The Choice of the Medium of Exchange in Acquisitions: A Direct Test of the Double-Sided Asymmetric Information Hypothesis

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Abstract

In this paper, we conduct a direct test of the double-sided asymmetric information hypothesis regarding the choice of the medium of exchange in acquisitions. Theoretical analyses (e.g., Hansen (1987) and Fishman (1989)) have argued that, in a setting of double-sided information asymmetry (where both acquirer and target have private information about their own value), acquirers are more likely to choose a stock acquisition as the degree of overvaluation of their equity is greater; conversely, the likelihood of making a cash offer increases with the magnitude of their undervaluation. On the target side, the above theoretical models have opposing predictions regarding the extent of information asymmetry about the target and the likelihood of observing a stock versus a cash offer. Our findings suggest that acquirers that choose stock as a medium of exchange are overvalued and that acquirers that choose cash are either undervalued or correctly valued. We also find that these valuation errors influence acquirers' choice between cash and stock and are significant determinants of the announcement effect. On the target side, we find that the greater the extent of informational asymmetry about the target firm in the equity market, the greater the likelihood that acquirers use cash as a medium of exchange.

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1. Introduction

It is well known that in perfect capital markets, the medium of exchange used in acquisitions is irrelevant, since the level and division of the merger-induced gains are exactly the same regardless of whether the acquisition is paid for using cash or equity. However, in recent years, several theoretical papers have argued that the choice between cash and stock in acquisitions is driven by considerations of asymmetric information, either on the part of acquirer or on the part of the target or both (see, e.g., Hansen (1987) and Fishman (1989)).[1] [2] The objective of this paper is to conduct a direct test of the above double-sided asymmetric information hypothesis.

The existing empirical literature has provided indirect evidence in support of the asymmetric information hypothesis. For example, Travlos (1987) and Franks, Harris and Mayer (1988), among others, find significantly negative returns for stock mergers and insignificantly positive returns for cash mergers and tender offers.[3] Additional evidence about the relationship between informational asymmetry and the medium of exchange is provided by Houston and Ryngaert (1997) who study conditional stock offers in bank

[1] For other frequently mentioned factors influencing the choice between cash and stock, such as taxes and corporate control reasons, see Brown and Ryngaert (1991), Amihud, Lev and Travlos (1990) and Martin (1996).

[2] Eckbo, Giammarino and Heinkel (1990) develop a model in which the bidder's value is revealed by the mix of cash and stock. In equilibrium the revealed bidder value is monotonically increasing and convex in the fraction paid in cash. However, they fail to find empirical support for their hypothesis using Canadian data.

[3] To the extent that a rather poor long-term performance of stock acquirers, as found by Franks, Harris and Mayer (1988), Franks, Harris and Titman (1991) and Loughran and Vijh (1997), is not anticipated by the

mergers and find that the abnormal returns to the bidder are increasing in the elasticity of the target's compensation with respect to the bidder's stock price.[4] [5] On the target side, Carleton et. al. (1983) find that likelihood of a stock offer increases with market-to-book and dividend payout ratios. Jennings and Mazzeo (1993) test the effect of the cost of acquiring information about the target on the likelihood of competition and managerial resistance to a takeover. In summary, the existing empirical literature has studied the effect of acquirer and target variables on the medium of exchange in acquisitions separately. If, however, theoretical models which argue that acquirer and target side variables simultaneously affect the medium of exchange choice are valid, studying the effect of these variables separately can potentially produce erroneous results..

The contribution of this paper is two fold. First, we study the impact of acquirer and target side variables simultaneously on the choice of the medium of exchange in acquisitions. This is the first paper to conduct such a test of double-sided asymmetric information models (e.g., Hansen (1987) and Fishman (1989)) of the choice of the medium of exchange. In particular, we test the implications of these models regarding the relationship between the extent of over- or undervaluation of the acquirer and the extent of information asymmetry about the target on the one hand, and the likelihood of observing a stock or cash acquisition on the other.

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market (and thus already reflected in the stock price) before the announcement, it is yet another indirect piece of evidence consistent with a possible overvaluation of stock acquirers.

[4] Yook, Gangopadhyay and McCabe (1999) using the extent of insider trading before an acquisition announcement as a proxy for insiders' private information. They argue that in the presence of asymmetric information there should be a higher level of insider trading for the firms that use stock as a medium of exchange (relative to those that use cash); they find empirical support for this relationship. Chang (1999) looks at the valuation of bidders and targets around the acquisition announcement. He uses IBES forecasts to obtain the intrinsic values of these firms and finds that both cash and stock acquirers are overvalued.

[5] The evidence regarding operating performance following mergers and acquisitions is inconclusive. Healy, Palepu and Ruback (1992) and Heron and Lie (2002) find improvement in the operating performance following mergers, but find no difference between the post-merger performance of firms acquired with cash

Second, we directly measure the extent of under- and overvaluation of the acquirer and study its effect on the medium of exchange choice. This contrasts with the existing literature, which has focussed only on indirect measures of acquirer misvaluation. In order to directly measure the extent of under- or overvaluation of the acquiring firm in the equity market relative to its value conditional on firm insiders' private information, we make use of a methodology similar to D'Mello and Shroff (2000) and Jindra (2000). Assuming that managers have rational expectations (so that there is no systematic bias in their prediction of their firm's future earnings stream), we make use of the realized values of the future earnings of the acquirer to estimate the intrinsic value of firm's shares conditional on insiders' private information. These intrinsic values are estimated using three different models: a price-earnings ratio based valuation model, the residual income model (RIM) and the Ohlson (2000) model. We then calculate the valuation error, defined as the log of the ratio of the stock price to the estimated fair value of firm's shares, thus directly measuring the extent of under- or overvaluation of the acquirer.

We test the hypotheses described above in several ways. First, we perform univariate tests to see if the cash acquirers were undervalued and stock acquirers overvalued and if targets taken over with stock had a higher or lower level of informational asymmetry than did cash targets. Second, we test whether valuation errors and the level of informational asymmetry on the target side influenced the choice between cash and stock as a medium of exchange (we use the standard deviation of analysts' forecasts, the number of analysts and other proxies to measure the extent of

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and stock. Linn and Switzer (2001) find an improvement in the operating performance following cash financed mergers, but no improvements following stock financed ones.

informational asymmetry about the target firm). Third, we also test whether the increase in the relative size of the target increases the likelihood of observing a stock offer. Finally, we conduct several sensitivity analyses to see if the valuation errors of the acquirer explain the stock returns upon announcement of the acquisition and if (as argued by Fishman (1989)) cash is indeed used to signal high valuation of target firm and thus deter competition.

We find that stock acquirers are indeed overvalued and some evidence that cash acquirers are undervalued. The results on the stock acquirer side are consistent and significant at least at a 5% level for most of the valuation models used. We also find that these valuation errors did influence the choice of the medium of exchange and that they explained some of the cross sectional variation in the announcement effects. On the target side, we find that the pre-emptive bidding considerations dominate contingent-payment ones. We also find that cash offers were less likely to attract competing bids. Finally, we find no support for the Hansen's (1987) relative-size hypothesis.

The rest of the paper is organized as follows. In section 2 we briefly summarize the theoretical literature on the informational asymmetry in the case of acquisitions and develop testable hypotheses. Section 3 describes the valuation models used to estimate intrinsic values of firm's stock while the following section describes data used in this study. The empirical tests and their results are described in section 5 and their implications are discussed in section 6. Section 7 concludes the paper.

2. Theory and Hypotheses

Consider a setting where a firm (acquirer) is considering the choice of the medium of exchange (all cash vs. all stock) in acquiring another firm (target). Both acquirer and target have private information about their own value (in other words, the interaction between the acquirer and target is characterized by double-sided asymmetric information). The profitability of the acquisition to the bidder depends upon the true value of the target, in addition to other factors unique to the bidder.

A key difference between a cash offer and an equity offer here is that while the value of an equity offer depends on the cash flows of the combined firm (which, in turn, depends on the true value of the acquirer, the target, and any gains generated by the acquisition) the value of a cash offer is independent of all these variables. In the above setting of double-sided asymmetric information, a cash offer made by an acquirer will be perceived by the target to have a high value, since it perceives that, if the acquirer were overvalued, he would have made an all equity offer. However, since the target itself has private information about its own value, acquirers making cash offers are in danger of overpayment (since bids are only accepted by targets with values less than or equal to the bid). In contrast, an equity offer has the advantage that the true value of the offer is contingent on the cash flows of the combined firm, so that the bidder can reduce this overpayment cost by sharing some of the target's mispricing with that firm and its insiders.

