

## **Information Uncertainty and Target Valuation in Mergers and Acquisitions**

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**Abstract:** This study examines how a target's information uncertainty affects an acquirer's valuation of the target and the acquirer's gain realized from the transaction. Targets with high information uncertainty perform poorly before the bids. Despite bidding a high premium in the transaction, the acquirer provides a low valuation multiple for a target with high information uncertainty. Acquirer announcement return and combined announcement return decrease if an acquirer assigns a high valuation multiple to the target, indicating that a low valuation given to a target is a significant factor making a deal profitable for the acquirer.

**Keywords:** information uncertainty, bid premium, valuation multiple, acquirer abnormal return

## 1. Introduction

Extensive studies in mergers and acquisitions show that acquirers earn negative or, at most, zero returns upon the bid announcement.<sup>1</sup> It is typically believed that the acquirer will be punished by investors if the bid price is too high (e.g., Roll, 1986; Hayward and Hambrick, 1997). However, some conflicting evidence has been reported in recent studies. Chatterjee et al. (2012) document that acquirers realize high gains from acquisitions of targets characterized by high divergence of investor opinion, despite paying high premiums for the targets in the deals. Raman et al. (2014) document that acquirers pay high bid premiums on targets with low earnings quality or high opaqueness. They also argue that acquirers can realize high returns from such acquisitions. In a similar vein, Cheng et al. (2016) show that acquirers pay high premiums on targets with high information asymmetry and acquiring investors respond more positively to such acquisitions.<sup>2</sup> The evidence indicates that acquirers are rewarded by investors, although they pay high premiums for the targets. However, the rationale behind this trend is not clear.

Motivated by this research, this study examines how a target's information uncertainty affects an acquirer's valuation of the target and the merger gain realized from the transaction. Target valuation is defined as the offer value relative to the target's earnings before interest, taxes, and depreciation and amortization of intangibles (EBITDA); to the target's enterprise value; to the target's sales; and to the target's book value of equity. Studies show that such valuation multiple has been widely adopted by investment bankers and appraisers in valuing both

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<sup>1</sup> See Jensen and Ruback (1983) and Andrade et al. (2001) for a review of takeover literature.

<sup>2</sup> Officer et al. (2009) also document that acquirers realize high returns from stock acquisitions of targets with high opaqueness. They argue that the stock acquisition can protect the acquirer in the event the target is a "lemon".

public and closely held businesses as acquisition and leveraged buyout candidates.<sup>3</sup> A high multiple is typically interpreted as a high valuation. Following earlier studies, the target's information uncertainty is measured with analyst forecast dispersion, forecast error, bid-ask spread, intensity of R&D expenses (R&D), and idiosyncratic volatility.

The investigation is conducted with a sample of 2,047 acquisitions announced during the period 1986-2008. The results show that the bid premium is *positively* associated with the level of a target's information uncertainty, thus keeping with earlier findings. Conversely, the valuation multiple is significantly *negatively* related to information uncertainty. If measured with valuation multiple, targets with high information uncertainty actually receive a low valuation from the acquirers. This evidence is consistent with existing literature documenting that information uncertainty has a negative impact on asset pricing (e.g., O'Hara, 2003; Hertz and Smith, 1993; Rock, 1986). As it is difficult to evaluate a target with high information uncertainty, it is not surprising that an acquirer tends to be more conservative and gives a low valuation multiple to a target with such characteristics.

The results also show that targets with high information uncertainty perform poorly before the acquisitions. They significantly underperform compared to their industry, size and market-to-book adjusted control firms. They also constantly underperform compared to targets with low information uncertainty in the years before acquisition. The valuation multiple is significantly positively related to the target's operating performance before the bids, implying that the target's operating ability is a significant determinant of its valuation multiple received in the transaction.

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<sup>3</sup> Kaplan and Ruback (1995) show that although the DCF approach yields the most reliable estimates overall, the use of a valuation multiple in the same industry results in the lowest valuation error. Damodaran (2002) notes that almost 90% of equity research valuations and 50% of acquisition valuations use some combination of multiples and comparable companies. Studies such as Officer (2007) and Koeplin et al. (2000) also use the valuation multiple to measure the acquirer's valuation of private targets where the stock price (and thus bid premium) is not available.

Furthermore, the acquirer announcement return, as well as combined announcement return, falls if an acquirer gives a high valuation multiple to the target. The valuation multiple is significantly *negatively* related to the acquirer and combined announcement return. This evidence shows that the acquirer benefits from the transaction by giving a low valuation multiple to the target with a high level of information uncertainty.

The results, taken together, show that although targets with high information uncertainty receive high bid premiums in acquisitions, acquirers actually give them a low valuation multiple. The low multiple, which indicates a low bid price, could be a significant factor that makes the deal profitable to the acquirer.

A low valuation multiple received by a target does not conflict with a high bid premium.<sup>4</sup> First, a low valuation multiple is, to a great extent, caused by a target's poor operating performance before the bid. Meanwhile, a poor operating performance often causes a low stock price. As stock price is the denominator in the calculation of bid premium, this can naturally lead to a high bid premium.

Second, note that the value of a stock can be estimated as the present value of its future cash flows using an appropriate discount rate. On the one hand, it is hard for investors to forecast a target's future cash flow if the target has a high level of information uncertainty. As such, the magnitude of future cash flow will be discounted more by investors, which can result in a lower current stock price for the target. On the other hand, the cost of capital is higher for a target with

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<sup>4</sup> For instance, Gilead obtained its Hepatitis C franchise in 2011 through the acquisition of the clinical-stage biotech company Pharmasset with an offer of \$11 billion. Some investors believed Gilead had overpaid, as the offer price was an 89% premium to Pharmasset's stock price. However, in an article in *The Wall Street Journal*, financial columnist Grant (2015) asserted that the deal was actually very inexpensive for Gilead because the deal price accounts for just 69% of trailing 12-month hepatitis C sales, considering that bid prices for deal targets in the same industry are elevated later—for instance, AbbVie paid 3.8 times the Wall Street consensus for peak sales in its Pharmacyclics acquisition in 2015.

a high level of information uncertainty, which can also result in a lower stock price. Both factors can cause a low stock price for the target, which, in turn, results in a high bid premium.<sup>5</sup>

This study shows that the bid premium and the valuation multiple may refer to different features in a takeover transaction. However, few studies examine the interplay of bid premium and valuation multiple in the valuation process, although many studies examine other perspectives of takeover transactions.<sup>6</sup> The bid premium is widely used by researchers to measure an acquirer's pricing of a target in mergers and acquisitions, whereas the valuation multiple is commonly adopted by practitioners to measure an acquirer's valuation of a target. Nonetheless, as Bancel and Mittoo (2014) show, there is a gap between the theory and practice of firm valuation. Based on their survey of 356 valuation experts across 10 European countries, they call for a serious debate between academics and practitioners to make the valuation framework more "practical". This study adds to them and shows that more thought is needed about the valuation process in mergers and acquisitions and, in particular, which one—bid premium or valuation multiple—is a more suitable measurement of an acquirer's bidding (e.g., overpayment or not) for a target.

This study is related to several recent papers on takeover transactions. Chatterjee et al. (2012) document that acquirers pay high premiums for the targets characterized by high divergence of investor opinion and acquirers realize high gains from such acquisitions. They propose that because acquirers must pay high premiums to buy targets with a high divergence of opinion,

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<sup>5</sup> The results, however, do not necessarily imply that bid premium is negatively associated with valuation multiple, although such a negative association could exist in theory.

<sup>6</sup> This includes payment method, bidding format (tender offer or not), bidding hostility, diversifying acquisition, etc. See section 2.5 for a discussion of these factors.

acquirers may seek only the targets that can provide the highest merger gains. Nonetheless, they do not show the sources of gains.<sup>7</sup>

Raman et al. (2014) and Cheng et al. (2016) document that acquirers realize high gains from acquisitions of targets with high information uncertainty. They both explain their findings from the perspective of information asymmetry, arguing that acquirers have private information about the targets with low earnings quality and that market investors' re-valuation of targets upon the bid announcement may cause a high abnormal return for acquirers. This interpretation, however, conflicts with existing evidence on mergers and acquisitions.<sup>8</sup> In an influential paper from the takeover literature, Bradley, Desai and Kim (1983) clearly show that the merger gain is not from information signaling that the target is undervalued by the market; rather, in their study, a target's stock price drops to its initial level in the two years following the unsuccessful bid if it cannot subsequently obtain another bid. Similarly, Fabozzi et al. (1988) also show that a target's bid premium disappears by the time the bid failure becomes public.

Although this study documents a high gain for the acquirer from the acquisition of a target with high information uncertainty, the interpretation of such gain is different from earlier studies. This study shows that the operating performance of targets with high information uncertainty is poor before the takeover transactions, indicating that these targets may not necessarily be undervalued by the investors.<sup>9</sup> This evidence is consistent with the traditional view (e.g., Jensen,

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<sup>7</sup> Morellec and Zhdanov (2005) propose a model in which the dispersion of beliefs regarding the benefits of a takeover can reduce the acquirer announcement return. Moeller et al. (2007) find that acquirers realize a lower announcement return in takeover transactions if heterogeneous beliefs about the acquirer's valuation are high. This evidence seems to be inconsistent with the argument of Chatterjee et al.

<sup>8</sup> McNichols and Stubben (2015) use almost exactly the same measure of earnings quality as Raman et al. and find that announcement returns are actually higher for acquirers if the target has a higher earnings quality. This finding seems to be inconsistent with the value-enhancing argument of Raman et al.

<sup>9</sup> However, none of the studies mentioned above examine the target's operating performance before the takeover transaction, although Cheng et al. (2016) examine the target's valuation before the bids measured with the Q ratio and market-to-book ratio.

1993) that the takeover can redeploy the assets of underperforming targets toward more profitable uses under the better management of high-performing acquirers. Importantly, due to the poor performance, the acquirers actually give a low valuation multiple to the targets with a high level of information uncertainty, despite bidding a high premium. The low valuation multiple could be a significant factor that makes deals profitable to the acquirers in the acquisitions of targets with high information uncertainty.

