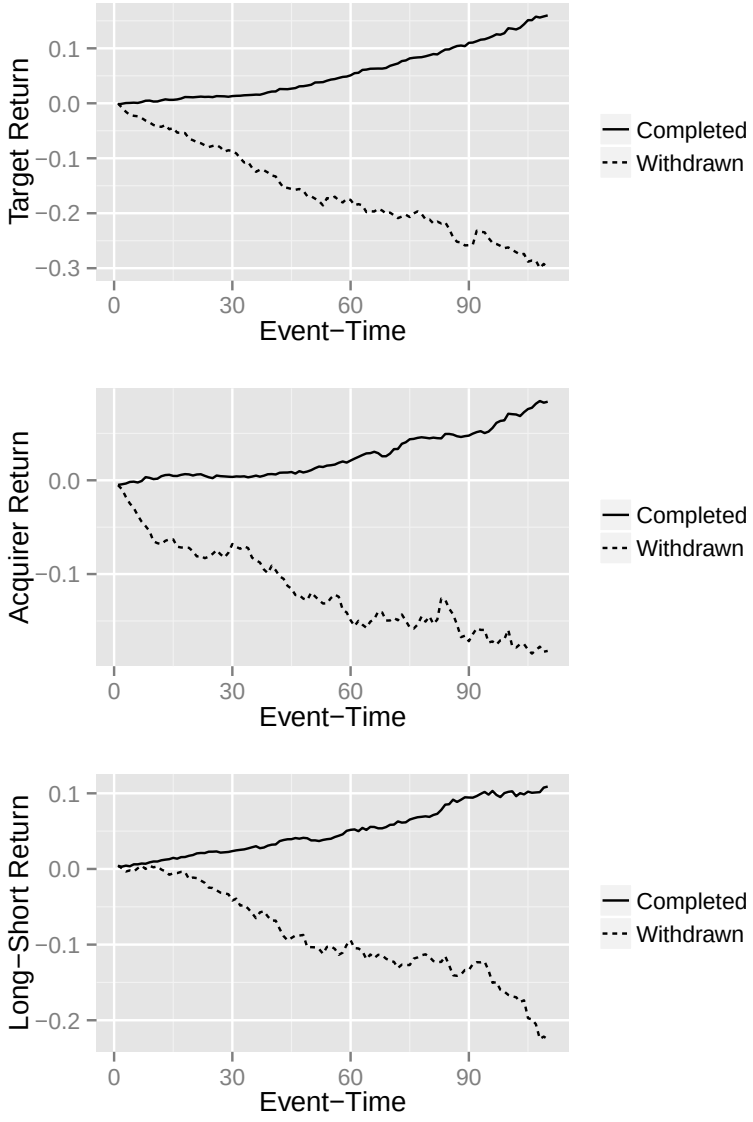


Figure 3: Value of Merger Arbitrage Portfolio

This figure shows the value of $1 invested in the merger arbitrage portfolio, or equivalently, the portfolio's cumulative return plus one. The solid line is the portfolio that goes long the target and additionally short the acquirer in a stock deal, adjusted by the merger's exchange ratio δ. The dashed line is the portfolio that only goes long the target and leaves out the acquirer. The dotted line is the stock market for comparison.

