# How do equity analysts impact takeovers?*

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**Abstract**
Firms covered by more analysts are more likely to become takeover targets and more likely to enter deals in which their acquirers initiate private merger negotiations. Moreover, when equity analysts' pre-acquisition price forecasts imply greater target undervaluation, target firms are more likely to initiate their own sale, takeover premiums are higher, those premiums tend to be revised upwards during private merger negotiations, and acquirer firms use less cash to structure the transaction. These results imply a material role for equity analysts during the M&A process: their coverage affects takeover probabilities while their price forecasts influence merger premiums and the merger consideration. Our findings support both investor recognition and information generation theories about the role of equity analysts in financial markets.

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## 1. Introduction

While existing research consistently agrees with the tenet that analyst coverage affects firm value, there is widespread disagreement about *how* analysts (and their forecasts) are value relevant. Much of the existing literature centers of three plausible theories of the value added by analysts: improved monitoring (e.g., Jensen and Meckling, 1976; Yu, 2008; Chen, Harford, and Lin, 2015); reduced information asymmetry (e.g., Healy and Palepu, 2001; Chang, Dasgupta, and Hilary, 2006; Bowen, Chen, and Cheng, 2008; Kelly and Ljungqvist, 2012; Bradley, Clarke, Lee, and Ornthanalai, 2014); and improved investor recognition (e.g., Merton, 1987; Irvine, 2003).

We contribute to this literature by empirically examining the role of equity analysts in the merger and acquisition (M&A) process. Specifically, we investigate two research questions. First, does analyst coverage affect the likelihood of becoming a takeover target? To the extent that the stock market recognition (or visibility) of firms (Merton, 1987) increases with analyst coverage, and assuming that such visibility is important in determining which firms a potential acquirer targets, firms with greater coverage by analysts should be more likely to be targeted by an acquirer.

Our second research question asks whether analysts' forecasts have information content in the M&A setting. Specifically, we examine whether price forecasts, which convey analysts' opinion on the fair value of a stock, are useful to M&A participants in takeover negotiations.[1] On the one hand, price forecasts may provide little value in the M&A setting because potential bidders typically have access to non-public information about the target firm once they sign a confidentiality agreement. Thus, the valuation estimates produced by equity analysts maybe less

[1] In the I/B/E/S database, the variable name for analysts' price forecast is "price target." We use the term "price forecast" to avoid potential confusion between "price target" and "takeover target," with the later referring to the firm that is being bought.

useful because the information set available to a potential acquirer should be much broader and deeper than that available to external equity analysts. On the other hand, anecdotal evidence frequently suggests that investment banks do consider external equity analysts' opinions, and explicitly use price forecasts, when evaluating the value of potential target firms.[2]

We analyze 1,317 M&A completed transactions involving publicly traded target U.S. firms announced between 1994 and 2016. To examine how equity analyst affect the acquisition process, for every target firm we manually collect information on the private negotiation process including the date the deal starts, the first bid price submitted by the winning bidder, and the identity of the party that initiates the transaction.

Our analyses start by comparing analyst coverage between takeover targets and control firms matched by industry and size. We find that target firms have significantly higher coverage pre-merger, compared to their matched control firms. On average, firms that are targeted in an acquisition are followed by about 9.8 analysts in the year prior to being targeted while matched non-target firms that are followed by about 6.5 analysts.

To ensure that our results are not driven by systematic differences in observable firm characteristics (such as operating performance), we use multivariate regressions to investigate how analyst coverage affects the likelihood of becoming a takeover target. Consistent with the univariate results, the multivariate analyses show a significantly positive association between analyst coverage and the likelihood of becoming a takeover target even after we include additional controls. The association between analysts' coverage and takeover likelihood, which obtains under

[2] Appendix B herein contains an example that illustrates how investment banks rely on analysts' price forecasts to determine takeover premiums.

alternative econometric specifications and robustness tests, delivers support for the *investor recognition* hypothesis.

We acknowledge that our takeover prediction tests could be subject to endogeneity concerns or omitted variable problems. For example, firms that appear to be more attractive to acquirers (thus are more likely to become takeover targets) could also attract more analyst coverage. To tackle this potential endogeneity (or omitted variables) problem, we adopt a two-pronged approach. First, to assess the robustness of our takeover prediction results to omitted correlated variables, we compute the Impact Threshold of a Confounding Variable (hereafter ITCV) following Frank (2000). Recent work (e.g., Call, Martin, Sharp and Wilde, 2018; Larcker and Rusticus, 2010) use this method to assess how large an omitted variables bias must be to overturn the statistical inference from an Ordinary Least Squares (OLS) model. The magnitudes of the thresholds in the ITCV test suggest that our OLS results are robust and are unlikely to be explained by correlated omitted variables.

Second, we implement an instrumental variable (IV) test. In our setting, the obvious source of an endogenous choice is the decision by analysts to cover a particular firm. Therefore, a valid instrumental variable should affect the likelihood of becoming a takeover target *only* through its effect on analyst coverage (and not directly). Following Yu (2008) and He and Tian (2013) we use expected analyst coverage, which captures changes in brokerage house size, as our instrument in a two-stage least squares test to correct for potential bias due to endogeneity in analyst coverage. This analysis generates inferences that are consistent with those from our baseline (OLS) regressions. Taken together, our ITCV and IV results suggest a positive *causal* effect of analyst coverage on the likelihood of a firm becoming a takeover target. These results are consistent with

our argument that analyst coverage significantly aids in the identification of potential takeover targets, likely by increasing the visibility of those firms to potential acquirers.

After documenting the effect of analysts' coverage in the likelihood that a firm becomes a takeover target, we examine whether analysts' stock price forecasts have wealth implications for the shareholders of the target firm. In this regard, we find strong evidence that equity analysts significantly impact takeover premiums. Notably, it is not coverage *per se* that appears to matter: rather, it is the specific information generated by the analyst community about the target firm's prospects before it becomes a takeover target. Specifically, to proxy for pre-merger undervaluation of the target, we consider the distance between the pre-acquisition market price of the target's shares and the average analyst's pre-acquisition price forecast for those shares. Our results show that targeted firms receive higher takeover premiums the greater is that pre-merger undervaluation. Moreover, takeover premiums tend to be revised upwards during private merger negotiations when pre-merger undervaluation is greater.

Our premium results are not only statistically significant but also economically important. A 1% increase in pre-merger undervaluation relative to equity analysts' price forecasts is associated with a 0.19% increase in premium,[3] and the variable measuring the pre-acquisition market-price distance from the average analyst's price forecast (i.e., undervaluation) explains about 17% of the cross-sectional variation in negotiated acquisition premiums. The premium evidence, which survives numerous robustness tests, provides support for the hypothesis that analysts *generate information* that is relevant during the M&A price-setting stage. This evidence is also consistent with the hypothesis that the work done by analysts to identify undervalued firms also enhances the

[3] Given that the average pre-merger target market value is $3.5 billion, a 0.19% increase in premium corresponds to an increase of $6.5 million in the purchase price.

scrutiny (or *monitoring*) of the managers of those firms, which in turn improves deal outcomes (e.g. premiums) for their shareholders in acquisitions.

Next, we examine whether pre-merger undervaluation relative to equity analysts' price forecasts affects the method of payment in the M&A setting. This analysis is motivated by the theoretical and empirical literature investigating the determinants of the choices between cash and stock paid to target shareholders. This literature generally shows that the problem of asymmetric information and incentives for *risk sharing* between target and bidder shareholders are primary motivations for bidders to reduce cash (and increase stock) financing in M&A deals.[4]

We find that pre-merger undervaluation relative to equity analysts' price forecasts (but not analyst coverage per se) is negatively related to the use of cash as a method of payment. We interpret our results as consistent with the hypothesis that analysts' stock price forecasts contain useful information regarding target firms' future growth potential. Although higher pre-merger undervaluation potentially indicates greater upside potential in an acquisition, it also suggests that the target firm is a riskier investment, for example if the anticipated growth is not realized. As a result, less cash (and more stock) in the method of payment allows the acquirer to share more of this execution risk with target shareholders (i.e., consistent with the risk sharing hypothesis).

Finally, our hand-collected data enables us to study whether analysts play a role in the identity of the party that initiates private merger negotiations. The results of these tests offer support for both the visibility hypothesis and the information generation hypothesis. We find that firms covered by more analysts are more likely to be targets in deals initiated by their acquirers. This evidence, combined with the results that firms with greater coverage are more likely to become

[4] See e.g., Hansen (1987); Fishman (1989); Houston and Ryngaert, (1997); Officer (2004).

takeover targets, lends strong support for the visibility hypothesis. Our tests also reveal that whenever analysts' forecasts imply greater target undervaluation, private merger negotiations are more likely to be initiated by the target firm. In tandem with the evidence that targets with greater undervaluation receive higher takeover premiums, this last result supports the view that analysts *generate information* that firms exploit to offer themselves as valuable takeover targets.

Our work expands the literature on M&As and on the role that equity analysts play in capital markets. Although there is extensive evidence on the influence of equity analysts on firms' information environments and stock prices, the role of equity analysts following *target firms* in the takeover setting is largely unexplored. A limited number of recent studies investigate the impact of analysts in the M&A setting, including Chen, Harford, and Lin's (2015) work on the effect of analyst coverage on *acquiring firms,* Tehranian, Zhao, and Zhu's (2014) study on whether the target firm's analysts initiate coverage of the combined firm after the target firm is delisted post-acquisition, and Becher, Cohn, and Juergens's (2015) analyses on whether analyst recommendations affects the likelihood of deal completion.