The remainder of this paper is structured as follows. Section 2 describes the data and constructs the variables used in the study. Section 3 examines the impact of a target's information uncertainty on its valuation in takeover transactions. Section 4 investigates the association between target valuation and acquirer announcement abnormal return and the total merger gain. Section 5 conducts robustness tests for alternative definitions of valuation multiple and alternative measures of target's information uncertainty. Section 6 presents the study's conclusions.

## **2. Data and Variables**

### **2.1 Data selection**

The sample of acquisitions in this study comes from the Securities Data Company's (SDC) U.S. Mergers and Acquisitions Database. The SDC database reports the characteristics of transactions, including the announcement date, bid price, deal value, payment method, and number of acquirers. The data regarding analysts' earnings forecasts are from the I/B/E/S database. The I/B/E/S dataset reports a monthly mean, median, and standard deviation of the forecasts for each firm based on the analysts' estimates that are submitted in that month. The

financial data used in this study are collected from the Compustat database, and the data on firm stock returns are collected from the CRSP database.

Data are first selected from the SDC database based on the following criteria: (1) the acquirer and the target are both American firms traded on the NYSE, AMEX or NASDAQ; (2) the deal value is equal to or greater than \$1 million; (3) the takeover announcement date falls between 1986 and 2008; and (4) the acquirer controls less than 50% of the target's outstanding shares before the announcement of the takeover and will control 100% of the target's shares upon the completion of the bids. The requirements yield 5,712 acquisitions. Then, events are deleted for which the time between the completion and announcement dates is more than 1,000 days. Events are also deleted for those missing the data needed to calculate the bid premium. In accordance with Officer (2003), if the absolute value of the percentage-based bid premium (see the definition of *Premium\_Value* in Section 2.3) is greater than 2, the transaction is also deleted. Applying these criteria, the sample from the SDC database is reduced to 4,568 transactions.

Next, the SDC database is merged with the Compustat, CRSP and I/B/E/S databases. The transactions should have the stock price data necessary to calculate stock performance and the financial data necessary to calculate firm-specific characteristics, including target size, relative size of the target to the acquirer, target sales growth, target ROA, target EBITDA, and target market-to-book ratio. In accordance with Schwert (2000), extreme outliers are excluded in which the target's sales growth or market-to-book ratio is greater than one hundred. The requirements yield a final sample of 2,047 transactions. An acquisition is not deleted if it is missing data on the analyst forecasts.

(Insert Table 1 here)

Table 1 reports the yearly distribution for the sample used in this study. Of the 2,047 bids announced over the period 1986-2008, 663 were conducted with a cash offer, 958 with an equity offer, and 426 with a mixed offer of cash and equity. Of the 2,047 total bids, 1,796 were completed and 251 fail.

## 2.2 Measures of information uncertainty

Two proxies are used to measure a target's information uncertainty. The first proxy is the dispersion of financial analysts' forecasts on target earnings. Specifically, forecast dispersion, *DISPERSION*, is calculated as the standard deviation of all earnings forecasts from the last month of the fiscal year before the takeover announcement. The second proxy is analyst forecast error. Specifically, forecast error, *ERROR*, is calculated as the ratio of the absolute difference between the forecast earnings and the actual earnings per share in the last month of the fiscal year before the takeover announcement to the price per share at the beginning of the month.

Analyst forecast dispersion and forecast error are widely used proxies for firms' information uncertainty (e.g., Thomas, 2002; Abarbanell and Lehavy, 2003). Generally, studies find that analyst forecast dispersion and forecast error decrease when firms disclose more information. Furthermore, Elton et al. (1984) demonstrate that forecast errors are reduced as the predictions approach the end of the fiscal year. They find that nearly 84% of the forecast error in the last month can be attributed to mistaken estimation of firm-specific factors rather than economy- or industry-wide factors. This indicates that forecasts near the end of a forecasting period are particularly appropriate as proxies for information uncertainty across firms.

### 2.3 Definition of bid premium and valuation multiple

Bid premium is widely used in the financial literature to calculate the acquisition price paid to the targets (e.g., Schwert, 1996; Officer, 2003; Chatterjee et al., 2012). Following their lead, bid premium, *Premium\_Value*, is calculated as the premium of the acquirer's offer price relative to the target's stock price 63 days prior to the bid announcement.

M&A textbooks suggest several methods to evaluate a company, including book value, continuing value, comparable multiples, discounted future cash flow or net present value approach.<sup>10</sup> Among these methods, the valuation multiple is an approach regularly used by investment bankers and appraisers in takeover practice. Damodaran (2002) notes that almost 90% of equity research valuations and 50% of acquisition valuations use some combination of multiples and comparable companies. Kaplan and Ruback (1995) compare different valuation methods and show that a valuation multiple in the same industry results in the lowest valuation error. In empirical studies, Officer (2007) and Koeplin et al. (2000) adopt this valuation method to investigate the pricing discounts of private companies relative to public firms in takeover transactions.

Based on the literature, the valuation multiple, *P/EBITDA*, is calculated as the ratio of offer value to the product of the percentage of the target outstanding shares acquired by the acquirer in the transaction and the target's earnings before interest, taxes, and depreciation and amortization of intangibles (EBITDA) at the end of the year immediately before the bid announcement.<sup>11</sup> Following Officer (2003), the offer value is computed as the aggregate value of cash, stock, and other securities offered by the acquirer.

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<sup>10</sup> For example, see Chapter 14 in Gaughan (2007) for a detailed discussion of different valuation methods adopted in the takeover valuation process.

<sup>11</sup> The results are qualitatively unchanged if *P/EBITDA* is calculated as the ratio of offer value to the target's EBITDA.

A high P/EBITDA ratio indicates that the acquirer gives a high valuation of the target. Here, transaction value is normalized by the target's EBITDA but not the target's net income because EBITDA is often used as a proxy for cash flow and is more reliable for capturing a firm's operating ability than net income. Moreover, EBITDA is generally positive, whereas net income is often negative for some firms, which also makes the P/EBITDA ratio more appropriate to evaluate a target than the P/E ratio. Even so, in robustness checks, similar results are obtained with the P/E ratio as a measure of valuation multiple if targets with negative net income at the end of the year before the bids are excluded.

#### 2.4 Definition of merger gain

An acquirer's gain from a takeover transaction is tested in two ways. The first one is acquirer investors' response to the acquisition. In an efficient market, if the acquirer offers too much for the target, the acquirer's stock price should drop, given the information available to the stock market at the time of the bid. As such, there would be a negative association between the valuation multiple and acquirer announcement return. Specifically, acquirer announcement return, ACAR, is calculated over the event window  $[-5, +5]$ , where day 0 is the bid announcement day. Abnormal return is defined as the market model residual, where the parameter is estimated over the  $[-205, -6]$  event window relative to the announcement day.

The second one is the total merger gain realized from the transaction. Following Chatterjee et al. (2012) and Bradley et al. (1988), synergetic gain realized from the takeover, CCAR, is calculated as the combined cumulative abnormal return of the acquirer and the target. Specifically, CCAR is obtained as the abnormal return over the event window  $[-5, +5]$  for a value-weighted portfolio of the acquirer and the target, where day 0 is the bid announcement day.

The weights for the acquirer and the target are based on their market value of equity 64 days prior to the bid announcement, and the target's weight is adjusted for the toehold held by the acquirer before the acquisition.

## 2.5 Construction of other variables

A number of variables about deal and firm characteristics are included in the empirical tests. DIVERSIFY is set to one if the primary business line of the acquirer is different from that of the target and zero otherwise. The two-digit SIC codes of the primary business line of the acquirer and the target are collected from the CRSP dataset. Morck et al. (1990) find that investors respond negatively to diversifying acquisitions, indicating that managers might overpay for the target. TOEHOLD equals one if the acquirer holds more than 5% of the target shares prior to the takeover announcement and zero otherwise. Gaspar et al. (2005) document that the acquirer offers a lower bid premium if it owns more shares of the target prior to the takeover.

TENDER is a dummy variable that equals one if the takeover is advanced via tender offer and zero otherwise. Berkovitch and Khanna (1991) propose a model in which a merger is a bargaining game between the acquirer and the target and a tender offer is an auction in which acquirers arrive sequentially and compete for the target. In equilibrium, there is a unique level of synergetic gain so that an acquirer with synergetic gain below this level will not acquire the target through a tender offer. As such, acquisition via tender offer implies a high synergetic gain and therefore a high bid premium.

Several studies find that competitive bids will drive up the bid price (Varaiya and Ferris, 1987; Walkling and Edmister, 1985). Hence, the dummy variable COMPETE is introduced, which equals one if there are multiple acquirers and zero otherwise. Boone and Mulherin (2007)

argue that the public takeover announcement is only a small part of the whole takeover process. Before the public announcement, there is a highly competitive market while the remainder negotiates with a single acquirer. As such, the measure of public acquirers, COMPETE, may not totally capture the competitiveness of the takeover. Considering this, an alternative proxy for competition, LIQUIDITY, is constructed to measure whether a particular acquisition takes place in an active takeover market. Following Moeller et al. (2004), LIQUIDITY is obtained as the value of all corporate control deals for firms with the same two-digit SIC code in a particular year divided by the book value of assets of all Compustat firms with the same two-digit SIC code in the corresponding year.

Target managerial resistance may affect the bid price and the success of the takeover. Cotter and Zenner (1994) find that the bid premium is positively related to managerial resistance. Thus, a variable HOSTILE is included, which equals one if the offer is resisted by the target and zero otherwise. Robinson and Shane (1990) examine the effect of the accounting reporting method on the bid premium. They document that the bid premium tends to be higher for acquisitions recorded using the pooling method. Thus, a dummy variable POOLING is added that equals one if the pooling-of-interest accounting method is reported in takeovers and zero if the takeover is accounted for by the purchase method. Berkovitch and Narayanan (1990) suggest that both the acquirer and target abnormal returns should be higher if the takeover is completed with a cash offer. Loughran and Vijh (1997) find supporting evidence for it. Therefore, the payment method CASH is included, which equals one for a pure cash offer and zero for a pure stock offer or mixture offer of stock and cash.