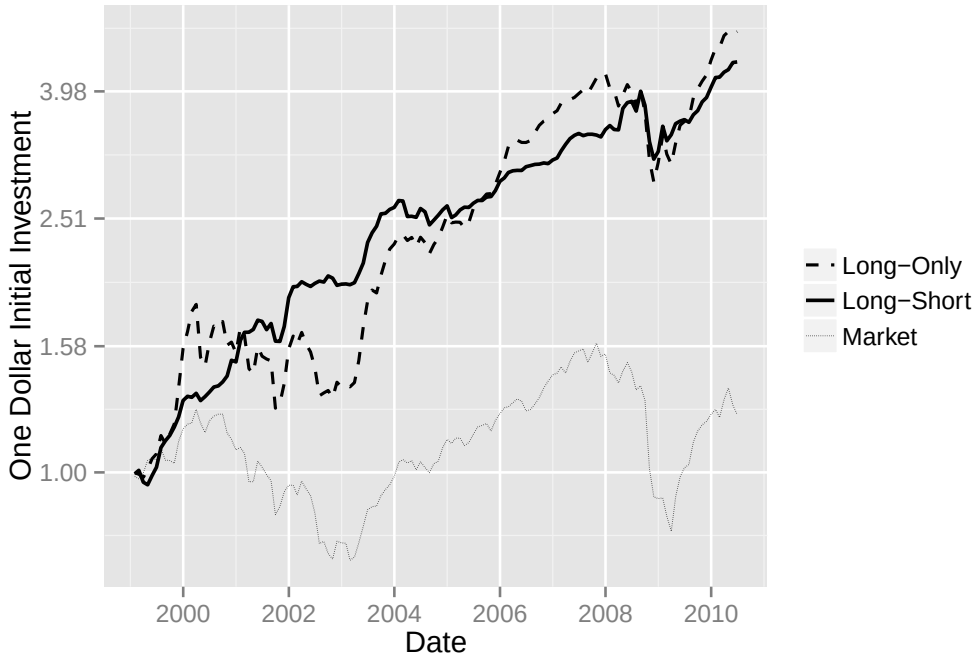


Figure 4: Media Measures in Event-time

This figure shows the event-time dynamics for the media content and media coverage measures, both split up by whether the merger will complete in the end. Media content is the media-implied probability of merger completion constructed from textual analysis of press articles and newswire articles, while media coverage is the number of press and newswire articles released. Section 3 contains details about the construction of the media measures.

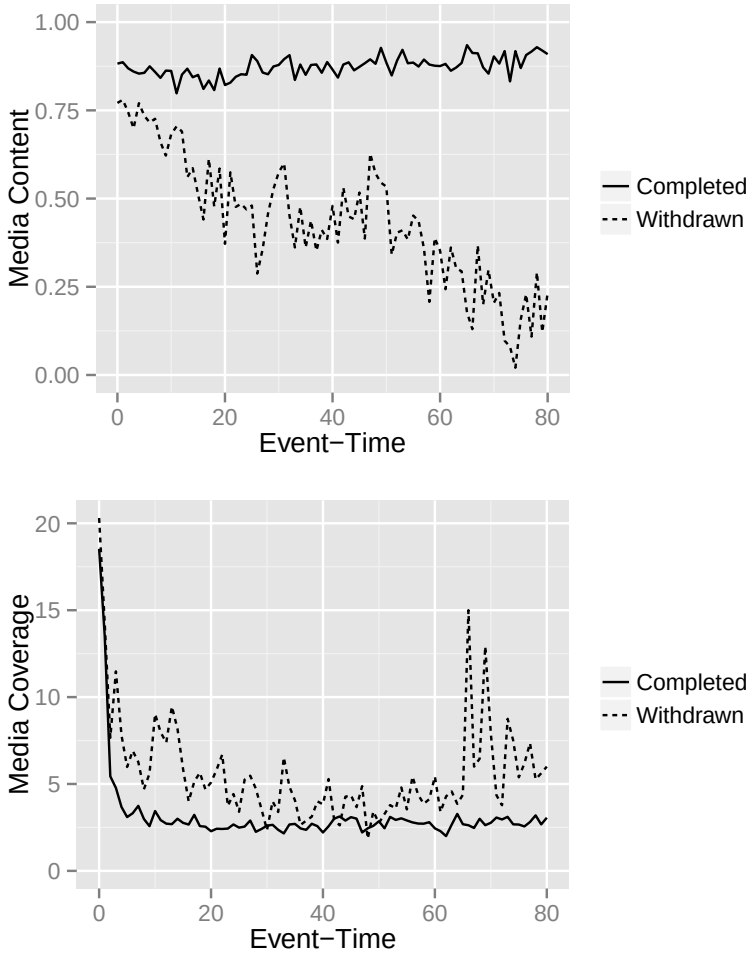


Figure 5: Media-implied Probability of Merger Completion

This plot shows the fitted line from a probit model and 95% confidence intervals, relating ex-ante media content to ex-post merger completion. The dependent variable on the y-axis is a dummy showing whether the merger completed in the end, while the independent variable on the x-axis is the media content measure, capturing the ex-ante media-implied probability of merger completion based on textual analysis of press and newswire articles. The media measure is highly predictive because it uses only media information released on the announcement day, but not thereafter, while the dependent variable on the y-axis is measured at the merger's resolution date, which on average takes place more than one hundred days later. As in the rest of the paper, media content is estimated using only past mergers in an rolling window (i.e., not based on the whole merger sample), which means that the predictive performance is out-of-sample, without a look-ahead bias.