Our study extends this literature by providing novel evidence indicating that (1) analyst coverage affects takeover probabilities and (2) analysts' price forecasts for target firms (before these firms become takeover targets) affect merger premiums and the method of payment. The valuation *work* of external equity analysts appears to meaningfully impact the price that the (eventually) successful acquirer pays to complete the acquisition, and the choices of cash versus stock offered to target shareholders as consideration.

This paper also contributes to the debate on the usefulness and informativeness of equity analysts' research reports.[5] Although some prior studies show that investors do consider equity analysts' price forecasts to be informative (e.g., Brav and Lehavy, 2003; and Asquith, Mikhail, and Au, 2005), others argue that price forecasts contain little information and are of limited value (e.g., Bradshaw, Brown, and Huang, 2013).[6] Our analyses of takeover premiums suggest that analysts' price forecasts are useful to sophisticated investors (i.e., M&A participants and investment banks) in appraising takeover targets and negotiating deal premiums. Our tests of the method of payment also suggest that analysts' price forecasts have valuable information regarding target firms' future growth opportunities (and the heightened execution risk that those growth opportunities engender).

The paper proceeds as follows. Section 2 explains our sample and data. Section 3 reports empirical results on the effect of analysts' coverage and price forecasts on takeover probabilities and conducts robustness and identification tests. Section 4 describes our findings on the effect of analysts' coverage and price forecasts on takeover premiums. Section 5 presents additional investigations on how equity analysts affect the private sale process. Section 6 concludes.

## 2. Sample description and summary statistics

We collect information on all completed M&A deals announced from 1994 to 2016 covered in the Thomson One Banker SDC database involving a publicly traded target with a share price one day prior to the announcement of no less than $5.[7] From this set, we retain all transactions for which

[5] Our study is also generally related to work considering the link between sell-side analysts and firm performance (see, for example, Womack, 1996, Barber, Lehavy, McNichols, and Trueman, 2001, Jegadeesh, Kim, Krische, and Lee, 2004, Loh and Stulz, 2011, and Derrien and Kecskes, 2013). See Bradshaw (2011) for a review of the accounting literature on the effect of analyst coverage.

[6] O'Brien (2001) quotes Michael Farr, president of money manager Farr, Miller & Washington regarding the value of price targets: "Price targets, at their worst, can be used to exploit unsophisticated investors", and Charles Lee, professor of accounting and finance of Cornell University: "I'm not sure I'd put any stock in price targets themselves."

[7] Discarding deals with target firms with a stock price lower than five dollars mitigates the possibility that financially distressed companies drive our findings.

the deal value reported by SDC is at least $1 million and the acquirer holds less than 50% of the target shares before the deal announcement and seeks to buy 50% or more of the shares of the target firm after the deal. These criteria produce a sample of 5,310 deals. We then match these deals with data from the Center for Research in Security Prices (CRSP) to obtain target-firm stock returns, from Compustat to get accounting variables, and from Institutional Shareholder Service (ISS) to find information on their takeover defenses (e.g. poison pills and staggered boards). Finally, we require that merger documents are accessible on the SEC's Electronic Data Gathering and Retrieval (EDGAR) so that we can collect detailed information on the private sale process and bid price information.[8] These steps produce a sample of 1,324 M&A transactions. Table 1 lists the steps that generate the sample of 1,324 observations.

*2.1 Matched samples*

For each of the 1,324 target firms, we identify similarly sized non-target firms from the same two-digit SIC industry as the target firm. Our procedure, which mimics that in Bena and Li (2014), requires that the difference in market capitalization between the target firm and the matched firms in the year before the merger is between 50% and 200%. We form two control samples, the first uses one-to-one matches and the other uses one-to-five matches. For the one-to-one matched sample, we include only the matched firm with market capitalization closest to that of the target firm. For the one-to-five matched sample, we include up to five control firms with market capitalization closest to that of the target firm. We eliminate seven target firms where no suitable

[8] For every deal, we manually collect information on the private negotiation process including the date the deal was first initiated, the first bid price submitted by the winning bidder and the number of bidders participating in the private negotiation process.

matches are identified. Consequently, our final sample consists of 1,317 completed M&A deals announced during 1994-2016.

*2.2 Sample distribution and summary statistics*

Table 2, Panel A presents the temporal distribution of our sample. Consistent with prior studies (e.g., Andrade, Mitchell, and Stafford, 2001; Harford, 2005), we observe increased merger activity in the late 1990s / early 2000s. The last column of Panel A reports the average number of analysts following target firms. We obtain information on analyst coverage from the I/B/E/S Summary History database. Figure 1 illustrates our measurement window for analyst coverage. We use the 12-month period *prior* to the private deal initiation date to compute the average number of analysts following the target firms. This measurement window lessens the concern that our results are driven by potential reverse causality (i.e., analyst coverage might be affected by takeover rumors or market speculation due to information leakage once the private negotiation starts). Panel A shows that the average number of analysts covering our target firms is fairly stable during our sample period, ranging from 8 to 12 prior to deal initiation.

Table 2, Panel B reports summary statistics for target firms and matched control firms separately. Panel B also provides univariate evidence on mean differences for firm characteristics between takeover target firms and matched firms for the one-to-one matched sample and the one-to-five matched sample, respectively. The results show that takeover targets have significantly higher analyst coverage compared to their matched firms. On average, target firms are covered by 9.8 analysts prior to deal initiation, compared to 6.5 for the one-to-one matched control firms and 6.6 for the one-to-five matched firms. The mean differences in analyst coverage between the sample of actual targets and both control samples are statistically significant at the 1% level.

In terms of other firm characteristics, not surprisingly, there are no statistically significant differences between the target firms and control firms in terms of market value and book value of total assets, indicating that our matching process successfully identifies control firms with similar size. However, target firms tend to have lower market-to-book ratios, lower sales growth, and lower cash holdings. Given these differences, in our regression analysis, we explicitly control for operating performance and other firm characteristics.

Bowen et al. (2008) find that, by improving a firm's information environment, analysts' coverage can reduce a firm's cost of capital. More recently, Kelly and Ljungqvist (2012), Bradley et al. (2014), and Amiram et al. (2016) suggest that analysts generate reports that increase the quality of the firm's information available to investors and other parties. With this literature as a backdrop, we construct the variable *Analyst price forecast growth % (PFG%)* to capture analysts' belief in stock price undervaluation or growth potential. Specifically, for each target firm (and the matched control firms), we first calculate the average of the consensus price forecast obtained from the I/B/E/S Summary History file during the 12-month period prior to deal initiation. We then divide this average price forecast by the firm's stock price one day prior to deal initiation. We use price forecasts released *prior* to deal initiation to make sure that these projections are not distorted by the M&A sale process.[9] Table 2, Panel B shows that *PFG%* is not statistically different between the target and matched control firms.

[9] Prior studies show that once firms start the private merger negotiation process, they may engage opportunistic behavior such as influencing media coverage, managing analysts' forecasts, or manipulating earnings (e.g., Erickson and Wang, 1999; Ahern and Sosyura, 2014; and He, Liu, Netter, and Shu, 2020).

## 3. Econometric analyses

Our empirical tests use two constructs to ascertain the role of equity analysts during M&As. The first measures the effect of coverage (proxied by the number of equity analysts that follow a firm) while the second (based on analysts' price forecasts) tracks potential target undervaluation.

### *3.1. Equity analysts and the likelihood of becoming a takeover target*

Following the theory in Merton (1987), existing studies argue that analyst coverage appears to increase investors' recognition and visibility of covered stocks (e.g., O'Brien and Tan, 2015; Li and You, 2015). In our context, it is possible that, by enhancing the visibility of some firms, analyst coverage increases their likelihood of becoming takeover targets. Consistent with this conjecture, our univariate evidence in Panel B of Table 2 suggests that analyst coverage affects the likelihood of becoming a takeover target. Next, we use multivariate analyses to further investigate this issue.

To study the impact of analyst coverage on takeover likelihood, we estimate linear probability regressions because incidental parameter bias is likely to arise in logit or probit models that include a large number of fixed effects (Angrist, 2001). Therefore, linear probability estimation is appropriate in our case since we include industry and year fixed effects, or deal fixed effects in our tests. We nevertheless supplement our linear probability tests with conditional logit models.[10]

Table 3 reports twelve regressions in which the dependent variable is an indicator set to one if the firm is a takeover target and set to zero for matched control firms. Our main independent variable in Models (1) through (6), *Log (Coverage)*, is the natural logarithm of one plus the average number of analysts following the firm during the 12-month period prior to the private deal

[10] These logit tests are available from the authors by request.

initiation date. Models (1) and (4) control for additional firm characteristics whereas Models (2) and (5) further include year and industry fixed effects to account for potential variation in industry factors and regulatory changes during the sample period. Models (3) and (6) add deal fixed effects to control for any unobserved deal-specific covariates (because up to five control firms are matched to a specific deal). In both panels, Models (1)-(3) analyze the one-to-one matched sample while Models (4)-(6) analyze the one-to-five matched sample.

The multivariate tests in Models (1)-(6) of Table 3 show that analyst coverage is significantly related to the likelihood of becoming a takeover target. The magnitude of the estimates is of first-order economic importance. According to the regressions that use the one-to-one matched sample (one-to-five matched sample), expanding coverage by one analyst (from the sample average level of coverage) is associated with an increase of 2.04% to 4.27% (1.07% to 1.50%) in the probability that the firm becomes a takeover target.[11]

To put our estimates in context, in the one-to-five matching sample mechanically one out of every six observations in the sample (16.7%) experiences a takeover.[12] Therefore, relative to the unconditional takeover probability of 16.7%, the marginal effects discussed above (1.07% to 1.50%) represent a 6.4% to 9.0% increase in the odds of becoming a takeover target associated with coverage by one additional analyst over the unconditional sample average of the number of analysts covering firms.