Thus, the choice between an all stock and an all cash acquisition is driven by the trade-off between the overpayment cost and the probability that the bid will be

successful. While a stock offer reduces the overpayment cost to the bidder, it also reduces the probability of a successful acquisition (since the target may perceive the offer to be of lower intrinsic value and reject the offer), thus increasing the opportunity cost arising from foregone synergy gains. Conversely, an all cash offer increases the overpayment cost to the acquirer, but increases the probability of the acquisition bid succeeding.

Hansen (1987) and Fishman (1989) draw on one or more of the above costs to develop an equilibrium involving the choice between stock and cash offers. Using a setting essentially similar to the one discussed above, Hansen (1987) develops an equilibrium in which acquirers who are overvalued by the equity market (relative to their intrinsic value conditional on insiders' private information), and who face significant information asymmetry when evaluating the target, are more likely to use equity offers. Those who are undervalued, or face a smaller degree of information asymmetry in evaluating targets, use all cash offers.

In Fishman (1989) the bidder has no private information about its own value, though the target has private information about its value. Also, the acquirer has private information about its gains from taking over the target; among other things, such gains depend on the target's true value. Further, Fishman (1989) assumes that there is more than one potential acquirer (bidder). Once an initial bidder identifies a target, rival bidders have to incur a cost to acquire information relevant to the valuation of their gains from acquiring the target before they can present a bid. Potential rival bidders will incur this cost only if they believe that the initial bidder's valuation of the target is below a critical value. As before, the key difference between a cash and an equity offer here also is that while the value of cash offer does not depend on the profitability of the

acquisition, the value of an equity offer is contingent upon the profitability of the acquisition. Thus an all cash offer signals that the acquirer's valuation of his gains from acquiring the target is high, thus deterring competition from the other bidders. [6] Thus, Fishman (1989) predicts that an all cash offer is more likely as the extent of information asymmetry about the target (and therefore the outsiders' cost of evaluating it) is greater (since in this case the benefits to the bidder of signaling to deter potential rivals is greater). He further predicts that all cash offers will yield a higher bidder abnormal returns (as a result of the value of deterrence).

Combining the insights in Hansen (1987) and Fishman (1989), one can develop several testable hypotheses regarding the extent of over- and under-valuation of the acquirer (conditional on insiders' private information) and the extent of asymmetric information about the target. The first hypothesis (H1) is that one would expect, ceteris paribus, to see a greater likelihood of a stock offer as the extent of overvaluation of the bidder is greater; conversely, the likelihood of a cash offer is greater as the extent of undervaluation of the acquirer increases.

The second testable hypothesis concerns the extent of asymmetric information about the target. If considerations of pre-emptive bidding are absent, one would expect that the "contingent payment" feature of stock acquisitions will dominate; thus, the greater the extent of asymmetric information about the target, the greater the likelihood of a stock offer. We will refer to this hypothesis as the contingent payment hypothesis (H2A).

[6] While the security formally assumed by Fishman (1989) is risky debt, the argument will go through for an all-equity offer as well.

The possibility that the acquirer may want to signal a high private valuation of its own gains from acquiring the target may dominate the above contingent payment considerations. Thus, if considerations of the acquirer signaling a high private valuation to other potential bidders in order to pre-empt competition dominates, then the acquirer will be more likely to use cash if the extent of asymmetric information about the target (and therefore potential bidders' cost of learning about the target) is greater. We will refer to this hypothesis as the pre-emptive bidding hypothesis (H2B).

Finally, Hansen (1987) has argued that the advantage of making a stock offer increases with the target's size relative to that of the acquirer. The larger the target is relative to the acquirer, the larger the influence of the target's performance and value on the performance and value of the combined firm. This implies a larger overpayment cost in cash offers, which in turn leads to an increase in the advantages of using stock as a medium of exchange. Thus, the third hypothesis we test is that, as the size of the target relative to that of the acquirer increases, the probability of a stock offer increases. We will refer to this as the relative size hypothesis (H3).

Before proceeding to test the above hypotheses, it is important to note the different aspects of the informational asymmetry relevant to the acquirer and the target sides in the determination of the medium of exchange in acquisitions. In the case of the acquirer, what matters is the extent of overvaluation or undervaluation of the acquirer by the equity market. On the target side, however, it is the extent of informational asymmetry faced by the acquirer in evaluating the target that is important.

3. Earnings-Based Valuation Models and Valuation Errors

In this section we describe the valuation models used to estimate the intrinsic value of the acquirer's shares and the calculation of valuation errors.

3.1. Estimating the intrinsic value of acquirer equity

In this sub-section we describe the valuation models used to estimate fair value of firm's stock. Assuming that managers have rational expectations (so that there is no systematic bias in their prediction of their firm's future earnings stream), we make use of the realized values of the future earnings of the acquirer to estimate the intrinsic value of firm's shares conditional on insiders' private information. To account for a possibility that any particular model might systematically overvalue one set of firms and undervalue the other, we use three different valuation models: (1) price-earnings ratio based model, (2) residual income based model (RIM) and (3) Ohlson (2000) model. [7]

3.1.1. The price-earnings ratio based model

The first model used to estimate fair value of acquiring firm's shares is price-earnings based valuation model[8] which is implemented as follows. We calculate the median price-earnings ratio of the firms with the same three-digit SIC code as the acquirer, excluding firms with negative earnings and firms that announced any form of acquisition during that particular year. We require at least five firms in the same 3-digit SIC code; if less than five firms were available, we use firms with the same 2-digit SIC code to calculate median PE ratio. Earnings-per-share (EPS) are defined as income before

[7] We chose these earnings based valuation models due to the ease of implementation. Other possible models include capital cash flow and dividend discount models (see, e.g., Kaplan and Ruback (1995)). Penman (1998), however, shows that, if implemented correctly, the three approaches (residual income, capital cash flow and dividend discount models) should yield identical estimates.

[8] See, among others, Kaplan and Ruback (1995), Kim and Ritter (1999) and Han, Suk and Sung (1998). The latter use target's industry-adjusted price-earnings ratios as a measure of overpayment in takeovers.

extraordinary items available for common shareholders (annual Compustat item # 237) divided by the number of shares outstanding (annual Compustat item #25). Stock prices are closing prices on the last day of the fiscal year preceding the acquisition announcement. PE ratios then are multiplied by the realized value of the next fiscal year's earnings to obtain fair value of the firm's shares. Firms with negative earnings are excluded.

The realized values of earnings after the acquisition are the sum of the earnings of the acquirer, the target and synergy (if any) generated by the merger. In order to obtain the acquirer's earnings, we make the following adjustments. For cash mergers and cash tender offers we subtract target's average income before extraordinary items available for common shareholders (Compustat item #237) calculated over the four years preceding the acquisition announcement from the actual income before extraordinary items after the completion of acquisition.[9] For stock mergers and tender offers in addition to the adjustment to the EPS described above, we also make two other adjustments. First, we adjust the number of shares by subtracting the number of shares issued to the target's shareholders. Second, we subtract the amount paid for the target from the combined firm's book value of equity and divide it by the adjusted number of shares to obtain the book value of a stand-alone acquirer.[10]

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[9] We exclude acquirers whose targets' average income before extraordinary items available for common shareholders (Compustat item #237) calculated over the four years preceding the acquisition announcement was negative. We also replicated the estimation using target's earnings in the last fiscal prior to acquisition; results were qualitatively unchanged.

[10] The adjustments described above subtract only target's earnings from the earnings of the joint firm, leaving acquirer's earnings and earnings due to synergy generated by the merger. This introduces a possible bias in our results for the cash acquirers which we expect to be undervalued. For the stock acquirers,

3.1.2. The residual income model

The second model used to estimate stock's fair value is residual income model (see Ohlson (1990)). Following the set-up used by D'Mello and Shroff (2000) and Jindra (2000), we calculate the fair value of firm's shares as follows:

$$V(0) = B_0 + \frac{EPS_1 - r * B_0}{1+r} + \frac{EPS_2 - r * B_1}{(1+r)^2} + TV \qquad (1)$$

B_0 is the book value of equity at the end of the fiscal year in which the acquisition announcement occurred (annual Compustat item #60) divided by the number of shares outstanding (annual Compustat item #25). EPS is income before extraordinary items available for common shareholders (annual Compustat item # 237) divided by the number of shares outstanding. *r* is the required rate of return on the firm's equity. We use two measures of *r*: (1) a constant required rate of return of 13% and (2) a firm-specific rate of return, obtained from the market model with beta calculated over 250 trading days ending on the 46th trading day before the acquisition announcement. In calculation of beta we require at least 100 observations. Risk free rate is the annualized rate on the one-month Treasury bills in the month preceding the announcement, while the market risk premium is calculated as the annualized average rate of return on the CRSP value-weighted index minus one-month T-bill between January 1945 and the month preceding the acquisition announcement. TV, terminal value, is calculated as follows:

$$TV = \frac{(EPS_2 - r * B_1) + (EPS_3 - r * B_2)}{2} * \frac{1}{(1+r)^2 * r}. \qquad (2)$$

however, inclusion of synergy will bias the results against us: if the firm is overvalued with synergy, it will be even more overvalued without it.