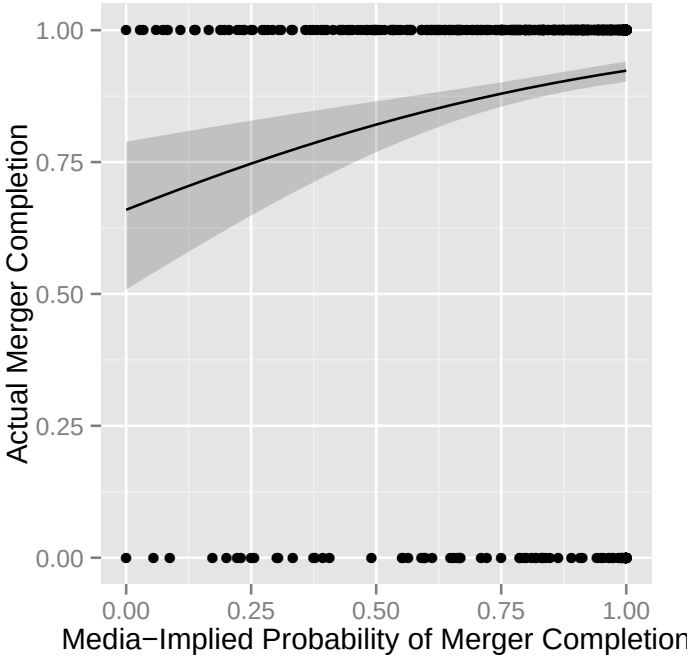


Figure 6: Slow-moving Information

This figure shows cross-sectional regression results of the long-only merger arbitrage return on the media content measure and controls. The control variables are the same as in Table 6. Specifically, the figure shows the regression coefficients of the media content measure as a function of the holding period of the subsequent return. Each dot on the figure corresponds to a separate regression with a different holding period on the x-axis. The timing for each regression is as follows. On the merger's announcement day, the media content measure is calculated, and for this calculation we only use information up to and including the announcement day (but no information released afterwards to avoid look-ahead bias). On the first trading day *after* the announcement day, we start calculating the cumulative merger arbitrage return until the end of the holding period. If markets are efficient, a longer holding period should not result in a larger media content coefficient, since this media information should already be reflected in prices.

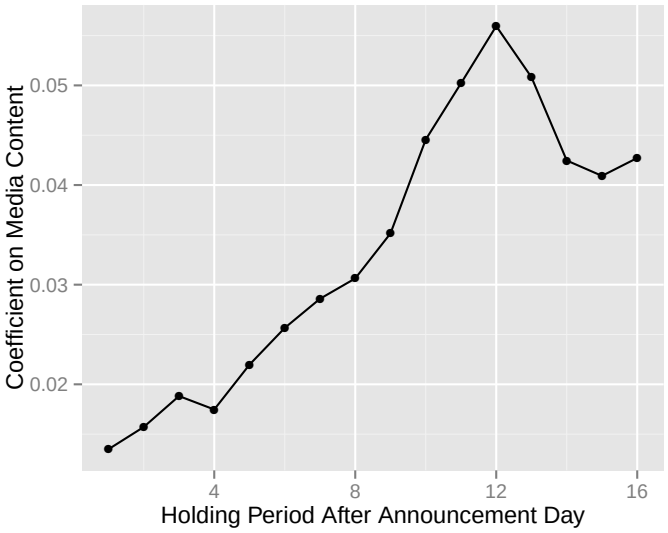


Figure 7: Simple Trading Strategy

This figure shows risk-adjusted annualized returns ("alphas") from a simple trading strategy that conditions on media content on the announcement day, i.e., the media-implied *ex-ante* probability of merger completion. If content on the announcement day is above a given threshold level, then starting on the next trading day after the announcement, the merger arbitrageur buys the target and additionally short-sells the acquirer in a stock deal, adjusted by the exchange ratio δ, according to the standard merger arbitrage investment strategy, and holds the deal for twelve trading days to capture potentially slow-moving media information. Otherwise, if the media content measure is below the threshold on the announcement day, he skips investing in this deal. All open deals are averaged in calendar time. The risk-adjusted return ("alpha") for each threshold level is the intercept from regressing the arbitrage portfolio return on the market and the Fama/French factors. The plot on the right-hand side repeats this analysis for media coverage instead of media content.

