Does Asymmetric Information Affect the Premium in Mergers and Acquisitions?

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Abstract

We test the influence of information asymmetry on the premium paid for an acquisition. We analyze mergers and acquisitions as English auctions. The theory of dynamic auctions with private and common value predicts that more informed bidders may pay a lower price. We test that prediction with a sample of 1,026 acquisitions in the United States between 1990 and 2007. We assume that blockholders of the target's shares are better informed than other bidders because they possess privileged information on the target. Our empirical results show that blockholders pay a much lower premium than do other buyers

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1. Introduction

Mergers and acquisitions have prevailed in economies around the world since the beginning of the previous century. The scope of this phenomenon varies from year to year. Three main waves of acquisitions have been observed in recent years, culminating in 1989, 1999 and 2007. The last wave that started in 2003 is characterized by the increasing presence of companies from emerging markets.

Acquisitions are an interesting growth avenue for many companies. Potential economies of scale, vertical integration, synergies and tax savings propel organizations to opt for this form of growth. Companies often disburse exorbitant amounts to acquire a target. Betton, Eckbo and Thorburn (2008) find that the average premium paid for American acquisitions between 1980 and 2002 equals 48% of the market value of the target before the initial bid, and some premiums even exceed 100%. The high prices disbursed do not always yield the anticipated outcome because some companies tend to overvalue the potential of the transaction.

The objective of this article is to empirically test the influence of several determinants of the premium identified in the literature on mergers and acquisitions by looking explicitly at a previously unexplored factor: information asymmetry between potential buyers. The theoretical literature related to acquisitions underlines the importance of examining whether such asymmetry influences the premium paid (Dasgupta and Tsui, 2004; Ravid and Spiegel, 1999; Fishman, 1988). Fishman (1988) proposes that the acquisition process is highly similar to an auction in an asymmetric information environment. The empirical literature emphasizes the role of toeholds (acquisition of target shares) in generating information (Betton et al., 2000, 2009): The presence of a toehold bidder may deter entry into the auction for the target. Betton et al. (2009) verify that the size of a toehold reduces both the final offer premium and the initial offer premium. Rather than following this line of research, we propose a different theoretical framework based on the recent literature on blockholders. We analyze the role of blockholders[1] of the target's shares. As documented in the recent literature, the monitoring activities of blockholders give them preferred

[1] In this paper, a block of shares is a proportion of the shares that represents at least 5% of the target company's stock. Blockholders with 5% or more of the shares of any company must file a form with the Securities and Exchange Commission (SEC); this information is public. Blockholders can influence the company by selecting appointees to the board of directors. In contrast, buyers with a proportion of shares of less than 5% are less likely to possess privileged information. In the case of toeholds, the purchase of shares remains private information when the proportion of shares is less than 5%. For our purposes, the blockholder is publicly known, has more information on the target than other bidders, and is identified as an influential stakeholder of the target. Toeholders usually do not have these characteristics because they can hold less than 5% of the target's stock.

access to managers and board members, and hence a distinct information advantage to evaluate the performance and fair value of the target (Heflin and Shaw, 2000; Brockman and Yan, 2009; Kang and Kim, 2008; Edmans, 2009).

Kang and Kim (2008) show that block acquirers prefer geographically proximate targets: the observed ratio of blocks acquired by firms located in the same state is 20%, whereas the fraction of all public firms that reside in a certain state relative to all public firms in the United States is only 7%. Another interesting result in this study is that geographic proximity is an important factor to explain incentives to perform an active governance role in targets and to develop information asymmetry, which corroborates Brockman and Yan (2009), Chen et al. (2007), and Edmans (2009). Edmans (2009) also documents that blockholders encourage managers to take actions that increase long-run value or to undertake investments that increase fundamental value. Our research question is then: How do these publicly known, better informed bidders influence the premium paid in mergers and acquisitions?

We also differ from the empirical literature on mergers and acquisitions by using auction theory to derive the pricing implication from the presence of informed bidders. Our main empirical contribution is to test for the presence of asymmetric information by extending recent empirical methodologies developed for other types of auctions. We instrument the blockholders variable because its presence in the bid could be endogenously determined.[2] This leads us to advocate two-stage estimation approaches. The first-stage instrumental variable estimation shows that the probability of informed bidders being present at an auction is higher when the target is from the same state or when the target's industry is regulated, but lower for well-performing targets in the same state. We compare the "treatment effect" approach to deal with the endogeneity problem at the second stage to three versions of the 2SLS approach. The results obtained from all four approaches are consistent and lead to the conclusion that the presence of informed bidders lowers the premium. Moreover, the treatment effect approach reveals that informed bidders are more active in auctions where their ability to lower the premium is higher.

The paper is structured as follows. Section 2 describes the influence of information asymmetry in the auction context. Section 3 presents the theoretical model. Empirical implications of the theory are also discussed. Section 4 contains the review of the empirical literature on the determinants of the premium. Section 5 specifies the econometric models used, along with the database and descriptive statistics for the variables. Section 6 presents and analyzes the results, and the robustness tests are found in Section 7. Section 8 concludes the paper.

[2] It must be emphasized that the presence of a toehold has never been instrumented in the literature, although acquiring shares is often interpreted as a strategy in the acquisition process.

2. Acquisitions and information asymmetry

2.1. Acquisition perceived as an auction

Several authors agree that the acquisition process is quite similar to that of the Japanese version of an English auction (Fishman, 1988; Ravid and Spiegel, 1999). Other authors model the acquisition as a sealed-bid second-price auction. Burkart (1995) and Rhodes-Kropf and Viswanathan (2004) endorse this view of the acquisition because such auctions are quite malleable and easier to analyze than the English auction.

Even though acquisitions do not always involve several potential buyers, researchers still characterize them as auctions. One possible explanation for this was proposed by Fishman (1988), who models the acquisition as costly in an asymmetrical information environment. He asserts that acquisitions including a single participant can be considered auctions in which the other interested participants are not manifested but could have come in at any time. Recent empirical studies have estimated models of mergers in the context of auctions (Brannman and Froeb, 2000; Ivaldi and Motis, 2007). They show that mergers can be a way to acquire private information, which affects bidding and premiums. It must be emphasized that these contributions do not consider asymmetric information between bidders.

2.2 The presence of toeholds

There is a sizeable body of literature on the effect of toeholds on the equilibrium price of an acquisition. Toehold bidders already own shares of the target before the first bid. Consequently, their payoff is not the same as for other bidders: when they win the takeover, they need to buy fewer shares than other bidders, and when they lose, they may sell their shares to the winner. This modification of the toehold payoff may affect toeholder's behavior during the auction (Bulow et al. 1999; Ettinger, 2009). In an ascending auction with private valuations and without a transaction cost for participating in the auction, Burkart (1995) and Singh (1998) show that toehold bidders are more aggressive than other bidders, and increase the selling price of the target. However, for auctions with participation costs, the results are less conclusive. The presence of toeholders may increase or decrease the equilibrium price of the merger (Ettinger, 2009), which is in line with the empirical literature studying the effect of toeholds on target prices and premiums. In this article we add a dimension to this discussion by considering asymmetric information in auctions. Our presentation is based on the current regulation in the US market, and considers only toehold bidders who can be identified by other bidders, meaning ones who hold at least 5% of the target's shares. We call these bidders blockholders as observed in this market, and we assume that blockholders are more informed about the target than other bidders are, as documented in the financial literature presented in the introduction.

2.3. Information asymmetry in sealed-bid auctions

The theoretical literature on sealed-bid auctions with information asymmetry began with Wilson (1967). He shows that the more informed party has a much higher marginal expected return than the uninformed competitors. Weverberght (1979), Milgrom and Weber (1982), and Engelbrecht-Wiggans, Milgrom and Weber (1983) revisit the problem and propose a different version of the equilibrium premium. They predict that the informed participant's anticipated profit is generally positive, whereas the expected profits of the other players are zero. The fear of the winner's curse (winning by bidding a too high price) prevails among uninformed players. Informed participants can then win the auction at a lower price. Hendricks and Porter (1988) test this main prediction of the theoretical literature on sealed bid auctions with common value in a context of information asymmetry. The empirical results strongly support the prediction of the theoretical model.

2.4. Information asymmetry in English auctions

The influence of information asymmetry in English auctions has also intrigued researchers. Hernando-Veciana and Tröge (2004) analyze an English auction with information asymmetry and distinguish common value from private value. They study the uninformed participants' behavior during the auction when the party that holds privileged information is present. They conclude that the uninformed bidder's strategies are mainly dictated by the interaction between the winner's curse and the loser's curse (losing by bidding too low). The authors argue that the probability of the loser's curse is markedly higher than the probability of the winner's curse among uninformed participants that have high private value. Uninformed bidders protect themselves from the loser's curse by submitting aggressive offers when an informed competitor is present. Informed players must then bid a large amount to discourage the other participants and win the auction. The converse may happen when uninformed participants have low private value as we will see in this article.

Dionne, St-Amour and Vencatachellum (2009) extend the empirical model developed by Hong and Shum (2003) and derive the empirical implications of the presence of an informed participant in an English auction with private and common value. In their model, the informed player makes an overall valuation because the common value cannot be distinguished from the private value. Dionne et al. (2009) conclude that the presence of an informed participant prompts more aggressive offers by uninformed players. They test their theoretical predictions on a sample of slave auctions in Mauritius between 1825 and 1834. Their results are consistent with the auction model when private valuations are significant for non-informed bidders because the equilibrium price is higher when the informed player wins the auction. In the following sections, we adopt the English auction interpretation of the acquisition process.

2.5. Privileged information of blockholders

Information asymmetry between bidders at an auction seems to influence the price paid by the winner considerably. If the target object at an auction is a complex good such as a company, the participants probably use disparate information to evaluate the target, which will affect the premium paid by the buyer. Several recent studies show that information asymmetry is manifested in a company when its ownership structure includes blockholders and diffused shareholders (Heflin and Shaw, 2000; Brockman and Yan, 2009; Kang and Kim, 2008; Edmans, 2009). Blockholders may have an advantage when appraising the performance and the fair value of the target in an acquisition. They may also have a higher private value of the target because they are already a stakeholder of the company.

3. Theoretical model

The theoretical model that corresponds to our empirical analysis is in relation with the model proposed by Dionne et al. (2009). We consider an open-bid, single-good, ascending auction with common value and potential private value. As in Wilson (1998), we restrict the auction model to the Japanese version of the English ascending auction where the dropping-out decision is public and irrevocable. Some bidders may have private values regarding some targets but we assume that, on average, these preferences are not significant for bidders that do not hold significant shares in the target (mean equal to zero). One important assumption is related to the presence of asymmetric information across bidders.