Next, we evaluate whether, aside from the effect of coverage per se, the price forecasts in (i.e., information generated by) analysts' research reports appear to influence the probability with which

[11] In unreported results, we find that the average analyst coverage in the one-to-one matched (one-to-five matched) sample is 8.1 (7.1). Thus, an increase of one analyst following corresponds to an increase of 12.3% (14.1%). We take the coefficient estimate and multiply it by the log value of the percentage increase to estimate the economic significance. For example, for Column (1), we use $0.176 \times \log(1.123) = 2.04\%$.

[12] This represents a takeover rate that is higher than the 5% takeover rate in the overall economy (Eckbo, 2014, p.60).

a firm is targeted in an acquisition. Our interest in evaluating analysts' price forecasts is based on evidence documenting that equity analysts' price forecasts contain information about a firm's future performance (e.g., Brav and Lehavy, 2003).[13] It is possible, therefore, that potential acquirers are not only attracted to their acquisition targets because analyst coverage increases the visibility of those firms, but that potential acquirers also pay attention to the information generated by analysts. Under this conjecture, acquirers pursue potential takeover target firms for which analysts' price forecasts imply substantial undervaluation at current (i.e., pre-acquisition) market prices. In other words, we are interested in studying whether potential acquirers appear to target firms for which analysts' reports suggest have the most untapped valuation potential (i.e., are "cheap buys"). Therefore, if M&A participants use analysts' price forecasts to help assess the target firm generally (and particularly that firm's level of over- or under-valuation at current stock market prices), then we expect *PFG%* to be correlated with the probability that a firm is targeted in a takeover.

In the takeover prediction regressions reported as Models (7) through (12) in Table 3, we include both analyst coverage and price forecasts (*PFG%*) to test whether it is the 'visibility effect' or 'the information generation effect', or both, that influence takeover probabilities. For this analysis our sample includes M&A deals announced from 2000 to 2016 because data on analysts' price forecasts begins in mid-1999. Models (7)-(12) show that the number of analysts covering the firm continues to strongly predict whether that firm receives a takeover bid. In contrast, analysts' valuation work (at least as proxied by their estimates of undervaluation at pre-merger market prices) appears to play no role in aiding with the identification of takeover targets.

[13] Brav and Lehavy (2003) show that analysts' price forecasts provide significant incremental information over and above that contained in stock recommendations and earnings forecasts. However, Bradshaw (2002) argues that analysts sometimes concoct price forecasts to ex-post justify their buy/sell recommendations.

Taken together, the results reported in Table 3 provide evidence consistent with a firm *recognition* (or visibility) role for external equity analysts. Analyst coverage per se increases the probability of a firm becoming a takeover target, while analysts' price forecasts (i.e., the information those analysts generate) do not.

### *3.2 Robustness tests and identification for takeover likelihood*

Our evidence on the visibility/recognition channel of analyst coverage affecting the takeover likelihood could be subject to endogeneity concerns if firms that appear to be more appealing to acquirers (i.e., more likely to become takeover targets potentially because of firm fundamentals) also attract more analysts' coverage. While our coverage / takeover likelihood tests use matched samples and include firm characteristics to control for observable systematic differences, the potential impact of *unobservable* omitted variables still remains a concern. We address this issue with two different econometric techniques: an impact threshold of a confounding variable (ITCV) analysis and an instrumental variable (IV) approach.

#### *3.2.1. Impact threshold of a confounding variable*

To empirically assess the robustness of our takeover prediction results to omitted correlated variables, we compute the Impact Threshold of a Confounding Variable (hereafter ITCV). This method, described by Frank (2000), has been used in recent studies to assess how large the potential bias has to be to overturn OLS statistical inference.[14] The bias arising from an omitted variable depends on the correlation between the omitted variable and: (1) the dependent variable, and (2) the independent variable of interest. The ITCV is the lowest product of the two correlations

[14] See, for example, Call, Martin, Sharp and Wilde (2018) and Larcker and Rusticus (2010).

that could cause the coefficient of interest to lose statistical significance if the omitted confounding variable were a control in the regression model. Therefore, the larger the magnitude of the ITCV the more robust the OLS results are to omitted variables concerns.

Table 4 reports the ITCV for our takeover prediction tests and the impact of each control variable as a benchmark. We use X to represent our main independent variable (i.e., analyst coverage), Y to represent the outcome variable (i.e., an indicator variable that equals 1 for takeover targets), and V to represent each covariate. We report the Threshold for % Bias to Invalidate/Sustain the Inference and the ITCV in the bottom two rows of Table 4. The Threshold for % Bias to Invalidate/Sustain the Inference is the percent of the estimate or the percent of observations that would have to be replaced with cases for which there is an effect of zero to invalidate the inference. ITCV is the minimum product of the correlation between analyst coverage and the confounding variable and the correlation between the dependent variable and the confounding variable that is required to overturn the significant OLS results.

According to the results in Table 4, to overturn our OLS estimates in the one-to-one matched sample, 88% of our observations would have to be replaced with cases for which there is a zero effect of analyst coverage on the likelihood of being a takeover target. The ITCV of 0.291 implies that an omitted variable would have to be correlated at 0.54 with the outcome variable (takeover target) and at 0.54 with the main independent variable (coverage) to invalidate an inference ($0.54 \times 0.54 = 0.291$).

Although there is no standard critical value for this analysis, the magnitudes of the Threshold for % Bias and the ITCV suggest that our OLS results are unlikely explained by correlated omitted variables. To further assess the severity of the endogeneity problem, we report the impacts of observed control variables to provide a benchmark to compare the ITCV. The results show that

among all control variables, log (total assets) has the biggest impact. The correlation between log (total assets) and X is 0.399 and the correlation between log (total assets) and Y is 0.06. The impact of this variable, which is the product of the two correlations, is 0.024. Notably, this control variable with the greatest impact (0.024) is still much smaller (less than one-tenth) compared to the ITCV of 0.291. We obtain very similar findings using the one-to-five matched sample.

Consequently, the results in Table 4 suggest that an omitted confounding variable must be more highly correlated with both analyst coverage and the probability of becoming a takeover target than any of our existing control variables to overturn our regression results.

*3.2.2. Instrumental variable approach*

The ITCV analysis provides evidence that our takeover target prediction results are unlikely attributed to correlated omitted variables. We nevertheless perform a different test to address the concern of potential correlated omitted variables with an instrumental variable (IV) analysis.

A legitimate instrumental variable must be correlated with the endogenous regressor (i.e., analyst coverage), but uncorrelated with the error term in the structural equation. In our setting, a valid instrument should affect the likelihood of being a takeover target only through its effect on analyst coverage. Following Yu (2008) and He and Tian (2013), we use expected analyst coverage, which captures the change of brokerage house size, as our instrument and use a 2SLS approach to correct for potential bias due to endogeneity in analyst coverage.

As discussed in Yu (2008) and He and Tian (2013), the size of a brokerage house, proxied by the total number of analysts working for it, usually depends on the change in its own revenue, profit, or business strategy. When a brokerage house increases (reduces) its size, it employs more (fewer) analysts and tends to cover more (less) firms. Thus, the change of brokerage house size is

likely to generate an *exogenous* change in a firm's analyst coverage, which would therefore satisfy the relevance condition for a valid instrument.[15] More importantly, it is unlikely that the change of brokerage house size (driven by its own business needs) directly affects the likelihood of certain covered firms becoming a takeover target, which satisfies the exclusion condition.

Similar to the tests in both Yu (2008) and He and Tian (2013), we use equations (1) and (2) to calculate expected analyst coverage for firm *i* in year *t*:

$$ExpCoverage_{i,t,j} = BrokerSize_{t,j} \,/\, BrokerSize_{0,j} \times Coverage_{i,0,j} \quad (1)$$

and

$$ExpCoverage_{i,t} = \sum_{j=1}^{n} ExpCoverage_{i,t,j} \quad (2)$$

where $ExpCoverage_{i,t,j}$ is the expected coverage of firm *i* from broker *j* in year *t*. $BrokerSize_{0,j}$ and $BrokerSize_{t,j}$ are the number of analysts employed by broker *j* in the benchmark year 0 and year *t*, respectively. $Coverage_{i,0,j}$ is the size of the coverage for firm *i* from broker *j* in the benchmark year 0. $ExpCoverage_{i,t}$ is the total expected coverage of firm *i* from all brokers in year *t*. Since our sample period starts in 1994, we use 1993, the year prior to the start year of our sample period, as the benchmark year.[16]

A potential concern about our instrument is that, after a decrease in size of the brokerage house, the choice of firms that would lose coverage is not random. On this issue, it is important to note

[15] He and Tian (2013) provide three real-world examples to illustrate that the change of brokerage house size is likely to provide a plausibly exogenous variation in analyst coverage.

[16] For this analysis, we exclude firms that do not have analyst coverage during our sample period. For firms that receive coverage after the benchmark year of 1993, we use the first year a firm receives coverage as the benchmark year to calculate expected coverage for the later years and exclude the benchmark year in the 2SLS analysis.

that such selection only affects the *ex-post realized* coverage and does not affect the *ex-ante expected* coverage (Yu, 2008).

Columns (1) and (3) of Table 5 show the first-stage regression results with analyst coverage as the dependent variable to check the relevance of the instrument for both the one-to-one and one-to-five matched samples, respectively. For both samples, the estimates of *Expected Coverage* are positive and significant at the 1% level. These findings are consistent with those in both Yu (2008) and He and Tian (2013).[17] More importantly, in line with our baseline results, the coefficients on the fitted value of analyst coverage in the second stage regressions (Columns 2 and 4) are positive and statistically significant.

