Information asymmetry and bank mergers

> Regulators, in particular banking and financial regulators, are needed to combat information asymmetry…The financial and banking crisis of 2008 showed the extent of this asymmetry and, in fact, the inability of regulators to remedy it… In general, the global financial crisis was often later characterized as a crisis of regulators and regulation.[1]

1. Introduction

In recent years, mergers between and acquisitions of banks have materially altered the market structure of commercial banking in the United States, and pose a challenge to regulators who must evaluate the micro- and macroprudential implications of the transactions.[2] Given the importance of financial markets and institutions to economic growth (e.g., Levine and Zervos, 1998) as well as banks' involvement in the 2007-09 financial crisis, the efficacy of banking regulation has wide-ranging implications.

A challenge facing bank regulators is information asymmetry (IA), the inability to know all that the bank's managers know about the financial health of the firm. Reliable information is especially important for regulators as they assess the desirability of a merger or acquisition.[3] For example, are there economies of scale or other types of efficiencies? What will be the impact of the transaction on customers? Is there a sufficient resource commitment to integrate the two banks? Are the risk cultures of the two banks compatible?

In this paper, we examine the evolution of information asymmetry during bank mergers and acquisitions (M&As). We find that information asymmetry increases following initial M&A

[1] Frison-Roche, Marie-Anne. Asymmetry: Asymmetric Regulation / Asymmetry of Information. https://bit.ly/2BnwRbj, date not shown.
[2] In 2001, there were 8023 commercial banks; by year-end 2018, there were 4689. Source: FRED, Federal Reserve Bank of St. Louis: https://fred.stlouisfed.org/series/USNUM
[3] A merger of banks requires the approval of the new bank's primary federal regulator and, in the case of state banks, approval by its state regulator. Merger and acquisition applications are also subject to comment from the Department of Justice.

announcements and decreases following deal completions. The findings are stronger for acquisitions involving private targets, mergers (as opposed to acquisitions), and all-cash deals. Relative to the pre-announcement period, successful mergers reduce IA after completion and failed deals increase it. We also find that the enactment of the Dodd-Frank Act reduced the magnitude of the changes in information asymmetry during the M&A process.

The implications of our findings are as follows. First, the period between the announcement of a deal and its completion (the "negotiation" period[4]) is a time during which regulators might invest more in monitoring the banks involved, especially for private targets, mergers, and cash deals. Second, given higher levels of IA following failed deals, regulators need to be more vigilant in monitoring the day-to-day activities following a failed deal. Third, in spite of criticism of the Dodd-Frank Act (e.g., "The right way to redo Dodd-Frank," *The Economist*, Feb. 11, 2017), our evidence suggests that it resulted a reduction in the variability of IA, thus mitigating the IA challenge faced by regulators, thus potentially creating greater stability of the financial system. Fourth, given the higher level of IA during the negotiation period, there is greater opportunity for both informed and (corporate) insider trading. Consequently, uninformed investors are at a greater-than-normal disadvantage during this period.

2. Information asymmetry

In this section, we describe a framework for thinking about the evolution of IA over the course of a merger or acquisition. The narrative motivates our use of spread-based measures of IA.

[4] In our sample, only 3.4 percent of the initial announcements report a completed deal. Deal uncertainty thus characterizes the period after the announcement and the appellation "negotiation period" is appropriate; the uncertainty is resolved with deal completion.

2.1 The pre-announcement period

Before the public announcement of a potential deal there is a level of IA related to the day-to-day operations of the (acquiring) bank. This level of IA is the baseline for our empirical analysis, and depends on a variety of factors. For example, deregulation of the banking industry has led to greater competition and an accompanying reduction in bank opacity (Jiang, Levine, and Lin, 2016). Other factors include the intensity of monitoring by regulators and the types of loans and other assets held by the bank. The economic actors in this period are the acquiring firm's managers and their financial advisors, market makers, and uninformed investors.[5]

2.2 The negotiation period

The initial announcement of a potential deal marks the beginning of a period during which the acquiring firm and the target firm negotiate the terms of the deal. A typical announcement is that of BNC Bancorp's intention to merge with Community First Financial Group on December 18, 2013:

> "BNC Bancorp (NASDAQ: BNCN), the parent company of Bank of North Carolina ("BNC" or "the Bank"), today announced that it has signed an Agreement and Plan of Merger ("Agreement") with Community First Financial Group, Inc. ("Community First"), the parent company of Harrington Bank, FSB ("Harrington Bank"). Harrington Bank is a federal savings bank with approximately $228.5 million in assets serving consumers, small businesses and professionals in the Chapel Hill and Durham areas of North Carolina."

During this period, the initial bid might change and other bidders could arrive. Because the negotiations occur behind closed doors, there is likely to be an increase in IA during this

[5] More realistically, there may be some informed traders active in the pre-announcement period, as suggested by price run-ups in target firms prior to merger announcements (e.g., Jarrell and Poulsen, 1989). If true, there will be a bias against finding a change in IA between the pre-announcement period and the negotiating period (that is, the bias would work against the results we find).

period (we formally describe our hypotheses in the next section). The economic actors in this period are the acquirer's managers and their investment advisors, the target's managers and their investment advisors, market makers, and risk arbitrageurs—arguably informed investors who are a risk to market makers.

2.3 The completion period

The completion period begins when the merger is effective. In our previous example, BNC Bancorp's announced that its merger with Community First Financial Group was final on June 2, 2014, less than six months after the announcement of the deal:

> "BNC Bancorp (NASDAQ: BNCN), the parent company of Bank of North Carolina ("BNC" or "the Bank"), today announced the successful completion of its merger with Community First Financial Group, Inc. ("Community First"), the parent company of Harrington Bank, FSB ("Harrington")."

Starting at this time, there is no longer uncertainty about whether the deal will go through or the terms of the deal. We hypothesize that IA will decline following deal completion relative to the negotiation period. The information released over the course of the M&A timeline might even lead to lower levels of IA in the completion period relative to the pre-announcement period.

2.4 Spread-based measures of information asymmetry

The literature contains a wide variety of proxies for information asymmetry. For example, Haggard, Howe, and Lynch (2015) use eleven IA measures. However, there is ambiguity about what some of the measures are capturing. In particular, Chae (2005) argues that returns-based measures can move in the opposite direction of changes in IA. Given the wide acceptance of the role that IA plays in determining bid and ask prices, we use spread-based measures. Spread-based measures are subject to estimation error, so we use six measures to assess the robustness of our results.

The bid-ask spread consists of at least two components, one due to IA and the other consisting of inventory costs, specialist monopoly power, and clearing costs (Glosten and Harris, 1988). Glosten and Harris conclude that a "significant amount" of spreads are due to information asymmetry. There is some debate about the relative size of the spread components, especially for small trades (George, Kaul, and Nimalendran, 2015). Nonetheless, changes in the IA component, regardless of their relative size, are indicative of changes in environmental IA.

3. Hypothesis Development

We divide the M&A process into the three periods of interest. First, the pre-announcement period (period 1) consists of the 42 trading days before the announcement of a merger. Second, the negotiation period (period 2) refers to the number of trading days between the announcement of a merger and its completion (the median is 167 days). Third, the post-completion period (period 3) consists of the 42 trading days that follow the completion of a merger.[6] We hypothesize that both the initial announcement and the completion of a deal influence the level of IA.

Specifically, we posit that IA increases following deal announcements. M&As are significant investments that require complex and often lengthy negotiation processes during which the two partners negotiate the terms of the deal. Because negotiations occur behind closed doors, there is a greater information gap between insiders and outsiders about the terms of a deal and its likelihood of success. Consequently, we predict that IA will be higher in the negotiation period (2) than in the pre-announcement period (1).