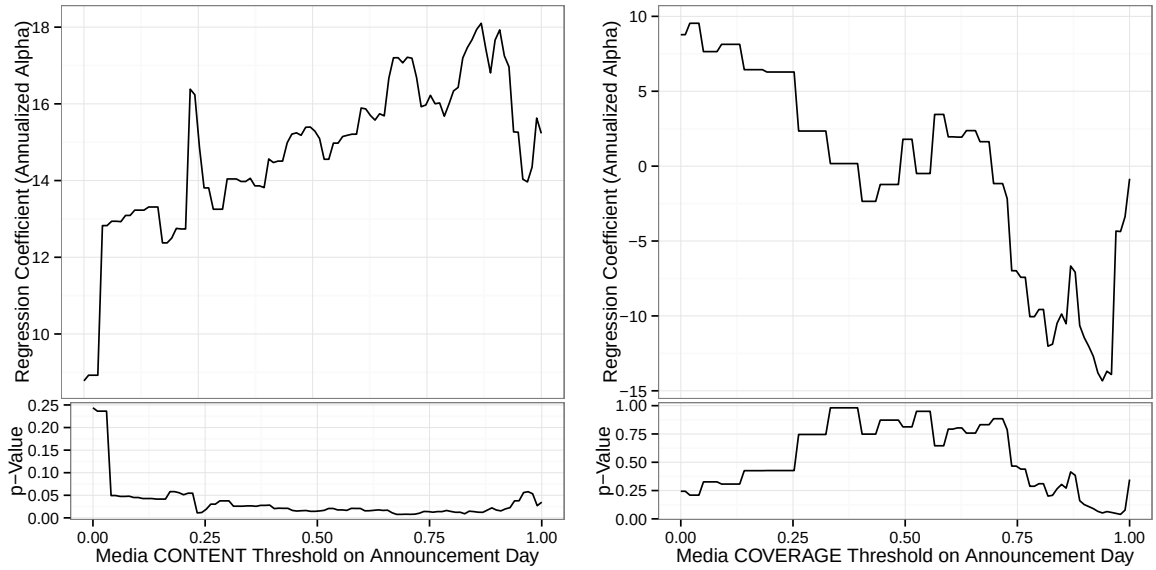


Figure 8: Returns Depend on Availability of Leverage

This figure shows the same plots as in Figure 7, with the difference that the data is split up depending on whether the Merrill Lynch High Yield Spread is above or below its median. Reflecting conditions in credit markets, this spread captures the availability of leverage to the arbitrageur.