The terminal value is calculated as an average in order to avoid affect of a possible unusual performance in year 3. No growth is assumed after year 3 and the terminal value of a share is calculated as a perpetuity. If terminal value is negative, we set it equal to zero because managers are unlikely to continue negative NPV investments forever. Also, in implementing this model we exclude firms with negative book value of equity and firms with relatively small future earnings which lead to a negative estimated fair value of shares.

We also implement the residual income model with IBES analyst forecasts. The model is implemented following Frankel and Lee (1998). We require that either one-year ahead forecast and the long-term growth estimate or at least one- and two-year earnings forecasts are available in the month preceding the acquisition announcement. If only one-year ahead forecast is available, we use long-term growth rate (LTG) in the month preceding the acquisition announcement to calculate earnings forecasts for years 2 and 3. When one- and two-year earnings forecasts are available, we use LTG to obtain forecasted earnings for year 3. If LTG is not available, we use forecasted earnings for the second year as a proxy for the third year's earnings. [11]

B_0 in equation (1) is defined as

$$B_0 = B_{-1} + FEPS_0 * (1-k) \qquad (3)$$

B_{-1} is book value of equity (Compustat item #60) at the end of the fiscal year preceding acquisition announcement divided by the number of shares outstanding; $FEPS_0$ is forecasted earnings for the year 0 and k is a dividend payout ratio, calculated as dividends paid in the year preceding the acquisition announcement (Compustat item # 21) divided

by the income before extraordinary items available for common shareholders (annual Compustat item # 237). We require *k* to be less than 1 (firms with *k* greater than 1 are excluded); in cases when firms have negative earnings, we set *k* equal to the ratio of dividends to 6% of total assets (Compustat item #6).[12] B_1 and B_2 are calculated similarly. Finally, if terminal value is negative, it is set equal to zero.

3.1.3. The Ohlson (2000) model

Our third valuation model is an alternative to the residual income model suggested by Ohlson (2000). In this model the earnings per share (adjusted for dividends per share) are used instead of the book value of equity in formula (3). We implement the model as follows:

$$V(0) = \frac{EPS_0}{r} + \frac{\frac{EPS_1}{r} - \left[(1+r)*\frac{EPS_0}{r} - DPS_1\right]}{1+r} + \frac{\frac{EPS_2}{r} - \left[(1+r)*\frac{EPS_1}{r} - DPS_2\right]}{(1+r)^2} + TV \qquad (4)$$

where DPS_t are dividends per share in year *t*, calculated as Compustat item #21 divided by Compustat item #25, and

$$TV = \frac{\left(\frac{EPS_2}{r} - \left[(1+r)*\frac{EPS_1}{r} - DPS_2\right]\right) + \left(\frac{EPS_3}{r} - \left[(1+r)*\frac{EPS_2}{r} - DPS_3\right]\right)}{2*(1+r)^2 * r} \qquad (5)$$

[11] Due to the fact that LTG variable is available only starting in 1982, for some of the firms in the earlier years of our sample we were not able to find matches for the estimation of this version of the residual income model.

[12] 6% were chosen because it is long term average return on equity.

In implementing this model we exclude firms that had negative EPS in any of the four years used in estimation. As in the case of the residual income model, if TV is negative, we set it equal to zero.

3.2. Valuation Errors

We define the valuation error, VE, of an acquirer as follows:

$$VE = \ln\left(\frac{P_0}{V_0}\right), \qquad (6)$$

where P_0 is the closing stock price of the acquirer on the day before acquisition announcement and V_0 is a fair value of firm's shares (as described above). This particular specification of valuation error is chosen in order to allow for a symmetric treatment of over- and undervaluation.

To account for a possible bias inherent in valuation models used to calculate fair value of firm's shares,[13] we compute valuation errors for a sample of matched firms. The matched firms were found as follows. First, we matched by the 3-digit SIC code (obtained from Compustat) and then by the book value of assets. When finding matched firm for an acquirer in a particular year, we excluded all firms that made acquisitions within five years (before and after) of that year. We then compare valuation errors of acquirers (VE_A) with those of matched firms (VE_M). If VE_A is less than VE_M, the acquirer is undervalued; if VE_A is greater than VE_M, the acquirer is overvalued. Table 3 provides a summary of notation used to denote VE's calculated using different valuation models.

4. Sample Selection and Data

In this study we look at the successful takeovers that were announced between 1975 and 1995. The list of acquirers and targets was obtained from W. Schwert. Accounting data was obtained from Compustat, while stock price and return data necessary to calculate firm specific discount rates and announcement effects came from CRSP. Analyst forecasts used in the estimation of the residual income model were obtained from IBES. Terms of the deals necessary to adjust the number of shares of stock acquirers were obtained from *The Wall Street Journal* and Dow Jones Newswire news stories.

We require acquirer to be a publicly traded corporation that has at least three years of accounting data available on Compustat after the acquisition announcement year. We also exclude firms that had negative book value of equity for the acquisition announcement fiscal year. These data requirements reduced sample size from 2,232 to 561. Further, data on 18 targets were not available from Compustat, 74 targets had negative average income before extraordinary items available for common shareholders (calculated over the four years preceding the acquisition announcement), for 28 companies terms of the merger deals could not be found and for 4 companies the models led to a negative intrinsic value of shares. Thus, our final sample size is 437 firms. Table 1 shows the distribution of the sample across the years while Table 2 gives summary statistics for the sample of acquirers.

Sample size varies for various tests and valuation models. For example, *VE(PE)* exclude firms that had negative earnings for the fiscal year following the announcement.

[13] Ritter and Warr (2001), Chang, Chen and Dong (1999), Lee, Myers and Swaminathan (1999), D'Mello and Shroff (2000) and Jindra (2000) show that the residual income model tends to consistently undervalue

For some acquirers there was not enough data to estimate IBES model and for some acquirers that made acquisition announcements before 1982 matched firms could not be found due to the fact that long-term growth estimates (LTG) are available only after 1982. On the target side, for 18 targets there was no accounting data available on the Compustat, while several others were either not in the IBES data base or did not have data for the required dates.

5. Empirical Tests and Results

In this section we test the hypotheses developed in section 2. First, we describe proxies for the extent of informational asymmetry in the equity market about the target. Second, we conduct univariate tests to see if there are any differences in the informational asymmetry (both on the acquirer's and the target's side) between firms that chose cash and firms that chose stock as a medium of exchange. Third, we run logit and multinomial logit regressions to test whether our proxies for informational asymmetry influence the choice between cash and stock. Finally, we also conduct a sensitivity analysis by looking at the relationship between the announcement effect and valuation errors.

5.1. Asymmetric information measures for targets

We calculate relative size of the target, *RSIZE*, as a ratio of target's market value of equity to the acquirer's market value of equity at the end of the fiscal year preceding the acquisition announcement.

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stocks (that is, there is a positive VE).

For the informational asymmetry about the target we use the following proxies. First, relatedness measure, *REL*, reflects the notion that the more related the firms are, the less the informational asymmetry between the acquirer and the target. *REL* takes on value of one if the target and acquirer have the same 3- digit SIC code (obtained from Compustat) and zero otherwise.

Our second proxy for the asymmetric information is the number of analysts, *NUMA*, that follow the target.[14] We use the number of analysts as reported by IBES for the last month of the fiscal year immediately preceding the acquisition announcement. The higher the number of analysts, the lower the informational asymmetry.

The third proxy used is the standard deviation of analyst forecasts, *STDFOR*, as reported by the IBES. Higher standard deviation implies less agreement between the analysts and consequently, a higher level of informational asymmetry. We use the value reported by IBES for the last month of the fiscal year immediately preceding the takeover announcement.

The fourth proxy is the forecast error, *FORERR*, defined as a ratio of the absolute value of the difference between IBES forecast and the realized value of the earnings to the stock price. All values are for the last month of the fiscal year preceding the acquisition announcement. Higher forecast error indicates a higher level of informational asymmetry.

Finally, we calculate residual standard deviation, *RSD*, defined as the standard deviation of the difference between the firm's stock return and the return on the CRSP value-weighted index in the year preceding the acquisition announcement. Higher

[14] This and the following three proxies have been used by, among others, Krishnaswami and Subramaniam (1999) to measure the level of informational asymmetry about a firm in the equity market.

residual standard deviation indicates higher firm specific risk and higher informational asymmetry.