As for firm characteristics, TSIZE is the logarithm of the target's market value of common equity at the end of the fiscal year before the takeover announcement. RSIZE is the ratio of the

target's market value of common equity to that of the acquirer at the end of the fiscal year before the takeover announcement. Several studies (e.g., Bhagat et al., 2005) find that the relative size of the target relative to the acquirer is negatively related to the target announcement return. MTB is the ratio of the target market value of common stock to the book value of equity at the end of the fiscal year before the takeover announcement. ROA is the ratio of the target's net income to the total assets at the end of the year prior to the takeover announcement. GROWTH is the target's proportional change in sales in the year before takeover announcement. TURNOVER is the turnover rate of target stock, obtained as the total trading volume from the 365 days prior to 63 days until the takeover announcement date divided by the market value of equity 63 days prior to the takeover announcement.

## 2.6 Data description

(Insert Table 2 here)

Table 2 reports the descriptive statistics about the whole sample and the sample of completed bids. Look at the whole sample. The average analyst forecast DISPERSION is 0.008 and the average forecast ERROR 0.032. The target's average percentage-based bid premium, Premium\_Value, is 0.636. These numbers are all very close to those reported by earlier studies (e.g., Chatterjee et al., 2012).

As for the valuation multiple P/EBITDA, the average offer value is 11.6 times the target's EBITDA. On average, the acquirer suffers a loss of 0.8% around the announcement of the takeover (ACAR) and realizes a total gain of 1.9% (CCAR).

### 3. Target Valuation

#### 3.1 Univariate test

To begin the analysis, a univariate analysis is performed on the linkage of the target's information uncertainty and bid premium and valuation multiple. Specifically, the analyst forecast DISPERSION and forecast ERROR are sorted separately in ascending order and then are divided into five quintiles to check the average and median value of bid premium and valuation multiple within each quintile.

(Insert Table 3 here)

Table 3 reports the results sorted with analyst forecast DISPERSION in panel A and forecast ERROR in panel B. The sorting results reveal several interesting facts about the bid premium and valuation multiple. First, the bid premium almost invariably increases monotonically with the target's information uncertainty level. Second, the valuation multiple almost invariably decreases monotonically with the information uncertainty level. Third, for both bid premium and valuation multiple, there is a significant difference between the top and bottom quintiles, as shown in the bottom row of the panel. For instance, in panel A, the average Premium\_Value is 0.505 for targets in quintile Q1 with the lowest forecast dispersion, which is significantly lower ( $p$ -value = 0.006) than 0.799 for those in quintile Q5 with the highest dispersion. On the other hand, the average P/EBITDA is 16.6 for targets in quintile Q1, which is significantly higher ( $p$ -value < 0.001) than 4.43 for those in quintile Q5.

Clearly, a target with a high level of information uncertainty receives a high bid premium from the acquirer. However, this does not mean that the acquirer overbids for the target. In actuality, the acquirer evaluates the target lower and gives the target a lower valuation multiple in the transaction.

### 3.2 Regression results

Then, multiple regressions are performed with the following model to test the association between a target's information uncertainty level and bid premium and valuation multiple:

$$\begin{aligned}
 \text{Premium}_i / \text{Multiple}_i = & a_0 + a_1 * \text{Inf Proxy}_i + a_2 * \text{DIVERSIFY}_i + a_3 * \text{TOEHOLD}_i \\
 & + a_4 * \text{TENDER}_i + a_5 * \text{COMPETE}_i + a_6 * \text{LIQUIDITY}_i \\
 & + a_7 * \text{HOSTILE}_i + a_8 * \text{POOLING}_i + a_9 * \text{CASH}_i + a_{10} * \text{MTB}_i \\
 & + a_{11} * \text{ROA}_i + a_{12} * \text{GROWTH}_i + a_{13} * \text{TURNOVER}_i + a_{14} * \text{TSIZE}_i \\
 & + a_{15} * \text{RSIZE}_i + a_{16} * \text{Industry Dummy}_i + a_{17} * \text{Year Dummy}_i + \text{error}_i
 \end{aligned}
 \tag{1}$$

In regression model (1), the dependent variable is bid premium, Premium\_Value, or the valuation multiple, P/EBITDA. The independent variables include the proxy of information uncertainty, DISPERSION or ERROR, and a group of control variables including the deal characteristics and target firm characteristics mentioned earlier. Ordinary least squares (OLS) regressions are run separately with model (1) for bid premium and valuation multiple by winsorizing 1% outliers of the continuous, dependent and independent variables. Following the Huber-White procedures, significance is calculated on the basis of heteroscedasticity-consistent standard errors. Year and industry dummies are included in the regression.

(Insert Table 4 here)

Table 4 presents the regression results. As shown in specification (1), controlling for deal and firm characteristics, the forecast DISPERSION is significantly positively related to Premium\_Value. This result confirms earlier studies that targets with a high information uncertainty level receive high bid premiums in mergers and acquisitions. However, in specification (2), the forecast DISPERSION is significantly negatively related to P/EBITDA, with an estimated coefficient of -23.7 and *p*-value less than 0.001, indicating that acquirers give a low valuation to targets with a high level of information uncertainty.

Specifications (3) and (4) are applied for forecast error. The results show that ERROR is positively related to bid premium and negatively related to the valuation multiple. All of the relations are statistically significant.

As for deal and firm characteristics, the variables are generally significantly correlated with the bid premium and valuation multiple, as expected. In particular, it is worth noting that in the regressions, target ROA and sales GROWTH are significantly positively related to P/EBITDA. For instance, in specification (2), ROA is positively related to P/EBITDA, with an estimated coefficient of 21.7 and a *p*-value less than 0.001. These pieces of evidence indicate that the target's pre-bid operating performance is a significant determinant of the valuation it received in the takeover transaction.

Overall, even after controlling for the deal and target characteristics, targets with a high level of information uncertainty tend to receive high bid premiums in takeovers. Notwithstanding the high bid premiums, targets with high information uncertainty actually receive a low valuation from the acquirers, as measured with the valuation multiple.

### 3.3 Target's pre-bid firm performance

Regression (1) shows that despite the high bid premiums, targets with a high level of information uncertainty actually receive a low valuation from the acquirers. Regression (1) also shows that the valuation multiple is significantly positively related to the target's pre-bid firm performance. This result indicates that targets with high information uncertainty may perform poorly before the bids, which is a significant reason for their low valuation multiple received in the bids. To gain a clear understanding on this aspect, this part examines the target's pre-bid firm performance.

A target's pre-bid stock return is calculated as the buy-and-hold return from the 1,095th day to the 64th day prior to the takeover announcement date.<sup>12</sup> Abnormal return is calculated with the industry, size, and market-to-book matched control firm approach. To be selected as a control firm, the firm should satisfy the following criteria: (1) the IPO date of the firm should be at least eight years before the target's takeover announcement date (thus, a minimum listing history of five years to calculate the three-year pre-bid return); (2) the firm should not advance any takeover, conduct a seasoned equity offering or share repurchase in the three years prior to the takeover announcement; (3) both the firm's market value of total equity and market-to-book ratio at the 1,095th day prior to the takeover announcement date should not be 20% larger or smaller than those of the target; and (4) the firm should have the same two-digit SIC code as the target firm. This forms the base set of control firms. Then, from them, the one with the closest market value of total equity relative to the target is selected as a control firm. Therefore, the target's pre-bid abnormal stock return is calculated as its raw stock return less that of the corresponding

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<sup>12</sup> Similar results are obtained by calculating the target's stock return as the buy-and-hold return from the 365th day to the 64th day prior to the takeover announcement date, i.e., the one-year pre-bid stock return.

control firm.

The target's accounting performance before the bids is also examined. Following Harford (1999) and Healy et al. (1992), the target's operating performance is measured with the return on total assets, ROA, obtained as the net income normalized by the target's total assets at the end of the year.<sup>13</sup> Therefore, the target's pre-bid abnormal operating performance is calculated as the target's average ROA in the three years prior to the takeover announcement less that of the corresponding control firm.

(Insert Table 5 here)

Table 5 reports the targets' pre-bid firm performances sorted into five groups by analyst forecast DISPERSION or forecast ERROR. Obviously, targets with a high level of information uncertainty underperform in the stock market before the acquisitions compared to their industry peers and those with a low level of uncertainty. For instance, in panel A, targets with low forecast dispersion in quintile Q1 receive an average (median) positive return of 48.1% (42.2%) in the three years before the takeover. In comparison, targets with high dispersion in quintile Q5 suffer an average (median) loss of 12% (27.5%). The difference of stock return between the two groups is highly significant with a *p*-value less than 0.001.

The accounting performance is also very poor for targets with a high level of information uncertainty. For instance, in panel A, the average (median) abnormal ROA is 3.3% (1.6%) for targets with low dispersion in quintile Q1, indicating that these targets outperform their industry peers in the three years before the takeover. In comparison, the average (median) abnormal ROA

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<sup>13</sup> The results are quite similar if operating performance is measured with return on total equity or operating cash flow return on total assets or total equity.

is -1.7% (-1.3%) for targets with a high forecast dispersion in quintile Q5, indicating that these targets constantly underperform their industry peers before the bids.

Clearly, targets with a high level of information uncertainty perform poorly before the acquisitions, no matter whether measured by accounting performance or stock performance. The poor performance explains why targets with a high level of information uncertainty receive a low valuation in the takeover transactions.

#### **4. Acquirer and Combined Abnormal Return**

This section examines acquirer investors' response to the bid and the total merger gain realized from the acquisition. In an efficient market, if the acquirer bids too high for the target, the acquirer's stock price should drop, given the information available to the stock market upon the bid announcement. Therefore, a negative association is expected between acquirer announcement return and the valuation multiple given to the target.

(Insert Table 6 here)

##### **4.1 Univariate test**

Again, a univariate analysis is performed on the linkage of the target's information uncertainty with acquirer announcement return (ACAR) and combined abnormal return (CCAR) by dividing the firms into five quintiles according to information uncertainty level to check the average and the median value of ACAR and CCAR within each quintile.