The total valuation of a target firm by bidder i, V_i, can be written as $\log(V_i) \equiv v_i$ as well its signal X_i, $\log(X_i) \equiv x_i$. As in Hong and Shum (2003), we assume that:

$$v_i = a_i + v \tag{1}$$

$$a_i = \overline{a}_i + \eta_i \tag{2}$$

$$x_i = v_i + \varepsilon_i \tag{3}$$

where:

$$\left[\eta_i, v, \varepsilon_i\right] \sim \text{N.I.D.}\left(\left[0, m, 0\right], \text{Diag}\left[t_i^2, r_o^2, s_i^2\right]\right). \tag{4}$$

The total valuation of a target v_i by agent i is the sum of private value a_i and common value v; its signal x_i is a random variable as well as its private value a_i. All random variables $\left[\eta_i, v, \varepsilon_i\right]$ are assumed i.i.d. Gaussian with $t_i^2\left(r_o^2\right)$ the variance of the private (common) value and s_i^2 the variance of the signal. All distribution parameters are common knowledge at the beginning of the auction.[3] One bidder $\left(I\right)$, the blockholder, has more information than other bidders. This bidder can be identified by all other bidders because he already holds more than 5% of the target's shares. Asymmetric information is introduced by assuming a more precise private value of the target for bidder $I : \eta_I = 0$. Moreover, $\overline{a}_I > 0$, which means that blockholders have, on average, more private value for the target than other bidders with ($\overline{a}_i = 0$ for all $i \neq I$) because they already own target's shares.

Our model differs from that of Dionne et al. (2009), where many bidders have private and common value, because these authors consider that all bidders may have personal feelings about slaves. Here, only blockholders have private value about the target on average because they hold private shares of the target. The other bidders are only concerned with the common value of the target. Blockholders' total bid is the sum of their private value and common value on average. They therefore overbid the common value and will often stay in the auction longer than in a pure common value auction. In a similar environment with private and common value, Hernando-Veciana and Troege (2004) show that outsiders with low private value drop out earlier in open bid auctions with a known, more informed insider than in more competitive auctions without a more informed bidder. The presence of the more informed bidder makes the auction less competitive and reduces the equilibrium price of the auction. However, the presence of a more informed insider tends to make the auction more competitive if there are many outsiders having

[3] On information revelation in auctions, see Benoît and Dubra (2006).

high private value and increases the equilibrium premium, as in Dionne et al. (2009). We now use numerical computations to show how our assumptions affect the equilibrium premium..

Hong and Shum (2003) derived the equilibrium bid b_i^k of agent *i* at round *k* under the log-normal assumption:

$$b_i^k = \frac{1}{A_i^k}\left(x_i + D_i^k x_d^k + C_i^k\right) \tag{5}$$

where A_i^k, D_i^k and C_i^k are functions of the distributional parameters t_i, m, r_o, s_i and x_d^k is the observable vector of signals from exited bidders at round *k*. Dionne et al. (2009) designed a Monte-Carlo experiment to compute the premium of agent *i*, at round *k* and Monte-Carlo experiment *j*. Here we extend their analysis to the case where the private value of non-informed agents is nil on average. We want to verify that the informed agent will pay a lower premium when he wins the auction.

We stochastically generate the distributional parameter at each replication of our Monte-Carlo experiment, as explained in Appendixes of Dionne et al. (2009). We define $\hat{\pi}(i,k) \equiv Median(\pi(i,k,:))$ as the median of the difference between all agents' bids with an informed agent present $b^1(i,k,j)$ and without an informed agent present $b^0(i,k,j)$:

$$\pi(i,k,j) \equiv b^1(i,k,j) - b^0(i,k,j) \quad \forall i,k = 1,...,N, \quad \forall j = 1,...,T \tag{6}$$

where *i* is for active agent *i* in bidding round *k* of the Monte-Carlo experiment replication *j*. Figure 1 plots the median premium $\hat{\pi}(i,k)$ against the bidding round $k = 1,...,10$. We chose 10 rounds instead of 30 because there are fewer bidders in mergers and acquisitions than in other auctions. We observe that the informed bidder retires at the median round 6 out of $N = 10$. We also observe that the median informed bidder premium remains negative until round 6 and converges to zero after, meaning that the premium is null when the informed bidder is out. So we must expect that the winning premium at the second highest bid in the next-to-ask bidding round is also negative when the informed player wins the auction.

(Figure 1 here)

In fact we can compute the premium conditional on *I* winning the auction as:

$$\pi(i=2,k=N-1,j|I=1,k=N,j) \equiv b^1(i=2,k=N-1,j|I=1,k=N,j) - b^0(i=2,k=N-1,j) \tag{7}$$

Panel (A) of Figure 2 presents the distribution of the equilibrium price premium where the informed bidder wins $T_I = 493$ times out of $T = 5,000$ replications. We indeed observe that almost all premiums are negative and Table 1 indicates that the median equilibrium premium is negative. Panels (B) to (E) plot various robustness checks of the benchmark, and the numbers are reported in Table 1. Four cases are considered. In Panel (B) we relax the assumption that the informed bidder has perfect information about its private value, by allowing for a less precise evaluation of the private value $\left(\eta_I = 0.5\eta_i, i \neq I\right)$. The effect of the modification is not important; almost all premiums remain negative. One main issue in the literature is how the equilibrium results are affected by the number of participants. In Panels (C) and (D), we consider the impact of allowing for a stochastic number of bidders where N is randomly chosen at each replication from a uniform distribution. Finally, Panel (E) considers the benchmark case when $N = 30$ to compare with Dionne et al. (2009). All median premiums (π) in Table 1 are negative. The corresponding mean ($\overline{\pi}$) are also negative and statistically different from zero. These robustness tests do not affect the main conclusion that the presence of a more informed bidder yields negative premiums when the average private value of the target is considered low by many auction participants, which corresponds to the results of a pure common value framework but with a different auction model.

(Figure 2 here)

As mentioned above, the theory predicts that the direction of the influence of information asymmetry on the premium depends on the inclusion of a low private value component in the valuation of the target. Below we will test whether information asymmetry significantly influences the premium in mergers and acquisitions. We will then analyze the direction of this impact to determine the type of valuation the buyers perform. We anticipate a significant negative influence on the premium if no significant private value is attributed to the target by many bidders.

Table 1: MEDIAN EQUILIBRIUM PRICES, MEDIAN PREMIUM, AND MEAN PREMIUM CONDITIONAL ON I WINNING THE AUCTION

b^0	b^1	π	$\bar{\pi}$	se	t	Number of observations
(A) Benchmark: N = 10, fixed						
0.818921	0.818908	-0.000013	-0.000030	0.00000297	-10.0807	493
(B) I imperfect information: N = 10, fixed						
0.885549	0.885541	-0.000012	-0.000026	0.00000229	-11.5201	664
(C) $N \sim U[3, 15]$ stochastic						
0.610281	0.610137	-0.000034	-0.000334	0.00013425	-2.4871	898
(D) $N \sim U[10, 15]$ stochastic						
0.817224	0.816874	-0.000008	-0.000013	0.00000530	-2.4986	333
(E) Benchmark : N = 30, fixed						
1.226641	1.226634	-0.000002	-0.000003	0.00000052	-5.7349	59

4. Empirical analysis mergers and acquisitions

4.1. Premium

We study takeovers in general, which include acquisitions in which the buyer holds the majority of the shares of the target after the transaction. We are interested in the final price the buyer pays to take control of the target. The price paid notably reflects the potential of the target and the negotiating power of the parties to the transaction. The premium is the measure of the auction outcome. Gondhalekar, Sant and Ferris (2004) analyze the premiums paid by buyers during a period that covers three decades: 1973 to 1999. The authors define the premium as the difference in percentage between the final price and the share price of the target 40 days before the announcement of the offer. They estimate the average premium for their entire sample at 53%. However, the premium varies considerably, ranging from a maximum of 103% in 1976 to a minimum of 22% in 1991.

Given that the *runup* (see the definition below) in the share price of the target is manifested mainly after the 42nd day before the announcement (Schwert, 1996), we use the p

rice on this date as the reference price to set the premium because it reflects the value the shareholders attribute to the company before the rumors. We therefore define the premium as follows: $\ln\ (\mathit{Final\ price} / \mathrm{Price}_{-42})$ where Price_{-42} represents the share price of the target, adjusted for splits and dividends, on the 42nd day before the announcement. This definition was also used by Betton, Eckbo and Thorburn (2008).

4.2. Determinants of the premium

4.2.1. Information asymmetry

The Blockholders variable is used to measure the effect of information asymmetry. We therefore capture the information asymmetry between bidders by identifying the buyer that holds a block of the target's shares before making the offer. The purchase of a block of shares is public information because it requires buyers to complete a report with the *Securities and Exchange Commission* (SEC) describing their intentions. The public nature of our information asymmetry variable is crucial because we assume, as in an English auction, that the informed participant's identity is known by all the players. We thus predict a significant relation between the premium and blockholders.

The Blockholders variable is equal to 1 if the buyer holds a block (more than 5%) of the target's shares before making the offer. If this variable is significant, our result corroborates the theory that information asymmetry between potential buyers plays an important role in determining the premium. By analyzing the sign of this significant coefficient, we can deduce whether the buyers include a private component in their valuation of the target. A negative sign would imply an absence of significant private value. We also instrument the Blockholders variable as discussed in the next section.

4.2.2. Control variables

Several studies have sought to identify the factors that influence the price paid in a takeover transaction. Knowledge of these factors is crucial because it allows the parties to the transaction to set the fairest price possible. The determinants analyzed in the literature are mainly related to the characteristics of the target, the buyer and the transaction.

Runup

To measure the *runup* effect, Schwert (1996) estimates the *runup* as the cumulative abnormal return on the target's stock over a two-month period before the announcement. The lowest estimate implies that at least 67% of the run-up is added to the total price paid to acquire the target. Thus, a higher runup is associated with a higher premium paid to acquire a target. Betton, Eckbo and Thorburn (2009b) defined the runup as the logarithm of the ratio of the share price of the target on the day before the announcement to the share price 42 days before the announcement.

They conclude that the higher the runup, the higher the premium paid to acquire the target. An increase of $1.00 of runup creates an average premium increase of $0.80.

Like Schwert (1996), we use the cumulative abnormal return over a two-month period before the announcement to reflect the *runup* in the share price of the target. First we estimate, for each target, a model that links the return of the target (R_{it}) to the return of the S&P 500 index (R_{mt}), for a period ranging from the 379th day before the announcement until the 64th day before the announcement: $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ where t = -379 to -64. Using the estimated alpha and beta coefficients, we compute the error term of the market model for each target, for each day of the two-month period before the announcement. The error term corresponds to the abnormal return: $\varepsilon_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$ where t = -42 to -1. The *runup*, i.e. the cumulative abnormal return, is computed by summing the error terms: $Runup_i = \sum_{t=-42}^{-1} \varepsilon_{it}$. We posit that the premium a buyer pays increases with the runup of the share price of the target, which is consistent with the markup price effect identified by Schwert (1996).

Market-to-book ratio of the target

The *market-to-book* ratio is used in the literature to represent new growth opportunities for companies. Thus, buyers pay more for a target with a high *market-to-book* ratio because it offers new investment opportunities. Gondhalekar *et al*. (2004) test this hypothesis but do not obtain significant results. Betton *et al*. (2008) assert that if the market-to-book ratio of the target is higher than the median ratio of the industry, the target is a growth company relative to its competitors and should therefore command a higher premium. They find that a market-to-book ratio higher than the industry median is associated with a 3% increase in the premium. Comment and Schwert (1995) obtain a lower premium because some bidders may be attracted by firms that are undervalued by the market. We include the market-to-book ratio of the target in our analysis. We calculate this ratio at the end of the most recent fiscal year before the announcement of the transaction. The impact of this ratio on the premium is ambiguous. A negative relation should be anticipated between the market-to-book ratio and the premium if a low ratio illustrates the undervaluation of the target, whereas a positive relation between the market-to-book ratio and the premium should be seen if a low ratio signals restricted investment opportunities.