In general, our ITCV results in Table 4 and the evidence from our IV tests in Table 5 suggest a positive causal effect of analyst coverage on the likelihood that a firm becomes a takeover target. These findings, which mitigate endogeneity and reverse causality concerns, are consistent with the hypothesis that, by increasing the visibility/recognition of some firms, analyst coverage helps acquirers identify potential takeover targets.

## 4. Equity analysts and takeover premiums

In this section we evaluate whether analysts' coverage and/or their price forecasts affect the prices paid by acquirers in takeovers (i.e., takeover premiums). If coverage itself generates visibility of the target firm (as suggested above), then coverage may also impact takeover premiums since greater visibility implies a larger pool of potential bidders for the target, and competition increases takeover premiums (Bulow and Klemperer, 1996; Klemperer, 1998).

[17] The Stock and Yogo (2005) tests reject the null hypothesis that the instrument is weak, as the F-test value of the first-stage regressions is well above the critical values.

It is possible, however, that potential acquirers pay attention to more than the simple fact that equity analysts cover a target firm. Instead, potential acquirers might actually consider on the valuation work done by those analysts. In the M&A setting, however, it is worth bearing in mind that analysts' valuations may be irrelevant because potential acquirers submit their takeover bids after a due diligence process based on access to confidential, non-public information about the target firm. Thus, the information set available to a potential acquirer might be much comprehensive than that available to external equity analysts.

Nonetheless, external equity analysts might be more likely to produce unbiased, independent projections of the target firm's value because their price forecasts are issued *before* the firm becomes a takeover target.[18] This independence (driven by the timing of the price forecasts relative to the acquisition) suggests that the work by analysts may be useful to potential acquirers and their advisors, and that M&A participants may use external equity analysts' price forecasts to guide their valuation and serve as a benchmark to negotiate takeover premiums. Therefore, it is an empirical question whether *PFG%* is related to M&A deal premiums.[19]

To estimate the total takeover premium received by target shareholders in an M&A deal, we divide the final public offer price (from SDC data) by the target's stock price one day prior to the deal initiation date (*the benchmark price*) and subtract one.[20] We further decompose the *Total*

[18] And thus, *before* the potential acquirer hires an M&A advisor who may, or may not, work for the same firm that does an analyst that issued a prior price forecast about that target.

[19] In fact, analysts price forecasts might be particularly important in situations in which the target themselves may have incentives to overstate positive information or omit negative information in the 'non-public information' they disclose to potential bidders. For example, in 2012, RAA management (a potential bidder) sued Savage Sports Holdings (the target) for misrepresentation and omission of significant negative information in the confidential documents RAA obtained after signing the non-disclosure agreement. Because of the 'non-reliance provisions' in the confidentiality agreement executed by the parties, however, the Court dismissed the claim by RAA.

[20] Prior studies show that the stock market is likely to incorporate merger-related information well before the date of a formal merger announcement, which is why we use the date on which the target or bidder board of directors begins negotiating (or considering) the deal to measure the benchmark price. See Eaton, Liu, and Officer (2019) for more detailed discussion about issues related to measuring M&A premiums.

*premium* into three components: *First private bid premium*, *Private revision premium*, and *Public revision premium*. The First private bid premium is the initial private bid price from the merger document relative to the benchmark price. The Private revision premium is the difference between the initial public offer price and the first private bid price relative to the benchmark price. The Public revision premium is the difference between the final public offer price and the initial public offer price relative to the benchmark price.

We use the merger between Hittite Microwave and Analog Devices detailed in Appendix C as an example to illustrate our decomposition of the total premium. This deal was initiated in a phone call made by the CEO of the bidder (Analog Devices) on November 13, 2013. The stock price of the target (Hittite Microwave) on November 12, 2013, was $61.62. Therefore, in this transaction, $61.62 is the benchmark price. During private negotiations, the first offer price proposed by Analog Devices to acquire Hittite Microwave's common stock was $74.00 per share on March 15th. The first publicly observed offer price after private negotiations was $78.00, which is the same as the final publicly observed offer price. In this example, the *Total premium* received by Hittite Microwave shareholders is 26.6% [($78.00-$61.62)/$61.62 = 26.6%]. The *First private bid premium* is 20.1% [($74.00-$61.62)/$61.62 = 20.1%]. The *Private revision premium* is 6.5% [($78.00-$74.00)/$61.62 = 6.5%] and the *Public revision premium* is 0% [($78.00-$78.00)/$61.62 = 0%]. Note also that 20.1% + 6.5% + 0% = 26.6% (the three premium components sum up to the total premium).

Table 6 reports the results of four OLS regressions in which Total premium, First private bid premium, Private revision premium, and Public revision premium are the respective dependent variables in columns (1)-(4). The regressions in Table 6 include industry and year fixed effects and control variables that mimic those in other papers studying takeover premiums (e.g., Bargeron,

Schlingemann, and Stulz, 2008). Both *PFG%* and *coverage* are included as the key independent variables in all four regressions explaining our measures of takeover premiums.

According to the coefficient estimates for *PFG%* in column (1) in Table 6, a 1% increase in analysts' price forecast is associated with a 0.19% increase in the *Total premium*. In untabulated analyses, we find that the R-squared of a univariate regression of *Total premium* on *PFG%* is 17%, indicating that this variable itself explains about 17% of negotiated total premiums. The coefficient on *PFG%* in column (2) indicates a positive and statistically significant association between analysts' price forecast and the *First private bid premium*. This result suggests that bidders are more confident submitting a high initial bid during private merger negotiations if equity analysts' price forecasts imply higher undervaluation at pre-bid stock market prices.[21] Columns (3) and (4) show that analysts' price forecasts also affect the *Private revision premium*, but not the *Public revision premium*. The absence of an effect on the public revision premium is not surprising given that post-M&A announcement premium revisions are rare during our sample period.[22]

The coefficient on the *coverage* variable, however, is only significant in one regression in Table 6 (column (3)).These results generally indicate that the number of analysts covering a firm has almost no significant role in the premium paid (except for a marginal effect on private bid revisions), but the valuation work of analysts' (i.e., *PFG%*) continues to be a strong predictor of M&A premiums. These findings suggest that it is the *content* of sell-side analysts' research (instead of the fact that a firm is covered by more analysts) that explains takeover premiums.[23]

[21] In untabulated analyses, we find that the R-squared of a univariate regression of *First private bid premium* on *PFG%* is 19%, indicating that this variable itself explains about 19% of the first private bid price.

[22] Consistent with prior studies (e.g., Betton, Eckbo, and Thorburn, 2008), public bids are revised in less than 10% of the deals in our sample.

[23] The coefficients for the other control variables in Table 6 generate results that are consistent with those in prior studies that examine the determinants of takeover premiums. For example, Bargeron, Schlingemann, and Stulz (2008) report higher premiums for public bidders. Officer (2003) reports a negative relation between premiums and target

Overall, the results in Table 6 indicate that M&A participants appear to incorporate the information in analysts' price forecasts when privately negotiating takeover premiums, supporting the information generation hypothesis about the role of equity analysts in M&A transactions. Moreover, the results in Table 6 are in line with anecdotal evidence suggesting that investment banks do consider external equity analysts' price forecasts when evaluating the value of the target firms. Appendix B provides an example that illustrates how investment banks use the information in analysts' price forecasts in M&A deals. In this example, the target firm hired two investment banks, both of which used equity analysts' price forecasts to evaluate whether the price offered by the acquirer to the target was appropriate.[24]

## 5. Additional analyses

### *5.1. Equity analysts and the method of payment*

We examine whether analysts' price forecasts impact the method of payment. This inquiry is motivated by a large theoretical and empirical literature investigating the determinants of the choices between cash and stock paid to target shareholders (e.g., Hansen 1987; Fishman, 1989; Houston and Ryngaert, 1997; Officer, 2004). This literature argues that the problem of asymmetric information and the incentive for risk sharing (between target and acquirer shareholders) affects the choice of using cash versus stock to finance an M&A deal.

size. Huang and Walkling (1987) report a positive effect for cash and for tender offers. Eckbo and Langohr (1989), Betton and Eckbo (2000), Goldman and Qian (2005), and Jarrell and Poulsen (1989) report that premiums decrease with toeholds.

[24] For example, the merger document states that one of the investment banks, Lazard, "reviewed Wall Street research equity analyst per share target prices for HMA common stock as of May 6, 2013 (which represents the last trading day prior to Glenview converting its Schedule 13G to a Schedule 13D with respect to its ownership of shares of HMA common stock). The range of these target prices was $10.00 to $14.00, as compared to the per share merger consideration of $13.39."

If equity analysts' price forecasts indeed contain useful information regarding a target firm's future growth potential, then a higher price forecast indicates stronger growth opportunities. We hypothesize that less cash will be used to finance a deal if analysts' price forecasts are high (relative to the pre-acquisition stock price). This conjecture is based on the idea that, if target shareholders are willing to share in the upside of the growth potential of the merged firm, then bidders will include more stock in the method of payment so that target shareholders share the downside deal execution risk (i.e., the risk that the growth opportunities are not realized).

We test how analysts affect method of payment in Table 7. The dependent variable is the percentage of consideration paid in cash. Consistent with our expectations, we find strong evidence that analysts' price forecasts are negatively related to the use of cash as a method of payment.[25] On the other hand, analyst coverage per se has no effect on the method of payment. We interpret our results as consistent with the risk sharing hypothesis described above.