Panel A of Table 6 presents the results sorted with analyst forecast DISPERSION. Clearly,

ACAR and CCAR increase almost monotonically with forecast dispersion for the whole sample, the sample of cash offers, and the sample of non-cash offers. In Panel B, ACAR and CCAR also increase monotonically with forecast ERROR. The evidence is consistent with the findings of Chatterjee et al. (2012) and Cheng et al. (2016).

In Panel C, acquirer announcement return and total merger gain are sorted by the valuation multiple. Obviously, there is a decreasing trend for ACAR with the valuation multiple. For instance, for the whole sample, acquirers in quintile Q1 on average realize a positive, statistically insignificant return of 0.3% when they offer a low P/EBITDA to acquire the targets. In comparison, when acquirers offer a high P/EBITDA for the targets, they suffer a significant average loss of 2.2%, as shown in quintile Q5. The difference of acquirer return is statistically significant between the two quintiles with a  $p$ -value of 0.003.

For both cash offers and non-cash offers, ACAR decreases almost monotonically with the valuation multiple P/EBITDA. In addition, the sorting results show that investors respond more positively to cash offers.<sup>14</sup> For instance, in quintile Q1, acquirers obtain a significant average positive return of 1.4% for cash offers but suffer a significant loss of 1% for non-cash offers. The difference between them is statistically significant (unreported).

There is also a decreasing trend for CCAR. CCAR decreases almost monotonically with the valuation multiple for the whole sample, cash offers, and non-cash offers. Collectively, this evidence shows that investors respond positively (or less negatively) when acquirers give a low valuation multiple to acquire the targets, and consequently, acquirers realize high merger gains in

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<sup>14</sup> According to Myers and Majluf (1984), an equity offer signals that the acquirer's common stock is overvalued, and consequently, investors will respond negatively to the bids. Berkovitch and Narayanan (1990) also propose a model in which a cash offer signals a high gain of the merger, and therefore, both acquirer and target abnormal return should be higher if the takeover is completed with a cash offer. Loughran and Vijh (1997) and Travlos (1987) conduct empirical studies on the impact of payment method on acquirer return.

the acquisitions. This provides the initial evidence that the low valuation multiple given to the target could be a significant factor that makes the deal profitable to the acquirer.

#### 4.2 Regression results

Then, multiple regressions are run to test the association between the acquisition return and information uncertainty and valuation multiple. The regression is run with the following model putting in important control variables:

$$\begin{aligned}
 ACAR_i/CCAR_i = & b_0 + b_1 * Multiple_i * 100 + b_2 * Inf Proxy_i + b_3 * Premium\_Value_i \\
 & + b_4 * DIVERSIFY_i + b_5 * TOEHOLD_i + b_6 * TENDER_i \\
 & + b_7 * COMPETE_i + b_8 * LIQUIDITY_i + b_9 * HOSTILE_i \\
 & + b_{10} * POOLING_i + b_{11} * CASH_i + b_{12} * RSIZE_i + b_{13} * AROA_i \\
 & + b_{14} * ASIZE_i + b_{15} * AGROWTH_i + b_{16} * AMTB_i \\
 & + b_{17} * Industry Dummy_i + b_{18} * Year Dummy_i + error_i \quad (2)
 \end{aligned}$$

The dependent variable in model (2) is the acquirer announcement abnormal return (ACAR) or the combined abnormal return (CCAR). The independent variables include the valuation multiple, P/EBITDA, proxies of target's information uncertainty, DISPERSION or ERROR, and a set of control variables. AROA is the ratio of the acquirer's net income to total assets at the end of the year prior to the takeover announcement. ASIZE is the logarithm of market value of the acquirer's common equity at the end of the year before takeover announcement. AGROWTH is the acquirer's proportional change in sales in the year before takeover announcement. AMTB is the ratio of the market value of the acquirer's common stock to the book value of equity at the

end of the year before takeover announcement. The definitions of other variables are the same as before.

The regression with model (2) is first performed putting in valuation multiple and proxies of information uncertainty separately. Then, the regression is performed putting in them together. In all regressions, winsorization is applied for 1% outliers of the continuous, dependent and independent variables.

(Insert Table 7 here)

Table 7 reports the regression results. In specification (1), controlling for deal characteristics and acquirer firm characteristics, the valuation multiple, P/EBITDA, is significantly negatively related to ACAR, with an estimated coefficient of -0.024 and a *p*-value of 0.019, indicating that acquirers realize high returns when they give a low valuation to acquire the targets. Note that the bid premium, Premium\_Value, is significantly negatively related to the acquirer abnormal return in the regression, indicating that acquirer investors respond negatively if the acquirers pay high premiums to acquire the targets.

In specification (2), forecast DISPERSION is significantly positively related to ACAR, with an estimated coefficient of 0.44 and a *p*-value of 0.046. Similarly, in specification (3), forecast ERROR is also significantly positively related to the acquirer announcement return with an estimated coefficient of 0.35 and a *p*-value of 0.022.

In specifications (4) and (5), I run the regression putting in the valuation multiple and proxies of information uncertainty together. As shown in both regressions, P/EBITDA is significantly negatively related to the acquirer announcement return, again confirming that the acquirers

realize high returns if they acquire the targets with a low valuation in the takeover transactions.

Table 7 also reports the regression results for the combined abnormal return (CCAR). In specification (6), P/EBITDA is significantly negatively related to CCAR, with an estimated coefficient of -0.021 and a  $p$ -value of 0.017. This result clearly shows that the low valuation multiple given to the target in the deal is a significant source of the high total merger gain. As for information uncertainty, forecast DISPERSION and forecast ERROR are both positively related to CCAR, with marginal statistical significance, as shown in specification (7) and (8). In specifications (9) and (10), the valuation multiple and proxies of information uncertainty are added together in the regressions. Again, there is a significant negative association between the target valuation multiple and the combined abnormal return.

Next, several robustness tests are performed by re-running the regressions with a completed takeover sample. Moeller et al. (2004) assert that acquirer size is a significant determinant of the acquirer announcement abnormal return. They document that large acquirers suffer a significant loss from the acquisitions. Therefore, the sample is divided into two groups based on the median value of the acquirer's market value of common equity at the end of the year before takeover announcement. In particular, the impact of target valuation on the acquisition returns is checked for those large acquirers whose market value is above the median.

(Insert Table 8 here)

The results for the robustness tests are reported in Table 8. For brevity, only the coefficients of key variables are reported. As shown, in all regressions, P/EBITDA is significantly negatively related to the acquirer announcement return (ACAR) and the combined abnormal return (CCAR).

This evidence again confirms that the low valuation multiple given to the target is a significant factor making the deal profitable to the acquirer.

Other robustness tests are also conducted by dividing the sample according to the payment method (CASH) and acquisition form (TENDER). Unreported results show that regardless of whether the acquisition is conducted with cash or stock, tender offer or merger, the valuation multiple, P/EBITDA, is significantly negatively related to the acquirer announcement return (ACAR) and the combined abnormal return (CCAR).

In summary, the regression results clearly show that there is a negative association between the valuation multiple and acquirer announcement abnormal return and the combined announcement abnormal return. The low valuation given to the target in the transaction is a significant factor that makes the deal profitable for the acquirer in the acquisition of a target with a high level of information uncertainty.

## **5. Robustness Tests**

### 5.1 Alternative measures for information uncertainty

In addition to analyst forecast dispersion and forecast error, several proxies are also used to measure a target's level of information uncertainty. The first proxy is the bid-ask spread. Many studies document that firms with larger bid-ask spreads have higher levels of information uncertainty (e.g., Welker, 1995; Leuz and Verrecchia, 2000; Affleck-Graves et al., 2002). Specifically, SPREAD is obtained as the daily relative bid-ask spread averaged over the fiscal year before the announcement of the takeover, where the daily relative spread is the ratio of the absolute value of the bid-ask spread over the midpoint of the spread.

The second proxy is the intensity of research and development expenditures. Research and development expenditures has a negative impact on the quality of reporting earnings (Francis et al., 2004). Specifically, R&D is calculated as the ratio of research and development expenses to sales at the end of the year before takeover announcement.

The last proxy is the idiosyncratic volatility of the target stock. Idiosyncratic volatility is widely used in the finance literature to measure a firm's information asymmetry level (e.g., Dierkens, 1991; Moeller et al., 2007). Studies document that a firm with high volatility exhibits a high level of information uncertainty. Specifically, in this study, idiosyncratic VOLATILITY is calculated as the standard deviation of the target's daily abnormal stock return from the 365 days prior to 63 days until the takeover announcement date.

(Insert Table 9 here)

Table 9 reports the bid premium and valuation multiple sorted by three alternative proxies of target's information uncertainty. As shown, for all three proxies, there is an increasing trend of bid premium with target's level of information uncertainty but a decreasing trend of valuation multiple P/EBITDA. The differences between the quintile Q1 and the quintile Q5 are all statistically significant.

## 5.2 Alternative measures for bid premium and valuation multiple

Financial studies also calculate bid premium as the target abnormal return in a trading window around the bid announcement (e.g., Officer, 2003; Chatterjee et al., 2012). As a robustness test, the bid premium is also calculated in this way. Specifically, the bid premium,

*Premium\_Return*, is the target abnormal return in a trading window [-63, +126], where day 0 is the takeover announcement date.

Except for price-to-earnings ratio, several multiples are also commonly used by practitioners in mergers and acquisitions. The first one is calculating the enterprise value of a target. Enterprise value represents the entire economic value of a company. It is the theoretical takeover price that an acquirer would have to pay to buy a target. Therefore, the offer value relative to target's enterprise value can be used to measure whether an acquirer pays a high price to acquire a target. The second one is the ratio of offer value to the book value of the target's equity. The third one is the ratio of offer value to the target's sales.