Because there is no uncertainty regarding the terms of a deal or the likelihood of its success following its completion, we predict that IA will decline following the completion of a

[6] Our results are not sensitive to the choice of a 42-day window and are robust to the use of alternative lengths for the pre-announcement and post-completion periods.

deal; that is, IA will decline in period (3) compared to period (2). We further conjecture that IA levels will revert back to ex-ante levels following completion, and could conceivably decrease even lower if relevant information about the banks' operations has been released during the negotiation period; that is, IA levels will be similar or lower in period (3) compared to period (1).

H1: Information asymmetry increases following the announcement of a deal, then decreases following the completion of the deal.

We next argue that the changes observed in the level of IA are affected by target and deal characteristics. For example, the type of target acquired likely impacts the magnitude of changes in IA. Because it is costlier to acquire information about private firms, there is less information about the target company for acquisitions involving private targets compared to public targets for which information is more readily accessible. We thus expect that the magnitude of changes in IA during each stage of the M&A process will be greater when the target is private.

Deal type also likely influences the magnitude of the changes in IA around our cutoff points of interest. Firms involved in a merger create a new entity or outright absorb a target. Acquisitions of assets are typically less complex and involve fewer intermediate steps (Reed et al., 1989), suggesting that the magnitude of changes in IA should be stronger (weaker) for mergers (acquisitions).

The method of payment might impact changes in IA. Because all-stock deal returns tend to be less volatile than that of all-cash deals (Eckbo, 2008), we posit that all-cash deals likely generate greater changes in IA. Additionally, Officer et al. (2008) assert that stock offers are a way for the bidder to share overvaluation risks with the target. As such, M&A deals are less risky for the acquirer, especially when the target is hard to evaluate. On the other hand, all-cash deals are riskier as they expose the bidder to potential target overvaluation.

H2: *Deal characteristics influence the magnitude of IA changes. Changes in IA during between the three periods of interest are likely to be more pronounced for private targets, for mergers as opposed to acquisitions, and for all-cash deals*.[7]

To further investigate how the M&A process influences IA, we look at failed deals. The failure of a deal might provoke a different response than would its completion. We expect changes in IA to be similar to completed deals between the pre-announcement period (1) and the negotiation period (2). However, we expect to see a different pattern following the completion date. Specifically, we do not expect IA levels to decrease as much as they do for completed deals.

H3: *The decrease in IA is less pronounced following the failure of a deal.*

Our last hypothesis pertains to the impact of the Dodd-Frank Act, enacted July 21, 2010. The Act was intended to make the banking system safer. Its goals included reducing IA between insiders and shareholders through a reduction in the ability of commercial banks to take risks, and an increase and regulation of public disclosures "in order to support market evaluation of the risk profile, capital adequacy, and risk management capabilities".[8] We investigate whether the Dodd-Frank Act influenced the information environment. If it did, the magnitude of the changes in IA around the two stages of the M&A process will be reduced after passage of the Act. If it did not, the magnitude of the changes in IA should be similar before and after the passage of the Act.

H4: *the magnitude of the changes in information asymmetry following the announcement or the completion of a deal are reduced after passage of the Dodd-Frank Act.*

[7] Only 33 of the sample mergers are labelled as "Hostile" by SDC. A bid might initially be contested, but once an agreement is reached, it is typically reclassified as "Friendly." We examine whether the IA changes are different for hostile mergers, but are agnostic about how they might differ from friendly mergers.

[8] https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf

4. Data Selection and Empirical Design

4.1. Data selection

From SDC, we identify all the completed domestic mergers and acquisitions in the banking sector from 1980 to 2016. Following Moller et al. (2005), we apply the following filters:

(1) The acquirer and the target are domestic banks (Compustat primary SIC code between 6020 and 6030).

(2) The acquirer is a public firm.

(3) The deal is worth at least $1 million in value.

(4) The acquirer owns less than 50% of the target's shares before the merger.

(5) The acquirer owns 100% of the target's shares after the merger.

We merge the dataset with Compustat to obtain information on banks' fundamentals. Following Haggard et al. (2015), we control for size (total assets), book-to-market ratio, debt-to-equity ratio, and income scaled by lagged assets. We retain deals for which we are able to obtain daily stock price data from CRSP. This approach yields 3,146 deals. **Figure 1** displays the distribution of the mergers over time. There are periods of heightened consolidation of the banking sector, especially during the 1990s. In the robustness section, we show that our results are not sensitive to merger waves.

4.2. Information asymmetry measures (IAMs)

Using Haggard et al. (2015)'s methods, we investigate the effect of M&As on the information environment by looking at six different information asymmetry measures (IAMs).[9]

[9] Haggard et al. (2015) use 11 information asymmetry measures. Data constraints prevent us from re-creating all of their measures. They use *Quoted Spread* and *Effective Spread* as two spread measures calculated from the TAQ database. We do not have access to the TAQ database. We adopt *PQ Spread*, *Effective Spread* and *PE Spread* from Chordia et al. (2000).

We use a window of 42 trading days before the announcement date to 42 trading days after the completion date; the results are not sensitive to the length of the pre- and post-periods.

We use six different spread-based variables. We calculate *Daily Spread* as the daily difference between the daily high and low trading prices divided by the closing price. *HL Spread* is the daily estimated effective spread calculated as in Corwin and Shultz (2012). *Roll* is the daily covariance in prices (Roll, 1984). *PQ Spread* is the difference between the closing bid and ask prices divided by the closing bid-ask midpoint. *Effective Spread* is twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is twice the absolute value of the price minus the bid-ask midpoint scaled by price. We follow Chordia et al. (2000) in calculating *PQ Spread, Effective Spread* and *PE Spread*.

4.3. Empirical design

We use December year-end information in year t-1 to calculate firms' fundamentals for the subsequent year. We divide the process into three periods as displayed in **Figure 2**. Consistent with the work of Schwert (1996) and Betton et al. (2008) on the M&A run-up period, we define the pre-announcement period (1) as the 42 trading days prior to the announcement date of the deal. The negotiation period (2) is the transition period that separates the date the merger is announced from the date the merger is completed. When the announcement date or the completion date occurs on a non-trading day, the next trading day is the cutoff for the relevant period. The post-completion period (3) consists of the 42 trading days after the date the merger is completed. We create indicator variables to capture the variation in IA over the three periods of interest.

We run the OLS model shown in equation (1), which estimates the change in IA as measured by each of our IAMs:

$$IAM_{i,t} = \beta_0 + \beta_1 \, Period\ of\ interest_{i,t} + \gamma_1 \, Deal\text{-}level\ controls_{i,j} + \gamma_2 \, Firm\ Controls_{i,y-1} \quad (1)$$

where the dependent variable *IAM* represents our information asymmetry measures. *Period of interest* represent the indicator variable capturing the appropriate time window depending on the test (see explanation of our pairwise period setting below). γ_1 is a vector of deal-level variables that influence the information environment, such as the value of the transaction, the method of payment, the type of deal, the attitude of the buyer, and a tender offer indicator. γ_2 is a vector of firm-level controls including book-to-market, debt-to-equity, total assets and income scaled by lagged total assets. We cluster standard errors by firm and year-month.

We run pairwise tests by looking at changes to the information environment between specific *Periods of interest*. For each hypothesis, we run three pairwise tests:

1. When testing changes in the information environment immediately following the announcement of a deal, we compare the pre-announcement period to the negotiation period ((1) vs (2)). The coefficient of the *Negotiation* variable indicates the change in IA compared to the pre-announcement period.
2. When testing changes in the information environment immediately following the completion of a deal, we compare the negotiation period to the post-completion period ((2) vs (3)). The coefficient of the *Post-Completion* variable indicates the change in IA compared to the negotiation period.
3. Finally, when testing whether the quality of the information environment reverts back to its ex-ante level, we compare the pre-announcement period to the post-completion period)(1) vs (3)). The coefficient of the *Post-Completion* variable indicates the change in IA compared to the pre-announcement period.