Sales growth of the target

The past performance of the target may have two opposite effects on the premium. First, buyers may be interested in targets that perform poorly because of the gains that could be realized if the current managers were replaced. In this case, the relation between the performance of the target and the premium is negative. Schwert (2000) analyzes the influence of past performance on the premium paid and obtains a negative but nonsignificant coefficient. Second, poor performance is often associated with fragile financial health, and is therefore likely to hinder the target's ability to negotiate. The relation between performance and the premium is thus positive. Like Bange and Mazzeo (2004), we measure past performance by sales growth during the fiscal year before the announcement of the offer, defined as: $\left(\text{Total sales}_t - \text{Total sales}_{t-1}\right)/\text{Total sales}_{t-1}$ where *t* represents the most recent fiscal year before the announcement (Shleifer, and Vishny (1994)).

Company size

The literature identifies two main variables that have been used to analyze the influence of company size on the premium paid. Some authors consider the size of the target directly, whereas others opt for a ratio of the size of the target to that of the buyer. Schwert (2000) and Comment and Schwert (1995), among others, use a direct measure of the target size and conclude that this variable has a significant negative effect on the premium because larger targets are associated with higher integration costs. Gondhalekar, Sant and Ferris (2004) and Moeller (2005) study a relative size variable and report an adverse effect of target size on the premium.

Consistent with Comment and Schwert (1995), we measure the target size as the logarithm of the total assets, and employ this variable at the end of the most recent fiscal year before the bid. We also use a ratio of the size of the target to that of the buyer. Specifically, the relative size is calculated by comparing the market value of the shares of the target to the market value of the buyer's stock. The market value is obtained at the start of the runup period, namely two months before the announcement. We assume that the size variables are negatively linked to the premiums paid by the buyer.

Financial synergies

The debt level of the parties to the transactions illustrates their financial health. Gondhalekar *et al.* (2004) propose that the buyer's leverage can influence the premium paid. Considerable leverage will probably be associated with closer monitoring of the company's operations by creditors. Creditors will, in turn, try to prevent the buyer from paying an overly high premium. They identify a significant negative influence of the buyer's debt ratio on the premium paid. A target that has considerable debt is less attractive, and the premium paid to obtain it is lower. We therefore predict a negative influence of the two parties' debt ratio on the premium paid. We estimate the debt level, for each of the parties to the transaction, as the ratio of long-term debt to total assets at the end of the most recent fiscal year before the announcement of the acquisition.

Governance of the buyer

The price paid during an acquisition can also be dictated by the buyer's hubris or agency problems. The hubris hypothesis, introduced by Roll (1986), stipulates that managers that possess exaggerated self-confidence overestimate their ability to manage the target, which leads them to pay considerable amounts to acquire it. Hayward and Hambrick (1997) examine the influence of CEO hubris on the premium paid during large acquisitions. They confirm that hubris is associated with a higher premiums paid. We use the return on the buyer's stock for a six-month period before the runup period, namely the return adjusted for splitting and dividends between the eighth and second month before the announcement. We thus posit that the recent performance of the organization, which leads managers to overestimate their ability to manage the target, is positively associated with the premium paid.

Agency problems can also influence the acquisition process. Such conflicts occur when the buyer's managers use the company's free cash flows to undertake projects that generate few profits for shareholders, consistent with Jensen (1986). Gondhalekar, Sant and Ferris (2004) argue that one implication of agency problems is that buyers characterized by a low market-to-book ratio but large free cash flows will favor more aggressive acquisition approaches and therefore pay higher premiums. To analyze the impact of governance problems, we include the buyer's free cash flows. Managers can use these cash flows to purchase a company at a high price, to serve their own interests. We expect a positive relation between the premium paid and the ratio of free cash flows to total assets.

Company managers that possess considerable free cash flows are more likely to pay a higher premium if investment opportunities are limited. Consequently, we include the market-to-book ratio of the buyer's assets at the end of the most recent fiscal year before the bid to control for growth opportunities. The numerator represents the market value of the assets, which is calculated as the book value of the assets, from which we subtract the book value of the equity and add the market value of the equity. The denominator is defined as the book value of the assets. We predict a negative influence of the buyer's market-to-book ratio on the premium.

Hostility

A target that receives a takeover bid can either accept the transaction or reject it aggressively. Schwert (2000) maintains that a hostile reaction is intended to prevent the acquisition or initiate negotiation of a better offer. Accordingly, hostility is a negotiation strategy intended to increase the price the buyer pays. Schwert also affirms that the hostile reaction is intended to decrease the probability of success of the transaction. Nonetheless, the author concludes that a manifestation of hostility seems to be mainly linked to strategic negotiation. Using the definition of hostility proposed by SDC Platinum, Moeller (2005) finds that hostile transactions command a higher premium.

We use one of the five definitions put forth by Schwert (2000) to characterize the hostility of the transaction. We create an indicator variable that takes the value of 1 when the transaction is defined as hostile according to SDC Platinum. This database defines a hostile transaction as an unsolicited offer that the board of directors of the targets rejects. We anticipate a positive relation between hostility and the premium in line with Schwert's (2000) assertion that hostility is a negotiation strategy intended to increase the price paid by the buyer.

Buyer's strategies

Potential buyers may choose to either negotiate with the managers of the target or to make a tender offer to shareholders. Public takeover bids do not require approval by the board of the target and are therefore quicker. Betton *et al*. (2008) identify a 6.1% drop in premium if potential buyers decide to make a public takeover offer. Moeller (2005) also reports that a public purchase offer has a negative impact on the premium, whereas Comment and Schwert (1995), Schwert (2000) and Bange and Mazzeo (2004) obtain a positive influence for a public offer. We use an indicator variable with a value of one for a public takeover offer and do not predict a net effect.

Potential buyers also choose the payment method. Slusky and Caves (1991), Comment and Schwert (1995, 2000) and Betton, Eckbo and Thorburn (2008) conclude that a wholly cash payment, which implies a prominent tax effect, increases the premium significantly. We control for the process by creating an indicator variable that equals 1 if the transaction is fully paid in cash. The influence of this variable on the premium paid is assumed to be positive.

The presence of more than one potential buyer creates competition that could increase the premium that the target could obtain from the buyer. We consequently include an indicator variable that equals 1 if a third party has submitted an offer for the target while the first buyer's offer is still pending. We predict a positive relation between the presence of several buyers and the premium. Table 2 summarizes the above discussion.

Table 2: DESCRIPTION OF INDEPENDENT VARIABLES

Independent variable	Predicted sign	Construction method and data source
1) Information Asymmetry		
Blockholders Low private value	Non-zero –	Indicator variable that takes the value of 1 if the buyer owns at least 5% of the shares of the target before the announcement. Note that this variable is also instrumented. See 5) below.
2) Target		
Runup	+	Cumulative abnormal return on the period ranging from the 42nd day before the announcement to the last day before the announcement. Source: CRSP
Market-to-book	Uncertain	Number of common shares outstanding (Compustat #25) × Share price (Compustat #24)/Book value of equity (Compustat #60).
Sales growth	Uncertain	Total sales (Compustat #12) at time t – Total sales at time t – 1/Total sales at time t – 1 where t represents the end of the most recent fiscal year before the announcement of the transaction
Size	–	Logarithm (Total assets (Compustat #6))
Leverage	–	Long-term debt (Compustat #9)/Total assets (Compustat #6)
3) Buyer		
Return on stock	+	(Buyer's share price 42 business days before the offer – Buyer's share price 168 business days before the offer)/Buyer's share price 168 business days before the offer. Source: CRPS
Free cash flows	+	Operating income before depreciation (Compustat #13) – Total income taxes (CST #16) – Change in tax credits and deferred investments (CST #35) – Interest expenses (CST #15) – Preferred dividends (CST #19) – Common dividends (CST #21)/Total assets (CST #6)
Market-to-book	–	Total assets (Compustat #6) – Book value of equity (CST #60) – Number of common shares outstanding (CST #25) × Share price (CST #24)/Total assets (Compustat #6)
Relative size	–	(Target: Number of common shares outstanding (CST #25) × Share price 42 days before the announcement (CRSP))/ Buyer: Number of common shares outstanding (CST #25) × Share price 42 days before the announcement (CRSP))
Leverage	–	Long-term debt (Compustat #9)/Total assets (Compustat #6)
4) Transaction		
Public purchase offer	Uncertain	Indicator variable that takes the value of 1 if the transaction is in the form of a public purchase offer
Cash payment	+	Indicator variable that takes the value of 1 if the transaction is fully paid in cash
Hostility	+	Indicator variable that takes the value of 1 if SDC Platinum describes the offer as hostile.
Multiple players	+	Indicator variable that takes the value of 1 if a third party has submitted an offer for the target whereas the first buyer's offer is still pending

Independent variable	Predicted sign	Construction method and data source
5) Instrumental variables discussed in Section 5		
Intrastate	+	Indicator variable that takes the value of 1 if the target and the blockholders are from the same state (Compustat).
Regulated industry	+	Indicator variable that takes the value of 1 if the target is regulated (SIC code begins with 4 or 6).
Intrastate × performance	–	Variable equal to the product of targets' performance and a dummy variable indicating that the target and the blockholders are from the same state. Performance of the target is measured by Operating income before depreciation (Compustat #13)/Total assets (Compustat #6).

This table presents the independent variables of our study, the hypotheses about their influence on the premium paid and the method used to construct the variables. All accounting ratios were computed from data gathered at the end of the most recent fiscal year before the announcement of the offer. Data sources are also indicated.

5. Methodology

In this section we specify the econometric models used in the study. We describe our sample in detail and present descriptive statistics of the premium and the independent variables of our model.

5.1. Econometric models

We postulate a linear relationship between the premium and the candidate explanatory variables identified in the previous section. Let X_i denote a row vector that contains all the regressors listed in Table 2, including the constant but excluding *Blockholders*$_i$. Then, the model becomes:

$$Y_i = X_i\underline{\beta} + \beta_{15}Blockholders_i + \mu_i, \tag{8}$$

where $Y_i = Premium_i$ and $\underline{\beta} = (\beta_0, \dots \beta_{14})'$. The test for the null hypothesis (H_0) of no information asymmetry consists in verifying $\beta_{15} = 0$ against the alternative (H_1) $\beta_{15} \neq 0$.

It is straightforward to estimate this model by ordinary least squares. However, there are reasons to suspect that the blockholders dummy variable is correlated with unobservable factors in (8), in which case the ordinary least square estimate of β_{15} would be biased. For instance, blockholders may submit bids during the acquisition process because they want to be more active in a particular industry, and the current offer by a competitor may reduce this opportunity. The endogeneity of $Blockholders_i$ would imply that $E(\mu_i | X_i, Blockholders_i) \neq 0$. Below, we examine two approaches to deal with this endogeneity issue.

5.1.1. Treatment effect approach

The endogeneity of the $Blockholders_i$ variable can be dealt with in line with the literature on the treatment effect (Heckman, 2001). Indeed, the presence of blockholders in an auction may be viewed as a "special treatment" that affects the distribution of the error term in (8) such that:

$$Y_i = X_i\underline{\beta} + \beta_{15} + \mu_{1i} \stackrel{\text{def}}{=} Y_{1i}, \qquad if\ Blockholders_i = 1, and$$

$$Y_i = X_i\underline{\beta} + \mu_{0i} \stackrel{\text{def}}{=} Y_{0i}, \qquad if\ Blockholders_i = 0,$$

where μ_{0i} and μ_{1i} are errors with potentially distinct distributions. One may further ask the following question: Is there any hidden self-selection effect in the process that drives the presence of blockholders in auctions? Indeed, blockholders may be keener to attend auctions where their informational advantage is higher. As a result, their ability to lower the premium would be higher for the auctions in which they participate to win than in other auctions.