*5.2. Equity analysts and deal initiation*

We use 849 observations for which our hand-collected data identifies the party that initiates private merger negotiations to further explore the role of analysts during M&As. For this purpose, in Table 8, we estimate four linear probability regressions in which the dependent variable is set to one if the bidder initiates the transaction and set to zero otherwise. The findings in Table 8 offer support for both the visibility hypothesis and the information generation hypothesis about the role

[25] We include control variables that have been documented to affect the choice of the method of payment in prior literature. Specifically, Hansen (1987) predicts that the problem of asymmetric information increases as the target's size increases. Officer (2004) documents that target firms' return volatility significantly affects the choice of using stock in an acquisition. Huang and Walking (1987), Jarrell and Poulsen (1989), and Martin (1996) show that tender offers are significantly associated with cash as a method of payment. All these control variables have the predicted signs and are statistically significant in our sample. In addition, we include year fixed effects in the regressions to control for the trend of declining all-stock deals after the elimination of pooling of interests accounting for M&As around 2001 (Li, Liu, Wu, 2018; de Bodt, Cousin, and Roll, 2018).

of equity analysts in M&A transactions. Consistent with the visibility hypothesis, the results show that firms covered by more analysts are more likely to become targets in deals initiated by their acquirers. According to the estimates in Model (3) of Table 8, a one standard deviation increase in coverage increases the probability that the bidder initiates the deal by 5.5 percentage points. This increase is economically important because bidders start private merger negotiations in about 60% of the transactions.

The results in Table 8 also show that more undervalued firms (again, relative to analysts' price forecasts) are more likely to initiate their own takeovers. This evidence, which lends support for the information generation hypothesis, suggests that firms potentially take advantage of analysts' price forecasts to offer themselves as attractive takeover targets.

## 6. Conclusion

There is no consensus in the literature about *how* analysts (and their forecasts) affect firm value. To fill this gap in the literature, we empirically examine the role of equity analysts in the M&A process. We begin by establishing a novel result: firms covered by more analysts are more likely to become takeover targets. In our setting, the obvious source of endogeneity is that the decision to cover a given firm is, in itself, a choice made by the analyst community. Consequently, unobservable characteristics may jointly explain the coverage choice by analysts and the takeover decision by an acquirer firm. To address these endogeneity and omitted variables concerns, we use both the Impact Threshold of a Confounding Variable method and an instrumental variable test. These analyses, which generate inferences that are consistent with those from our baseline empirical tests, suggest a positive causal effect of analyst coverage on the likelihood that a firm becomes a takeover target.

In terms of takeover premiums, our empirical analyses indicate that it is not coverage *per se* that appears to matter: rather, it is the specific information generated by the analyst community about the target firm's prospects. We find that targeted firms receive higher takeover premiums the greater the distance between their pre-acquisition stock market price and the average analyst's pre-acquisition share price forecast (i.e., the greater the amount of underpricing at pre-acquisition market prices implied by analysts' forecasts). That distance is economically important as it explains about 17% of the cross-sectional variation in negotiated acquisition premiums. Moreover, whenever the same distance suggests higher target undervaluation, takeover premiums tend to be revised upwards during private merger negotiations. In addition, we find that M&A deals involving targets with greater undervaluation involve less cash used to buy the target and are more likely to be initiated by the target themselves (whereas targets in deal covered by more analysts, regardless of the implied undervaluation, are significantly more likely to be initiated by the acquirer).

Collectively, our results are consistent with our argument that analyst coverage significantly aids in the identification of potential takeover targets and analysts' price forecasts help acquirers (or their investment banks) formulate and structure offer prices to be paid to targets in those takeovers. Analysts' estimates of the current undervaluation of the target firm, for example, explain a meaningful amount of variation in premiums paid in takeovers as well as the choice of the method of payment. From this robust evidence we conclude that the content of equity analysts' reports has a significant and substantial impact in the M&A offer-setting stage. These findings contribute important evidence to the debate in the literature about how and why the work of external equity analysts matters in capital markets.

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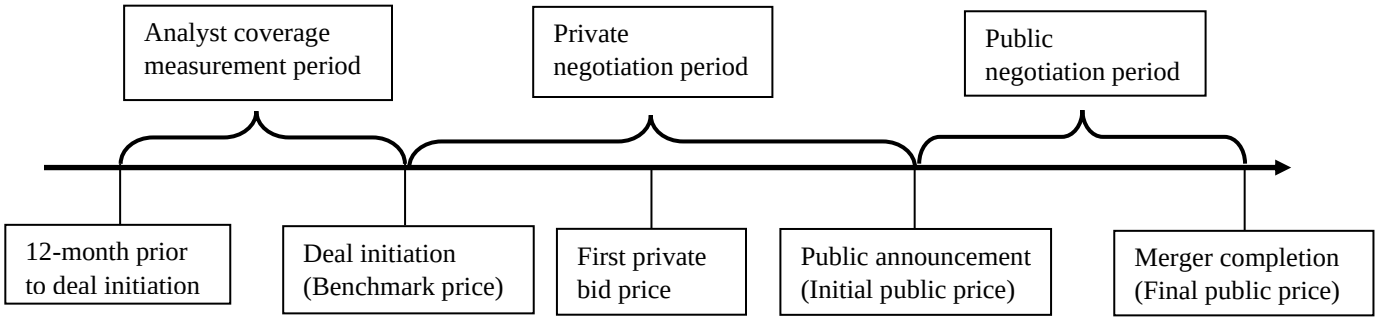
**Figure 1. The timeline**

This figure illustrates the timeline that we measure analyst coverage, the private negotiation, and the public negotiation. Analyst coverage is measured during the 12-month window prior to the private deal initiation date. The private negotiation period is from deal initiation to the public merger announcement. The public merger process is from the public merger announcement to deal completion. *First private bid price* is the first private bid price submitted by the winning bidder during the private negotiation process. *Initial public price* is the initial publicly observed offer price obtained from SDC. *Final public price* is the final offer price reported by SDC.



## Table 1. Sample selection

This table describes the formation of our sample from SDC. We draw a sample of completed deals from the 1994 to 2016 time period, and we require that the form of the deal is coded as "merger". We require the targets to be public firms and the deal value reported by SDC to be greater than $1 million. We further require that bidders seek to purchase 50% or more of ownership of the target. We drop deals with a target stock price less than or equal to $5 the day prior to the public announcement date. We merge these SDC data with CRSP to obtain target price data prior to deal initiation. We drop deals without target price information on CRSP and poison pill/staggered board information from ISS (formerly IRRC). Furthermore, we drop deals for which merger documents are not available on the SEC's EDGAR website and deals. Finally, we require that there is at least one matched firm for each target firm. Specifically, for each takeover target, we require that the controlled non-target firms be from the same industry (measured by the same two-digit SIC codes). We further require that the difference in market capitalization between the target firm and the matched firms in the year before the merger is between 50% and 200%. The final sample consists of 1,317 completed deals announced between 1994 to 2016.

| Sample filters | # of deals |
|---|---|
| Date announced: 1994 to 2016; Form of the deal: Merger (stock or asset) | 41,066 |
| Target Status: Public | 11,957 |
| Target share price one day prior to announcement > $5 | 7,351 |
| Deal value: > $1 million | 6,541 |
| Percent of shares acquirer is seeking to purchase >= 50% | 6,521 |
| Deal status: Completed | 5,504 |
| Information of price per share paid to target shareholders is available on SDC | 5,310 |
| Target return on CRSP | 4,887 |
| Poison pill and staggered board information on ISS | 1,596 |
| Merger documents available on SEC EDGAR | 1,324 |
| Requiring target firms to have at least one matched firm | 1,317 |

## Table 2. Sample distribution and summary statistics

This table presents the sample distribution of deals by year and summary statistics. Panel A presents the temporal distribution for the full sample. Percent of deals in each year is calculated using the number of deals announced during that year divided by the total number of deals over the sample period. Panel A also presents mean analyst coverage by year for takeover target firms. Panel B presents summary statistics for firm characteristics for target firms and matched firms separately. We report summary statistics for two matched samples: one to one match and one to five match. Specifically, for each takeover target, we require that the controlled non-target firms be from the same industry (measured by the same two-digit SIC codes). We further require that the difference in market capitalization between the target firm and the matched firms in the year before the merger is between 50% and 200%. For the one to one matched sample, we include only one control firm that has the smallest size difference. For the one to five matched sample, we include up to 5 control firms that have the smallest size differences. Panel B also provides univariate evidence on mean differences for firm characteristics between takeover target firms and matched firms. Definitions of all variables are provided in Appendix A. The sample consists of 1,317 completed deals announced between 1994 and 2016 from the Thomson One Banker SDC database.