In our tests of the impact of the Dodd-Frank Act on changes in IA, we augment equation (1) as follows:

$$IAM_{i,t} = \beta_0 + \beta_1 \text{ Dodd-Frank}_{i,t} + \beta_2 \text{ Period of interest}_{i,t} + \beta_3 \text{ Period of interest}_{i,t} * \text{Dodd-Frank}_{i,t} + \gamma_1 \text{ Deal-level controls}_{i,j} + \gamma_2 \text{ Firm Controls}_{i,y-1} \quad (2)$$

where *Dodd-Frank* is an indicator variable equal to 1 if the observation occurs after the passage of the Dodd-Frank Act, 0 otherwise, and *Period of interest * Dodd-Frank* is the interaction between *Dodd-Frank* and the appropriate *Period of interest* variables.

4.4. Summary statistics

Table 1 provides details on the sample as well as summary statistics for the information asymmetry measures (IAMs) and control variables. To mitigate the impact of outliers, we winsorize IAMs and control variables at the one percent level, in conformity with past literature. **Panel A** breaks down the composition of our sample. Our sample comprises 3,146 deals representing 651,123 individual firm-day observations. There are 582 individual acquirers, indicating the presence of serial acquirers. Overlapping acquisitions can be problematic from an econometric standpoint. We address the serial acquirer concern in the robustness section by showing that our results are qualitatively similar when we remove overlapping acquisitions.

Panel B reports the characteristics of the deals in our sample. Our sample is roughly split between private target and public targets, each representing over 45% of the sample. Targets that are subsidiaries represent about 9% of the sample. A large majority of the deals are mergers (86%) while the remaining 14% are acquisitions. The overwhelming majority of the deals in our sample are friendly M&As; only 1% of the deals are hostile.[10] The M&As in our sample also

[10] We classify as hostile any deal reported as hostile or neutral by SDC.

vary in the method of payment. Approximately 47% are all stock-deals, 15% are all-cash deals, while the remaining acquisitions are paid for with a mix of cash and stock.

Panel C presents sample summary statistics. The average bank engaging in an M&A has assets of about $24 billion. The median size of $4.6 billion and the high standard deviation suggests that some large entities have been M&A-active. The average book-to-market ratio is 0.675, indicating that M&A-active banks tend to be more highly valued by the market. The average debt-to-equity ratio is 1.718, with a median value of 1.407, while the average bank's income is about 1.2% of lagged assets. Panel C also reports the means, medians, and standard deviations of our six measures of information asymmetry.

The statistics are consistent with past literature. For example, the sample in Chordia et al. (2000) has a mean (median) *PQ Spread* value of 0.016 (0.011) and a mean (median) *Effective Spread* of 0.225 (0.179), similar to our corresponding mean (median) values of 0.015 (0.09) and 0.242 (0.125).

5. Results

5.1. Initial results

The coefficient on the *Period of interest* variable captures the direction and the magnitude of the change in IA between any two periods of observation. For each pairwise test, the coefficient reported is that of the latest period compared to the preceding one. For example, in our first pairwise test between the pre-announcement period (1) and the negotiation period (2), the coefficient reported is that of the *Negotiation* indicator variable. This setting makes the interpretation of the coefficient simple as a positive (negative) coefficient implies an increase (decrease) in opacity immediately following the announcement of deal.

Tables 2 through 8 report the coefficients of the variable of interest, *Period of interest*. In each table, the first column reports the results of our regression comparing the pre-announcement period (1) to the negotiation period (2). In this setting, we report the coefficient of the *Negotiation* variable. The second column reports the results of our regression comparing the negotiation period (2) to the post-completion period (3). In this setting, we report the coefficient of the *Post-Completion* variable, which allows us to investigate changes to the information environment following the completion of a deal. Finally, the third column reports the results of our regression comparing the pre-announcement period (1) to the post-completion period (3). For this test we report the coefficient of the *Post-Completion* variable, which allows us to investigate whether IA reverts to its pre-announcement level following the completion of a deal. **Figure 3** offers a visual depiction of the three periods of interest.

We compute the IAMs such that a *positive* coefficient implies an *increase* in IA from one period to the next, and a *negative* coefficient implies a *decrease* in IA (the coefficients are percentage changes). We cluster standard errors by firm and year-month.

Table 2 reports the results of our setting for the full sample (for brevity's sake, we do not report the coefficients of the control variables). Evidence regarding the impact of deal announcement is mixed. The six IAMs have positive point estimates, but only *PE Spread* and *HL Spread* are statistically significant at conventional levels, offering modest evidence of an increase in IA following announcement of a deal.

The second column reports the coefficient of the IAMs comparing the negotiation period to the post-completion period ((2) vs (3)). Five out of six IAMs significantly point towards a reduction in IA following the completion of a merger (only *HL Spread* is

insignificant). For example, *Daily Spread* and *Roll* decrease by 1.9 and 2.8 basis points in the post-completion period compared to the negotiation period.

The finding of the second column are consistent with a decline in IA following deal completion. However, it does not provide further clues as to whether IA level revert back to ex-ante levels following completion (that is back to pre-announcement levels). The third column addresses this question by reporting the coefficients of the IAMs comparing the pre-announcement period to the post-completion period ((1) vs (3)). Four out of our six IAMs are significantly negative, evidence that IA declines to lower levels in the post-completion period compared to pre-announcement levels. The magnitudes of the IAMs are lower than in the second column confirming the idea of a possible increase in IA following the announcement of a deal, followed by an even greater decrease in IA once the deal is completed.

In sum, the first set of tests suggests that the announcement of a merger increases IA and confirms that the subsequent completion of a merger decreases IA below pre-announcement levels, which is consistent with our first hypothesis.

5.2. Public, Private, and Subsidiary Targets

We now investigate whether the magnitudes of the reported changes in IA are influenced by deal characteristics. For example, the quality of the information about the target available to investors is likely to influence the information environment through the M&A process. To investigate this possibility, we look at the type of target as a proxy for the quantity and quality of information available to investors. We decompose our sample into three subsamples: 1) public targets; 2) private targets; and 3) subsidiaries.

Panel A of **Table 3** reports the results of the regressions for the public target sub-sample. We do not find evidence of any change in IA following the announcement of a deal as none of

our IAMs is significant. Our interpretation is that because public firms are more visible, with information more easily accessible to investors and as a consequence, there is no significant change in our IA following the announcement of a deal. The next two columns present coefficients that are similar to those observed in the full sample: a decrease in IA once the merger is effective that leads to lower IA level post-completion than pre-announcement, consistent with the notion that the additional release of information "cleared the air."

Panel B presents the results for the private target subsample. The first column shows that the announcement of a deal involving a private target significantly increases the levels of IA. Five out of six IAMs are statistically significant, with a much greater magnitude than in the full sample or in the public target sample. We conclude that much of the increase in IA detected following the announcement of a merger comes from mergers involving private targets, consistent with our second hypothesis.

The results for the post-completion period in the second column are unambiguous as well. All IAMs indicate a decrease in opacity following the completion of a merger involving a private target. Every IAM is significant, some with magnitudes about twice as large as that of the public sample. For example, *Effective Spread* decreases by 2 basis points and *Roll* is lower by 3.6 basis points. The decreases are significant given their respective means of 0.24 and 0.39. Only one IAM is significant in the third column with results that are less pronounced than for public firms. The results suggest that the information environment reverts to pre-announcement levels following completion. We conclude that M&A deals involving private targets temporarily increase opacity but that IA levels revert back to their normal levels following the completion of the deal.