According to the treatment effect formulation, the error term of (8) is given by:

$$\mu_i = \mu_{1i}Blockholders_i + (1 - Blockholders_i)\mu_{0i}. \tag{9}$$

To estimate the coefficients of (8) by OLS, the initial set of predictors is augmented with a set of instruments or exclusion variables denoted Z_i. Consequently, the premium can be represented as:

$$Y_i = X_i\underline{\beta} + \beta_{15}Blockholders_i + E(\mu_i|X_i, Z_i, Blockholders_i) + \tilde{\mu}_i, \tag{10}$$

where the new error satisfies $\tilde{\mu}_i = \mu_i - E(\mu_i|X_i, Z_i, Blockholders_i)$ so that $E(\tilde{\mu}_i|X_i, Z_i, Blockholders_i) = 0$. For estimating (10), we assume the existence of a latent variable k_i such that $Blockholders_i = 0$ if $k_i \leq 0$ and $Blockholders_i = 1$ if $k_i > 0$. This latent variable further satisfies:

$$k_i = X_i\underline{\delta} + Z_i\underline{\gamma} + e_i, \tag{11}$$

where $e_i \sim N(0,1)$ and $\underline{\delta}$ and $\underline{\gamma}$ are vectors of parameters.

We estimate (11) by Probit using three variables as instruments: *(i)* Intrastate, *(ii)* Regulated industry and *(iii)* an interaction variable between Intrastate and Performance of the target. The first variable comes from the contribution of Kang and Kim (2009). They document that blockholders prefer targets in the same state because proximity reduces the transaction costs yielding higher returns. They also show that the monitoring of intrastate firms is more valuable for targets that have greater asymmetric information, such as targets with poor past performance. Blockholders are consequently more likely to buy shares in intrastate underperforming firms to better exploit their informational advantage. Blockholders may be more present in poorly performing targets of their state because they have a higher probability of obtaining long-run value by exploiting asymmetric information with other competitors. The other variable controls for the fact that the industry of the target is regulated. Blockholders should better exploit their informational advantage for these firms because they are more knowledgeable about the different laws regulating the target. Considering only auctions where blockholders are present, the effect of their presence compared to the outcome if they were absent is given by:

$$E(Y_{1i} - Y_{0i} | X_i, Z_i, Blockholders_i = 1) = \beta_{15} + (\lambda_1 - \lambda_0) \frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)}.$$

Likewise, considering only auctions where blockholders are not present, the presence of blockholders would have induced the following effect:

$$E(Y_{1i} - Y_{0i} | X_i, Z_i, Blockholders_i = 0) = \beta_{15} - (\lambda_1 - \lambda_0) \frac{\varphi(\hat{\eta}_i)}{1 - \Phi(\hat{\eta}_i)}.$$

Accordingly, the average effect of the presence of blockholders on the premium is:

$$E(Y_{1i} - Y_{0i} | X_i, Z_i) = \beta_{15}.$$

Finally, the equation that lets us estimate all parameters without bias is given by:

$$Premium_i = X_i \underline{\beta} + \beta_{15} Blockholders_i + IMR_i \underline{\lambda} + \tilde{\mu}_i, \tag{12}$$

where $\underline{\lambda} = (\lambda_1, \lambda_0)$, $IMR_i = [IMR_{1i}, IMR_{0i}]$, $IMR_{1i} = \frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)} Blockholders_i$, and $IMR_{0i} = \frac{-\varphi(\hat{\eta}_i)}{1-\Phi(\hat{\eta}_i)}(1 - Blockholders_i)$.

5.1.2. A Two-Stage Least Squares (2SLS) approach

Given that $Blockholders_i$ is a binary variable, we consider two approaches to proxy its expectation conditional on X_i and Z_i. The first approach relies on the linear probability model (LPM):

$$Blockholders_i = X_i \underline{\delta} + Z_i \underline{\gamma} + e_i, \tag{13}$$

from which the fitted values are deduced as $\widehat{Blockholders}_i = X_i \underline{\hat{\delta}} + Z_i \underline{\hat{\gamma}}$. The second approach is based on the Probit model presented in the previous subsection, from which fitted values are deduced as $\widehat{Blockholders}_i = \Phi(\hat{\eta}_i)$. Either the LPM or the Probit model is a good proxy for $E(Blockholders_i = 1 | X_i, Z_i)$. Hence, the first-stage functional form does not affect the consistency of the second-stage estimates (Angrist and Krueger, 2001). The second stage estimating equation is:

$$Y_i = X_i \underline{\beta} + \beta_{15} \widehat{Blockholders}_i + \check{\mu}_i. \tag{14}$$

We apply two formal tests to assess the validity of the results: Sargan's over-identifying restrictions test for the exogeneity of the instruments (H0: the instruments are exogenous) and the Durbin-Wu-Hausman test for the relevance of the instrumental variable method (H0: the *Blockholders* variable is exogenous). These tests are performed only within the 2SLS approach that relies on the LPM at first stage.

Dionne, Gouriéroux and Vanasse (henceforth, DGV, 2001; see also Blundell and Smith, 1989) propose the following extension of Equation (14) to make it robust to nonlinearities within the framework that employs a Probit at first stage:

$$Y_i = X_i\underline{\beta} + \tilde{\beta}_{15}\Phi(\hat{\eta}_i) + \beta_{15}Blockholders_i + \mu_i. \quad (15)$$

By adding and subtracting $Blockholders_i - \Phi(\hat{\eta}_i)$ to $\Phi(\hat{\eta}_i)$, Equation (15) becomes:

$$Y_i = X_i\underline{\beta} + (\beta_{15} + \tilde{\beta}_{15})Blockholders_i - \tilde{\beta}_{15}(Blockholders_i - \Phi(\hat{\eta}_i)) + \mu_i. \quad (16)$$

$Blockholders_i$ is endogenous if $\tilde{\delta}$ is significantly different from zero. By comparing (16) and (17), we see that $Blockholders_i$ is endogenous if $\tilde{\beta}_{15}$ is significantly different from zero in the model of DGV. In that event, the (unbiased) coefficient of $Blockholders_i$ is equal to $\beta_{15} + \tilde{\beta}_{15}$ as indicated by (16).

5.2. Sample formation

The sample was derived from three databases. First we identified takeover transactions through the Thomson Financial SDC Platinum database. We targeted successful transactions that occurred between January 1, 1990 and December 31, 2007, involving American public targets and buyers. We included only transactions in the form of mergers, acquisitions of a majority interest, acquisitions of total assets or acquisitions of particular assets.[4] Further, we chose only transactions intended to take control of the company and therefore we require that the buyer hold less than 50% of the shares of the target before the acquisition. We initially observed 5,984 takeovers. Given that we are investigating the premium and its determinants, it is crucial to know the price that the buyer paid to take control of the target. After eliminating transactions for which this information was not available, we obtained a sample of 4,879 takeovers.

We also eliminated transactions for which information about the transaction was not available in SDC Platinum. Accordingly, 478 observations were removed from the sample because they did not provide information

[4] We exclude transactions categorized as exchange offers, buybacks, recapitalizations, acquisitions (by the shareholders), acquisitions of remaining interest and acquisitions of partial interest.

on the indicator variables of public purchase offers, cash payments, hostility and multiple players. We then gathered accounting data concerning the targets and buyers using Compustat to test several hypotheses concerning determinants of the premium. Most accounting information pertained to the end of the most recent fiscal year before the announcement. However, we compiled data concerning sales, tax and deferred investment credits for the year before the most recent fiscal year before the announcement to test our hypotheses concerning growth of the target's sales and the buyer's free cash flows. Transactions for which accounting data were not available in the periods desired (2990) were eliminated.

Lastly, we obtain the sequence of share prices of the target and the buyer from the database of the *Center for Research in Security Prices* (CRSP). These prices were used to calculate the premium, the recent return on the buyer's stock and the runup of the target. We eliminated transactions for which information related to share prices of the parties involved was not available (385). We obtained a final sample of 1,026 takeover transactions for which all the data required to construct the variables of our model are available.

Half of the acquisitions in our sample occurred between 1996 and 2001. This period is marked by a concentration of transactions because it captures the wave of acquisitions that ended in 1999. This wave was caused in particular by increased consolidation of industries powered by globalization and a favorable economic environment. The periods of 1990 to 1995 and 2002 to 2007 were calmest regarding takeovers, with 16.18% and 33.53% respectively of the acquisitions in our sample. The largest number of transactions—129—occurred in 1999; this coincides with the peak of the wave of acquisitions identified in the literature. The year 1992 was the calmest, with a total of 14 takeovers.

5.3. Statistical description of the premium

The dependent variable of our model, namely the premium paid by the buyer, varies considerably. The average premium is 34.62%, and the standard deviation is 30.46%. The maximum premium paid by a buyer is 223.65%, whereas the lowest premium is –160.94%, which signifies that in some cases the buyers paid a price below the share value to acquire the target.[5]

[5] Given the significant variations in the premium, we perform a sensitivity test on the extreme values and present the results in Section 7. We also perform a sensitivity test on the extreme values for each of the independent variables related to the characteristics of the target and of the buyer.

5.4. Statistical description of the explanatory variables

Table 3 contains a statistical description of all of the explanatory variables of the model. Several variables have large standard deviations. We consequently include the median in the table. Our first finding is that the rumors preceding the announcement of an offer create an average runup of 8.4%, which indicates a strong positive reaction by the market. This cumulative abnormal return on the target's stock is nonetheless lower than that identified by Schwert (1996) for the period of 1975 to 1991, which was 13.3%. The runup varies considerably in our sample, and although it is generally positive, the minimum runup is -241%. The sensitivity analysis proves, however, that the result related to the runup is not influenced by this extreme value. Further, the market value of the target is on average almost four times higher than the book value. This mean market-to-book ratio probably does not reflect the reality of our sample owing to the presence of high extreme values. By comparison, the median market-to-book ratio is 2.13. The growth in median sales of the target is about 10%, which signals good financial health.

The typical buyer is in good financial health, with considerable free cash flows and solid stock return performance. The average performance of the buyer's stock in the six months preceding the runup period is 16%. Further, buyers and targets have a similar median market-to-book ratio, 1.83 vs. 2.13. The leverage of the targets and buyers is similar because debt represents 18% to 19% of their assets respectively. Given the similar debt structure of the parties to the transaction, it is improbable that the financial synergies identified by Slusky and Caves (1991) dictate the choice of the target and the price paid. The largest differences are seen in company size: on average, the targets are about one-quarter of the size of the buyers. The transactions included in our sample are often friendly and are negotiated with the managers of the target. Hostile offers represent barely 2% of acquisitions, and public purchase offers occur in 20% of the cases. Further, a potential buyer is rarely faced with competing offers because the presence of several buyers has been identified in only 5% of cases. Transactions paid entirely in cash represent 32% of takeovers.