Panel A: Sample distribution

| Year | # of deals | % deals | Mean analyst coverage |
|---|---|---|---|
| 1994 | 7 | 0.53% | 11.27 |
| 1995 | 20 | 1.52% | 10.54 |
| 1996 | 36 | 2.73% | 11.12 |
| 1997 | 56 | 4.25% | 8.23 |
| 1998 | 99 | 7.52% | 11.77 |
| 1999 | 139 | 10.55% | 9.06 |
| 2000 | 121 | 9.19% | 9.13 |
| 2001 | 54 | 4.10% | 10.11 |
| 2002 | 19 | 1.44% | 8.43 |
| 2003 | 26 | 1.97% | 10.29 |
| 2004 | 48 | 3.64% | 8.74 |
| 2005 | 69 | 5.24% | 10.16 |
| 2006 | 83 | 6.30% | 8.85 |
| 2007 | 94 | 7.14% | 9.51 |
| 2008 | 39 | 2.96% | 9.59 |
| 2009 | 34 | 2.58% | 10.28 |
| 2010 | 51 | 3.87% | 9.82 |
| 2011 | 51 | 3.87% | 9.43 |
| 2012 | 44 | 3.34% | 8.84 |
| 2013 | 39 | 2.96% | 8.20 |
| 2014 | 56 | 4.25% | 11.05 |
| 2015 | 70 | 5.32% | 12.53 |
| 2016 | 62 | 4.71% | 9.12 |
| Total | 1,317 | 100.00% | |

Panel B: Summary statistics

| Variable | Mean | Median | Std Dev | Mean | Median | Std Dev | Mean | Median | Std Dev | Test of difference | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Target firms | | | Matched firms (one to one) | | | Matched firms (one to five) | | | (1) - (4) | (1) - (7) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | Diff | Diff |
| Analyst coverage | 9.78 | 8.33 | 7.02 | 6.46 | 4.83 | 6.60 | 6.59 | 4.92 | 6.57 | 3.31*** | 3.18*** |
| PFG% | 0.29 | 0.17 | 0.56 | 0.37 | 0.11 | 1.86 | 0.35 | 0.11 | 1.73 | -0.08 | -0.06 |
| Total assets | 7,787 | 1,434 | 36,126 | 7,067 | 1,153 | 29,751 | 6,501 | 1,139 | 27,228 | 720 | 1,287 |
| Market cap | 3,500 | 1,227 | 7,408 | 3,404 | 1,200 | 7,305 | 3,238 | 1,190 | 6,872 | 96 | 262 |
| Market-to-book ratio | 3.43 | 2.13 | 15.44 | 5.29 | 2.32 | 24.25 | 4.81 | 2.32 | 27.20 | -1.86** | -1.38* |
| ROA | 0.04 | 0.04 | 0.09 | 0.06 | 0.04 | 0.60 | 0.04 | 0.04 | 0.31 | -0.02 | 0.00 |
| Δ Sales | 0.11 | 0.07 | 0.25 | 0.24 | 0.11 | 1.06 | 0.24 | 0.10 | 1.98 | -0.13*** | -0.13** |
| Cash | 0.14 | 0.07 | 0.16 | 0.18 | 0.08 | 0.21 | 0.17 | 0.09 | 0.21 | -0.04*** | -0.04*** |
| Leverage | 0.21 | 0.18 | 0.20 | 0.21 | 0.16 | 0.21 | 0.20 | 0.16 | 0.22 | 0.01 | 0.01 |
| Profitability | 0.14 | 0.11 | 0.23 | -3.15 | 0.12 | 109.02 | -1.51 | 0.11 | 58.20 | 3.30 | 1.65 |
| R&D intensity | 0.06 | 0.03 | 0.07 | 0.07 | 0.03 | 0.10 | 0.07 | 0.03 | 0.10 | -0.008* | -0.01** |

## Table 3. Analyst coverage and the probability of becoming takeover targets

This table reports coefficient estimates from linear probability regression models. The dependent variable is equal to one for the takeover target firm, and zero for the matched control firms. The main independent variable, *Log (Coverage)*, is the natural logarithm of one plus the average number of analysts following the firm in the 12-month period prior to the private deal initiation date. For Models (7) to (12), in addition to *Log (Coverage)*, we include an additional independent variable, *Analyst price forecast growth % (PFG%)*, defined as the average price forecast during the 12-month period prior to the private deal initiation date divided by the target firm stock price prior to deal initiation. Definitions of all other variables are provided in the Appendix. Heteroscedasticity-robust standard errors are estimated, and robust t-statistics or z-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

| Dep. Var. | Target=1 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Sample | One to one match | | | One to five match | | | One to one match | | | One to five match | | |
| Log(Coverage) | 0.176*** | 0.192*** | 0.368*** | 0.081*** | 0.087*** | 0.114*** | 0.106*** | 0.124*** | 0.355*** | 0.065*** | 0.073*** | 0.126*** |
| | (18.22) | (19.37) | (16.64) | (21.32) | (22.18) | (18.57) | (4.56) | (4.75) | (6.03) | (6.47) | (6.55) | (7.80) |
| PFG% | | | | | | | 0.033 | 0.019 | -0.000 | 0.024** | 0.021* | 0.008 |
| | | | | | | | (1.26) | (0.69) | (-0.00) | (2.35) | (1.96) | (0.45) |
| Log(total assets) | -0.042*** | -0.047*** | 0.170*** | -0.014*** | -0.014*** | 0.078*** | -0.015 | -0.023 | 0.165*** | -0.007 | -0.011* | 0.077*** |
| | (-6.15) | (-5.57) | (4.79) | (-4.84) | (-3.93) | (7.78) | (-1.31) | (-1.57) | (2.83) | (-1.44) | (-1.69) | (5.09) |
| Market-to-book ratio | -0.009*** | -0.011*** | 0.004 | -0.004*** | -0.005*** | 0.002 | -0.010*** | -0.013*** | -0.002 | -0.006*** | -0.007*** | -0.002 |
| | (-4.29) | (-4.55) | (0.66) | (-4.78) | (-5.03) | (1.23) | (-2.78) | (-3.51) | (-0.24) | (-4.12) | (-5.12) | (-0.97) |
| ROA | -0.125 | -0.134 | 0.279 | -0.076 | -0.087* | 0.086 | -0.025 | -0.041 | 0.594 | 0.009 | 0.005 | 0.288** |
| | (-1.16) | (-1.16) | (1.15) | (-1.58) | (-1.73) | (1.22) | (-0.15) | (-0.23) | (1.43) | (0.13) | (0.06) | (2.57) |
| Δ Sales | -0.175*** | -0.181*** | -0.249*** | -0.076*** | -0.078*** | -0.085*** | -0.170*** | -0.175*** | -0.238** | -0.089*** | -0.083*** | -0.080*** |
| | (-7.19) | (-6.97) | (-4.14) | (-8.50) | (-8.37) | (-5.23) | (-4.03) | (-3.78) | (-2.04) | (-5.61) | (-5.04) | (-2.74) |
| Cash | -0.222*** | -0.245*** | -0.256* | -0.110*** | -0.105*** | -0.087** | -0.132 | -0.135 | -0.201 | -0.094** | -0.081* | -0.081 |
| | (-3.26) | (-3.30) | (-1.75) | (-3.62) | (-3.23) | (-2.09) | (-1.41) | (-1.30) | (-0.88) | (-2.13) | (-1.72) | (-1.32) |
| Leverage | 0.065 | 0.067 | -0.283* | 0.038 | 0.029 | -0.116*** | 0.011 | 0.007 | -0.324 | 0.040 | 0.043 | -0.087 |
| | (1.08) | (0.94) | (-1.92) | (1.39) | (0.87) | (-2.71) | (0.14) | (0.07) | (-1.37) | (1.03) | (0.92) | (-1.40) |
| Profitability | 0.056 | 0.066* | 0.125 | 0.027** | 0.034** | 0.044** | 0.074 | 0.089 | 0.119 | 0.031 | 0.051** | 0.040 |
| | (1.59) | (1.71) | (1.57) | (2.05) | (2.47) | (1.98) | (1.24) | (1.30) | (0.84) | (1.38) | (2.16) | (1.08) |
| R&D | 0.111 | 0.246 | 0.640 | 0.144 | 0.206** | 0.355*** | 0.299 | 0.458 | 0.561 | 0.280** | 0.396*** | 0.556*** |
| | (0.58) | (1.12) | (1.49) | (1.58) | (2.08) | (2.72) | (1.06) | (1.37) | (0.78) | (2.06) | (2.66) | (2.80) |
| Constant | 0.567*** | 0.866*** | -1.338*** | 0.177*** | 0.511*** | -0.555*** | 0.484*** | 0.846*** | -1.372*** | 0.137*** | 0.502** | -0.628*** |
| | (10.45) | (3.86) | (-4.88) | (7.20) | (2.99) | (-7.24) | (5.98) | (3.02) | (-2.90) | (3.49) | (2.39) | (-5.12) |
| Industry FEs | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes | No |
| Year FEs | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes | No |
| Deal FEs | No | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes |
| Observations | 2,446 | 2,446 | 2,446 | 7,064 | 7,064 | 7,064 | 1,479 | 1,479 | 1,479 | 4,120 | 4,120 | 4,120 |
| R-squared | 0.116 | 0.14 | 0.32 | 0.051 | 0.062 | 0.098 | 0.033 | 0.067 | 0.295 | 0.020 | 0.038 | 0.105 |

**Table 4. The Impact Threshold of a Confounding Variable**

This table reports the impact threshold of a confounding variable (ITCV) for our OLS regression analysis of the effect of analyst coverage on the likelihood of becoming a takeover target. The dependent variable is equal to one for the takeover target firm, and zero for the matched control firms. The main independent variable, *Log (Coverage)*, is the natural logarithm of one plus the average number of analysts following the firm in the 12-month period prior to the private deal initiation date. Definitions of all other variables are provided in the Appendix. We report and the Impact of each observed control variable in the regression analysis. X represents *Log(Coverage)*, Y represents the outcome variable (*target)*, V represents each covariate. We report the Threshold for % Bias to Invalidate/Sustain the Inference and the Impact Threshold for Confounding Variable (ITCV) in the bottom two rows. The Threshold for % Bias to Invalidate/Sustain the Inference is the percent of the estimate or the percent of observations that would have to be replaced with cases for which there is an effect of zero to invalidate the inference. ITCV is the minimum product of the correlation between analyst coverage and the confounding variable and the correlation between the dependent variable and the confounding variable that is required to overturn the significant results.

