The Effect of Valuation Uncertainty in the Choice of Selling Mechanism

Rafael Rogo*

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Abstract

In this paper, I examine the disagreement between the theoretical and empirical literature on the superiority of auction over bilateral negotiation as selling mechanism in corporate takeover. I hypothesize that the costs of disclosing proprietary information in auctions need to be offset against the well established benefits of competition among bidders. This tradeoff predicts that targets with valuable proprietary information will choose negotiation to mitigate valuation uncertainty at lower costs and maximize their expected revenue. Specifically, I show that the level of valuation uncertainty related to proprietary information is positively associated with the propensity of negotiation. Further I show that litigation concerns and agency problems also drive the mechanism choice.

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1 Introduction

In corporate takeovers targets must choose the optimal way to sell the firm. The options range from negotiating with one potential acquirer to opening a public auction to many bidders. Auction theory emphasizes the advantages of auctions as mechanisms that maximize seller's revenues by inducing competition among bidders. Under standard assumptions, an auction dominates a one-to-one negotiation in terms of higher expected revenue to the seller (Bulow and Klemperer [1996], and [2009]). However, empirical evidence suggests that often targets prefer negotiation instead of auctions [1] (Boone and Mulherin [2007]). I empirically examine a possible explanation to this apparent challenge to theoretical predictions. I hypothesize that the competition induced by auctions comes at the expense of costly proprietary information leakages that under negotiation are limited.

Corporate takeovers are long and complex processes that last on average hundreds of days, and include exhaustive due diligence by acquirer[2]. The amount of information required by buyers is often significant, and buyers uncertainty about the targets' value translates on relatively low bids which in turn lowers seller's expected revenue (Milgrom and Weber [1982]).

Incentives for sellers to commit to disclose private information to bidders are clear. However, most of the relevant information is related to proprietary information and therefore committing to disclose it is costly for the seller, and presumably the magnitude of this cost will be associated to the number of bidders that ultimately gain access to the information.

Takeover targets recognize that the choice of selling mechanism affects the distri-

[1] Following prior research, a mechanism is defined as auction whenever the number of buyers that singed a confidentiality agreement is greater than one, and negotiation otherwise. In fact, the analysis compares multi versus single-buyer transactions.

[2] For a sample of 543 M&A transactions from 1998 to 2005, Anilowski et al. [2008] report 102 days as the average length of transactions and 40 days for due diligence.

bution of sensitive information and that in auctions the probability of information leakage is higher, since the number of buyers that have access to private information in greater. When selecting the selling mechanism, "Anteon's board of directors was also concerned that an auction process materially increased the possibility of information leaks[3]". In addition, the board from Spinnaker Exploration describes the choice for negotiation by stating: "the reasons for taking this approach were to minimize the exposure of Spinnaker's sensitive confidential information to competitors...[4]" That is, the tradeoff that a target firm faces in the choice of selling mechanism can be summarized by the following decision process: "...the probable success of an auction process weighed against its significant risks (including confidentiality concerns, delay and the impact on Capital One's willingness to continue pursuing its proposal).[5]"

In this sense, the optimality of auctions as selling mechanism ceases to hold when valuation uncertainty associated to some proprietary information is too strong. In other words, the choice between auctions and negotiations involves a tradeoff between the benefits of inducing higher competition among bidders in an auction versus the benefits of lower information leakage costs in negotiation.

I find empirical support to the relevance of this tradeoff. I construct a measure of buyers' uncertainty that is related to the target's proprietary information. First, I use a principal component analysis that aggregates different sources of information quality to obtain a measure of overall uncertainty in buyers' valuation. Among these sources I include measures of earnings quality, the riskiness and complexity of financial statements, and the level of firm-specific information incorporated in price. Furthermore, I decompose overall uncertainty into its proprietary and non

[3]Source: ANTEON INTERNATIONAL, DEFM14A, February 01, 2006
[4]Source: SPINNAKER EXPLORATIO, DEFM14A, November 10, 2005
[5]Source: CAPITAL ONE, NATIONA, DEFR14A, October 12, 2005

proprietary components.

Finally, I estimate the choice of selling mechanism as a function of these two components and other determinants, such as litigation concerns and agency problems. I find robust evidence for the hypothesis that the uncertainty about proprietary information favors negotiation as optimal selling mechanisms. In particular, I document that an increase in the valuation uncertainty related to proprietary information from the 1st to the 3rd quartile increases the probability of a negotiation by 21%. Given that the average probability of bilateral negotiation is 51%, this increase is substantial.

Then, I run a series of analyses challenging the theory behind the tradeoff in net benefits of disclosure as a determinant of selling mechanism choice. I show that the fraction of uncertainty less likely to be resolved through disclosure during the transaction, related to non proprietary information, does not impact the mechanism choice.

Further, employing a switching endogenous model that takes into account the selectivity effects of the choice of selling mechanism, I document a negative impact in takeover premium of fraction of uncertainty that could be resolved happens only in auction, since in negotiation, such uncertainty is resolved through disclosure. My results are consistent with the prediction and it suggests that in auction either the target did not disclose the relevant information to buyers and therefore they bid conservatively, or target disclosed as much as it would in a negotiation, but because of the likelihood of information leakage, target had its value diminished due to loss of competitive advantage. Finally, I investigate who bears the costs of disclosure based on a market reaction to the merger announcement. Surprisingly, I find it is shared by the target and the buyer, that is, market participants believe that buyers fail to fully incorporate the effect of the uncertainty in the bid.