Panel C reports the results for the sample with targets that are subsidiaries. The subsidiaries of our sample are by definition firms whose voting rights are controlled by a parent firm. The results suggest that the change in the level of IA is insignificant for the subsidiaries sample. All of the coefficients are statistically indistinguishable from zero, regardless of the period observed. We interpret these results as consistent with the notion that there is less uncertainty when acquirers acquire targets with which they are already familiar, hence the lack of change in the information environment during the M&A process.

Overall, our findings suggest that M&As involving private targets trigger significant changes in IA throughout the M&A process, that M&A involving public targets tend to decrease IA levels in the long-run, and M&A involving subsidiary targets do not affect IA levels. We conclude that the magnitude of changes in IA during an M&A are significantly influenced by target characteristics.

5.3. Merger vs. acquisitions

We next test whether the type of deal observed similarly impacts IA levels during the M&A process. Firms involved in a merger create a new entity with a new ownership and management structure, or absorb a target while facing significant integration costs. We posit that there might be greater changes in IA surrounding a merger than there are for an acquisition in which the bidding firm takes over the target firm.

Panel A of **Table 4** reports the types of firms targeted for each deal type. The merger sample resembles the full sample: every type of target is proportionately represented, except for subsidiaries, which are underrepresented. This pattern is reversed in the acquisition sample as subsidiaries represent almost half of the sample, with public targets accounting for only 3% of all acquisitions.

Panel B reports the coefficients for the sample of merger deals. In the first column the results are consistent with that of the full sample in terms of magnitudes; three IAMs are significant, offering evidence of a modest increase in IA. The results in the second and third column are also consistent with the results of the full sample, suggesting that IA decreases significantly following the conclusion of a deal below its pre-announcement levels.

Panel C reports the results for the acquisitions sample. There is only weak evidence of an impact of the M&A process on IA. We find modest evidence of increase IA in the negotiation period followed by mild evidence of a decrease in opacity in the post-completion period. Our IAMs capture some variation, although they do not all point in the same direction and are on average less significant. We interpret these results as consistent with acquisitions influencing the information environment less than mergers.

5.4. Hostile versus friendly deals

We investigate whether changes in the information environment differ between hostile and friendly deals. There are few hostile deals (a total of 33 in our sample); **Table 5** reports the result of our regression for hostile deals. We find no evidence of changes in IA associated with hostile M&As. The IAMs are inconsistent in their point estimates and with only one exception, none of them is significant. The small sample size at least partly explains the insignificant coefficients.

5.5. Method of payment

We now look at whether the choice of the method of payment influences changes in IA over the M&A process. Specifically, we look at the all-stock and all-cash deals in our sample. **Panel A** of **Table 6** reports the results of our regressions for the all-stock deals in our sample, about 47% of all deals.

The first observation is that there is no change associated with the announcement of an all-stock deal. Past literature suggests an explanation for this finding: all-stock offers are seen as less risky for the bidder, especially when acquiring volatile targets (Officer et al., 2008), as it allows the acquirer to share overvaluation risk with the target. The risk sharing important because overvaluation is one of the principal risks associated with M&As (Rhodes-Kropf, 2004).

The coefficients in the second column are similar to those of the full sample, with evidence of a decrease in IA following deal completion, as four out of six IAMs significantly point in that direction. Similarly, the results reported in the third column comparing the pre-announcement period and the post-completion period suggest that IA decreases even beyond pre-announcement level following deal completion. In sum, results for all-stock deals indicate that the announcement of a deal paid for with only equity has little influence on IA, but that the completion of such a deal does.

Panel B presents the results for all-cash deals. All-cash deals are less common and represent about 15% of our sample. The coefficients on the *Negotiation* variable suggest that IA increases significantly following the announcement of an all-cash deal. *Daily spread* is higher by 2.9 basis point and *Roll* increases by 3.2 basis points in the negotiation period. The magnitude of all coefficients is even higher than for private targets confirming that all-cash deals are a significant driver of our initial result of an increase in IA following the announcement of a deal. Similarly, we observe a commensurate decrease in IA of a similar magnitude following the completion of all-cash deals, bringing back IA levels to their pre-announcement level.

We conclude that the method of payment of a deal influences the magnitude of the changes in IA during the takeover process. All-cash deals influence IA around both the announcement date and the competition date, making the transition period a particularly high levels of IA. In

contrast, all-stock deals appear to influence the information environment primarily around the conclusion of the deal, as there is scant evidence of any change around the announcement of these deals.

5.6. Failed deals

We next examine the impact of failed deals on the bidder's information environment. Using a model similar to equation (1), we investigate changes to the information environment following the announcement of the deal, and following its failure. **Table 7** reports the results of the three pairwise regressions for failed deals. The coefficients around deal announcement (first column) indicate a strong increase in IA.

The failure of a deal (second column) significantly decreases IA, consistent with our earlier findings. However, in contrast to previous tests, the comparison between the pre-announcement period and the post-completion period (column 3) shows that IA levels do not revert to pre-announcement levels following the failure of the deal. The coefficients suggest that although IA decreases following the failure of a deal, it remains significantly higher post-failure than it was pre-announcement. This result suggests that an unsuccessfully ending degrades the information environment over the long term.

5.7. Impact of the Dodd-Frank Act

We now investigate whether changes in IA during the M&A process are different in the post-Dodd-Frank period. We create an indicator variable *Dodd-Frank* equal to one if an observation occurs after the enactment of the Act, and interact it with our existing indicator variables for the *Period of interest*. **Table 8** reports the coefficients of interest of the regression, including the indicator variable for *Dodd-Frank*, the indicator variable for the *Period of interest* observed, and the interaction between the two. **Panel A** reports the results of our pairwise

comparison between the pre-announcement period and the negotiation period. **Panel B** (**Panel C**) report the results of our pairwise comparison between the negotiation period and the post-completion period (pre-announcement period and post-completion period).

The coefficients on the indicator variable for the enactment of *Dodd-Frank* are uniformly negative and significant across all panels. This pattern suggests that the passage of the law reduced IA overall. The interaction between *Dodd-Frank* and the *Period of interest* provides further information the effect the law had on changes in the information environment. Most coefficients point in the opposite direction to that of the *Period of interest* indicator variable, but with a lower magnitude while being statistically significant (though most interaction terms are not significant in Panel A). The pattern suggests that following the enactment of Dodd-Frank, changes to the acquiring firm's information environment associated with the announcement or the completion of a deal are less pronounced than before.

In untabulated results, we run F-tests to see whether changes observed in the information environment following the announcement and the completion of a deal are still significant after the passage of Dodd-Frank.[11] For almost every significant IAM in the pre-Dodd-Frank era, we find evidence that their magnitude decreases following Dodd-Frank. However, some remain statistically significant, suggesting that the evidence of an increase (decrease) in opacity following the announcement (completion) of the deal weakens following the passage of the Act.

[11] We test whether the coefficients discussed above are collectively different from zero. A failure to reject the null hypothesis implies that following the enactment of the Dodd-Frank Act there is no change in the information environment between the two observed periods of interest. A rejection of the null implies that the effect of the announcement (the completion) of a deal is still present, though attenuated, following the passage of Dodd-Frank.

6. Robustness

6.1. Window of observation

The size of the window of observation determines how far back (and forward) we go to analyze the changes in the information environment. In our baseline regressions, we use a window of 42 trading days before the announcement date as it is commonly referred to in the M&A announcement return literature as the length of the "run-up" period, and 42 trading days after the effective date in order to have a balanced setting (see Schwert, 1996, and Betton et al., 2009). To confirm that our results are not sensitive to a specific window, we conduct our tests over different time windows (+/–60 days, +/–25 days). In untabulated results, we find that our results are robust to such changes.