5.2. Univariate tests

5.2.1. Univariate tests on the acquirer side

On the acquirer's side, we compare means and medians of the valuation errors of acquirers with those of matched firms. We expect *VE* for the firms that use stock as a medium of exchange to be positive and significantly different from zero, while for the firms using cash *VE* is expected to be negative. We perform these tests using VEs estimated using all three valuation models. Table 4 summarizes the results of these univariate tests. In panel A we classify all observations only by the medium of exchange. In other words, all cash observations include both cash mergers and cash tenders, while stock observations include stock mergers and stock tenders. Panels B and C report valuation errors for mergers and tenders separately.

As can be seen from the panel A of Table 4, we find some evidence that acquirers that use cash as a medium of exchange have lower mean and median valuation errors than matched firms. The differences, however, are not always statistically significant. It is interesting to notice that mean and median *VE(PE)* are negative even though we use only next year's actual earnings, implying that the results are robust not only to different models but also to the length of assumed forecasting ability of managers.

Stock acquirers, on the other hand, had a significantly higher valuation errors than did matched firms and the difference was significant at least at 5% for most valuation models, except *VE(PE)* and *VE(OHLC).* Also, the fraction of the overvalued firms among

stock acquirers was around two thirds and was statistically significantly different from 50% at a 1 percent level for all but one model.

The results for mixed acquisitions were inconclusive. Valuation errors varied with valuation models and no differences were statistically significant. Also, the sample size in this case was rather limited (only 15 observations), making it hard to reach any reliable inferences.

As can be seen from panels B and C of Table 4, the results hold also when the sample is split by the mode of acquisition. We find some evidence of undervaluation for both cash tenders and cash mergers, but the results are mostly statistically insignificant. Stock mergers, at the same time, are significantly overvalued. There is some evidence that stock tenders are in most cases undervalued, but for most models differences are not statistically different from zero (this is partly due to the fact that we have only 10 stock tenders in our sample).

As an additional sensitivity analysis we also did a comparison of valuation errors obtained using private information (realized values of future earnings) and public information (IBES analysts forecasts). The results are reported in Table 5. We find that for acquirers that chose stock private-information-based valuation errors were significantly higher than public-information-based valuation errors. The estimated valuation errors using realized values of future earnings implies 16 to 20 percent lower valuation estimates than those based on the analysts' forecasts. This indicates that overvaluation of these acquirers was not expected by the stock market at the time of acquisition announcement and therefore was managers' private information. At the same time we find no statistically significant differences for the acquirers that chose cash as a

medium of exchange. That is, for these acquirers VEs calculated using public information were statistically indistinguishable from those calculated using private information.

5.2.2. Univariate tests on the target side

On the target side, we compare the means and medians of our proxies for the informational asymmetry. If the contingent payment hypothesis (H2A) is true, we expect to find informational asymmetry to be higher for the firms taken over using stock than for the firms taken over using cash. In particular, we expect *STDFOR*, *FORERR* and *RSD* to be higher, while *REL* and *NUMA* to be lower for stock targets than for cash targets. If the pre-emptive bidding hypothesis (H2B) is true, we expect the opposite relationship.

Table 6 reports results of univariate tests of the target side informational asymmetry. We find that the relative size of the targets that were taken over using cash was not significantly different from that of the targets taken over with stock. Target side informational asymmetry tests lend support to the pre-emptive bidding hypothesis. In particular, we find that *REL* and *NUMA* are significantly lower, but *STDFOR* is significantly higher for cash targets than for the stock targets. These results imply higher informational asymmetry about cash targets. The differences of *FORERR* and *RSD* between cash and stock targets were not statistically significant.

5.3. The choice between cash and stock

Next, we test whether the valuation errors and informational asymmetry about the target influence the choice between stock and cash as a medium of exchange. In particular, we run the following logit regression:

$$\log\left[\frac{P(y=1)}{1-P(y=1)}\right]_i = \beta_0 + \beta_1 VE_i + \beta_2 CD_i + \beta_3 RSIZE_i + \beta_4 REL + \\ + \beta_5 STDFOR_i + \beta_6 NUMA_i + \beta_7 RSD_i + \varepsilon_i \quad (7)$$

where dependent variable takes on value of one if the firm used cash and zero if it used stock as a medium of exchange and CD_i is a ratio of acquirer's cash holdings at the end of the fiscal year preceding acquisition announcement to the amount paid for the target. We include this variable to control for the availability of cash and expect the coefficient on it to be positive: the larger the acquirer's cash holdings as a fraction of the payment for the target, the more likely the firm is to choose cash. If the asymmetric information hypothesis is true, we expect the coefficient on *VE* to remain significant even if we include *CD* as an independent variable.

The expected signs of the coefficients are as follows. We expect the coefficient on *VE* to be negative and significantly different from zero: the higher the valuation error, the more likely the firm is to use stock. If H2A is true, coefficients on *REL* and *NUMA* are expected to be positive, while the coefficients on *STDFOR*, *FORERR* and *RSD* negative, reflecting the hypothesized positive relationship between the level of informational asymmetry and the likelihood of using stock as a medium of exchange, while under H2B the opposite would be true.

We also test for the robustness of our results to the mode of acquisition, namely, we want to make sure that our results are not driven by a one particular mode of acquisition (e.g., cash mergers as opposed to cash tenders). We do so by running a multinomial regression:

$$\log\left[\frac{P(y=j)}{P(y=J)}\right]_i = \beta_{0j} + \beta_{1j}VE_i + \beta_{2j}RSIZE_i + \beta_{3j}REL_i + \\ + \beta_{4j}STDFOR_i + \beta_{5j}NUMA_i + \beta_{6j}RSD_i + \varepsilon_j \quad (8)$$

where J is a comparison group and j takes on the following values: zero for stock mergers, one for cash mergers, two for cash tenders and three for stock tenders. We use two different comparison groups: stock merger and cash tender to test the robustness of our results. First, notice that we obtain a coefficient for each group (except for the comparison group) so that the regression output will contain 21 coefficients (3 intercepts and 3 coefficients for each of the six independent variables). Second, it should be noted that the coefficients of the multinomial regression reflect the influence of a variable on the probability of choosing a particular mode of acquisition and medium of exchange *relative* to that of the comparison group. Therefore, the expected signs and levels of significance of the coefficients will vary with the comparison group. For example, if we choose stock mergers as a comparison group, we expect the coefficient on *VE* for cash mergers and cash tenders to be negative and significantly different from zero, reflecting the expectation that higher VEs are decreasing probability of choosing a cash merger or cash tender (relative to the probability of choosing a stock merger). The coefficient on *VE* for stock tenders, however, is expected to be insignificantly different from zero (in other words, we expect influence of *VE* on the probability of choosing stock to be the same for stock mergers and stock tenders). Conversely, when cash tender is chosen as a comparison group, we expect the coefficient on *VE* for stock mergers to be positive and significantly different from zero, while for cash tenders to be insignificantly different from zero.

Finally, we also employ the multinomial logit framework to test for the differences between cash, stock and mixed acquisitions. In this case we run regression as specified by equation (9) with the following values of dependent variable: one for cash, two for stock and three for mixed payment as a medium of exchange. Cash and stock were chosen as comparison groups. The expected coefficient on the VE for stock acquisitions is expected to be positive and significantly different from zero (indicating that an increase in VE is associated with a higher probability of choosing stock relative to cash), while the coefficient on *VE* for mixed acquisitions is expected to be insignificantly different.

Table 7 reports results of logit regressions. We find that valuation errors are inversely related to the probability of choosing cash as a medium of exchange. That is, the higher the valuation error, the larger the probability of choosing stock as a means of payment for the target firm. The results are mostly consistent across different models. All coefficients, except for price-earnings based valuation model, are significant at a 1 percent level.[15] It should be noted that the significance of the *VE(RIMC)* and *VE(RIMF)* coefficients as compared to *VE(PE)* indicates that information about the firm's earnings beyond the next year's seems to be of crucial importance in choosing between cash and stock as a medium of exchange.