Four percent of the buyers in our sample held a block of the target's stock before the announcement of the offer. This result differs from Betton *et al*. (2009), who conclude that between 1973 and 2002, 13% of the buyers held shares of the target before the announcement. The difference in the percentages is explained mainly by two factors aside from the fact that the variable used by Betton *et al*. (2009) includes all the shares held before the announcement, rather than only blocks of shares (≥ 5% of total shares).

Table 3: STATISTICAL DESCRIPTION OF THE INDEPENDENT VARIABLES

Independent variable	Mean	Standard deviation	Median	Minimum	Maximum
1) Target					
Runup	0.084	0.285	0.067	-2.409	1.677
Market-to-book	3.826	19.758	2.125	-95.472	536.733
Sales growth	0.238	1.029	0.103	-0.891	23.781
Size	5.385	1.756	5.244	0.105	11.696
Leverage	0.178	0.214	0.104	0.000	1.722
2) Buyer					
Return on stock	0.160	0.564	0.099	-0.807	13.948
Free cash flows	0.072	0.106	0.082	-0.824	0.358
Market-to-book	2.430	2.011	1.834	0.354	29.699
Relative size	0.254	0.377	0.117	0.000	4.046
Leverage	0.187	0.174	0.153	0.000	1.040
3) Transaction					
Public purchase offer	0.196	0.397	0	0	1
Cash Payment	0.316	0.465	0	0	1
Hostility	0.019	0.138	0	0	1
Multiple players	0.052	0.221	0	0	1
4) Information asymmetry					
Blockholders	0.040	0.196	0	0	1
5) Instruments					
Intrastate	0.22	0.42	0	0	1
Intrastate × performance	0.013	0.109	0	-1.473	0.616
Regulated industry	0.17	0.375	0	0	1

This table presents the descriptive statistics of the independent variables, namely the mean, standard deviation, median, minimum and maximum. These statistics were calculated based on our sample of 1026 takeover transactions between 1996 and 2007.

We observe that 22% of the blockholders come from the same state, which is similar to the 20% result of Kang and Kim (2008). 17% are from a regulated industry. To ensure that there is no perfect linear relation between the independent variables in (8), we estimated the matrix of correlation coefficients. Results are presented in on_line Appendix A. The highest significant correlation, 39%, is observed between the leverage of the target and the leverage of the buyer. Indebted buyers are therefore more inclined to bid on targets that possess considerable leverage, which hampers financial synergies posited by Slusky and Caves (1991). The second highest positive correlation is between the purchase offer and cash payment, 36.7%. Potential buyers therefore seem to believe that the optimal strategy consists in pairing the public purchase offer with cash payment.

6. Results

We first employ univariate analyses to establish the profile of informed transactions. Next, we conduct multivariate analyses based on the treatment effect, the OLS, the 2SLS and the Dionne et al. (2001, DGV) approaches to investigate the presence of asymmetric information and hidden self-selection effects. Robustness tests based on alternative model specifications and alternative definitions of the variables are presented in the next section.

6.1. Univariate results: Profile of informed transactions

Table 4 presents the means and medians of the variables studied according to the buyer's information level. We distinguish informed and uninformed transactions. A transaction is informed when the buyer holds a block of shares of the target before the announcement. The statistics elucidate differences between transaction types. We confirm these differences by performing the Mann-Whitney U test of the equality of medians.[6] The null hypothesis of this test stipulates that the data of informed transactions and those of uninformed transactions originate from independent samples with equal medians.

The premium paid by an uninformed buyer is about twice as high as that paid by an informed buyer. This statistical result supports the idea that information asymmetry between buyers influences the premium paid considerably. The difference between the premiums is significant at 1%. At first glance, the additional information possessed by a buyer that holds a block of shares seems to be advantageous because it lowers the premium. Further, the fact that the informed buyer pays a lower premium implies that uninformed potential buyers do not consider the private value of the target important as shown with the theoretical model.

Further, the median runup is markedly lower for informed transactions (-1.7%) than for uninformed transactions (7.2%), which signifies that investors respond less favorably to rumors of an acquisition by an informed buyer. The null hypothesis of equality of medians is rejected at 5%. The statistical results elucidate some characteristics of buyers that hold a block of shares of the target before the announcement. Not only are their free cash flows significantly lower than those of uninformed buyers, but their median market-to-book ratio is statistically lower. The market therefore overvalues the assets of informed buyers less strongly. Further, on average buyers bid on larger targets when they hold a block of shares, but the difference is not statistically different according to the equality of medians.

[6] We performed the Jarque-Bera test distinctly on each of the variables. The results indicate that none of the variables is normally distributed. We consequently opted for a non-parametric test.

Table 4: PROFILE OF INFORMED AND UNINFORMED TRANSACTIONS

	Mean		Median		
	Informed transactions	Uninformed transactions	Informed transactions	Uninformed transactions	Equality of medians
Premium	0.182	0.353	0.163	0.340	no***
Independent variable					
1) Target					
Runup	0.002	0.087	-0.017	0.072	no**
Market-to-book	3.875	3.824	1.995	2.129	yes
Sales growth	0.207	0.240	0.085	0.104	yes
Size	5.576	5.377	5.700	5.238	yes
Leverage	0.218	0.176	0.134	0.101	yes
2) Buyer					
Return on stock	0.141	0.161	0.085	0.099	yes
Free cash flows	0.063	0.072	0.066	0.083	no*
Market-to-book	1.941	2.450	1.519	1.846	no*
Relative size	0.313	0.251	0.117	0.118	yes
Leverage	0.222	0.185	0.169	0.152	yes
3) Transaction					
Public purchase offer	0.341	0.190	0	0	
Cash Payment	0.341	0.315	0	0	
Hostility	0.073	0.017	0	0	
Multiple players	0.049	0.052	0	0	
Number of observations	41	985			

This table presents the mean and median of the independent variables of our model for transactions in which the buyer holds at least 5% of the shares of the target before the announcement (informed), and for transactions in which the buyer does not have this percentage of the shares before the announcement (uninformed). The results of the Mann-Whitney U test of equality of medians are also presented. ***,**, * indicate that the null hypothesis of equality of medians is rejected at the level of confidence of 1%, 5% and 10% respectively.

We observe that informed buyers opt more often for a public purchase offer than do uninformed buyers. This type of approach, however, is not universal among informed buyers: it is used on average in 34% of the cases. Manifestations of hostility are also more frequent when the transactions are informed, but are nonetheless atypical (7.3%). Of the 41 blockholders who won the bid, 33% were from the same state as the target, while the corresponding percentage for all winners is 22.5%. The mean of the premium for blockholders in the same state that won the bid is 16.2% while the average premium is 34.62%.

6.2. Multivariate analyses

This section discusses the estimation results displayed in Table 5, which consists of the results for the standard OLS based on (8), the treatment effect approach based on (12), the 2SLS approaches (2SLS-LPM and 2SLS-Probit) based on (14) and the DGV model presented at (16).

6.2.1. Treatment effect approach

The results from all models in Table 5 clearly support our hypothesis that information asymmetry between potential buyers significantly influences the premium paid during an acquisition. This result is consistent with the theoretical and empirical studies (see Hendricks and Porter, 1988; Hong and Shum, 2003; Dionne *et al*., 2008) that find that information asymmetry between the participants influences the equilibrium price of an auction.[7]

The coefficient of the Blockholders variable (i.e., the average treatment effect) is negative ($\hat{\beta}_{15} = -0.308$) and significant at the 13% level, which suggests that the premium paid by an informed buyer is on average lower than that paid by uninformed buyers. This difference is explained by the fact that participants who do not hold additional information are afraid of suffering from the winner's curse, and thus withdraw early from the auction, which allows informed buyers to pay a lower premium. The literature review brought to light theoretical and empirical research that demonstrated that the winner's curse prevails when potential buyers do not consider the private value as important when determining the premium. Thus, our negative coefficient shows that in the auction process leading to an acquisition, the target is mainly appraised based on its common value. Elements such as portfolio synergies or cultural similarities do not seem to be relevant.

One may argue that a 13% significance level is quite lax compared with the conventional 10% and 5% levels. However, we must also consider the term $(\lambda_1 - \lambda_0)\frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)}$ which measures the informational advantage of blockholders in auctions where they are present. The coefficient λ_1 is estimated as 0.070 and non-significant at the 48% level, while λ_0 is estimated as 0.317 and significant at the 5% level. A formal one-sided test indicates that $\lambda_1 - \lambda_0$ is negative ($\hat{\lambda}_1 - \hat{\lambda}_0 = -0.247$) and significant at the 7.8% level. This provides evidence that an important

[7] The result can also indicate that blockholders have a competitive advantage that may reduce the outcome of an auction in presence of participation costs in the auction (Bulow et al., 1999; Ettinger, 2009). We cannot separate the two interpretations because we do not have access to participation costs, which are usually small. We argue that this competitive advantage is mainly explained by an information advantage, as shown in the recent financial literature discussed in the introduction.

part of the advantage granted by information asymmetry comes from the fact that informed buyers select strategically the auctions that they attend.

The total effect of the presence of blockholders (which includes the average treatment effect and the effect of the treatment on the treated) is estimated as:

$$\hat{\Delta} = \hat{\beta}_{15} + \left(\hat{\lambda}_1 - \hat{\lambda}_0\right) \frac{\sum_{i=1}^{n} \frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)} Blockholders_i}{\sum_{i=1}^{n} Blockholders_i} = -0.788$$

where $\frac{\sum_{i=1}^{n} \frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)} Blockholders_i}{\sum_{i=1}^{n} Blockholders_i}$ is the average of the ratio $\frac{\varphi(\hat{\eta}_i)}{\Phi(\hat{\eta}_i)}$ over the subsample of auctions where blockholders were present. The standard error of $\hat{\Delta}$ (0.13) was obtained using a cross-validation of estimating $\hat{\Delta}$ by leaving out one observation iteratively.

The model's adjusted R-square is equal to 0.27, compared with values of around 0.20 for the models tested by Slusky and Caves (1991), Comment and Schwert (1995), Gondhalekar, Sant and Ferris (2004) and Moeller (2005), and the value of 0.27 for the final offer premium in Betton et al. (2009). The latter model contains a toehold variable with a negative sign. However, the presence of a toehold is not instrumented in their model and is not associated with an asymmetric information problem in auctions.

Lastly, the coefficients of the three instruments are statistically significant in the Probit model that explains the presence of blockholders. Informed buyers tend to participate more in auctions held in their own state and in a regulated industry.[8] However, they are less active in auctions that concern well-performing targets in their own state. The other variables that determine the presence of informed buyers are runup (-), public purchase offer (+) and hostility (+).

6.2.2. OLS and 2SLS approaches

The coefficient of the Blockholders dummy variable in the OLS regression of Table 5 is quite low compared with all methods that rely on instrumental variables.

[8] One referee asked us to add the intrastate variable to the premium equation. This variable is not statistically significant in all models of Table 5. Results are available upon request.