6.2. Serial acquirers

Serial acquirers are firms that complete multiple bids within a defined period. Past literature has used different criteria to define what it means to be a "serial acquirer." For example, Fuller et al. (2002) define serial acquirers as firms that acquire five or more firms within a three-year window. Laamanen and Keil (2008) include any firm that makes at least four acquisitions in 10 years, and Aktas et al. (2009) consider any firm that makes at least two acquisitions within a span of 12 months to be a serial acquirer.

Serial acquirers could be problematic for our analysis if they make subsequent acquisitions in a manner that creates overlapping time periods for two (or more) M&As. To address that concern, we re-run our series of tests by eliminating any overlapping M&A activities, keeping only "uncontaminated" observations. The length of the window used to define the announcement period and the post-completion period affects the number of observations, but our results remain qualitatively similar for all time windows.

6.3. Merger waves

Merger waves might affect our results. To address this possibility, we run our tests controlling for the different merger waves with indicator variables. In different specifications, we control for the merger waves as defined in previous literature (Betton et al., 2007) or by controlling for the years of our sample with the largest number of M&As. The (untabulated) results are qualitatively similar with the addition of these controls.

7. Conclusion

We examine changes in the information environment associated with M&As in the banking sector. Examining 3,146 M&As between 1980 to 2016, we find evidence to support the idea that the announcement and the completion of an M&A deal significantly influence acquiring firms' IA levels. We find evidence that the announcement of a deal increases IA, especially for all-cash deals and deals involving a private target. The completion of a deal decreases lifts uncertainty and decreases IA levels, sometimes even beyond initial pre-announcement levels. Our findings that, although the effect of deal announcement on IA levels depend on deal and target characteristics, the impact of the completion of the deal decreases IA for the majority of deals.

We find evidence that successful M&As to decrease IA, sometimes beyond pre-announcement levels, while failed deals tend to have the opposite effect. Finally, we find evidence suggesting that the passage of the Dodd-Frank Act contributed to reduced changes in IA in the banking sector. Following the enactment of the law, changes in IA following the announcement or the completion of the merger are less pronounced than before. Moreover, the passage of the law decreased overall levels of information asymmetry.

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Figure 1: Distribution of mergers and acquisitions over time