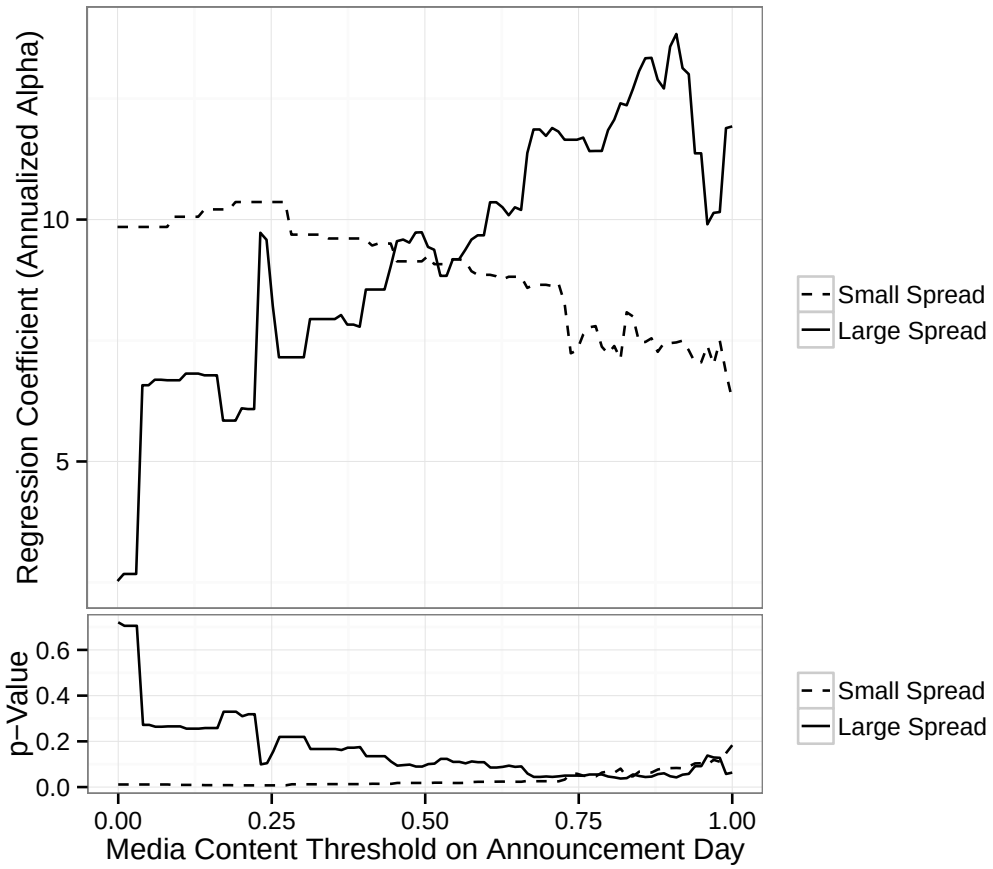
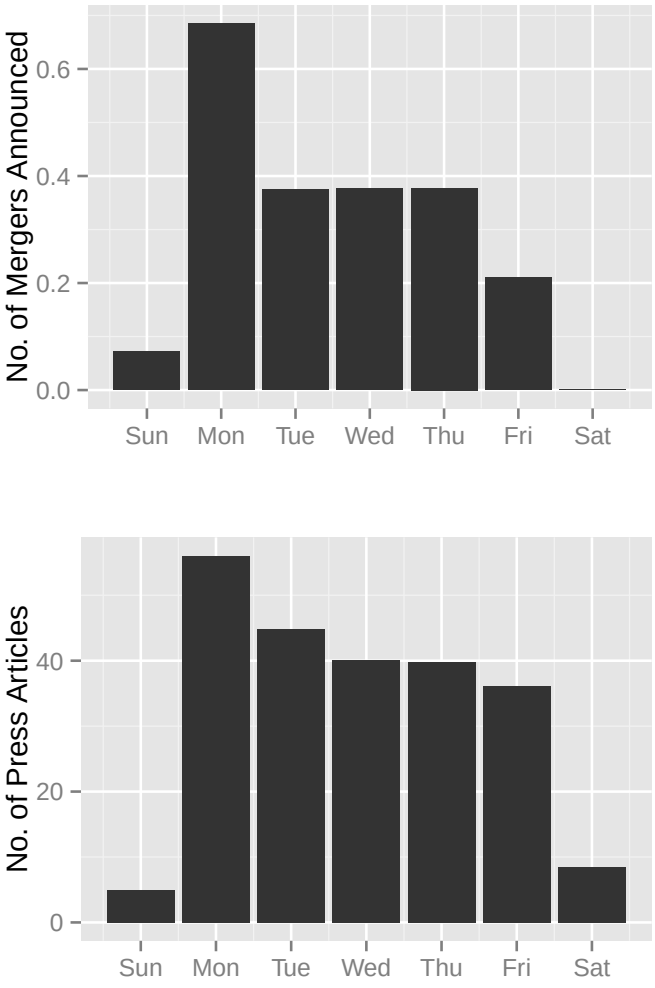


Figure 9: Merger Monday

These plots show for each day of the week the number of announced merger deals and the number of press articles released discussing previously announced merger deals. Merger Mondays can occur for several reasons, one being that details of the merger are finalized over the weekend and announced on Monday, while another reason is holding the M&A announcement on purpose for Monday morning, hoping for a full week of positive press following the announcement.



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