On the target side, we find that the coefficient on *RSIZE* is positive and statistically significant. Thus, we do not find support for the relative size hypothesis (H3). The coefficients on several proxies for the target side asymmetric information are also significant. Coefficients on *NUMA* and *REL* are negative, indicating that the higher the

[15] When VE(PE) is included alone, without the target side variables it is significant at 5% (results not reported).

informational asymmetry, the higher the likelihood of using cash as a medium of exchange. Both of these coefficients, however, are significant in some, but not all of the regressions. The positive and significant coefficients on *STDFOR* and *RSD* also lend support to the pre-emptive bidding hypothesis (H2B). The coefficients, in most cases, are significant at least at a 5% level, except for RSD in regression 5. [16]

Table 8 reports results of multinomial regressions. Regressions 1 and 2 split the sample by the mode of acquisition and the medium of exchange. Results of the regression 1 implies that the probability of choosing a cash tender or a cash merger (relative to the probability of choosing a stock merger) is decreasing with VE. The influence of VEs on the probability of choosing a stock tender, however, is not different from that on the probability of choosing a stock merger.

Regression 2 shows results of the same regression, just with cash tenders as a comparison group. Here we can see that the influence of VEs on the probability of choosing a stock merger is significantly different from that on the probability of a cash tender, but that the influence of VEs on the probability of a cash merger or a stock tender is not different.

On the target side we find that an increase in STDFOR increases probability of choosing cash tenders, cash mergers and stock tenders and that an increase in RSD causes an increase in the probability of choosing a cash tender (regression 1). From regression 2 we see that the probability of a stock merger decreases with STDFOR and RSD.

[16] We also controlled for the target's market-to-book ratio, as in Carleton et. al (1983), who argue that this ratio would be positively correlated with the potential capital gains tax liability of target firm shareholders. One would expect cash takeovers to be used more frequently when the market-to-book ratio of the target is low. We find that inclusion of target's market-to-book ratio does not change our results.

Regression 3 reports results of the regression where the dependent variable is split by the medium of exchange, including mixed acquisitions. We find that VEs of mixed acquirers do not have a significant influence on the odds of choosing a mixed form of payment relative to either a cash or a stock one. This seems to indicate that the influence of the valuation errors on the probability of choosing a mixed form of payment is similar to that on the probabilities of choosing either a cash or a stock as a medium of exchange. In other words, mixed form of payment seems to be in-between cash and stock acquisitions. Another interesting result to notice is that odds of choosing a mixed form of payment are increasing with the standard deviation of analysts' forecasts of the target's earnings (STDFOR). This holds for odds relative to the probabilities of both cash and stock. In other words, STDFOR causes the probability of choosing a mixed form of payment to increase faster than the probability of cash as a medium of exchange.

5.4. Sensitivity analysis (1): Announcement effects and valuation errors

As the first sensitivity analysis, we look at the relationship between the announcement effects and the valuation errors of acquirers. We estimate market model parameters over 250 trading days ending on the 46^{th} day prior to the acquisition announcement. Abnormal returns are calculated over different windows ranging from five days before to five days after the announcement. If the choice of a medium of exchange reveals part of managers' private information, we expect to find a significant relationship between the magnitude of the announcement effect and valuation error. The regression employed is as follows:

$$ANNEF_i = \beta_0 + \beta_1 VE_i + \beta_2 LNSIZE_i + \varepsilon_i \quad (9)$$

where,

$ANNEF_i$ = announcement effect for the firm *i*;

$LNSIZE_i$ = log of acquirer's book value of assets at the end of the fiscal year preceding the acquisition announcement;

We use *LNSIZE* to control for the fact that larger firms have lower informational asymmetry and therefore the choice of the medium of exchange is expected to reveal less new information, implying the negative sign of the *LNSIZE* coefficient: the larger the firm, the lower the announcement effect.

Table 9 reports announcement effects over different event windows. Our results are consistent with previous studies. We find that stock acquisitions have a statistically significant negative announcement effects while the announcement effects for cash acquisitions are somewhat positive, but mostly insignificant.

Table 10 reports results of the regressions with announcement effects as a dependent variable. We find that our proxies for under- and overvaluation of the acquirers capture some of the information revealed to the market by the takeover announcement. Coefficients on VE's are negative and significant at least at 5% for all regressions which include valuation errors calculated using private information. This implies that the higher the valuation error, the lower the announcement effect. The results remain significant even when we include *LNSIZE*. The coefficient on this variable is negative, reflecting the fact that there is less asymmetric information about larger firms and therefore the information revealed in the announcement has less of an impact on the stock price.

5.5. Sensitivity analysis (2): Medium of exchange and competition

Even though the competition is not the focus of this paper, as an additional sensitivity analysis we test the prediction of Fishman (1989) that cash is used to signal an acquirer's high valuation of a target and to therefore deter competition. In testing this prediction we also introduce the bid premium paid in the acquisition, which, as argued by Fishman (1988), can also deter competition.[17]

Since the choice of the medium of exchange and the bid premium are determined simultaneously in Fishman (1988), we test the above hypothesis in the following simultaneous equations framework:

$$Compete = \beta_0 + \beta_1 CASH_i + \beta_2 BPREM_i + \beta_3 NUMA_i + \\ + \beta_4 STDFOR_i + \beta_4 RSD_i + \beta_5 REL_i + \varepsilon_i \quad (10a)$$

$$BPREM_i = \delta_0 + \delta_1 CASH_i + \delta_2 VE_i + \delta_3 NUMA_i + \\ + \delta_4 STDFOR_i + \delta_5 RSD_i + \delta_6 REL_i + \eta_i \quad (10b)$$

$$CASH_i = \alpha_0 + \alpha_1 BREPM_i + \alpha_2 VE_i + \alpha_3 NUMA_i + \\ + \alpha_4 STDFOR_i + \alpha_5 RSD_i + \alpha_6 REL_i + \upsilon_i \quad (10c)$$

where, *Compete* is a binary variable that takes on value of one if there was a competing offer, *BPREM* is the percentage bid premium and *CASH* is a binary variable that takes on a value of one if the initial offer was in cash, and zero otherwise. Equations 10b and 10c are estimated simultaneously and the predicted values of BPREM and CASH then used in equation 10a. Clearly, in a double-sided asymmetric information framework, it is important to include both the acquirer and target-side variables in the estimation of the influence of cash on the likelihood of a competing offer. The above framework is similar to that used by Jennings and Mazzeo (1993). They, however, use only the target-side variables and find that the use of cash is associated with *increased* competition.

In the Fishman (1989) model the extent of informational asymmetry regarding the target influences the extent of competition in two ways. First, targets with low informational asymmetry are more likely to attract competing bids. Second, informational asymmetry influences competition by affecting the choice of the medium of exchange by the acquirer. In the presence of a high level of informational asymmetry about the target, the acquirer chooses cash to pay for the acquisition, thus signaling its high valuation of the target firm, which deters potential competition.

The results of our estimation are reported in Table 11. We first replicated the results of Jennings and Mazzeo (1993) (regressions 4, 5 and 6) and find that without the acquirer side variables our results are consistent with their findings. However, when we include an acquirer side variable, our findings become opposite of those by Jennings and Mazzeo (1993).[18] We find that cash does indeed deter competition as the coefficient on *CASH* is negative and statistically significant. We thus find support for Fishman (1989) prediction that cash deters competition, even though the coefficients on the target-side asymmetric information variables seem to be opposite to those predicted by Fishman (1989).

6. Interpretation of results

We find support for the informational asymmetry hypothesis on the acquirer side. First, stock acquirers are significantly overvalued with respect to the value computed conditional on insiders' private information and there is some evidence that cash

[17] The bid premium is the percentage by which the initial bid exceeds the target's closing share price 10 trading days before the acquisition announcement.

[18] The results are unchanged when other measures of valuation errors on the acquirer side are used in regressions.

acquirers are undervalued. These results hold for most of the valuation models used to estimate fair values of the acquirers' shares. Second, the estimated valuation errors have a significant influence on the choice between cash and stock as a medium of exchange. The results are robust even when we split the sample by both the mode of acquisition and the medium of exchange. As an additional sensitivity analysis we show that our proxies for the extent of under- or overvaluation explain some of the information revealed to the stock market by the acquisition announcement (as measured by the abnormal returns around the announcement). We also present evidence that cash does indeed deter potential competing bidders.

Our findings on the target side indicate that pre-emptive bidding considerations dominate the contingent-payment advantages of using stock as the medium of exchange by acquirers. Thus, targets with a greater extent of informational asymmetry about them in the equity market are more likely to be taken over with cash rather than stock. Further, we find no support for the relative-size hypothesis.

7. Conclusion

This paper is the first attempt to directly test the double-sided asymmetric information hypotheses in the case of acquisitions. Our findings suggest that acquirers that use stock as the medium of exchange are overvalued. We also find some evidence that acquirers using cash are undervalued. Thus, we find that the valuation errors regarding the acquirer influence the choice between cash and stock offers. Further, these valuation errors are significant determinants of the abnormal returns upon the announcement of an acquisition. On the target side, we find that pre-emptive bidding

considerations dominate the contingent payment features of using stock as the medium of exchange. In particular, a higher level of informational asymmetry about the target leads to a higher likelihood of using cash as the medium of exchange. Finally, we find no support for the relative size hypothesis.