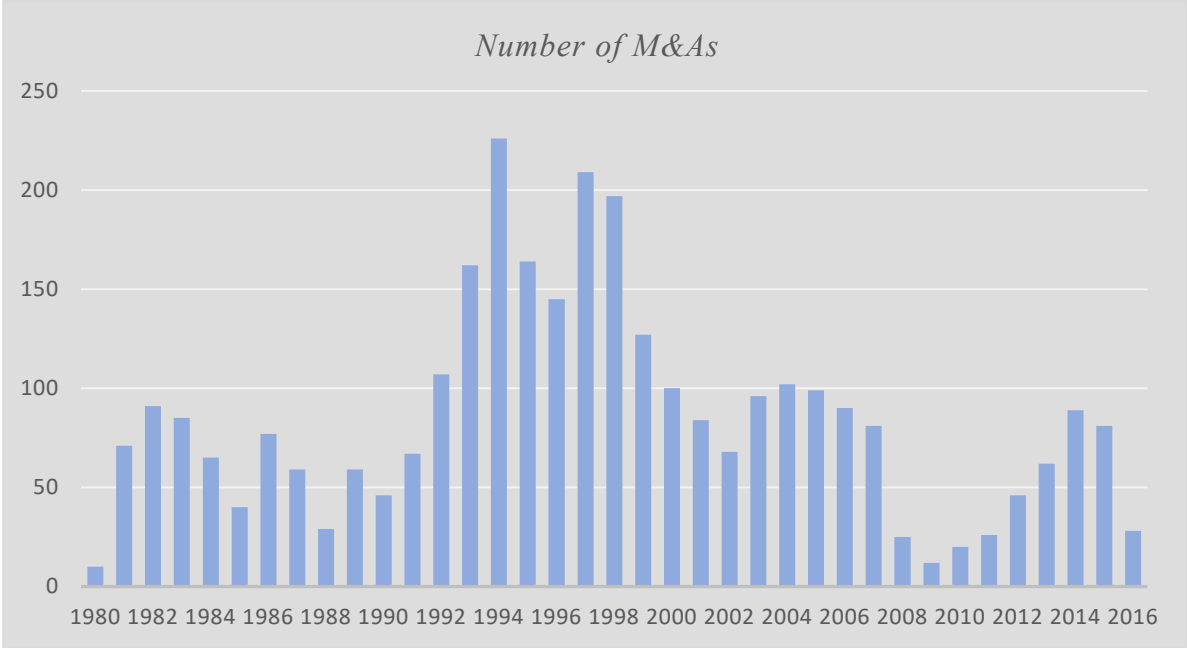

Figure 2: The M&A process

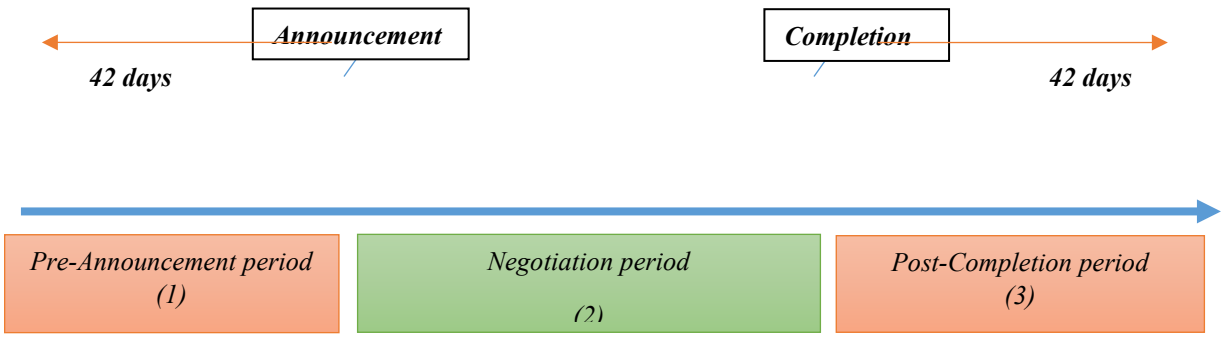

Figure 3: The information environment during the M&A process

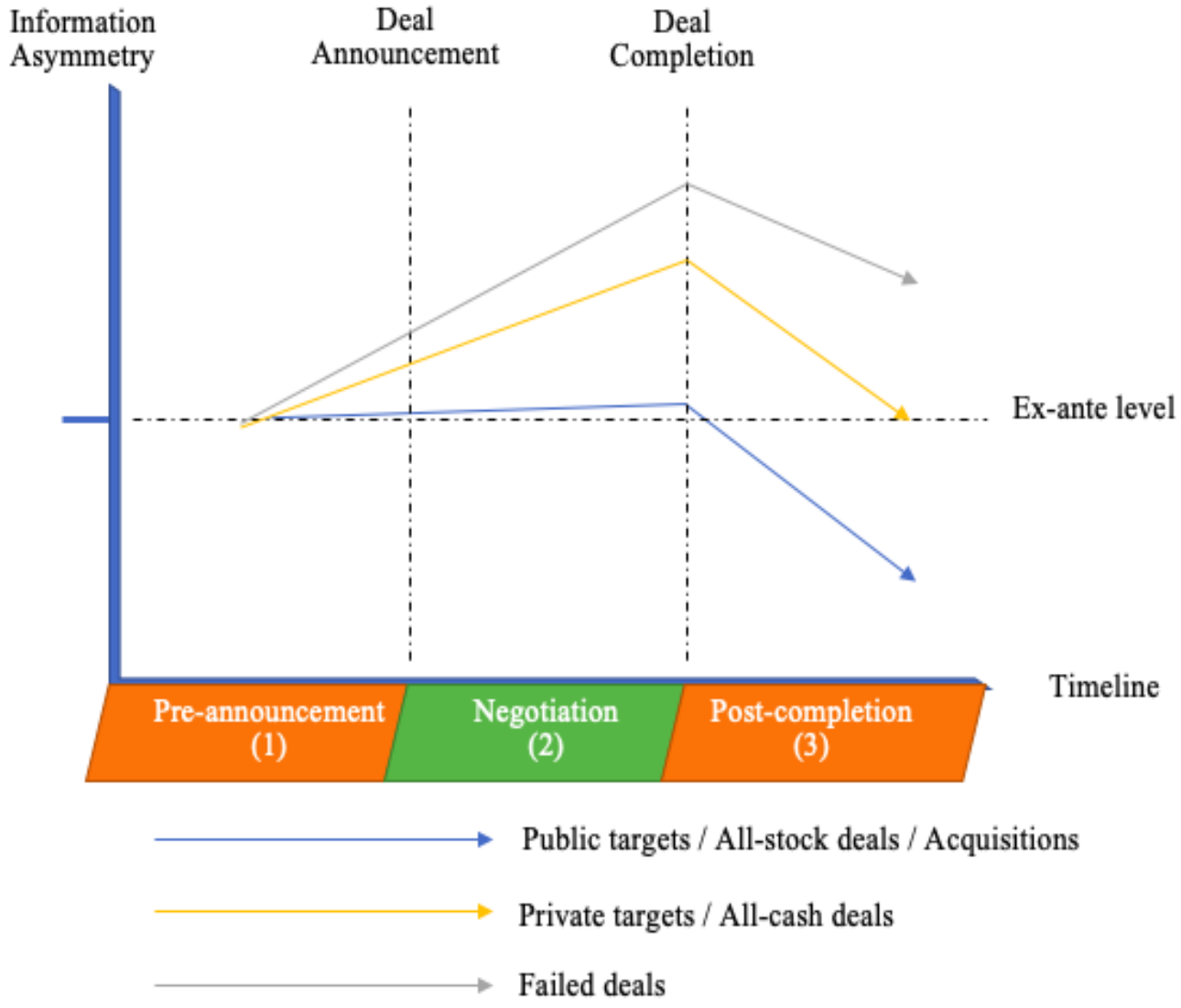

Table 1: Sample statistics

Panel A reports the number of firm-year observations, the number of individual mergers, as well as the number of single acquirers. *Panel B* reports the characteristics of the deals. *Panel C* reports the summary statistics of the control variables per deal, and the information asymmetry measures on a firm-day basis, as percentages. *Panel D* reports the summary statistics of the information asymmetry measures on a firm-day basis, as percentages, broken down by periods of observation. Column (1) reports summary statistics of the information asymmetry measures during the pre-announcement period. Column (2) reports summary statistics of the information asymmetry measures during the negotiation period. Column (3) reports summary statistics of the information asymmetry measures during the post-completion period.

Panel A: Full Sample	
Firm-day observations	651,523
Pre-Announcement Period	130,251
Negotiation Period	388,743
Post-Completion Period	132,529
Number of individual mergers	3,146
Number of individual acquirers	582

Panel B: Deal Characteristics		
Target Status	N	Percent
Mutual	9	0.29
Private	1,440	45.77
Public	1,424	45.26
Subsidiary	273	8.68
Deal Type		
Acquisition of Assets	438	13.92
Merger	2,708	86.08
Deal Nature		
Friendly	3,113	98.95
Neutral/Hostile	33	1.05
Method of Payment		
All-Cash	467	14.84
All-Stock	1,470	46.73
Mixed	1,209	38.43

Table 1 – *Continued*

Panel C: Summary Statistics – full sample				
IAMs	N	Mean	Median	Std
Daily Spread	535,471	0.281	0.250	0.372
PQ Spread	535,471	0.015	0.009	0.019
Effective Spread	535,471	0.242	0.125	0.370
PE Spread	535,471	0.009	0.004	0.014
HL Spread	612,588	0.009	0.005	0.013
Roll	535,471	0.391	0.250	0.497
Controls				
Total Assets $_{t-1}$	3,146	24,560	4,641	113,244
Book to Market $_{t-1}$	3,146	0.675	0.631	0.302
Debt to Equity $_{t-1}$	3,146	1.718	1.407	1.299
Income Scaled $_{t-1}$	3,146	0.012	0.012	0.005

Panel D: IAMs summary statistics per period of interest

	Pre-announcement (1)		*Negotiation (2)*		*Post-completion (3)*	
IAMs	N	Mean	N	Mean	N	Mean
Daily Spread	108,357	0.285	313,614	0.284	113,500	0.262
PQ Spread	108,357	0.015	313,614	0.015	113,500	0.014
Effective Spread	108,357	0.246	313,614	0.245	113,500	0.227
PE Spread	108,357	0.009	313,614	0.010	113,500	0.009
HL Spread	121,616	0.009	364,256	0.009	126,716	0.009
Roll	108,357	0.401	313,614	0.396	113,500	0.363

Table 2: Information environment through the M&A process

We estimate six proxies of information asymmetry following the method employed by Haggard, et al. (2015), and Chordia et al., (2000) for a period going from 42 days prior the announcement date of a merger to 42 days following the date the merger is effective. We run the following OLS regression model (1): $IAM_{i,t} = \beta_0 + \beta_1$ *Period of interest*$_{j,t} + \gamma_1$ *Deal-level Controls*$_{i,j} + \gamma_2$ *Firm-level Controls*$_{i,y-1}$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The following measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	0.707	1.53	5.26%	**-1.978*****	-4.55	6.23%	**-1.331****	-2.39	5.15%
PQ Spread	0.038	1.59	22.77%	**-0.101*****	-4.49	23.62%	**-0.065****	-2.29	23.06%
Effective Spread	0.524	1.28	5.40%	**-1.493*****	-4.07	6.52%	**-0.989****	-2.04	5.87%
PE Spread	**0.031****	2.28	14.26%	**-0.040*****	-3.17	15.22%	-0.012	-0.74	14.86%
HL Spread	**0.018***	1.66	9.68%	-0.015	-1.44	9.96%	0	-0.02	8.56%
Roll	0.749	1.07	8.50%	**-2.836*****	-4.31	9.30%	**-2.167****	-2.57	8.16%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 3: Target ownership status

We split our sample into three sub-samples: Public target (*Panel A*), Private target (*Panel B*), and Subsidiary target (*Panel C*) depending on the nature of the target ownership. We run the following OLS regression model (1): $IAM_{i,t} = \beta_0 + \beta_1$ *Period of interest*$_{j,t} + \gamma_1$ *Deal-level Controls*$_{i,j} + \gamma_2$ *Firm-level Controls*$_{i,y-1}$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The following measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

Panel A: Public target

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	-0.034	-0.05	3.74%	**-1.318****	-2.25	4.10%	**-1.456***	-1.89	3.23%
PQ Spread	0.024	0.75	20.36%	**-0.089*****	-3.16	18.94%	**-0.072****	-1.98	18.62%
Effective Spread	-0.382	-0.63	4.37%	**-1.304*****	-2.58	5.15%	**-1.756****	-2.46	4.23%
PE Spread	0.017	0.98	15.45%	**-0.032***	-1.92	15.46%	-0.017	-0.80	15.24%
HL Spread	0.010	0.73	9.24%	0.005	0.38	8.32%	0.013	0.76	7.34%
Roll	-0.474	-0.47	5.14%	**-2.269****	-2.46	5.11%	**-2.959****	-2.43	4.17%

T-statistics in arentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 3 – *Continued*