| Observed covariates | Cor (V, X) | Cor (V, Y) | Impact | Cor (V, X) | Cor (V, Y) | Impact |
|---|---|---|---|---|---|---|
| Sample | One to one match | | | One to five match | | |
| Log(total assets) | 0.399 | 0.060 | 0.024 | 0.317 | 0.046 | 0.015 |
| Profitability | 0.144 | 0.078 | 0.011 | 0.132 | 0.045 | 0.006 |
| Δ Sales | -0.055 | -0.137 | 0.008 | -0.049 | -0.084 | 0.004 |
| Cash | -0.025 | -0.071 | 0.002 | -0.012 | -0.048 | 0.001 |
| ROA | 0.077 | 0.015 | 0.001 | 0.088 | 0.010 | 0.001 |
| Leverage | 0.043 | 0.022 | 0.001 | 0.030 | 0.022 | 0.001 |
| Market-to-book ratio | 0.001 | -0.092 | 0.000 | 0.014 | -0.053 | -0.001 |
| R&D | 0.015 | -0.010 | 0.000 | 0.024 | -0.002 | 0.000 |
| The Threshold for % Bias to Invalidate/Sustain the Inference | | | 88.22% | | | 89.44% |
| Impact Threshold for Omitted Confounding Variable (ITCV) | 0.540 | 0.540 | 0.291 | 0.444 | 0.444 | 0.197 |

**Table 5. Two-stage least squares (2SLS) regression with the instrumental variable**

This table reports the 2SLS regressions of the probability of becoming takeover targets on analyst coverage, with expected analyst coverage (Log( Exp. Coverage)) as the instrumental variable. The first-stage regression generates the fitted (instrumented) value of Log(Coverage) for the use in the second-stage regressions. Definitions of all variables are provided in the Appendix. Heteroscedasticity-robust standard errors are estimated, and robust t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | 1st stage | 2nd stage | 1st stage | 2nd stage |
| Dep. Var. | Log(Coverage) | Target=1 | Log(Coverage) | Target=1 |
| Sample | One to one match | | One to five match | |
| Log( Exp. Coverage) | 0.302*** | | 0.208*** | |
| | (4.15) | | (6.96) | |
| Log(Coverage) | | 0.552*** | | 0.276*** |
| | | (7.29) | | (9.99) |
| Log(total assets) | -0.027 | 0.174*** | -0.025 | 0.086*** |
| | (-0.30) | (4.72) | (-0.68) | (6.71) |
| Market-to-book ratio | -0.015 | 0.014** | -0.006 | 0.004* |
| | (-1.03) | (2.12) | (-1.14) | (1.80) |
| ROA | -0.536 | 0.437 | -0.270 | 0.136 |
| | (-0.86) | (1.17) | (-0.91) | (1.39) |
| Δ Sales | -0.190 | -0.244*** | -0.109*** | -0.067*** |
| | (-1.00) | (-3.91) | (-3.35) | (-4.64) |
| Cash | 0.157 | -0.316** | 0.082 | -0.119** |
| | (0.76) | (-1.96) | (0.62) | (-2.26) |
| Leverage | -0.182 | -0.490*** | 0.096 | -0.164*** |
| | (-0.41) | (-2.77) | (0.73) | (-3.40) |
| Profitability | 0.117 | 0.038 | 0.220*** | -0.016 |
| | (0.58) | (0.40) | (3.45) | (-0.95) |
| R&D | -0.404 | 0.274 | 0.977*** | 0.105 |
| | (-0.38) | (0.53) | (2.95) | (0.69) |
| Constant | -0.920 | -0.800*** | -0.135 | -0.552*** |
| | (-1.36) | (-2.78) | (-0.45) | (-5.55) |
| Deal FEs | Yes | Yes | Yes | Yes |
| Observations | 1,825 | 1,825 | 5,127 | 5,127 |
| R-squared | 0.227 | 0.448 | 0.204 | 0.070 |

## Table 6. The information content of analysts' forecasts

This table reports OLS regression results of the effects of analysts' price forecasts on takeover premiums and offer price revisions. The dependent variables are *Total premium, First private bid premium, Private revision premium,* and *Public revision premium.* The main independent variable, *Analyst price forecast growth % (PFG%),* is the average price forecast during the 12-month period prior to the private deal initiation date divided by the target firm stock price prior to deal initiation. Definitions of all other variables are provided in the Appendix. Heteroscedasticity-robust standard errors are estimated, and robust t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Total premium | First private bid premium | Private revision premium | Public revision premium |
| Log(Coverage) | 0.038 | 0.017 | 0.020** | -0.005 |
| | (1.51) | (0.76) | (2.11) | (-1.18) |
| PFG% | 0.189*** | 0.187*** | 0.051** | -0.007 |
| | (4.44) | (4.80) | (2.55) | (-0.74) |
| Auction | -0.011 | 0.013 | -0.034*** | -0.004 |
| | (-0.53) | (0.70) | (-3.50) | (-0.69) |
| Tender offer | 0.059** | 0.023 | 0.031** | 0.013** |
| | (2.02) | (0.93) | (2.19) | (2.10) |
| Target size | -0.053*** | -0.033*** | -0.013** | 0.002 |
| | (-3.94) | (-2.68) | (-2.04) | (0.62) |
| Poison pill | 0.001 | 0.034 | 0.002 | -0.004 |
| | (0.05) | (1.56) | (0.22) | (-0.66) |
| Staggered board | -0.016 | -0.000 | -0.006 | -0.002 |
| | (-0.72) | (-0.02) | (-0.59) | (-0.29) |
| Public bidder | 0.051** | 0.026 | 0.030*** | -0.001 |
| | (2.04) | (1.15) | (2.68) | (-0.27) |
| Toehold | -0.114** | -0.121** | -0.025 | 0.042* |
| | (-2.03) | (-2.46) | (-0.98) | (1.92) |
| Hostile | 0.017 | -0.152** | -0.065** | 0.165*** |
| | (0.23) | (-2.02) | (-2.10) | (5.02) |
| Diversifying | 0.009 | 0.016 | 0.000 | -0.004 |
| | (0.35) | (0.73) | (0.01) | (-0.72) |
| Stock | -0.091** | -0.019 | -0.013 | 0.001 |
| | (-2.53) | (-0.45) | (-0.64) | (0.18) |
| Constant | 0.749*** | 0.572*** | 0.182*** | -0.023 |
| | (4.79) | (3.68) | (2.76) | (-0.72) |
| Industry FEs | Yes | Yes | Yes | Yes |
| Year FEs | Yes | Yes | Yes | Yes |
| Observations | 833 | 705 | 705 | 833 |
| R-squared | 0.261 | 0.290 | 0.244 | 0.206 |

## Table 7. Equity analysts and the method of payment

This table reports the relation between analyst coverage, price forecasts, and the method of payment in M&As. The dependent variable is the percentage of consideration paid in cash. Major independent variables are analyst coverage and price forecasts. Definitions of all variables are provided in the Appendix. Heteroscedasticity-robust standard errors are estimated, and robust t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | | % of cash paid | |
| Log(Coverage) | -0.001 | | -0.002 |
| | (-0.10) | | (-0.12) |
| PFG% | | -0.072*** | -0.072*** |
| | | (-4.19) | (-4.41) |
| Auction | 0.074*** | 0.081*** | 0.082*** |
| | (3.96) | (3.43) | (3.38) |
| Tender offer | 0.324*** | 0.188*** | 0.188*** |
| | (6.55) | (5.77) | (5.71) |
| Target size | -0.043*** | -0.051*** | -0.051*** |
| | (-3.74) | (-5.42) | (-4.21) |
| Poison pill | -0.002 | 0.034 | 0.034 |
| | (-0.12) | (1.37) | (1.34) |
| Staggered board | 0.011 | -0.008 | -0.008 |
| | (0.59) | (-0.38) | (-0.36) |
| Public bidder | -0.215*** | -0.210*** | -0.210*** |
| | (-9.18) | (-7.76) | (-7.74) |
| Toehold | 0.071 | 0.023 | 0.023 |
| | (1.36) | (0.30) | (0.30) |
| Diversifying | 0.064*** | 0.058*** | 0.058*** |
| | (3.43) | (3.52) | (3.48) |
| Target return volatility | -5.030*** | -5.507*** | -5.507*** |
| | (-4.41) | (-5.90) | (-5.92) |
| Market-to-book ratio | -0.000 | -0.002 | -0.002 |
| | (-0.13) | (-0.36) | (-0.36) |
| Constant | 1.092*** | 1.310*** | 1.308*** |
| | (10.09) | (15.66) | (15.40) |
| Industry FEs | Yes | Yes | Yes |
| Year FEs | Yes | Yes | Yes |
| Observations | 1,317 | 849 | 849 |
| R-squared | 0.521 | 0.516 | 0.516 |