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Table 1
Number of acquisitions by calendar year, mode of acquisition, and form of payment, 1975-1995

	mergers			***tenders***			
	stock	***cash***	***mixed***	***stock***	***cash***	***mixed***	***total***
1975	3	3	0	0	2	1	9
1976	5	3	0	2	9	1	20
1977	8	7	1	0	9	0	25
1978	5	11	1	2	10	1	30
1979	8	11	0	0	13	0	32
1980	7	8	0	0	7	2	24
1981	5	5	2	1	10	0	23
1982	6	3	0	1	9	0	19
1983	9	4	1	1	10	0	25
1984	5	6	0	0	16	0	27
1985	5	8	1	1	22	0	37
1986	4	4	0	0	29	0	37
1987	4	2	1	0	10	1	18
1988	4	7	0	0	16	0	27
1989	3	0	0	1	11	0	15
1990	6	4	1	0	3	0	14
1991	1	1	0	0	3	0	5
1992	3	3	0	1	1	0	8
1993	8	2	0	0	1	0	11
1994	8	3	0	0	4	1	16
1995	10	2	0	0	3	0	15
Total	117	97	8	10	198	7	437

Table 2
Summary statistics for the acquirers. All values are in millions of dollars (unless otherwise specified) and as of the end of the fiscal year preceding acquisition announcement. Market value of equity is calculated a product of the number of shares outstanding and share price at the end of the fiscal year preceding acquisition announcement. Cash/sales is a ratio of firms holdings of cash and marketable securities and sales in the fiscal year preceding acquisition announcement. Cash/sales is a ratio of firms holdings of cash and marketable securities and book value of firm's assets. Debt-equity ratio is long-term debt over book value of firm's equity. Total liabilities-equity ratio is total liabilities divided by the book value of shareholders' equity.

	mean	median	min	max
book value of assets	3,695.1	1,405.3	1.42	70,560.0
market value of equity	2,487.9	815.12	2.59	48,948.9
cash/sales (%)	12.00	5.01	0.04	354.7
cash/assets (%)	9.13	5.60	0.01	68.0
debt-equity ratio	0.77	0.47	0.00	11.49
total liabilities-equity ratio	1.71	1.35	0.01	13.57

Table 3
Definitions of variables

VE(PE)	Valuation error calculated using price-earnings ratio
VE(RIMC)	Valuation error calculated using residual income model (RIM) with a constant (across firms) discount rate of 13%
VE(RIMF)	Valuation error calculated using residual income model (RIM) with firm-specific discount rate
VE(OHLC)	Valuation error calculated using Ohlson (2000) model with a constant (across firms) discount rate of 13%
VE(OHLF)	Valuation error calculated using Ohlson (2000) model with firm specific discount rate
VE(IBESC)	Valuation error calculated using residual income model (RIM) with constant (across firms) discount rate of 13% and analyst forecasts of earnings
VE(IBESF)	Valuation error calculated using residual income model (RIM) with firm-specific discount rate and analyst forecasts of earnings

Table 4

Means and medians of the valuation errors. *VE(RIMC)* and *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with constant discount rate of 13% and firm-specific discount rate, respectively. *VE(PE)* are valuation errors calculated using price-earnings ratio approach. *VE(OHLF)* are valuation errors calculated using Ohlson (2000) model and firm specific discount rate. The results of *t*-tests for the difference in means, non-parametric Wilcoxon signed rank tests for the difference in medians and Sign test for the fraction of firms with positive/negative valuation errors are given in panels. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively.

Panel A: All observations

	acquirers			*matched*			*difference*		
	mean	*median*	*N*	*mean*	*median*	*N*	*mean*	*median*	*percentage pos / neg*
cash									*negative*
VE(PE)	-9.78	-11.30	264	-0.04	-9.86	264	-9.74 (-1.75)**	-1.44 (-1.37)**	49.6
VE(RIMC)	18.19	16.15	293	25.51	26.25	293	-7.32 (-2.03)**	-10.10 (-1.71)**	53.5
VE(RIMF)	26.19	24.25	293	29.05	29.53	293	-2.86 (-0.74)	-5.28 (-0.43)	49.8
VE(OHLC)	7.28	8.68	157	27.42	20.12	157	-20.14 (-1.57)**	-11.44 (-1.25)*	53.5
VE(OHLF)	32.41	32.28	124	43.41	31.42	124	-11.00 (-0.83)	0.86 (0.30)	47.6
stock									*positive*
VE(PE)	-5.48	-5.68	104	-14.06	-13.20	104	8.58 (1.41)**	7.52 (1.94)**	60.6**
VE(RIMC)	56.69	48.24	125	35.78	32.45	125	20.91 (3.17)***	15.79 (3.16)***	64.8***
VE(RIMF)	64.27	55.54	127	36.37	35.86	127	27.90 (3.76)***	19.68 (3.91)***	64.6***
VE(OHLC)	36.05	32.93	84	17.81	14.21	84	18.23 (1.40)**	18.72 (1.92)**	63.1***
VE(OHLF)	54.90	59.38	65	30.66	34.74	65	24.24 (2.26)***	24.64 (2.46)***	66.2***
mixed									*positive*
VE(PE)	-5.90	-1.43	11	-19.77	-36.60	11	13.88 (0.84)	35.17 (0.71)	54.5
VE(RIMC)	17.06	10.01	15	25.39	20.89	15	-8.33 (-0.34)	-10.88 (0.00)	53.3
VE(RIMF)	24.63	41.04	15	18.67	-22.22	15	5.95 (0.21)	63.26 (0.68)	73.3*

Panel B: Mergers

	acquirers			*matched*			*difference*		
	mean	*median*	*N*	*mean*	*median*	*N*	*mean*	*median*	*percentage pos / neg*
cash									*negative*
VE(PE)	-11.73	-8.24	86	0.03	-11.15	86	-11.76 (-1.34)**	2.91 (-0.71)	47.7
VE(RIMC)	12.18	10.45	96	19.32	18.55	96	-7.13 (-1.10)*	-8.10 (-0.61)	51.0
VE(RIMF)	21.04	20.37	96	22.48	22.42	96	-1.44 (-0.21)	-2.05 (-0.45)	44.8
VE(OHLC)	-1.97	1.66	59	10.44	13.74	59	-12.41 (-0.62)	-12.08 (-0.35)	50.8
VE(OHLF)	14.65	30.78	45	26.46	21.01	45	-11.81 (-0.61)	9.77 (0.05)	46.7
stock									*positive*
VE(PE)	-5.96	-6.73	96	-16.53	-15.15	96	10.57 (1.63)**	8.42 (2.19)***	61.5**
VE(RIMC)	58.18	50.57	115	35.49	34.11	115	22.69 (3.25)***	16.46 (3.33)***	67.0***
VE(RIMF)	67.16	60.77	117	37.90	36.14	117	29.26 (3.72)***	24.63 (3.91)***	65.0***
VE(OHLC)	39.58	34.33	78	17.59	14.21	78	21.99 (1.62)**	20.12 (2.10)***	62.8**
VE(OHLF)	61.45	71.28	59	32.98	34.74	59	28.47 (2.60)***	36.54 (2.70)***	66.1***
mixed									*positive*
VE(PE)	9.45	9.97	4	-2.08	0.24	4	11.53 (0.41)	9.73 (0.37)	50.0
VE(RIMC)	18.47	7.37	8	47.79	23.20	8	-29.32 (-0.85)	-15.83 (-0.70)	37.5
VE(RIMF)	35.00	37.67	8	50.85	14.19	8	-15.85 (-0.39)	23.48 (0.00)	62.5