Panel B: Private target

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	**1.214***	1.73	9.13%	**-2.816*****	-3.99	9.23%	**-1.656***	-1.88	8.16%
PQ Spread	0.049	1.21	28.85%	**-0.115*****	-3.07	28.51%	-0.067	-1.38	26.94%
Effective Spread	**1.311****	2.13	7.73%	**-1.956*****	-3.38	7.94%	-0.629	-0.86	7.88%
PE Spread	**0.046****	2.15	14.63%	**-0.054*****	-2.63	14.91%	-0.009	-0.33	14.77%
HL Spread	**0.038****	1.99	12.69%	**-0.047*****	-2.57	11.94%	-0.013	-0.58	10.48%
Roll	**1.685***	1.79	15.76%	**-3.597*****	-3.46	15.23%	-1.951	-1.51	14.58%

Panel C: Subsidiary target

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	1.782	1.26	8.57%	-2.039	-1.63	8.65%	-0.196	-0.12	5.43%
PQ Spread	0.036	0.46	24.40%	-0.103	-1.45	24.15%	-0.063	-0.74	27.16%
Effective Spread	1.293	1.19	8.72%	-0.998	-0.98	7.67%	0.251	0.21	8.83%
PE Spread	0.012	0.29	14.12%	-0.037	-0.97	14.92%	-0.027	-0.59	14.98%
HL Spread	-0.027	-0.71	7.52%	0.018	0.51	7.51%	-0.006	-0.14	5.83%
Roll	1.646	0.78	14.87%	-2.701	-1.52	14.81%	-0.825	-0.36	15.91%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 4: Deal type

Panel A reports the type of target firms involved in both type of deals. We split our sample into two sub-samples: Merger (*Panel B*) and Acquisition of assets (*Panel C*), depending on the form of the deal. We run the following OLS regression model (1): $IAM_{i,t} = \beta_0 + \beta_1$ *Period of interest*$_{j,t} + \gamma_1$ *Deal-level Controls*$_{i,j} + \gamma_2$ *Firm-level Controls*$_{i,y-1}$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The following measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012).

Panel A: Type of deal per target status

Deal Type / Target Status	*Merger*		*Acquisition of Assets*	
	Number	Percentage	Number	Percentage
Private	1,211	44.72	238	54.34
Public	1,409	52.03	15	3.42
Subsidiary	88	3.25	185	42.24
Total	2,708	100	438	100

Roll is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

Table 4 – *Continued*

Panel B: Mergers

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	0.439	0.89	6.27%	**-1.793*** **	-3.84	6.45%	**-1.413** **	-2.32	5.52%
PQ Spread	**0.039***	1.68	24.66%	**-0.100*** **	-4.24	23.97%	**-0.064** **	-2.09	23.28%
Effective Spread	0.340	0.76	5.89%	**-1.606*** **	-4.05	6.52%	**-1.288** **	-2.38	5.87%
PE Spread	**0.031** **	2.19	15.64%	**-0.043*** **	-3.16	15.83%	-0.012	-0.72	15.48%
HL Spread	**0.024** **	2.05	10.94%	-0.016	-1.45	10.20%	0.005	0.36	9.09%
Roll	0.486	0.64	9.13%	**-2.825*** **	-4.00	9.11%	**-2.440*** **	-2.66	7.98%

Panel C: Acquisitions

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	**2.813** **	2.43	5.34%	**-3.609*** **	-3.19	5.72%	-0.753	-0.58	3.76%
PQ Spread	0.064	0.97	24.67%	**-0.123***	-1.80	23.18%	-0.061	-0.80	23.92%
Effective Spread	**2.058** **	2.38	6.48%	-0.989	-1.07	6.39%	1.009	0.99	6.19%
PE Spread	0.041	1.30	12.48%	-0.036	-1.07	12.25%	0.003	0.09	12.61%
HL Spread	0.004	0.13	9.00%	-0.031	-0.93	8.25%	-0.024	-0.68	6.96%
Roll	2.736	1.51	12.37%	-3.200	-1.56	11.80%	-0.438	-0.21	11.83%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 5: Deal nature

We look at the impact of hostile deals on the information environment. We run the following OLS regression model (1): $IAM_{i,t} = \beta_0 + \beta_1$ *Period of interest*$_{j,t} + \gamma_1$ *Deal-level Controls*$_{i,j} + \gamma_2$ *Firm-level Controls*$_{i,y-1}$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The following measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	-4.220	-1.58	40.74%	3.036	1.52	48.88%	1.805	0.75	30.63%
PQ Spread	-0.033	-0.43	78.22%	0.024	0.55	81.98%	0.090	0.86	77.11%
Effective Spread	0.909	0.63	29.93%	-0.651	-0.57	34.23%	1.004	0.54	26.28%
PE Spread	0.089	1.35	46.42%	-0.061	-1.54	50.21%	0.044	0.47	44.14%
HL Spread	-0.001	-0.02	18.41%	-0.030	-0.69	30.81%	0.053	0.77	29.17%
Roll	**-8.165****	-2.09	46.58%	4.661	1.62	59.39%	1.812	0.64	43.84%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 6: Method of payment

We split our sample into two sub-samples: All-cash acquisitions (*Panel A*) and All-stock acquisitions (*Panel B*), depending on the method of payment used to conclude the deal. We run the following OLS regression model (1): $IAM_{i,t} = \beta_0 + \beta_1$ *Period of interest*$_{j,t} + \gamma_1$ *Deal-level Controls*$_{i,j} + \gamma_2$ *Firm-level Controls*$_{i,y-1}$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The following measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

Panel A: All-stock deals

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	-0.052	-0.09	10.64%	**-1.306****	-2.20	9.95%	**-1.414***	-1.89	9.41%
PQ Spread	0.011	0.32	30.36%	**-0.066****	-2.15	29.97%	-0.058	-1.44	27.77%
Effective Spread	-0.065	-0.13	10.89%	**-1.318*****	-2.80	11.06%	**-1.394****	-2.32	10.95%
PE Spread	0.01	0.51	18.75%	-0.024	-1.40	19.11%	-0.015	-0.68	18.62%
HL Spread	0.016	1.02	13.66%	-0.008	-0.51	12.66%	0.004	0.19	11.23%
Roll	-0.097	-0.11	16.89%	**-2.274*****	-2.63	15.86%	**-2.498****	-2.29	14.93%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 6 – *Continued*

Panel B: All-cash deals

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2	*Post-Comp.*	T-stat	Adj. R^2
Daily Spread	**2.853*****	2.76	4.26%	**-3.785*****	-3.66	4.23%	-0.921	-0.77	2.62%
PQ Spread	0.086	1.48	21.75%	**-0.125****	-2.06	20.34%	-0.047	-0.66	21.06%
Effective Spread	**2.168****	2.54	5.12%	**-1.939****	-2.20	5.35%	0.273	0.27	4.52%
PE Spread	**0.066****	2.17	12.71%	**-0.067****	-2.12	12.46%	-0.003	-0.09	12.31%
HL Spread	**0.089*****	3.15	9.41%	**-0.098*****	-3.50	8.69%	-0.014	-0.46	7.37%
Roll	**3.280****	2.09	7.99%	**-3.734****	-2.29	7.68%	-0.397	-0.21	7.46%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 7: Withdrawn deals

We investigate failed deals. We run the following OLS regression model (1):

$$IAM_{i,t} = \beta_0 + \beta_1 \, Period\ of\ interest_{j,t} + \gamma_1 \, Deal\text{-}level\ Controls_{i,j} + \gamma_2 \, Firm\text{-}level\ Controls_{i,y\text{-}1}$$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-failure* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. The vector of *deal-level control* variables includes *transaction value*, an indicator variable capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in ***Appendix A***.