Table 5: RESULTS - DETERMINANTS OF THE PREMIUM

	OLS	Treatment Effect		2SLS-LPM		2SLS-Probit	DGV-Probit
	Premium	Premium	Blockholders	Premium	Blockholders	Premium	Premium
1) Information asymmetry							
Blockholders	-0.136***	-0.308(*)		-0.704**		-0.670***	-0.117***
Intrastate × performance			-1.138**		-0.153**		
Regulated Industry			0.551***		0.056***		
Intrastate			0.519***		0.052***		
Prob(Blockholders=1)							-0.536***
IMR1		0.070					
IMR0		0.317**					
2) Target							
Runup	0.510***	0.485***	-0.679**	0.487***	-0.048**	0.487***	0.488***
Market-to-book	0.000	-0.000	0.001	0.000	0.000	-0.000	-0.000
Sales growth	-0.016**	-0.016**	0.007	-0.016*	0.001	-0.016**	-0.016**
Size	-0.011**	-0.011**	-0.022	-0.011*	-0.003	-0.011**	-0.011**
Leverage	-0.028	-0.015	0.249	-0.016	0.017	-0.016	-0.016
3) Buyer							
Return on stock	-0.001	-0.000	0.009	0.000	0.002	-0.001	-0.001
Free cash flows	0.095	0.091	0.754	0.089	0.053	0.090	0.090
Market-to-book	0.001	-0.001	-0.076	-0.001	-0.002	-0.001	-0.001
Relative size	-0.066***	-0.061***	0.083	-0.060**	0.014	-0.062***	-0.062***
Leverage	0.044	0.060	0.396	0.060	0.031	0.059	0.058
4) Transaction							
Public purchase offer	0.049**	0.068***	0.512***	0.070***	0.046***	0.067***	0.067***
Cash payment	-0.030	-0.033	-0.022	-0.032	-0.001	-0.033	-0.033
Hostility	0.151**	0.198***	0.701**	0.209***	0.108**	0.204***	0.203***
Multiple player	-0.009	-0.019	-0.129	-0.022	-0.019	-0.020	-0.020
Constant	0.372***	0.399***	-2.058***	0.394***	0.017	0.396***	0.395***
(Adjusted or Pseudo) R^2	0.273	0.275	0.109	0.270	0.027	0.271	0.276
Sargan test					0.5477		
Durbin-Wu-Hausman test					0.0315		
Number of observations	1,026	1,026	1,026	1,026	1,026	1,026	1,026

This table presents the results of the regression of ordinary least squares, the treatment effect approach, the 2SLS based on the LMP, the 2SLS based on the Probit and the Dionne, Gouriéroux and Vanasse (2001) model. The total number of observations is 1026. ***, **, * and (*) indicate that the coefficients are significant at 1%, 5%, 10% and 13% respectively. The statistics reported for the Durbin-Wu-Hausman test and the Sargan test are the p-values.

This suggests that the Blockholders variable is endogenous, as confirmed by the p-value of the Durbin-Wu-Hausman test and by the significance of the coefficient of $\Phi(\hat{\eta}_i)$ in the DGV model. Sargan's test indicates that the instruments used are truly exogenous. Note that we have implemented this test with the 2SLS-LPM model since it is designed for linear model. The results of the LMP are qualitatively identical to those delivered by the Probit. In particular, the coefficients of all three instruments are statistically significant and have the same signs as in the Probit.[9]

The effect of the presence of blockholders on the premium is estimated as -0.704 in the 2SLS-LPM and significant at the 5% level. This coefficient is estimated as -0.670 in the LPM-Probit and significant at the 1% level. In the DGV model, the overall effect of the presence of blockholders is equal to -0.653 and is obtained by summing the coefficient of $\Phi(\hat{\eta}_i)$ and that of $Blockholders_i$. We see that these three numbers are quite comparable and similar to the total effect estimated with the treatment effect model. The adjusted R-squares are approximately equal to 27% for all models, which suggests that the 2SLS approaches have as much explanatory power as the treatment effect approach. However, as illustrated in the previous subsection, the latter approach provided us with a richer framework because it allows us to decompose the overall effect of informational advantage into exogenous and endogenous parts.

6.2.3. Effects of control variables

The estimated coefficients of all other explanatory variables show very little variations across the models that rely on the instrumental variables. This confirms that the consistency of the second stage estimation does not depend on the functional form of the first stage. The results presented in Table 5 are consistent with the theories found in the literature on mergers and acquisitions. Our results support the markup pricing hypothesis formulated by Schwert (1996), whereby potential buyers adjust their offer to movements in the share price of the target triggered by rumors of a transaction. In our model, the premium is higher when the cumulative abnormal return of the target in the two months preceding the announcement increases. This relation is significant at 1% in all models. The target is therefore revalued considerably when there is a runup in the share price.

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[9] Our over-identification test has the potential weakness of not having power against the alternative that all instruments are invalid. However, this alternative is not necessarily pertinent here because intrastate and regulation dummy variables are valid under different economic conditions. Moreover, the two variables *Intrastate* and *Regulated Industry* are not correlated. The coefficient of *Regulated Industry* in a simple logit estimation explaining *Intrastrate* is equal to -0.09 with p-value of 0.66.

Our results are also consistent with the findings of Morck, Shleifer and Vishny (1988). Targets that perform poorly command a higher premium because buyers can replace the managers and thus increase the firm value. For the transactions in our sample, a decrease in the growth of the sales of the target in the year preceding the announcement triggers a premium increase at 10% (or better). Thus, fragile financial health, which can be associated with slowed growth in sales, does not seem to impede the negotiating power of the targets. Rather, buyers are more interested in the potential of a target with weaker performance.

The absolute size of the target also negatively influences the premium, which supports the idea that buyers fear the higher integration costs associated with larger targets. This relation is significant at 10% (or better). Similarly, the size of the target relative to the buyer (Relative size) is also negatively related to the premium, at 5% (or better). The two results pertaining to the size variable are consistent with our hypotheses, and validate the theory of integration costs.

In addition, we observe that the debt level of the target, which directly influences the free cash flows available to the buyer, weakens the buyer's negotiating power. A highly indebted target draws a lower premium from the buyer because of its more fragile financial health. However, this result is not as significant as the next two (Buyer Leverage and Buyer Free cash flows). Buyers that possess considerable leverage are not constrained to pay a lower premium because of more intense surveillance by creditors. On the contrary, highly indebted buyers can pay a higher premium. Thus, buyers with considerable leverage seem to benefit from a greater possibility of contracting debt, and may use this advantage to pay a higher premium. We also observe that an increase in the buyer's free cash flows is associated with a higher premium.

Our results are consistent with several hypotheses pertaining to the attributes of the transaction. First, buyers that opt for a public purchase offer pay a higher premium than buyers that negotiate with managers of the target. Advantages linked to the speed of execution of a transaction in the form of a public purchase offer are therefore attenuated by the higher premium that buyers must pay. This positive relation between the premium and choice of a public purchase offer, significant at 5% (or better), is in line with the results obtained by Comment and Schwert (1995), Schwert (2000) and Bange and Mazzeo (2004).

Contrary to our predictions, we observe that transactions paid entirely in cash command a lower premium. The premium paid during cash-based transactions is lower than the premium on share-based transactions. However, this relation is not significant at the usual confidence levels. The tax disadvantages for shareholders of the target associated with the cash payment therefore do not play a significant role in determining the premium. Our results indicate that the shareholders of the target try to avoid uncertainty about the future value of the shares associated with share-based bids.

Like Schwert (2000), we note that hostile transactions are associated with a higher premium. Hostile offers trigger a higher premium than do friendly offers. This relation is significant at a confidence level of 5% (or better) and has a similar degree of influence to that determined by Schwert (2000), who used the definition by SDC Platinum.

7. Robustness tests

The variables of our initial model were constructed based on the most pertinent calculation methods found in the literature. Other variables could have been used to test the hypotheses. In this section, we perform robustness tests on the dependent variable and the independent variables to validate our results. We also perform sensitivity tests on the extreme values of the dependent variable and the independent variables. All robustness regressions are performed with the 2SLS models. Some are also conducted with the OLS model. The results are then compared with the corresponding model in Table 5. Our conclusion about the effect of information asymmetry remains robust across all these regressions.

7.1. Definition of the dependent variable

Initially, we define the premium as a logarithm of the ratio of the price offered to the share price of the target 42 business days before the announcement of the offer. Similar empirical studies employ different temporal points of comparison for the premium paid. We validate our results by comparing the price offered with the share price of the target 60 days before the announcement, as did Betton and Eckbo (2000).

The Premium 60 columns in Table 6 show the results. Our conclusion about the effect of information asymmetry remains robust when the 60-day premium is used. With a few exceptions, the coefficients of the other explanatory variables keep their signs and order of magnitude.

7.2. Sensitivity to extreme values of the dependent variable

Given that the descriptive statistics demonstrated a considerable standard deviation of the premium, we validate that our results are not attributable to the presence of extreme values in the dependent variable. We tested the sensitivity of the model to extreme values by eliminating the acquisitions for which the premium value is situated beyond the 1st and 99th percentiles. The results shown in Table 6 (Extreme values) are in line with those of the initial model. The coefficients of almost all variables keep their sign and magnitude.

7.3. Definition of the independent variables

We also validate that the results are not attributable to the method used to construct the independent variables. Appendix B shows and discusses the results of these robustness tests. Again, the Blockholders coefficient remains negative and significant when we apply different definitions for the independent variables. The results of the Sargan and Durbin-Wu-Hausman tests are also stable.

8. Conclusion

We model the corporate acquisition process as an English ascending auction owing to the presence of potential buyers. Our main objective is to analyze whether information asymmetry between potential buyers has a significant impact on the premium paid during acquisitions. Our second objective is to validate several determinants of the premium paid, which were identified in the empirical literature.

Our empirical analysis yields interesting conclusions related to the corporate acquisition process. First, we observe that information asymmetry between participants influences the premium paid during a takeover significantly. Informed buyers, that is buyers that hold at least 5% of the shares of the target before the announcement of the offer, pay a significantly lower conditional premium (around 70% lower) than do buyers that do not possess privileged information. Further, the analysis of this negative coefficient provides deep insight into the way the target is valued. Informed buyers pay a lower premium because participants that do not hold private information are afraid of suffering from the winner's curse (winning by bidding too high) and either withdraw from the auction early or do not participate. The winner's curse prevails among uninformed buyers when participants do not significantly factor private value into their valuation of the target. Our negative coefficient thus shows that in the auction process leading to an acquisition, the participants mainly consider the target's common value. They do not seem to use personal criteria such as portfolio synergies or cultural similarities in their valuation.