Panel C: Tender Offers

	acquirers			*matched*			*difference*		
	mean	*median*	*N*	*mean*	*median*	*N*	*mean*	*median*	*percentage pos / neg*
cash									*negative*
VE(PE)	-8.72	-14.00	177	-1.81	-8.52	177	-6.91 (-1.00)*	-5.48 (-1.02)*	50.3
VE(RIMC)	21.12	20.58	197	28.53	32.31	197	-7.41 (-1.70)**	-11.73 (-1.63)**	54.8*
VE(RIMF)	28.70	24.82	197	32.25	34.16	197	-3.55 (-0.75)	-9.34 (-0.81)	52.3
VE(OHLC)	12.85	11.30	98	37.64	21.29	98	-24.79 (-1.49)**	-9.99 (-1.29)**	55.1
VE(OHLF)	42.52	36.98	79	53.06	35.62	79	-10.54 (-0.59)	1.36 (0.34)	48.1
stock									*positive*
VE(PE)	0.27	2.46	8	15.61	12.44	8	-15.33 (-1.32)**	-9.98 (-1.12)*	50.0
VE(RIMC)	39.55	24.97	10	39.04	12.71	10	0.05 (0.03)	12.26 (0.46)	40.0
VE(RIMF)	30.44	-5.4	10	18.47	17.46	10	11.97 (0.57)	-22.86 (0.26)	60.0
VE(OHLC)	-9.87	-4.23	6	20.82	18.07	6	-30.68 (-0.70)	-22.30 (-0.11)	66.6
VE(OHLF)	-9.58	-21.76	6	7.81	19.41	6	-17.39 (-0.40)	-41.70 (-0.11)	66.6
mixed									*positive*
VE(PE)	-14.67	-1.43	7	-29.88	-36.61	7	15.21 (0.69)	35.18 (0.68)	57.1
VE(RIMC)	15.44	55.08	7	-0.22	20.89	7	15.67 (0.46)	34.19 (1.01)	71.4
VE(RIMF)	12.78	41.04	7	-18.09	52.67	7	30.87 (0.79)	-11.63 (1.18)	85.7

Table 5

Comparison of valuation errors calculated using private and public information. Private information VEs are estimated using realized values of future earnings. Public information VEs are calculated using IBES forecasts. *VE(RIMC)* and *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with constant discount rate of 13% and firm-specific discount rate, respectively. The results of *t*-tests for the difference in means, non-parametric Wilcoxon signed rank tests for the difference in medians. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively.

	private		*public*		*difference*	
	mean	*median*	*mean*	*median*	*mean*	*median*
VE(RIMC)						
cash						
all	17.18	17.51	14.41	13.37	2.77	4.14
					(0.72)	(0.98)
cash mergers	8.76	9.83	7.62	3.25	1.14	6.58
					(0.16)	(0.55)
cash tenders	21.18	20.74	17.36	18.78	3.82	1.96
					(0.85)	(0.86)
stock						
all	59.34	48.24	40.36	41.41	18.98	6.83
					(2.49)***	(1.88)**
stock mergers	57.60	50.57	41.61	43.39	15.99	7.18
					(2.20)**	(1.91)**
stock tenders	39.55	24.97	21.28	14.92	18.27	10.05
					(0.63)	(0.16)
VE(RIMF)						
cash						
all	28.92	24.54	25.82	24.83	3.10	-0.29
					(0.67)	(0.21)
cash mergers	17.83	20.76	24.18	19.48	-6.35	1.28
					(-0.88)	(0.51)
cash tenders	28.75	26.26	26.54	28.80	2.21	2.54
					(0.46)	(-0.60)
stock						
all	66.88	57.02	48.94	45.05	17.94	11.97
					(2.05)**	(1.54)*
stock mergers	69.96	61.91	49.25	45.81	20.71	16.10
					(2.28)**	(1.87)**
stock tenders	30.44	-5.40	44.16	29.40	-13.72	-24.00
					(-0.43)	(-0.98)

Table 6

Results of univariate tests of the target side informational asymmetry. *RSIZE* is the market value of target's equity divided by the market value of acquirer's equity. *REL* is relatedness measure which takes on value of one if the firms are in the same 3-digit SIC code and zero otherwise. *STDFOR* is standard deviation of earnings forecasts as reported by IBES for the last month of the fiscal year preceding acquisition announcement, while *NUMA* is the number of analysts following the target in the same month. *FORERR* is forecast error defined as the ratio of the absolute value of the difference between analyst forecast and realized value of earnings to the stock price; all values are for the last month of the fiscal year preceding acquisition announcement. *RSD* is standard deviation of the difference between target's stock returns and CRSP value-weighted index calculated over the year preceding acquisition announcement. Results of non-parametric Wilcoxon rank-sum tests are reported in panels, except for the *RSIZE* for which t-test for the difference in means and Wilcoxon signed-rank test for the difference in medians is used. *** and ** indicate significance at 1 and 5 percent, respectively.

	cash			*stock*			*difference*	
	mean	*median*	*N*	*mean*	*median*	*N*	*mean*	*median*
RSIZE	0.320	0.131	309	0.280	0.156	179	0.040	-0.025
							(0.72)	(0.32)
REL	0.302	0	341	0.424	0	191	-0.122	0
							(-2.86)***	
STDFOR	19.81	10	177	13.09	7	104	5.91	3
							(2.23)**	
NUMA	7.13	5	210	8.76	7	123	-1.63	-2
							(-2.28)**	
FORERR	0.0572	0.0111	182	0.0576	0.0102	110	-0.0004	0.0009
							(-0.28)	
RSD	0.0289	0.0272	327	0.0296	0.0274	185	-0.0007	-0.0002
							(-0.38)	

Table 7

Results of logistic regressions regarding the choice of the medium of exchange. The dependent variable takes on value of one if the acquiring firm paid with cash and zero if it paid with stock. *VE(RIMC)* and *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with constant discount rate of 13% and firm-specific discount rate, respectively. *VE(PE)* are valuation errors calculated using price-earnings ratio approach. *VE(OHLF)* are valuation errors calculated using Ohlson (2000) model and firm specific discount rate. *CD* is firm's holdings of cash and marketable securities at the end of the fiscal year preceding acquisition announcement divided by the amount paid for the target. *RSIZE* is the market value of target's equity divided by the market value of acquirer's equity. *REL* is relatedness measure which takes on value of one if the firms are in the same 3-digit SIC code and zero otherwise. *STDFOR* is standard deviation of earnings forecasts as reported by IBES for the last month of the fiscal year preceding acquisition announcement, while *NUMA* is the number of analysts following the target in the same month. *RSD* is standard deviation of the difference between target's stock returns and CRSP value-weighted index calculated over the year preceding acquisition announcement. *t*-statistics are given in parentheses. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively. White heteroskedasticity adjusted errors are used in calculating t-statistics.

	1	2	3	4
intercept	0.222	-0.065	-0.918	-0.508
	(0.33)	(-0.10)	(-1.31)	(-0.56)
VE(RIMC)	-1.601			
	(-3.64)***			
VE(RIMF)		-1.221		
		(-2.85)***		
VE(PE)			-0.150	
			(-0.68)	
VE(OHLC)				-0.459
				(-1.80)*
CD	0.112	0.121	0.150	0.093
	(2.08)**	(2.04)**	(2.46)**	(1.00)
RSIZE	1.275	1.215	1.580	0.448
	(2.54)**	(2.58)***	(2.31)**	(0.69)
REL	-0.332	-0.378	-0.643	-0.880
	(-0.95)	(-1.12)	(-1.93)*	(-1.98)**
STDFOR	0.024	0.027	0.037	0.052
	(2.32)**	(2.43)**	(2.43)**	(2.38)**
NUMA	-0.037	-0.033	-0.062	-0.102
	(-1.56)	(-1.44)	(-2.40)**	(-2.46)**
RSD	36.362	39.403	52.352	58.372
	(1.86)*	(2.04)**	(2.47)**	(1.91)*
Wald-stat	34.24	31.50	34.10	26.85
Pseudo R-squared	20.72	18.13	16.27	19.39
N	217	219	197	124

Table 8
Results of multinomial logistic regressions regarding the choice of the medium of exchange. *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with a firm-specific discount rate. *t*-statistics are given in parentheses. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively. White heteroskedasticity adjusted errors are used in calculating *t*-statistics.