As robustness tests, the valuation multiple is also calculated with these three measures. Specifically, Offer/EV is calculated as the offer value in a deal normalized by the product of the percentage of target outstanding shares acquired in the transaction and the enterprise value of a target at the end of the year immediately before the bid announcement, where enterprise value is obtained as the market value of equity, plus the book value of debt, minus the book value of cash and cash equivalent. Offer/BV is calculated as the offer value in a deal normalized by the product of the percentage of target outstanding shares acquired in the transaction and the book value of a target's equity at the end of the year immediately before the bid announcement. Offer/Sale is calculated as the offer value in a deal normalized by the product of the percentage of the target's outstanding shares acquired in the transaction and the target's sales at the end of the year immediately before the bid announcement.<sup>15</sup>

(Insert Table 10 here)

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<sup>15</sup> The three measures are also calculated as the ratio of offer value to the target's enterprise value, the target's book value of equity, or the target's sales without multiplying the percentage of target shares acquired. The results are qualitatively unchanged.

Panel A in Table 10 presents the alternative measures of bid premium and valuation multiple sorted by analyst forecast dispersion. Bid premium increases with the target's information uncertainty, whereas the valuation multiple monotonically decreases with information uncertainty. On average, the offer value equals 1.30 times the target's enterprise value, 1.69 times the target's book value of equity and 4.74 times the target's sales for quintile Q1, where targets have the lowest forecast dispersion. In quintile Q5, where targets have highest forecast dispersion, the average offer value is only 0.69 times the target's enterprise value, 1.29 times the target's book value of equity and 2.32 times the target's sales. The differences of the valuation multiple between the two quintiles are statistically significant with  $p$ -values less than 0.001.

Panel B reports the sorting results by analyst forecast error. Again, there is a decreasing trend of the valuation multiple with the target's level of information uncertainty.

### 5.3 Other robustness tests

Many other robustness tests are also conducted in this study: (1) The sample is divided according to some factors that may affect the acquirer's valuation of the target, including acquisition form, payment method, deal attitude, acquisition time, target size, whether the takeover is a diversifying transaction, and whether the takeover is successfully completed. (2) Some exceptional cases are deleted that may contaminate the results. Specifically, unsuccessful bids are excluded. Then, targets with negative accounting performance (net income) at the end of the year before the takeover are deleted. Finally, bids with a target price below \$2 per share 63 days prior to the takeover announcement are excluded, considering that these firms are likely to be more affected by market microstructure effects (Ball et al., 1995). (3) Targets with an analysts

following of less than three are deleted, considering that the dispersion of analyst forecasts would be higher if there are fewer analysts following the firm. (4) The valuation multiple is adjusted with the median value of all takeover targets with the same two-digit SIC industry code. Specifically, the median valuation multiple, P/EBITDA, is calculated for all of the public takeover targets over the period 1986-2008. Then, the median multiple of all targets with the same two-digit SIC industry code is deducted from each takeover target's valuation multiple. (5) The whole sample is divided into five sub-samples according to target size and then each sub-sample is sorted into five groups with the proxy of information uncertainty to check the industry-adjusted valuation multiple P/EBITDA within each group.

(Insert Table 11 here)

Table 11 presents the sorting results of the robustness tests. For brevity, only results of P/EBITDA with forecast DISPERSION as the proxy of information uncertainty are reported. As before, forecast DISPERSION is sorted in ascending order and then is divided into five quintiles to check the average and median values of P/EBITDA within each quintile.

As shown, for all of the robustness tests, targets with a high forecast dispersion in quintile Q5 receive a lower valuation multiple than those with a low forecast dispersion in quintile Q1. The valuation difference between the two quintiles is statistically significant.

In particular, for all five sub-samples divided according to target size, targets with a low forecast dispersion in quintile Q1 receive a positive industry-adjusted P/EBITDA, indicating that these targets are priced above the industry median value in the transactions. In comparison, targets with a high forecast dispersion in quintile Q5 receive a negative industry-adjusted

P/EBITDA, indicating that these targets are priced below the median value of the industry. These results clearly indicate a negative association between a target's level of information uncertainty and its valuation received in takeover transactions.

## **6. Conclusion**

This study examines how a target's information uncertainty affects an acquirer's valuation of the target and the merger gain realized from the transaction. When a target has a high level of information uncertainty, it obtains a high bid premium from an acquirer. Even so, information uncertainty is significantly negatively associated with the valuation multiple. This evidence indicates that a target with a high level of information uncertainty actually receives a low valuation from an acquirer in a takeover transaction.

Targets with a high level of information uncertainty perform poorly before the acquisition. The poor performance explains why these targets receive a low valuation in the transactions. This evidence is consistent with the traditional view that the takeover can redeploy the assets of underperforming targets toward more profitable uses under the better management of high-performing acquirers.

Acquirer investors respond negatively if the acquirers buy the targets with a high valuation multiple. The valuation multiple is significantly negatively related to the acquirer announcement return and the combined abnormal return of the acquirer and the target. This evidence indicates that the low valuation given to the targets with a high level of information uncertainty is a significant factor that makes the deal profitable for the acquirers.

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**Table 1****Sample distribution by announcement year**

This table presents the yearly distribution of the total 2,047 mergers and acquisitions announced between 1986 and 2008. In the sample, both the acquirer and the target are American firms traded on NYSE, AMEX or NASDAQ, the deal value is equal to or greater than \$ 1 million, and the acquirer controls less than 50% of the target's outstanding shares before the announcement of the takeover and will control 100% of the target's shares upon the completion of the bids.

	Cash Offer	Mixture Offer	Equity Offer	Completed Bids	Whole Sample
1986	24	3	7	25	34
1987	20	6	11	32	37
1988	41	14	21	59	76
1989	25	6	22	38	53
1990	13	5	12	26	30
1991	7	5	17	21	29
1992	9	1	18	24	28
1993	9	7	30	34	46
1994	17	8	24	38	49
1995	31	12	69	99	112
1996	29	19	87	121	135
1997	34	52	97	165	183
1998	52	41	93	164	186
1999	57	39	98	169	194
2000	47	21	64	115	132
2001	33	33	53	108	119
2002	26	22	27	70	75
2003	32	27	30	82	89
2004	33	28	38	91	99
2005	31	22	43	90	96
2006	30	19	35	76	84
2007	35	18	36	80	89
2008	28	18	26	69	72
Total	663	426	958	1,796	2,047

**Table 2**  
**Descriptive statistics of the variables**

This table presents the descriptive statistics of the variables used in this study. The definitions of the variables are provided in the Appendix.

	Whole Sample			Completed Takeovers		
	Number	Mean	Median	Number	Mean	Median
DISPERSION	1,853	0.008	0.002	1,549	0.007	0.002
ERROR	1,928	0.032	0.015	1,662	0.031	0.014
Premium_Value	2,047	0.636	0.537	1,796	0.761	0.546
P/EBITDA	2,047	11.6	10.2	1,796	11.3	9.99
ACAR	2,047	-0.008	-0.005	1,796	-0.005	-0.004
CCAR	2,031	0.019	0.013	1,790	0.017	0.012
DIVERSIFY	2,047	0.69	1	1,796	0.68	1
TOEHOLD	2,047	0.04	0	1,796	0.04	0
TENDER	2,047	0.22	0	1,796	0.22	0
COMPETE	2,047	0.07	0	1,796	0.08	0
LIQUIDITY	2,047	0.02	0.01	1,796	0.02	0.01
HOSTILE	2,047	0.12	0	1,796	0.07	0
POOLING	2,047	0.17	0	1,796	0.19	0
CASH	2,047	0.32	0	1,796	0.31	0
MTB	2,047	2.65	1.70	1,796	2.35	1.71
ROA	2,047	0.03	0.04	1,796	0.03	0.04
GROWTH	2,047	0.38	0.13	1,796	0.36	0.13
TURNOVER	2,047	5.53	3.48	1,796	5.26	3.56
TSIZE	2,047	5.06	5.10	1,796	5.09	5.12
RSIZE	2,047	0.34	0.16	1,796	0.29	0.17

**Table 3**  
**Bid premium and valuation multiple sorted by information uncertainty**

This table shows the average and median (in parenthesis) bid premium and valuation multiple of five groups sorted by the target's information uncertainty level measured by analyst forecast DISPERSION and forecast ERROR for 2,047 mergers and acquisitions announced between 1986 and 2008. The definitions of the variables are provided in the Appendix.

	Premium_Value	P/EBITDA
<i>Panel A: Sorted by DISPERSION</i>		
Q1 [Low]	0.505 (0.513)	16.6 (13.9)
Q2	0.512 (0.527)	12.3 (11.3)
Q3	0.662 (0.567)	11.1 (11.8)
Q4	0.755 (0.581)	8.34 (7.44)
Q5 [High]	0.799 (0.618)	4.43 (3.56)
Difference	0.006 <sup>a</sup> 0.003 <sup>b</sup>	<.001 <.001
<i>Panel B: Sorted by ERROR</i>		
Q1 [Low]	0.631 (0.465)	11.6 (11.3)
Q2	0.650 (0.539)	10.9 (10.2)
Q3	0.727 (0.518)	11.5 (9.56)
Q4	0.739 (0.570)	12.1 (9.96)
Q5 [High]	0.801 (0.639)	4.90 (7.04)
Difference	0.002 0.021	<.001 <.001

<sup>a</sup>: *p*-value of the T-test for the average value between Q1 and Q5.

<sup>b</sup>: *p*-value of two-tailed Wilcoxon test for the median value between Q1 and Q5.