The measures follow Haggard et al. (2015) and Chordia et al. (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

	(1) v (2)			(2) v (3)			(1) v (3)		
IAMs	*Negotiation*	T-stat	Adj. R^2	*Post-Withd.*	T-stat	Adj. R^2	*Post-Withd.*	T-stat	Adj. R^2
Daily Spread	**4.063*****	3.78	1.48%	**-2.797****	-1.76	3.44%	**0.707****	1.68	6.03%
PQ Spread	**0.142****	1.80	22.88%	**-0.327*****	-2.78	26.24%	**0.039****	1.69	24.36%
Effective Spread	**2.602****	2.57	7.57%	**-2.243****	-1.69	7.37%	0.524	1.28	5.85%
PE Spread	**0.077****	1.65	15.15%	**-0.201*****	-2.70	13.64%	**0.030****	2.28	15.06%
HL Spread	-0.056	-1.61	11.37%	**-0.108****	-2.13	9.40%	**0.018****	1.66	10.60%
Roll	**5.774*****	3.46	9.33%	-3.628	-1.57	11.75%	0.748	1.07	9.34%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 8: Dodd-Frank Act

We observe the impact of the Dodd-Frank act on the information environment surrounding acquirers during the M&A process. We run an OLS regression on a series of variables of interest and series of control variables using the model defined in equation (2):

$$IAM_{i,t} = \beta_0 + \beta_1 \, Dodd\text{-}Frank_{j,t} + \beta_2 \, Period\ of\ interest_{j,t} + \beta_3 \, Dodd\text{-}Frank_{i,t} * Period\ of\ interest_{j,t} + \gamma_1 \, Deal\text{-}level\ Controls_{i,j} + \gamma_2 \, Firm\text{-}level\ Controls_{i,y\text{-}1}$$

where the dependent variable *IAM* represents any of our information asymmetry measures, *Period of interest* represent the indicator variable *Negotiation* which equals 1 for all observations that occur between the announcement and completion of a deal, 0 otherwise, or the indicator variable *Post-completion* which equals 1 for all observations that occur after the date the merger is effective, 0 otherwise. *Dodd-Frank* is an indicator variable equal to 1 if the observation occurs after the passage of the Dodd-Frank Act, 0 otherwise, and *Dodd-Frank * Period of interest* is the interaction between *Dodd-Frank* and the *Period of interest* variables.

The vector of deal-level control variables includes *transaction value*, and indicator variables capturing the *type* of the merger, the *nature* of the deal, a *tender* indicator, and *the method of payment*. We include *book to market*, *debt to equity*, *total assets and income scaled by lagged total assets* as firm-level controls. We cluster all standard errors by firm and year-month. For clarity, we do not report the coefficients on controls. All variables are defined in **Appendix A**. The measures follow Haggard et al. (2015) and Chordia et al., (2000). The coefficients of our market measures are reported in percent. We calculate *Daily Spread* as the mean daily difference between the day's high and low trading price divided by the closing price. *PQ Spread* is computed as the difference between the bid and ask prices divided by half the bid plus the ask price. *Effective Spread* is calculated as twice the absolute value of the price minus the bid-ask midpoint. *PE Spread* is computed as twice the absolute value of the price minus the bid-ask midpoint scaled by price. *PQ Spread, Effective Spread* and *PE Spread* are calculated in accordance with Chordia et al., (2000). *HL Spread* is the daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012). *Roll* is the daily estimated spread estimated by the covariance in prices calculated in accordance with Roll (1984). For readability, all coefficients are scaled by a factor of 100.

Panel A: Pre-announcement period (1) vs negotiation period (2)

	Dodd-Frank		*Negotiation period*		*Dodd-Frank * Negotiation Period*		
IAMs	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Adj. R2*
Daily Spread	**-0.273*** **	-12.71	0.274	0.54	-0.292	-0.49	11.09%
PQ Spread	**-0.014*** **	-11.17	0.015	0.56	0.004	0.09	28.95%
Effective Spread	**-0.225*** **	-16.15	0.139	0.31	-0.001	0	9.15%
PE Spread	**-0.008*** **	-10.79	0.019	1.39	-0.026	-0.92	18.10%
HL Spread	**-0.003*** **	-17.11	0.014	1.14	-0.011	-0.55	11.19%
Roll	**-0.376*** **	-17.49	0.046	0.06	0.496	0.52	14.40%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Table 8 – *Continued*

Panel B: Negotiation period (2) vs post-completion period (3)

	Dodd-Frank		*Post-completion period*		*Dodd-Frank * Post-completion Period*		
IAMs	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Adj. R2*
Daily Spread	**-0.273*** **	-12.74	**-1.961*** **	-4.10	**1.710*** **	3.06	11.40%
PQ Spread	**-0.013*** **	-15.57	**-0.099*** **	-4.08	**0.082** **	2.04	28.06%
Effective Spread	**-0.224*** **	-13.05	**-1.451*** **	-3.60	**1.181** **	2.29	9.98%
PE Spread	**-0.008*** **	-17.99	**-0.037*** **	-2.75	0.034	1.39	18.25%
HL Spread	**-0.003*** **	-13.71	-0.014	-1.16	0.014	0.70	10.43%
Roll	**-0.368*** **	-13.16	**-2.78*** **	-3.81	**2.045** **	2.30	14.56%

Panel C: Pre-announcement period (1) vs post-completion period (3)

	Dodd-Frank		*Post-completion period*		*Dodd-Frank * Post-completion Period*		
IAMs	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Coefficient*	*T-stat*	*Adj. R2*
Daily Spread	**-0.269*** **	-19.58	**-1.721*** **	-2.80	**1.434** **	2.00	9.41%
PQ Spread	**-0.013*** **	-19.02	**-0.087*** **	-2.77	**0.087***	1.70	27.47%
Effective Spread	**-0.223*** **	-14.30	**-1.314** **	-2.45	**1.200***	1.78	9.01%
PE Spread	**-0.008*** **	-19.20	-0.019	-1.13	0.010	0.33	17.72%
HL Spread	**-0.003*** **	-14.22	-0.002	-0.16	0.002	0.10	8.96%
Roll	**-0.372*** **	-15.65	**-2.772*** **	-2.95	**2.486** **	2.20	12.97%

T-statistics in parentheses. ***, **, and * denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

Appendix A: Variable definitions

Variable	*Definition*
Book-to-Market	Book value of assets over market value of assets.
Daily Spread	The mean daily difference between the day's high and low trading price divided by the closing price.
Deal Nature	An indicator variable equal to 1 if the deal is friendly, 0 otherwise.
Deal Type	An indicator variable equal to 1 if the deal is a merger, 0 otherwise.
Debt to Equity	Long-term debt over equity.
Dodd-Frank	an indicator variable equal to 1 if the observation occurs after the passage of the Dodd-Frank Act, 0 otherwise
Effective Spread	Twice the absolute value of the price minus the bid-ask midpoint.
HL Spread	The daily mean of the estimated effective spread calculated in accordance with Corwin and Shultz (2012).
Income Scaled	Net income scaled by lagged assets.
Negotiation	An indicator variable equal to 1 for all observations that occur during the negotiation period of the merger, 0 otherwise.
Pct cash	The percentage of the transaction value paid for in cash.
Pct stock	The percentage of the transaction value paid for with equity.
PE Spread	Calculated in accordance with Chordia et al., (2000).
PQ Spread	The difference between the bid and ask prices divided by half the bid plus the ask price.
Post-Completion	An indicator variable equal to 1 for all observations that occur after the date the merger is effective, 0 otherwise.
Post-Failure	An indicator variable equal to 1 for all observations that occur after the date the merger failed, 0 otherwise (Failed deal sample).
Roll	The daily estimated spread estimated by the covariance in prices calculated as in Roll (1984).
Tender	An indicator variable equal to 1 if a tender offer was used, 0 otherwise.
Total Assets	Total assets of the firm (in $ million).
Transaction value	The dollar value of the transaction (in $million).