Table 6: OLS AND 2SLS-LPM ROBUSTNESS TESTS – DEPENDENT VARIABLE

	OLS		Treatment Effect		2SLS		2SLS Extreme values	
	Premium 60	Extreme values	Premium 60	Blockholders	Premium 60	Blockholders	Premium	Blockholders
1) Information asymmetry								
Blockholders	-0.155***	-0.125***	-0.361(*)		-0.930***		-0.701***	
Intrastate × performance				-1.138**		-0.154***		-0.163***
Regulated Industry				0.551***		0.057***		0.057***
Intrastate				0.519***		0.052***		0.054***
Prob(Blockholders=1)								
IMR1			0.081					
IMR0			0.446**					
2) Target								
Runup	0.482***	0.414***	0.446***	-0.679**	0.450***	-0.047**	0.388***	-0.051**
Market-to-book	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Sales growth	-0.009	-0.009	-0.010	0.007	-0.009	0.001	-0.009	0.001
Size	-0.007	-0.013**	-0.008	-0.022	-0.008	-0.002	-0.014***	-0.002
Leverage	-0.039	-0.015	-0.023	0.249	-0.022	0.018	-0.002	0.021
3) Buyer								
Return on stock	0.019	-0.003	0.019	0.009	-0.019	0.002	-0.002	0.003
Free cash flows	0.132	0.078	0.120	0.755	0.124	0.055	0.083	0.057
Market-to-book	-0.007	0.000	-0.010**	-0.076	-0.010*	-0.002	-0.002	-0.002
Relative size	-0.068**	-0.063***	-0.065**	0.084	-0.058*	0.015	-0.056**	0.015
Leverage	0.052	0.037	0.074	0.397	0.074	0.031	0.049	0.026
4) Transaction								
Public purchase offer	0.038	0.048***	0.065**	0.513**	0.066**	0.046***	0.069***	0.049***
Cash payment	-0.022	-0.030*	-0.027	-0.023	-0.025	-0.001	-0.033	-0.003
Hostility	0.122*	0.150***	0.187**	0.701**	0.200**	0.108	0.208***	0.106**
Multiple player	-0.023	-0.010	-0.036	-0.129	-0.041	-0.019	-0.025	-0.019
Constant	0.375***	0.397***	0.417***	-2.058***	0.406***	0.016	0.424***	0.013
R^2	0.208	0.254	0.211	0.100	0.207	0.027	0.252	0.030
Sargan test					0.179		0.454	
Durbin-Wu-Hausman test					0.008		0.007	
Number of observations	1,024	1,005	1,024	1,024	1,024	1,024	1,005	1,005

This table presents the results of the robustness test done with a 60-day premium, namely the price offered/price-60. The sample comprises 1,024 observations. The table also illustrates the sensitivity of the results to extreme values of the dependent variable by eliminating values beyond the 1st and 99th percentiles. The sample is then reduced to 1,005 observations. ***,**, * indicate that the coefficients are significant at 10%, 5%, and 1% respectively. The statistics reported for the Durbin-Wu-Hausman test and the Sargan test are the p-values.

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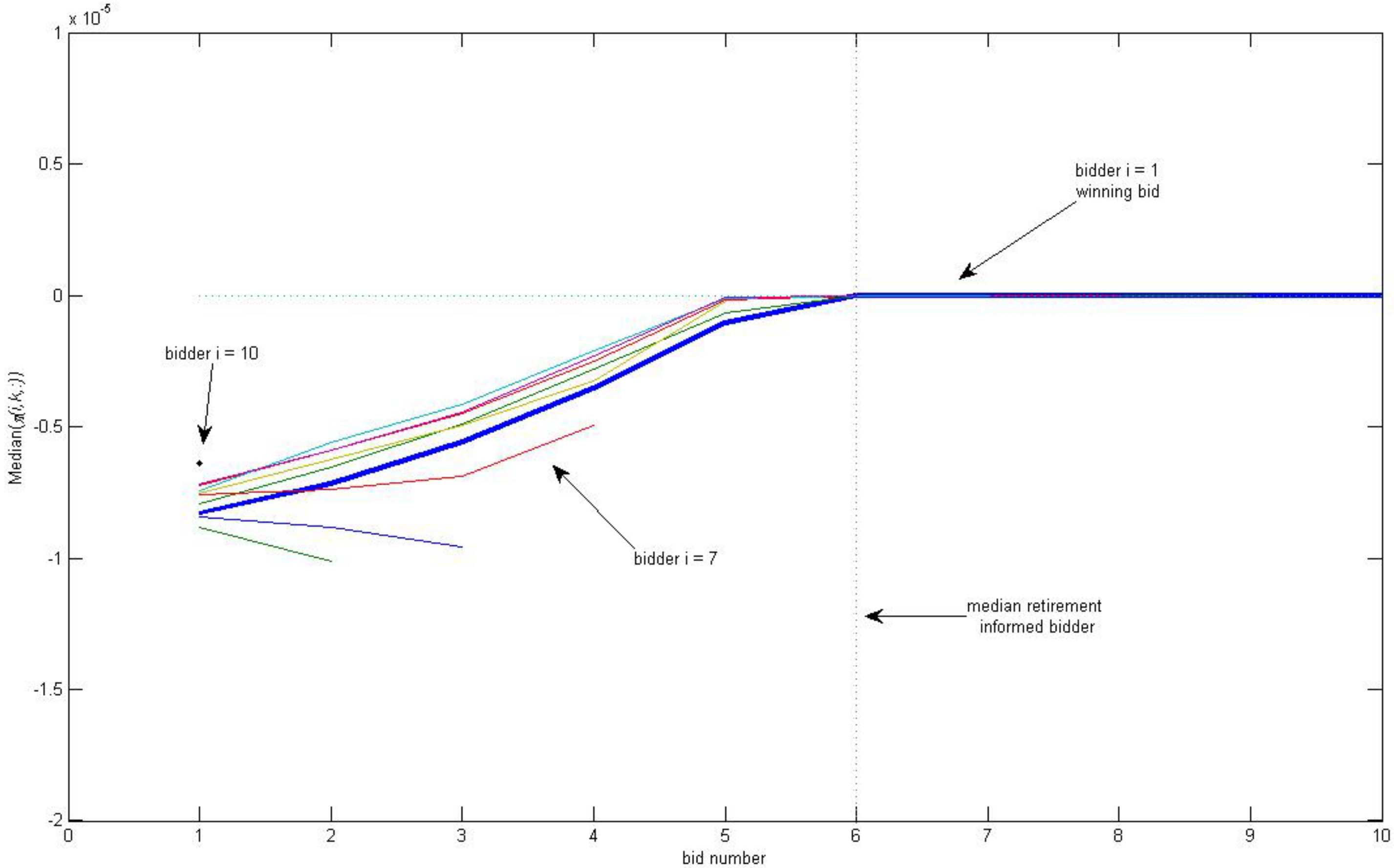

Figure 1: Median informed bidder premium. Each line corresponds to the median informed bidder premium. Median $\left(\pi\left(i,k,j\right)\right)$ where $\pi\left(i,k,j\right)$ is given in equation (6) and the premium is calculated for each agent i = 1, …, 10, at each round k.

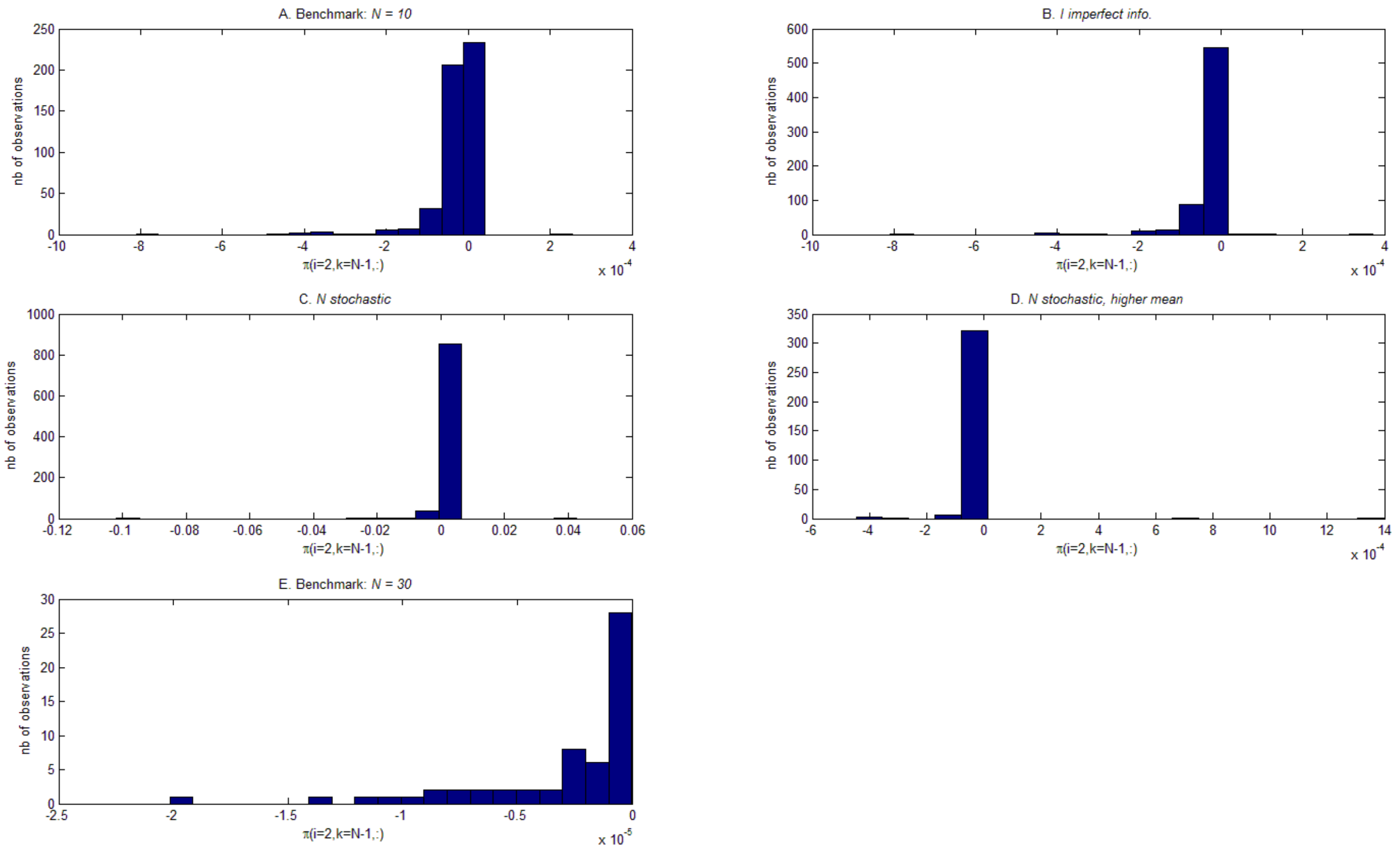

Figure 2: Distribution of equilibrium price premium conditional on I winning the auction. The equilibrium price in equation (7) is the second highest bid premium $\pi\left(i=2, k=N-1, j \middle| I=1, k=N\right)$ conditional on the informed bidder winning the auction. (A) Benchmark case, $N=10$, fixed; (B) Imperfect information a_I random, $\eta_I = 0.50\eta_i$, $N=10$; (C) $N \sim U[3,15]$ stochastic; (D) $N \sim U[10,15]$ stochastic; (E) Benchmark case, $N = 30$, fixed.

Appendix A: MATRIX OF CORRELATION COEFFICIENTS OF INDEPENDENT VARIABLES

	T Runup	T Market-to-book	T sales growth	T Size	T Leverage	B Return on stock	B Free cash flows	B Market-to-book	Relative size	B Leverage	Public purchase offer	Cash payment	Hostility	Multiple players	Blockholders (not instrumented)
Characteristics of the target															
Runup	1.000														
Market-to-book	-0.010	1.000													
Sales growth	0.046	0.042	1.000												
Size	-0.140*	0.032	-0.040	1.000											
Leverage	0.022	0.122*	0.057	0.257*	1.000										
Characteristics of the buyer															
Return on stock	0.018	0.017	0.015	-0.033	-0.031	1.000									
Free cash flows	0.068*	0.015	0.025	0.006	-0.081*	-0.061*	1.000								
Market-to-book	0.030	0.072*	0.123*	-0.173*	-0.1420*	0.118*	0.072*	1.000							
Relative size	-0.105*	-0.019	-0.011	0.253*	0.112*	0.052	-0.148*	-0.139*	1.000						
Leverage	0.003	-0.028	0.006	0.1529*	0.3900*	0.002	-0.099*	-0.214*	0.220*	1.000					
Transaction															
Public purchase offer	0.040	-0.031	0.012	-0.063*	-0.037	-0.056	0.054	-0.037	-0.097*	-0.061*	1.000				
Cash payment	-0.026	-0.020	-0.031	-0.165*	-0.205*	-0.076*	0.124*	-0.060*	-0.192*	-0.122*	0.367*	1.000			
Hostility	-0.019	-0.009	-0.018	0.128*	0.033	-0.022	0.008	-0.005	0.000	-0.007	0.161*	-0.005	1.000		
Multiple players	-0.014	-0.020	-0.025	0.113*	0.018	-0.040	0.007	-0.037	0.086*	-0.006	0.096*	-0.016	0.190*	1.000	
Information asymmetry															
Blockholders (not instrumented)	-0.058	0.000	-0.006	-0.006	0.038	-0.007	-0.017	-0.050	0.032	-0.042	0.075*	0.011	0.079	-0.003	1.000

This table presents the correlation coefficient between the independent variables of our model. *indicates a level of significance greater than or equal to 5%.