**Table 4**  
**Regressions of bid premium and valuation multiple on information uncertainty**

This table presents the regression results of bid premium and valuation multiple on the target's information uncertainty level measured by analyst forecast DISPERSION and forecast ERROR for 2,047 mergers and acquisitions announced between 1986 and 2008. The definitions of the variables are provided in the Appendix. Significance is based on White-adjusted standard errors with *p*-values reported in parentheses. \*, \*\*, and \*\*\*, denote the significance level of 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)
	Premium_Value	P/EBITDA	Premium_Value	P/EBITDA
Intercept	0.73*** (<.001)	12.8*** (0.004)	0.63*** (<.001)	19.4*** (<.001)
<b>DISPERSION</b>	<b>6.07**</b> <b>(0.036)</b>	<b>-23.7***</b> <b>(&lt;.001)</b>		
<b>ERROR</b>			<b>3.23***</b> <b>(0.008)</b>	<b>-13.9***</b> <b>(&lt;.001)</b>
DIVERSIFY	0.01 (0.517)	0.55 (0.789)	-0.10** (0.014)	-1.26 (0.269)
TOEHOLD	-0.18*** (<.001)	-7.34** (0.023)	-0.38*** (<.001)	-3.33* (0.056)
TENDER	0.12*** (<.001)	1.78 (0.344)	0.19*** (<.001)	2.02 (0.140)
COMPETE	0.08* (0.073)	3.03 (0.317)	0.04 (0.561)	-2.05 (0.214)
LIQUIDITY	0.27** (0.039)	1.08 (0.783)	0.29** (0.032)	0.66 (0.858)
HOSTILE	0.004 (0.894)	1.39 (0.659)	-0.12* (0.078)	-4.66*** (0.005)
POOLING	0.07*** (0.008)	2.52 (0.353)	0.002 (0.167)	5.16*** (0.001)
CASH	0.02* (0.057)	-0.315 (0.761)	0.002 (0.165)	-0.52 (0.506)
MTB	-0.002** (0.037)	0.71** (0.036)	-0.04*** (<.001)	0.26 (0.269)
ROA	0.08 (0.693)	21.7*** (<.001)	0.28 (0.292)	26.9*** (<.001)
GROWTH	0.006 (0.284)	0.38** (0.015)	0.014 (0.289)	0.62* (0.097)
TURNOVER	0.004 (0.265)	-0.28*** (0.007)	0.003 (0.364)	-0.23** (0.016)
TSIZE	-0.02** (0.040)	0.005* (0.083)	-0.03 (0.107)	-0.46 (0.341)
RSIZE	-0.03*** (0.006)	1.98** (0.045)	-0.09*** (0.002)	2.31*** (<.001)
Year Dummies	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes
Observation	1,853	1,853	1,928	1,928
Adj R <sup>2</sup>	0.167	0.115	0.143	0.141

**Table 5**  
**Target pre-bid firm performance**

This table reports the average and median (in parenthesis) target pre-bid buy-and-hold stock return and operating performance of five groups sorted by target's information uncertainty level measured by analyst forecast DISPERSION and forecast ERROR for 2,047 mergers and acquisitions announced between 1986 and 2008. Raw Return is a target's pre-bid stock return, calculated as the buy-and-hold return from the 1,095th day to the 64th day prior to the takeover announcement date. Abnormal Return is Raw Return adjusted with the industry, size, and market-to-book matched control sample. Abnormal ROA is target's average ratio of net income to total assets in the three years prior to the takeover announcement deducting that of the industry, size, and market-to-book matched control firms. The definitions of other variables are provided in the Appendix. \*, \*\*, and \*\*\*, denote the significance level of 10%, 5%, and 1%, respectively.

	Raw Return	Abnormal Return	Abnormal ROA
<i>Panel A: Sorted by DISPERSION</i>			
Q1 [Low]	0.481*** (0.422)	0.235*** (0.282)	0.033*** (0.016)
Q2	0.341*** (0.310)	0.287** (0.122)	0.007 (0.0001)
Q3	0.261*** (0.265)	-0.146* (-0.223)	-0.019 (-0.0003)
Q4	0.148*** (0.056)	-0.169* (0.001)	-0.026* (-0.006)
Q5 [High]	-0.120* (-0.275)	-0.348*** (-0.422)	-0.017** (-0.013)
Difference	<.001 <sup>a</sup> <.001 <sup>b</sup>	<.001 <.001	0.006 <.001
<i>Panel B: Sorted by ERROR</i>			
Q1 [Low]	0.448*** (0.371)	0.302*** (0.266)	0.029** (0.015)
Q2	0.419*** (0.339)	0.238** (0.189)	0.016* (0.003)
Q3	0.666*** (0.135)	-0.122* (-0.028)	0.0009 (-0.0005)
Q4	0.310*** (-0.014)	-0.161* (-0.099)	-0.022** (-0.011)
Q5 [High]	-0.129* (-0.287)	-0.588*** (-0.457)	-0.027*** (-0.016)
Difference	<.001 <.001	<.001 <.001	<.001 0.003

<sup>a</sup>: *p*-value of the T-test for the average value between Q1 and Q5.

<sup>b</sup>: *p*-value of two-tailed Wilcoxon test for the median value between Q1 and Q5.

**Table 6**  
**Acquirer and combined abnormal return sorted by information uncertainty and valuation multiple**

This table reports the average and median (in parenthesis) acquirer cumulative abnormal return (ACAR) and combined cumulative abnormal return (CCAR) sorted into five groups by analyst forecast DISPERSION, forecast ERROR, and valuation multiple P/EBITDA for 2,047 mergers and acquisitions announced between 1986 and 2008. Cash offer includes bids conducted with a pure cash offer. Non-cash offer include bids conducted with a pure equity offer and a mixed offer of cash and equity. The definitions of the variables are provided in the Appendix. \*, \*\*, and \*\*\*, indicate that the average value is significantly different with zero at the 10%, 5%, and 1% level, respectively.

	ACAR			CCAR		
	Whole Sample	Cash Offer	Non-Cash Offer	Whole Sample	Cash Offer	Non-Cash Offer
<i>Panel A: Sorted by DISPERSION</i>						
Q1 [Low]	-0.026*** (-0.010)	0.007 (-0.0003)	-0.029*** (-0.016)	0.014*** (0.010)	0.031*** (0.014)	0.010* (0.007)
Q2	-0.017** (-0.006)	-0.003 (-0.005)	-0.018*** (-0.010)	0.021*** (0.015)	0.032*** (0.026)	0.014*** (0.010)
Q3	-0.016 (-0.007)	0.009** (0.014)	-0.010** (-0.009)	0.013*** (0.010)	0.034*** (0.022)	0.004 (0.002)
Q4	-0.0049 (-0.003)	0.015*** (0.009)	-0.009*** (-0.005)	0.015*** (0.015)	0.037*** (0.028)	0.009** (0.012)
Q5 [High]	0.0007 (0.0004)	0.017*** (0.009)	-0.011* (-0.011)	0.030*** (0.019)	0.041*** (0.025)	0.019*** (0.016)
Difference	0.007 <sup>a</sup> 0.002 <sup>b</sup>	0.059 0.023	0.015 0.008	0.031 0.018	0.076 0.068	0.021 0.010
<i>Panel B: Sorted by ERROR</i>						
Q1 [Low]	-0.014*** (-0.009)	0.001 (-0.004)	-0.022*** (-0.017)	0.016*** (0.010)	0.024*** (0.015)	0.011*** (0.008)
Q2	-0.011** (-0.009)	0.002 (-0.002)	-0.021*** (-0.013)	0.018*** (0.012)	0.025*** (0.021)	0.012*** (0.008)
Q3	-0.004** (-0.005)	0.007* (0.005)	-0.009*** (-0.007)	0.020*** (0.018)	0.029*** (0.025)	0.013*** (0.011)

Q4	-0.001 (-0.005)	0.002* (0.004)	-0.010*** (-0.008)	0.021*** (0.019)	0.026*** (0.028)	0.015** (0.012)
Q5 [High]	0.0002 (0.0001)	0.011** (0.014)	-0.007** (-0.004)	0.023*** (0.020)	0.031*** (0.027)	0.017*** (0.014)
Difference	0.014 0.029	0.028 0.035	0.019 0.056	0.041 0.028	0.026 0.033	0.025 0.009

*Panel C: Sorted by P/EBITDA*

Q1 [Low]	0.003 (0.006)	0.014*** (0.011)	-0.010*** (-0.008)	0.037*** (0.024)	0.045*** (0.037)	0.015*** (0.012)
Q2	-0.005 (-0.001)	0.010*** (0.007)	-0.007** (-0.004)	0.036*** (0.032)	0.045*** (0.041)	0.022*** (0.010)
Q3	-0.0004 (-0.003)	0.015*** (0.003)	-0.007** (-0.007)	0.018*** (0.019)	0.031*** (0.029)	0.014*** (0.011)
Q4	-0.017** (-0.006)	-0.004 (-0.006)	-0.023*** (-0.007)	0.006*** (0.009)	0.016*** (0.012)	0.001 (0.007)
Q5 [High]	-0.022*** (-0.014)	-0.008* (-0.007)	-0.026*** (-0.024)	0.005* (0.006)	0.017*** (0.009)	0.0006 (0.004)
Difference	0.003 0.016	0.001 0.015	0.005 0.020	0.029 0.003	0.008 0.012	0.018 0.036

<sup>a</sup>:  $p$ -value of the T-test between Q1 and Q5.

<sup>b</sup>:  $p$ -value of two-tailed Wilcoxon test between Q1 and Q5.

**Table 7**

**Regressions of acquirer and combined cumulative abnormal return on valuation multiple and information uncertainty**

This table presents the regression results of acquirer cumulative abnormal return (ACAR) and combined cumulative abnormal return (CCAR) on valuation multiple and information uncertainty for 2,047 mergers and acquisitions announced between 1986 and 2008. AROA is the ratio of the acquirer's net income to total assets at the end of the year prior to the takeover announcement. ASIZE is the logarithm of the market value of the acquirer's common equity at the end of the year before takeover announcement. AGROWTH is the acquirer's proportional change in sales in the year before takeover announcement. AMTB is the ratio of the market value of the acquirer's common stock to book value of equity at the end of the year before takeover announcement. Other variable definitions are reported in the Appendix. Significance is based on White-adjusted standard errors with *p*-values reported in parentheses. \*, \*\*, and \*\*\*, denote the significance level of 10%, 5%, and 1%, respectively.