	1	2	3	4
dependent variable	0 if stock merger 1 if cash merger 2 if cash tender 3 if stock tender	0 if stock merger 1 if cash merger 2 if cash tender 3 if stock tender	1 if cash 2 if stock 3 if mixed	1 if cash 2 if stock 3 if mixed
comparison group	stock merger (0)	cash tender (2)	cash (1)	stock (2)
intercept 0		0.479 (0.66)		
intercept 1	-0.775 (-0.86)	-0.296 (-0.38)		0.283 (0.43)
intercept 2	-0.479 (-0.66)		-0.283 (-0.43)	
intercept 3	-5.103 (-2.61)***	-4.624 (-2.46)**	-2.347 (-1.23)	-2.064 (-1.06)
VE(RIMF) if dep=0		1.357 (4.19)***		
VE(RIMF) if dep=1	-1.012 (-2.56)***	0.344 (0.97)		-1.271 (-4.28)***
VE(RIMF) if dep=2	-1.357 (-4.19)***		1.271 (4.28)***	
VE(RIMF) if dep=3	-0.362 (-0.456)	0.994 (1.26)	1.126 (1.34)	-0.146 (-0.17)
RSIZE if dep=0		-0.013 (-0.05)		
RSIZE if dep=1	-0.582 (-1.24)	-0.594 (-1.33)		-0.090 (-0.41)
RSIZE if dep=2	0.013 (0.05)		0.090 (0.41)	
RSIZE if dep=3	0.270 (0.62)	0.257 (0.59)	-0.181 (-0.22)	-0.270 (-0.33)
REL if dep=0		0.563 (1.52)		
REL if dep=1	-0.060 (-0.13)	0.502 (1.20)		-0.335 (-1.01)
REL if dep=2	-0.563 (-1.52)		0.335 (1.01)	
REL if dep=3	-0.742 (-0.68)	-0.179 (-0.17)	-1.115 (-0.92)	-1.450 (-1.19)
STDFOR if dep=0		-0.049 (-3.12)***		
STDFOR if dep=1	0.049 (2.86)***	-0.000 (-0.01)		0.025 (2.29)**
STDFOR if dep=2	0.049 (3.12)***		-0.025 (-2.29)**	
STDFOR if dep=3	0.069 (3.54)***	0.020 (1.62)	0.026 (2.79)***	0.051 (3.64)***
NUMA if dep=0		0.007 (0.27)		
NUMA if dep=1	-0.060 (-1.63)	-0.053 (1.56)		0.016 (0.75)
NUMA if dep=2	-0.007 (-0.27)		0.016 (0.75)	
NUMA if dep=3	0.019 (0.30)	0.025 (0.42)	-0.007 (-0.12)	-0.024 (-0.38)
RSD if dep=0		-55.302 (-2.47)**		
RSD if dep=1	36.577 (1.32)	-18.724 (-0.79)		44.557 (2.20)**
RSD if dep=2	55.302 (2.47)**		-44.557 (-2.20)**	
RSD if dep=3	56.331 (0.94)	1.030 (0.02)	-75.614 (-1.08)	-31.056 (-0.44)
LR	65.48	65.48	53.73	53.73
Pseudo R-squared	13.14	13.14	15.43	15.43
N	229	229	235	235

Table 9
Abnormal returns to acquirer's equity upon the acquisition announcement. Market model parameters are calculated over 250 trading days ending 46 trading days before the acquisition announcement. Announcement date is denoted as date 0. *t*-statistics are given in parentheses. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively.

	all acquisitions			*mergers*			*tenders*		
	mean	*median*	*N*	*mean*	*median*	*N*	*mean*	*median*	*N*
cash									
[0]	0.07	-0.10	349	0.67**	0.26	113	-0.22	-0.21**	236
[-1;0]	0.22	-0.13	349	1.24**	0.39	113	-0.27	-0.43**	236
[-1;+1]	0.52*	-0.14	349	1.94**	0.36	113	-0.16	-0.30	236
[0;+5]	0.41	0.06	349	0.90*	0.53	113	0.18	-0.17	236
[-5;+5]	0.77*	-0.05	349	2.30**	0.26*	113	0.04	-0.54	236
stock									
[0]	-1.48***	-1.20***	197	-1.48***	1.20***	187	-1.35	-1.10	10
[-1;0]	-1.27***	-1.20***	197	-1.311***	-1.22***	187	-0.54	-0.15	10
[-1;+1]	-2.48***	-2.28***	197	-2.5***	-2.35***	187	-2.15	-0.65	10
[0;+5]	-3.22***	-3.11***	197	-3.20***	-3.13***	187	-3.47*	-2.20	10
[-5;+5]	-3.13***	-2.59***	197	-3.27***	-2.84***	187	-0.45	1.46	10
mixed									
[0]	-0.62	-0.45	15	-0.69	0.35	8	-0.55	-0.69	7
[-1;0]	-0.62	-0.86	15	-0.83	-0.24	8	-0.38	-1.24	7
[-1;+1]	-0.51	-0.38	15	0.03	1.19	8	-1.12	-1.03	7
[0;+5]	-3.17*	-1.96	15	-1.23	0.08	8	-5.40	-3.12	7
[-5;+5]	-3.95*	-1.95	15	-2.71	-2.70	8	-5.38	-1.94	7

Table 10

Relationship between valuation errors and abnormal returns to acquirer's equity upon the acquisition announcement. *t*-statistics are given in parentheses. *VE(RIMC)* and *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with constant discount rate of 13% and firm-specific discount rate, respectively. *VE(PE)* are valuation errors calculated using price-earnings ratio approach. *VE(OHLF)* are valuation errors calculated using Ohlson (2000) model and firm specific discount rate. *LNSIZE* is log of the acquirer's book value of assets at the end of the fiscal year preceding acquisition announcement. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively. White heteroskedasticity adjusted errors are used in calculating *t*-statistics.

	1	2	3	4
dependent variable	*[0;+5]*	*[0;+5]*	*[0;+5]*	*[0;+5]*
intercept	0.033	0.032	0.051	0.056
	(2.03)**	(1.96)**	(3.44)***	(2.94)***
VE(RIMC)	-0.031			
	(-4.55)***			
VE(RIMF)		-0.031		
		(-4.72)***		
VE(PE)			-0.012	
			(-2.54)***	
VE(OHLF)				-0.010
				(-2.25)**
LNSIZE	-0.005	-0.003	-0.008	-0.008
	(-2.22)**	(-1.96)**	(-4.25)***	(-3.23)***
Adjusted R-square	10.89	11.96	7.18	9.36
N	419	421	413	278

Table 11

Effect of the choice of the medium of exchange on the likelihood of competition. The results presented are from a simultaneous equation estimation. The equations are defined as follows:

$$Compete = \beta_0 + \beta_1 CASH_i + \beta_2 BPREM_i + \beta_3 NUMA_i + \beta_4 STDFOR_i + \beta_4 RSD_i + \beta_5 REL_i + \varepsilon_i \quad (1)$$

$$BPREM_i = \delta_0 + \delta_1 CASH_i + \delta_2 VE_i + \delta_3 NUMA_i + \delta_4 STDFOR_i + \delta_5 RSD_i + \delta_6 REL_i + \eta_i \quad (2)$$

$$CASH_i = \alpha_0 + \alpha_1 BREPM_i + \alpha_2 VE_i + \alpha_3 NUMA_i + \alpha_4 STDFOR_i + \alpha_5 RSD_i + \alpha_6 REL_i + \upsilon_i \quad (3)$$

Compete takes on value of one if there was a competing offer and zero otherwise. *BPREM* is the bid premium, defined as the percentage by which the initial bid exceeds the target's closing share price 10 trading days before the acquisition announcement. *CASH* takes on value of one if the initial offer was in cash. *VE(RIMF)* are valuation errors estimated using residual income model (RIM) with a firm-specific discount rate. *REL* is relatedness measure which takes on value of one if the firms are in the same 3-digit SIC code and zero otherwise. *STDFOR* is standard deviation of earnings forecasts as reported by IBES for the last month of the fiscal year preceding acquisition announcement, while *NUMA* is the number of analysts following the target in the same month. *RSD* is standard deviation of the difference between target's stock returns and CRSP value-weighted index calculated over the year preceding acquisition announcement. *t*-statistics are given in parentheses. ***, ** and * indicates significance at 1, 5 and 10 percent level, respectively. White heteroskedasticity adjusted errors are used in calculating t-statistics.

equation	1	2	3	4	5	6
Dependent variable	Compete	BPREM	CASH	Compete	BPREM	CASH
intercept	15.517	0.592	-2.324	-3.939	0.340	-4.405
	(2.67)***	(1.53)	(-0.47)	(-1.41)	(70.19)***	(-1.22)
CASH	-8.172	-0.486		16.326	-0.024	
	(-2.51)**	(-0.81)		(4.36)***	(-0.19)	
BPREM	-44.523		8.256	-22.969		12.832
	(-3.34)***		(0.53)	(-2.45)**		(0.06)
VE(RIMF)		-0.062	-1.622			
		(-0.08)	(-1.76)*			
NUMA	-0.034	-0.02	-0.027	0.113	0.001	-0.046
	(-1.03)	(-0.10)	(-0.78)	(2.96)***	(0.15)	(-0.31)
STDFOR	0.057	0.002	0.024	-0.043	-0.000	0.030
	(3.62)***	(0.11)	(1.81)*	(-2.86)***	(-0.00)	(0.45)
RSD	180.99	5.201	32.11	-28.396	1.578	19.897
	(3.58)***	(0.20)	(0.92)	(-0.91)	(0.31)	(0.05)
REL	-0.664	-0.018	0.078		-0.013	0.077
	(-2.76)***	(-0.30)	(0.29)		(-0.70)	(0.03)
Pseudo R-squared	14.07			16.16		
N	224	224	224	224	224	224