Appendix B

Table B1 presents the results regarding the definitions of the independent variables.

Details on the independent variables

Sales growth

We use the **Return on equity** of the target, defined as the ratio of income before extraordinary items to the book value of the equity, to reflect the past performance of managers of the target rather than sales growth. This variable supports the hypothesis that the acquisition of poorly managed targets is motivated by realizable gains if the current managers are replaced (Cudd and Duggal, 2000). The coefficient of return on equity is not significant, however.

Financial synergies

We confirm the results associated with leverage of the parties to the transaction by replacing long-term debt with **Total liabilities**. For the indebtedness of the target (T leverage), the influence on the premium remains negative and non-significant. Regarding the buyer's leverage (B leverage), the use of **Total liabilities** doubles the positive coefficient and makes it significant at 5%.

Company size

We confirm that a small target draws a higher premium because of lower integration costs. We obtain a negative and significant coefficient for the size of the target (**Size market value**), which is defined as the logarithm of the market value of common shares outstanding. This alternative size variant creates a slightly lower coefficient, significant at 1% rather than 5%. Further, the robustness test done on the relative size variable (**Relative size II**) corroborates our initial results. By comparing total assets of the target with those of the buyer, we estimate a negative coefficient. However, it is no longer significant.

Table B1: 2SLS-LPM ROBUSTNESS TESTS – ALTERNATE DEFINITION OF THE INDEPENDENT VARIABLES

	2SLS (Sales growth)	2SLS (T leverage)	2SLS (B leverage)	2SLS (T size)	2SLS (Hostility I)	2SLS (Hostility II)	2SLS (Relative size)
1) Information asymmetry							
Blockholders	-0.641*	-0.663**	-0.716**	-0.730**	-0.697**	-0.766**	-0.685**
2) Target							
Runup	0.487***	0.492***	0.483***	0.477***	0.487***	0.487***	0.494***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth		-0.016*	-0.016*	-0.015*	-0.016*	-0.016*	-0.016*
Return on equity	**-0.001**						
Size	-0.011**	-0.010*	-0.015**		-0.012**	-0.010*	-0.013**
Size market value				**-0.018*** **			
Leverage	-0.022		-0.015	-0.022	-0.016	-0.010	-0.010
Total liabilities		**-0.032**					
3) Buyer							
Recent performance	0.000	-0.001	0.001	0.001	-0.001	-0.001	-0.002
Free cash flows	0.085	0.085	0.104	0.112	0.087	0.086	0.100
Market-to-book	-0.002	-0.002	0.001	0.001	-0.001	-0.001	0.000
Relative size	-0.061**	-0.062**	-0.052**	-0.049**	-0.061**	-0.061**	
Relative size II							**-0.004**
Leverage	0.057	0.058		0.066	0.056	0.055	0.037
Total liabilities			**0.100****				
4) Transaction							
Public purchase offer	0.067**	0.070***	0.069***	0.069**	0.074***	0.074***	0.071***
Cash payment	-0.031	-0.034	-0.033	-0.033	-0.034	-0.035	-0.026
Hostility	0.204***	0.205***	0.211***	0.223***			0.212***
Unsolicited offer					**0.157****		
Poison pill						**0.264****	
Multiple player	-0.019	-0.022	-0.021	-0.021	-0.052	-0.002	-0.028
Constant	0.391***	0.403***	0.365***	0.422***	0.398***	0.394***	0.390***
R^2	0.270	0.272	0.273	0.269	0.268	0.269	0.264
Sargan test	0.526	0.591	0.403	0.529	0.571	0.646	0.747
Durbin-Wu-Hausman test	0.090	0.052	0.029	0.025	0.031	0.021	0.040
Number of observations	1,026	1,026	1,026	1,026	1,026	1,026	1,026

We perform robustness tests with the 2SLS method by using alternate independent variables. Regarding the characteristics of the target, we test for sales growth, size and leverage. We also test the robustness of the relative size, leverage of the buyer, and hostility of the transaction (Unsolicited offer and Poison pill). Results of the instrumental equation are not presented but are available. The statistics reported for the Durbin-Wu-Hausman test and the Sargan test are the p-values.

Hostility

The robustness tests done on the hostility variable are satisfactory. First, we created an indicator variable that takes the value of 1 when the offer is unsolicited (**Unsolicited offer**), i.e. when the offer comes as a surprise to the Board of Directors of the target and no recommendation is formulated. We confirm the positive and significant impact of this form of hostility on the premium (Hostility I). Nonetheless, the coefficient is reduced by about half and becomes significant at 5% rather than 1%. Further, the use of a "**Poison pill**" by the target, a defense method often associated with hostility, has a positive and significant influence on the premium (Hostility II).

Sensitivity to extreme values of the independent variables

Table B2 shows the results obtained for the 2SLS-LPM model when extreme values beyond the 1^{st} and 99^{th} percentiles were eliminated. Most of our results are robust to the sensitivity test of the extreme values on the independent variables related to the characteristics of the target. The elimination of extreme values of the runup, size of the target and leverage influences the results very little. The effect of the sensitivity test is more evident in the market-to-book ratio of the target, which becomes negative but not significant. The greatest influence of the sensitivity test is seen in the target's sales growth. The coefficient is no longer significant, whereas the buyer's free cash flows become significant. Thus the extreme values markedly influence the results related to sales growth.

Further, we observe that our results are also robust to the sensitivity test of extreme values done on the independent variables related to the characteristics of the buyer. Apart from the coefficients of the buyer's market to book and leverage, which change signs but remain non-significant, the results related to the buyer's characteristics are not influenced by extreme values. In all cases, the coefficient of the Blockholders variable is not significantly affected, nor are the values of the tests.

Table B2: 2SLS-LPM SENSITIVITY TEST OF THE EXTREME VALUES OF THE INDEPENDENT VARIABLES

Independent variable	Initial model	Runup	T-Market-to-book	Sales growth	Size	T-Leverage
1) Information asymmetry						
Blockholders	-0.704**	-0.588**	-0.575**	-0.598**	-0.719**	-0.514**
2) Target						
Runup	0.487***	**0.426*** **	0.489***	0.476***	0.484***	0.503***
Market-to-book	0.000	0.000	**-0.004**	0.000	0.000	0.000
Sales growth	-0.016*	-0.011	-0.016*	**-0.013**	-0.016*	-0.018**
Size	-0.011*	-0.013***	-0.012**	-0.011**	**-0.011* **	-0.012**
Leverage	-0.016	0.016	-0.028	-0.032	-0.013	**0.014**
3) Buyer						
Return on stock	0.000	-0.002	0.002	-0.006	-0.002	-0.001
Free cash flows	0.089	0.111	0.089	0.150*	0.084	0.095
Market-to-book	-0.001	-0.001	0.002	-0.002	-0.001	0.000
Relative size	-0.060**	-0.069***	-0.057**	-0.059**	-0.060**	-0.062***
Leverage	0.060	0.036	0.057	0.063	0.060	0.039
4) Transaction						
Public purchase offer	0.070***	0.074***	0.064**	0.066***	0.070***	0.071***
Cash payment	-0.032	-0.032	-0.032	-0.034	-0.034	-0.037
Hostility	0.209***	0.192***	0.200***	0.202***	0.208***	0.186***
Multiple players	-0.022	-0.025	-0.020	-0.031	-0.022	-0.019
Constant	0.394***	0.406***	0.400***	0.393***	0.396***	0.390***
Adjusted R^2	0.270	0.200	0.265	0.264	0.268	0.273
Sargan test	0.548	0.453	0.405	0.590	0.588	0.496
Durbin-Wu-Hausman test	0.031	0.065	0.191	0.063	0.025	0.141
Number of observations	1,026	1,004	1,004	1,004	1,004	1,015

Table B2: 2SLS-LPM SENSITIVITY TEST OF THE EXTREME VALUES OF THE INDEPENDENT VARIABLES (CONTINUED)

Independent variable	Initial model	Return on stock	Free cash flows	B-Market-to-book	Relative Size	B-Leverage
1) Information asymmetry						
Blockholders	-0.704**	-0.628**	-0.796***	-0.754**	-0.707**	-0.663**
2) Target						
Runup	0.487***	0.480***	0.500***	0.481***	0.491***	0.494***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth	-0.016*	-0.011	-0.015*	-0.017**	-0.003	-0.016*
Size	-0.011*	-0.012**	-0.010*	-0.011**	-0.011*	-0.010**
Leverage	-0.016	-0.026	-0.017	-0.012	-0.017	-0.013
3) Buyer						
Return on stock	0.000	**0.010**	-0.002	0.001	0.000	0.000
Free cash flows	0.089	0.031	**0.036**	0.074	0.094	0.082
Market-to-book	-0.001	0.000	0.001	**0.006**	-0.002	-0.001
Relative size	-0.060**	-0.060**	-0.052*	-0.070***	**-0.069****	-0.054**
Leverage	0.060	0.049	0.058	0.078	0.057	**-0.008**
4) Transaction						
Public purchase offer	0.070***	0.066***	0.074***	0.072***	0.069**	0.070***
Cash payment	-0.032	-0.034	-0.026	-0.031	-0.032	-0.029
Hostility	0.209***	0.202***	0.218***	0.213***	0.211***	0.205***
Multiple players	-0.022	-0.021	-0.025	-0.018	-0.021	-0.021
Constant	0.394***	0.404***	0.393***	0.379***	0.395***	0.395***
Adjusted R^2	0.2703	0.2670	0.2827	0.2702	0.2721	0.2831
Sargan test	0.5477	0.3486	0.3830	0.5081	0.5082	0.5001
Durbin-Wu-Hausman test	0.03148	0.04865	0.00810	0.03507	0.02960	0.03815
Number of observations	1,026	1,004	1,004	1,004	1,005	1,015

This table presents the results of the initial 2SLS model and the results of this sensitivity tests on the extreme values of each of the independent variables related to the characteristics of the target and the buyer. For each of the independent variables we tested the sensitivity of the model to extreme values by eliminating acquisitions for which the value of the independent variable is situated beyond the 1st and 99th percentiles. For each regression, we present the coefficients and their p-value. ***,**, * indicate that the coefficients are significant at 10%, 5% and 1% respectively. Tested variables are indicated at the top of each column. Results of the instrumental equation are not presented but are available. The statistics reported for the Durbin-Wu-Hausman test and the Sargan test are the p-values.