	ACAR					CCAR				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	-0.007*	-0.008**	-0.011**	-0.008*	-0.01***	0.01***	0.01**	0.01***	0.01***	0.01***
	(0.065)	(0.021)	(0.023)	(0.059)	(<.001)	(<.001)	(0.018)	(<.001)	(0.007)	(<.001)
<b>P/EBITDA*100</b>	<b>-0.024**</b>			<b>-0.019**</b>	<b>-0.023**</b>	<b>-0.021**</b>			<b>-0.018**</b>	<b>-0.016*</b>
	<b>(0.019)</b>			<b>(0.042)</b>	<b>(0.029)</b>	<b>(0.017)</b>			<b>(0.036)</b>	<b>(0.072)</b>
<b>DISPERSION</b>		<b>0.44**</b>		<b>0.37*</b>			<b>0.17*</b>		<b>0.09*</b>	
		<b>(0.046)</b>		<b>(0.091)</b>			<b>(0.063)</b>		<b>(0.089)</b>	
<b>ERROR</b>			<b>0.35**</b>		<b>0.29</b>			<b>0.06*</b>		<b>0.24</b>
			<b>(0.022)</b>		<b>(0.111)</b>			<b>(0.058)</b>		<b>(0.106)</b>
Premium_Value	-0.003***	-0.003***	-0.004***	-0.004**	-0.003***	0.004**	0.001	0.001	0.007*	0.005**
	(0.004)	(0.006)	(0.006)	(0.018)	(0.006)	(0.036)	(0.125)	(0.127)	(0.079)	(0.027)
DIVERSIFY	-0.011	-0.014	-0.003	-0.006	-0.004	-0.006	-0.004	-0.005	-0.004	-0.004
	(0.354)	(0.183)	(0.554)	(0.341)	(0.299)	(0.515)	(0.415)	(0.228)	(0.551)	(0.370)
TOEHOLD	0.011**	0.012***	0.011***	0.011***	0.011***	-0.022	-0.025	-0.022	-0.023	0.025
	(0.031)	(0.003)	(<.001)	(0.010)	(0.006)	(0.208)	(0.547)	(0.809)	(0.185)	(0.796)
TENDER	-0.005	0.01	0.001	-0.004	0.001	0.018**	0.018**	0.02***	0.017**	0.02***
	(0.558)	(0.148)	(0.979)	(0.593)	(0.891)	(0.036)	(0.040)	(0.003)	(0.045)	(<.001)
COMPETE	0.01	0.02	0.04**	0.01	0.02	0.01	0.01	0.02**	0.01	0.01
	(0.179)	(0.161)	(0.021)	(0.250)	(0.162)	(0.355)	(0.327)	(0.025)	(0.427)	(0.192)
LIQUIDITY	0.003	0.002	-0.004	0.002	0.001	0.002	0.001	-0.002	0.002	-0.002
	(0.659)	(0.887)	(0.256)	(0.862)	(0.944)	(0.826)	(0.973)	(0.539)	(0.726)	(0.729)
HOSTILE	-0.011	-0.004	-0.012	-0.004	-0.02***	0.009	0.019	-0.01	0.011	-0.003
	(0.238)	(0.598)	(0.185)	(0.699)	(0.002)	(0.401)	(0.117)	(0.138)	(0.341)	(0.579)
POOLING	0.012	0.011	0.01	0.012	0.01**	0.009	0.008	-0.005	0.009	-0.006
	(0.191)	(0.187)	(0.119)	(0.139)	(0.044)	(0.264)	(0.361)	(0.921)	(0.271)	(0.212)

CASH	0.02***	0.02***	0.03***	0.02***	0.03***	0.02***	0.02***	0.02***	0.02***	0.02***
	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(<.001)	(0.002)	(<.001)	(0.003)
RSIZE	-0.006	-0.01	-0.003	-0.002	0.004	0.01**	0.01*	0.01***	0.01**	0.01***
	(0.383)	(0.242)	(0.420)	(0.386)	(0.873)	(0.012)	(0.064)	(0.005)	(0.036)	(0.006)
AROA	0.0004	0.0008	0.0005*	0.0004	0.0004	0.0001	0.0003	0.0004	0.0001	0.0002
	(0.177)	(0.273)	(0.091)	(0.173)	(0.177)	(0.794)	(0.679)	(0.139)	(0.827)	(0.749)
ASIZE	-0.0023	-0.0028	-0.0025	-0.0025	-0.0024	-0.0012***	-0.0012***	-0.0011***	-0.0011***	-0.0013***
	(0.141)	(0.156)	(0.224)	(0.101)	(0.505)	(0.009)	(<.001)	(0.001)	(<.001)	(<.001)
AGROWTH	0.05	0.04	0.02**	0.04	0.02	0.003*	0.002*	0.002**	0.002	0.002*
	(0.367)	(0.268)	(0.025)	(0.523)	(0.913)	(0.056)	(0.052)	(0.043)	(0.324)	(0.085)
AMTB	-0.06	-0.05	-0.04	-0.05	-0.02	-0.001	-0.005	-0.003	-0.005	-0.004*
	(0.475)	(0.426)	(0.215)	(0.463)	(0.407)	(0.101)	(0.118)	(0.165)	(0.115)	(0.053)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	2,047	1,853	1,928	1,853	1,928	2,031	1,846	1,924	1,846	1,924
Adj R <sup>2</sup>	0.098	0.096	0.085	0.104	0.103	0.123	0.127	0.115	0.131	0.128

**Table 8**  
**Robustness tests on acquirer and combined abnormal return regressions**

This table presents the robustness tests about the regression of acquirer cumulative abnormal return (ACAR) and combined cumulative abnormal return (CCAR) on valuation multiple and information uncertainty for 2,047 mergers and acquisitions announced between 1986 and 2008. Panel A reports the regression result for the completed takeover sample. Panel B reports the regression result for the completed takeover sample with the acquirer firm size larger than the median value. Acquirer size is the logarithm of the market value of the acquirer's common equity at the end of the year before takeover announcement. The coefficients of control variables are not reported. The definitions of the variables are provided in the Appendix. Significance is based on White-adjusted standard errors with *p*-values reported in parentheses. \*, \*\*, and \*\*\*, denote the significance level of 10%, 5%, and 1%, respectively.

	ACAR					CCAR				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Panel A: Completed takeover sample</i>										
<b>P/EBITDA*100</b>	<b>-0.038***</b> <b>(0.001)</b>		<b>-0.033***</b> <b>(0.007)</b>	<b>-0.027***</b> <b>(0.001)</b>		<b>-0.027**</b> <b>(0.035)</b>		<b>-0.024**</b> <b>(0.043)</b>	<b>-0.019**</b> <b>(0.035)</b>	
DISPERSION		0.50** (0.014)		0.46** (0.046)			0.13* (0.056)		0.19* (0.089)	
ERROR			-0.33 (0.135)		-0.36 (0.126)			-0.21 (0.246)		-0.24 (0.215)
Observation	1,796	1,549	1,662	1,549	1,662	1,790	1,548	1,661	1,548	1,661
<i>Panel B: Completed takeover sample, acquirer size is larger than the median</i>										
<b>P/EBITDA*100</b>	<b>-0.023**</b> <b>(0.012)</b>		<b>-0.029**</b> <b>(0.012)</b>	<b>-0.023**</b> <b>(0.011)</b>		<b>-0.022**</b> <b>(0.047)</b>		<b>-0.030**</b> <b>(0.041)</b>	<b>-0.024**</b> <b>(0.027)</b>	
DISPERSION		0.36* (0.054)		0.34* (0.097)			0.07 (0.271)		0.08 (0.262)	
ERROR			-0.21 (0.401)		-0.25 (0.337)			-0.38 (0.147)		-0.41 (0.133)
Observation	898	775	831	775	831	895	774	830	774	830

**Table 9**  
**Bid premium and valuation multiple sorted by alternative measures of information uncertainty**

This table shows the average and median (in parenthesis) bid premium and valuation multiple of five groups sorted by the target's information uncertainty for 2,047 mergers and acquisitions announced between 1986 and 2008. Information uncertainty is measured with bid-ask spread (SPREAD), intensity of R&D expenses (R&D), and idiosyncratic volatility (VOLATILITY). The definitions of the variables are provided in the Appendix.

	Premium_Value	P/EBITDA
<i>Panel A: Sorted by SPREAD</i>		
Q1 [Low]	0.493 (0.509)	15.8 (13.4)
Q2	0.535 (0.521)	13.1 (11.5)
Q3	0.638 (0.586)	10.8 (10.2)
Q4	0.733 (0.602)	8.56 (7.25)
Q5 [High]	0.768 (0.634)	4.65 (3.89)
Difference	<.001 <sup>a</sup> <.001 <sup>b</sup>	<.001 <.001
<i>Panel B: Sorted by R&amp;D</i>		
Q1 [Low]	0.538 (0.506)	13.5 (12.0)
Q2	0.576 (0.531)	10.8 (10.1)
Q3	0.665 (0.568)	9.4 (9.01)
Q4	0.706 (0.648)	8.6 (7.92)
Q5 [High]	0.764 (0.673)	5.3 (4.85)
Difference	0.007 0.016	<.001 <.001
<i>Panel C: Sorted by VOLATILITY</i>		
Q1 [Low]	0.608 (0.526)	12.8 (11.2)
Q2	0.662 (0.587)	10.6 (10.1)
Q3	0.718 (0.633)	9.7 (8.32)
Q4	0.732 (0.665)	7.86 (6.85)
Q5 [High]	0.756 (0.653)	4.92 (5.06)

Difference	0.034	<.001
	0.018	<.001

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<sup>a</sup>:  $p$ -value of the T-test for the average value between Q1 and Q5.

<sup>b</sup>:  $p$ -value of two-tailed Wilcoxon test for the median value between Q1 and Q5.

**Table 10**  
**Alternative measures of bid premium and valuation multiple sorted by information uncertainty**

This table shows the average and median (in parenthesis) bid premium and valuation multiple of five groups sorted by target's information uncertainty measured with analyst forecast DISPERSION and forecast ERROR for 2,047 mergers and acquisitions announced between 1986 and 2008. Bid premium is calculated as the target's abnormal return in a trading window around the bid announcement, Premium\_Return. Valuation multiple is calculated as the offer value relative to the target's enterprise value (Offer/EV), the offer value relative to the book value of the target's equity (Offer/BV), or the offer value relative to the target's sales (Offer/Sale). The definitions of the variables are provided in the Appendix.