## Table 8. Equity analysts and deal initiation

This table reports linear probability estimates of the relation between the party that initiates an M&A transaction and equity analysts. The dependent variable is an indicator variable that equals one if a bidder initiates the transaction, and zero otherwise. The key independent variables are analyst coverage and price forecasts. The Appendix provides definitions for all variables used in our regressions. Heteroscedasticity-robust standard errors are estimated, and robust *t*-statistics appear in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Bidder initiation | | | |
| Log(Coverage) | 0.086** | 0.049 | 0.081** | 0.049* |
| | (2.45) | (1.43) | (2.20) | (1.78) |
| PFG% | -0.110*** | -0.072* | -0.085* | -0.073* |
| | (-2.75) | (-1.65) | (-1.94) | (-1.73) |
| Target size | -0.024 | -0.009 | -0.02 | |
| | (-1.25) | (-0.48) | (-1.03) | |
| Poison pill | -0.071* | 0.014 | 0.007 | |
| | (-1.95) | (0.38) | (0.19) | |
| Staggered board | -0.006 | 0.004 | -0.006 | |
| | (-0.16) | (0.10) | (-0.17) | |
| Public bidder | -0.05 | -0.017 | -0.032 | |
| | (-1.22) | (-0.43) | (-0.76) | |
| Tender offer | 0.07 | 0.054 | 0.051 | |
| | (1.48) | (1.24) | (1.08) | |
| Diversifying | 0.019 | 0.029 | 0.003 | |
| | (0.48) | (0.82) | (0.06) | |
| Toehold | 0.210** | 0.190** | 0.182* | |
| | (2.16) | (2.41) | (1.81) | |
| Constant | 1.000*** | 0.483*** | 0.792*** | 0.809*** |
| | (5.92) | (2.82) | (3.11) | (4.71) |
| Industry FEs | Yes | No | Yes | Yes |
| Year FEs | No | Yes | Yes | Yes |
| Observations | 849 | 849 | 849 | 849 |
| R-squared | 0.119 | 0.098 | 0.179 | 0.170 |

## Appendix A. Variable definitions

| Variable | Definition | Data Source |
|---|---|---|
| A.1. Premium and return variables | | |
| Total premium | The final public offer price obtained from SDC relative to target stock price 1 day prior to the deal initiation. | SDC, CRSP, merger documents |
| First private bid premium | The first private bid price obtained from merger document relative to target stock price 1 day prior to the deal initiation. | CRSP, merger documents |
| Private revision premium | The difference between the initial public offer price obtained from SDC and the first private bid price relative to target stock price 1 day prior to the deal initiation. | SDC, CRSP, merger documents |
| Public revision premium | The difference between the final public offer price obtained from SDC and the initial public offer price relative to target stock price 1 day prior to the deal initiation. | SDC, CRSP, merger documents |
| A.2. Deal characteristics | | |
| Auction | An indicator variable that equals 1 if two or more bidders signed a confidentiality agreement during the sale process (Boone and Mulherin, 2007), and zero otherwise. | Merger documents |
| Hostile | An indicator variable that equals 1 if the deal is characterized as hostile or unsolicited by SDC. | SDC |
| Tender Offer | An indicator variable that equals 1 if the deal is a tender offer, and zero otherwise. | SDC |
| Stock | An indicator variable that equals 1 if the method of payment is stock only, and zero otherwise. | SDC |
| Public bidder | An indicator variable that equals 1 if bidder public status is 'Public', and zero otherwise. | SDC |
| Toehold | An indicator variable that equals 1 if a bidder has an ownership stake of 5% or more in the target, and zero otherwise. | SDC |
| Diversifying | An indicator variable that takes the value of one if the acquirer is not from the same two-digit SIC industry as the target firm, and zero otherwise. | SDC |
| A.3. Firm characteristics | | |
| Analyst coverage | The average number of analysts following the firm in the 12-month period prior to the private deal initiation date. | I/B/E/S, merger documents |
| Analyst price forecast growth% (PFG%) | The average price forecast during the 12-month period prior to the private deal initiation date divided by the firm stock price prior to deal initiation. | I/B/E/S, merger documents |

| | | |
|---|---|---|
| Market cap | The stock price times the number of shares outstanding. We use this value to measure target or bidder size prior to deal initiation. | CRSP |
| Cash | Cash holdings divided by the book value of assets. | Compustat |
| Poison pill | An indicator variable that equals 1 if a firm has a poison pill in place at the time of the merger, and zero otherwise. | ISS, SDC |
| Staggered board | An indicator variable that equals 1 if a firm has a staggered board at the time of the merger, and zero otherwise. | ISS, SDC |
| Total assets | Book value of total assets. | Compustat |
| Market-to-book ratio | Market value of equity divided by the book value of equity. | |
| ROA | Return on assets, measured by the ratio of earnings to the book value of assets. | Compustat |
| Δ Sales | The proportional change in sales revenue. | Compustat |
| Leverage | The ratio of book value of debt divided by the book value of assets. | Compustat |
| Profitability | The ratio of operating cash flow to total sales. | Compustat |
| R&D intensity | The ratio of R&D expense to the book value of assets. | Compustat |
| Target return volatility | The standard deviation of the daily stock return of the target firms in the year prior to deal initiation. | CRSP |

## Appendix B.
## An example of analysts' forecasts of price forecast being used by investment banks in their merger valuation

Target: Health Management Associates, Inc.
Acquirer: Community Health Systems, Inc.
SEC filings: DEFM 14A[26]

**Opinions of Financial Advisors to HMA**

***Lazard Opinion***

***HMA Analyst Price Targets Analysis***

Lazard reviewed Wall Street research equity analyst per share target prices for HMA common stock as of November 8, 2013. The range of these target prices was $12.00 to $15.00, as compared to the per share merger consideration of $13.39.

Additionally, Lazard reviewed Wall Street research equity analyst per share target prices for HMA common stock as of May 6, 2013 (which represents the last trading day prior to Glenview converting its Schedule 13G to a Schedule 13D with respect to its ownership of shares of HMA common stock). The range of these target prices was $10.00 to $14.00, as compared to the per share merger consideration of $13.39.

***Morgan Stanley Opinion***

***Trading Range and Research Targets***

Morgan Stanley reviewed the historical trading range of HMA's common stock for various periods ended May 24, 2013. Morgan Stanley noted that, as of May 24, 2013, the closing price of HMA's common stock was $11.04 per share, compared to the implied consideration per share of HMA's common stock of $13.78 pursuant to the merger agreement based on the 0.06942 exchange ratio, the cash consideration of $10.50 per share and the closing price of CHS common stock of $47.23 per share as of July 29, 2013 (we refer herein to this consideration as the "Implied Merger Consideration"). Morgan Stanley also noted that the low and high closing prices for HMA's common stock for the 52-week period ending July 26, 2013 (but disregarding all closing prices after May 24, 2013) were $6.27 and $13.63, respectively.

Morgan Stanley reviewed sell side analyst price targets for HMA's common stock prepared and published by twenty equity research analysts that published price targets for HMA since May 3, 2013. These targets reflect each analyst's estimate of the 12-month future public market trading price of HMA's common stock and were not discounted to present value. The range of undiscounted price targets per share of HMA's common stock as of July 26, 2013 was $10.00 to $17.00, with a median of $14.00. In order to better compare the published stock price targets with the Implied Merger Consideration, Morgan Stanley discounted such stock price targets to present value (as of July 26, 2013) by applying, for a one-year discount period, an illustrative discount rate of 13%, which was selected based on Morgan Stanley's professional judgment and taking into consideration HMA's assumed cost of equity using a capital asset pricing model, which is a financial valuation method that takes into account both returns in equity markets generally and volatility in a company's common stock. This calculation indicated a range of stock price targets for HMA's common

[26] The full document is available at
https://www.sec.gov/Archives/edgar/data/792985/000119312513451466/d633024ddefm14a.htm

stock of approximately $8.75 to $15.00 per share. Morgan Stanley then compared the results of its analysis to the Implied Merger Consideration, noting that the Implied Merger Consideration was within the range of stock price targets derived from this analysis. The public market trading price targets published by securities research analysts do not necessarily reflect current market trading prices for HMA's common stock and these estimates are subject to uncertainties, including the future financial performance of HMA and future financial market conditions.

## Appendix C.

## An example of price revision during the private negotiation process

Target: Hittite Microwave Corp
Acquirer: Analog Devices Inc.
SEC filings: SC14D9[27]
Background of the merger (Simplified)

On November 13, 2013, Mr. Roche, the President and Chief Executive Officer of Analog Devices, called Mr. Hess, the Chief Executive Officer of Hittite Microwave, and informed him that a relationship with Hittite might be of interest to Analog Devices. They discussed a range of ways in which the two companies might work together, ranging from engaging in cooperative marketing efforts on one end of the spectrum to a potential acquisition of Hittite by Analog Devices at the other end of the spectrum.

On March 15, 2014, Mr. Roche telephoned Mr. Hess to inform him that a written proposal would be forthcoming from Analog Devices, and later that day Mr. Hess received a letter from Analog Devices proposing to acquire us for cash in the amount of **$74.00 per share**.

On March 31, 2014, Mr. Hess called Mr. Roche and communicated to him that we were not for sale at $74, but that he was authorized to meet with representatives of Analog Devices and share more detailed information on our growth prospects with the expectation that it would enable Analog Devices to materially increase its offer.

On April 18, 2014, Mr. Roche called Mr. Hess, and informed him that Analog Devices was willing to increase its offer to $75.50 per share, while noting that Analog Devices' valuation assumptions had not changed as a result of the April 10 meeting and that Analog Devices was stretching in making this offer. Mr. Hess promptly informed the other Directors of the revised Analog Devices proposal by e-mail.

The Directors concluded, after considering all these factors, that it would be advisable to respond to Analog Devices' revised proposal with a counteroffer of $78.00, and that it would be in the best interest of our stockholders to sell the company in an all cash transaction if that price could be obtained.

On April 30, 2014, Mr. Roche telephoned Mr. Hess and informed him that Analog Devices would be willing to increase its offer to $76.50 per share. Mr. Hess stated that this price was unacceptable.

On May 7, 2014, Mr. Roche sent to Mr. Hess a written non-binding offer by Analog Devices to acquire us for **$78.00 per share** in cash.

On June 9, 2014, prior to the opening of trading on the Nasdaq Global Market, Analog Devices and we issued a joint press release announcing the merger.

[27] The full document is available at
https://www.sec.gov/Archives/edgar/data/1130866/000119312514244685/d745183dsc14d9.htm