	Premium_Return	Offer/EV	Offer/BV	Offer/Sale
<i>Panel A: Sorted by DISPERSION</i>				
Q1 [Low]	0.371 (0.336)	1.30 (1.27)	1.69 (1.57)	4.74 (2.84)
Q2	0.392 (0.365)	1.14 (1.21)	1.63 (1.56)	3.70 (2.33)
Q3	0.438 (0.405)	1.01 (1.01)	1.60 (1.50)	3.42 (2.31)
Q4	0.456 (0.424)	0.84 (0.87)	1.51 (1.22)	2.99 (1.38)
Q5 [High]	0.448 (0.408)	0.69 (0.79)	1.29 (1.14)	2.32 (1.11)
Difference	0.008 <sup>a</sup> <.001 <sup>b</sup>	<.001 <.001	<.001 <.001	<.001 <.001
<i>Panel B: Sorted by ERROR</i>				
Q1 [Low]	0.349 (0.304)	1.21 (1.29)	1.82 (1.38)	2.88 (1.73)
Q2	0.408 (0.376)	0.95 (1.17)	1.76 (1.27)	2.71 (1.34)
Q3	0.427 (0.411)	0.96 (1.02)	1.58 (1.23)	1.79 (1.34)
Q4	0.429 (0.401)	0.89 (0.94)	1.46 (1.19)	1.62 (1.30)
Q5 [High]	0.449 (0.413)	0.59 (0.48)	1.25 (0.83)	1.23 (1.04)
Difference	0.003 0.008	<.001 <.001	0.036 0.003	0.023 0.021

<sup>a</sup>: *p*-value of the T-test for the average value between Q1 and Q5.

<sup>b</sup>: *p*-value of two-tailed Wilcoxon test for the median value between Q1 and Q5.

**Table 11**  
**Robustness tests of valuation multiple sorted by information uncertainty**

This table shows the average and median (in the parenthesis) valuation multiple P/EBITDA of five groups sorted by the target's information uncertainty measured with analyst forecast DISPERSION for 2,047 mergers and acquisitions announced between 1986 and 2008. The definitions of the variables are provided in the Appendix.

	Q1 [Low Disp.]	Q2	Q3	Q4	Q5 [High Disp.]	Differ.
<i>Acquisition Form</i>						
Tender offer	20.5 (11.3)	10.9 (10.1)	9.5 (10.0)	8.4 (6.9)	5.3 (7.2)	0.029 <sup>a</sup> 0.002 <sup>b</sup>
Non-Tender	14.0 (12.6)	14.7 (12.0)	11.5 (10.6)	8.3 (10.1)	6.4 (7.5)	0.006 <.001
<i>Payment Method</i>						
All-Cash offer	16.5 (12.8)	11.0 (9.9)	10.2 (7.8)	3.1 (7.0)	5.3 (6.4)	0.003 <.001
All-Stock offer	18.7 (12.0)	17.4 (13.3)	14.5 (10.6)	9.1 (9.6)	8.8 (8.4)	0.026 0.017
<i>Diversifying Acquisition</i>						
Diversifying	16.6 (13.1)	13.0 (10.7)	9.4 (9.9)	9.1 (9.8)	6.4 (7.4)	0.001 <.001
Non-Diversifying	12.5 (10.5)	15.3 (13.4)	14.1 (10.6)	6.5 (9.9)	5.8 (7.4)	0.067 0.036
<i>Deal Attitude</i>						
Hostile Bid	17.0 (14.7)	8.5 (8.4)	4.5 (7.3)	3.3 (8.4)	3.2 (6.4)	0.053 0.068
Friendly Bid	15.2 (12.0)	14.5 (12.3)	11.9 (10.7)	8.8 (10.1)	6.0 (7.5)	<.001 <.001
<i>Acquisition Time</i>						
Period 1986-1995	18.6 (16.7)	15.6 (12.3)	11.3 (9.0)	10.4 (9.0)	7.4 (7.1)	0.017 <.001
Period 1996-2005	14.8 (11.6)	13.2 (11.6)	11.1 (10.7)	7.2 (10.3)	5.2 (7.7)	0.002 <.001
<i>Target Size and Industry-adjusted P/EBITDA</i>						
TSIZE_1 [Small]	1.8 (1.1)	2.8 (-0.9)	1.65 (-0.1)	-12.8 (-17.8)	-23.8 (-10.0)	0.008 0.042
TSIZE_2	8.2 (8.8)	1.8 (6.6)	5.3 (7.6)	-15.4 (-2.3)	-5.6 (-8.1)	0.029 0.007
TSIZE_3	3.0 (2.2)	5.2 (0.88)	9.7 (6.5)	-12.0 (-5.2)	-2.2 (-5.5)	0.038 0.012
TSIZE_4	6.5 (8.1)	1.2 (0.9)	-0.6 (-2.3)	1.6 (0.7)	-14.5 (-8.5)	<.001 <.001

TSIZE_5 [Big]	3.8 (2.9)	0.9 (1.7)	5.4 (2.7)	-2.3 (0)	-3.4 (-2.6)	0.015 0.001
<i>Other Tests</i>						
Completed Bids	16.6 (12.6)	14.1 (12.0)	11.9 (10.1)	8.3 (9.7)	6.8 (7.5)	<.001 <.001
Excluding exceptional cases	25.4 (16.0)	18.6 (13.6)	18.3 (12.7)	16.6 (12.4)	14.4 (9.4)	<.001 <.001
Cases with at least three analysts	13.6 (12.8)	11.9 (10.7)	10.2 (9.8)	9.6 (8.4)	5.6 (4.2)	0.023 <.001

<sup>a</sup>:  $p$ -value of the T-test for the average value between Q1 and Q5.

<sup>b</sup>:  $p$ -value of two-tailed Wilcoxon test for the median value between Q1 and Q5.

## Appendix

This table defines the variables used in this study, which contains 2,047 mergers and acquisitions announced between 1986 and 2008.

Variable	Definition
Premium_Value	The premium of the offer price relative to the target's stock price 63 days prior to the takeover announcement.
P/EBITDA	The ratio of the offer value to the product of the percentage of target outstanding shares acquired in the transaction and the target's earnings before interest, taxes, and depreciation and amortization of intangibles (EBITDA) at the end of the year immediately before the bid announcement.
DISPERSION	The standard deviation of analysts' earnings forecasts made in the event window [-126, -64] on the target's one-year-ahead earnings, scaled by the target's stock price on the trading day -64, where day 0 is the takeover announcement day.
ERROR	The ratio of the absolute difference between the forecast earnings and the actual earnings per share in the last month of the fiscal year before the takeover announcement to the price per share at the beginning of the month.
ACAR	Acquirer cumulative abnormal return over the event window [-5, +5], where day 0 is the bid announcement day. Abnormal return is defined as the market model residual, where the parameters are estimated over the [-205, -6] event window relative to the announcement day.
CCAR	The combined cumulative abnormal return of the acquirer and the target over the event window [-5, +5], where day 0 is the bid announcement day. The weights for the acquirer and the target are based on their market value of equity 64 days prior to the announcement of the takeover, and the target weight is adjusted for the percentage of target shares held by the acquirer prior to the takeover.
DIVERSIFY	Equals one if the primary business line of the acquirer is different with that of the target and zero otherwise.
TOEHOLD	Equals one if the acquirer holds more than 5% of the target shares prior to the takeover announcement and zero otherwise.
TENDER	Equals one if the takeover is advanced via tender offer and zero otherwise.
COMPETE	Equals one if there are multiple acquirers and zero otherwise.
LIQUIDITY	The value of all corporate control deals for firms with the same two-digit SIC code in a particular year divided by the book value of assets of all Compustat firms with the same two-digit SIC code in the corresponding year.
HOSTILE	Equals one if the offer is resisted by the target and zero otherwise.
POOLING	Equals one if the pooling-of-interest accounting method is reported

	in takeovers and zero if the purchase method is used.
CASH	Equals one for a pure cash offer and zero for a pure stock offer or a mixed offer of stock and cash.
MTB	The ratio of the market value of the target's common equity to book value of equity at the end of the year before takeover announcement.
ROA	The ratio of the target's net income to total assets at the end of the year prior to the takeover announcement.
GROWTH	The target's proportional change in sales in the year before takeover announcement.
TURNOVER	The turnover rate of target stock obtained as the total trading volume from 365 days until 63 days prior to the takeover announcement date divided by the market value of equity 63 days prior to the takeover announcement.
TSIZE	The logarithm of the market value of the target's common equity at the end of the year before takeover announcement.
RSIZE	The ratio of the market value of the target's common equity to that of the acquirer at the end of the year before takeover announcement.
SPREAD	The daily relative bid-ask spread averaged over the fiscal year before the announcement of the takeover, where the daily relative spread is the ratio of the absolute value of the bid-ask spread over the midpoint of the spread.
R&D	The ratio of research and development expenses to sales over the fiscal year before the announcement of the takeover.
VOLATILITY	The standard deviation of the target's daily abnormal stock return from 365 days until 63 days prior to the takeover announcement date.
Premium_Return	The target abnormal return in a trading window [-63, +126], where day 0 is the bid announcement day.
Offer/EV	The offer value in a deal normalized by the product of the percentage of the target's outstanding shares acquired in the transaction and the enterprise value of a target at the end of the year immediately before the bid announcement, where enterprise value is obtained as the market value of equity, plus the book value of debt, minus the book value of cash and cash equivalent.
Offer/BV	The offer value in a deal normalized by the product of the percentage of target outstanding shares acquired in the transaction and the book value of the target's equity at the end of the year immediately before the bid announcement.
Offer/Sale	The offer value in a deal normalized by the product of the percentage of the target's outstanding shares acquired in the transaction and the target's sales at the end of the year immediately before the bid announcement.

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