One important concern in this study is that targets that chose negotiation may have tried auction but only one potential buyer was interested in a business combination. In this case, it is not a matter of choice, but available options. In order to ensure that my results are not merely capturing low attractiveness of the target, I select the cases where it was clearly stated in the "Background of the Merger" that although several were contacted, only one acquirer presented interest in engaging in a business combination, and perform the analysis also excluding those cases, and the results are similar. Then, because the content of this disclosure is discretionary, I further control for determinants of attractiveness, using proxies identified in (Palepu [1986]).

The study contributes to the existing literature in the following ways. First, in the choice of selling mechanism literature, I document an economic reason for sellers to deviate from the theoretical prediction of auction, namely, having the opportunity to mitigate valuation uncertainty at lower cost in negotiation through disclosure of proprietary information. As a consequence, corporate laws demanding all targets to run public fair auction (Revlon Duty) under the premise of maximizing shareholders could be misleading. I further show that litigation and agency problems are also determinants of the mechanism choice.

Regarding the literature on proprietary cost hypothesis, although analytical studies document the effect of proprietary information on voluntary disclosure and consequently on information asymmetry, empirical research has only provided partial direct evidence on that (Harris [1998], Berger and Han [2003], Leuz [2004], Tang [2008]). In characterizing the uncertainty related to proprietary information as a determinant of selling mechanism choice, this study contributes to the real-effect-perspective literature arguing that proprietary information has substantial effects on firms' real decisions and, more generally, on the allocation of resources in the econ-

omy. In particular, it might be value-maximizing for a target to choose an inefficient private negotiation outcome in order to avoid incurring the disclosure costs.

The rest of the paper is organized as follows. In the following section, I discuss the role valuation uncertainty on the selling mechanism choice. The related literature and the development of my hypotheses are presented in Section 3. Section 4 describes the sample selection and descriptive statistics. Section 5 discusses the research design. The empirical results are presented in Section 6 and finally section 7 concludes.

2 The role of valuation uncertainty

Creation of valuation uncertainty

Relevant information is indispensable for an appropriate valuation. If buyers cannot observe directly certain relevant pieces of information, i.e. incomplete information, they are required to form beliefs and rely on their expectation regarding the information they cannot observe directly. Valuation based on expectations of unobserved information is embedded with uncertainty[6]. Figure 1A presents the path from the type of information unobserved by outsiders to the creation of valuation uncertainty.

Decomposition of overall uncertainty

As discussed above, valuation uncertainty is a consequence of incomplete information. Some of this information is known by insiders (asymmetric uncertainty) and

[6]Uncertainty in valuation can be represented as in Zhang [2006] as follows: assume buyer i valuation estimate for the target ($\widetilde{s}$) is characterized as a target's fundamental value ($\widetilde{v}$), such as future cash flow or dividend, plus a noise term ($\widetilde{e}$), that is, $\widetilde{s} = \widetilde{v} + \widetilde{e}$. The variance of the valuation estimate measures overall uncertainty: $var(\widetilde{s}) = var(\widetilde{v}) + var(\widetilde{e})$, where $var(\widetilde{v})$ is a firm's underlying fundamental volatility and $var(\widetilde{e})$ reflects the quality of information, and assuming that noise is unrelated to a firm's fundamental value ($cov(\widetilde{v}, \widetilde{e}) = 0$).

some is intrinsic to the business (symmetric uncertainty[7]). The conceptual difference between symmetric and asymmetric uncertainty can be illustrated by the following example. Consider a target firm whose operational profits are based on a fair coin flipping, where "heads" means a profit equals to 10, and 0 otherwise. In estimating future cash flow of this target, bidders that know that the coin is fair, have no gain from requesting better information quality from management, since no matter how rich the information is, the profit depends only on the realization of the state of the world. That is, there is no uncertainty related to information quality, and insiders' disclosure would not resolve the uncertainty inherent in the business. On the other hand, assume now that the coin is not fair and only insiders know the ex-ante probabilities of each state. In this case, the symmetric and asymmetric uncertainty take place and richer information disclosed by insiders about the ex-ante probability would refine buyers' valuation estimate, and resolve valuation uncertainty related to the incomplete information about the probability of each state. But again, even with full disclosure from insiders, symmetric uncertainty would not vanish.

In this sense, I decompose overall uncertainty (OU) in three components based on I denote the symmetric uncertainty related to inherent business uncertainty as OU_SYMM. Since uncertainty arises because of incomplete information, I further decompose the asymmetric uncertainty into two components based on seller's reasons to withhold the relevant information.

- OU_PROP: valuation uncertainty caused by buyers' lack of knowledge about proprietary information[8] withheld by managers, such as competitive advantage,

[7]Symmetric uncertainty stands for the difficulty in estimating target's value due to underlying fundamental volatility of the business, i.e. inherent to the business. Therefore, uncertainty is shared by target's managers as well.

Asymmetric uncertainty is related to valuation uncertainty due to low quality of information available to outsiders. That is, it is restricted to outsiders.

[8]Proprietary information is defined as information whose disclosure reduces the present value of cash flows of the firm endowed with the information (Dye [1986]).

know-how, and supply arrangements.

- OU_NONPROP: valuation uncertainty originated from buyers not observing non proprietary information[9] privately known by managers due to agency problems and private benefits derived from that, which includes, for instance, bad news opportunistically withheld.

- OU_SYMM: inherent uncertainty in target's underlying business

It is worth reinforcing that both OU_PROP and OU_NONPROP would be completely resolved with a full disclosure from insiders to outsiders, unlike OU_SYMM.

Benefits of disclosure of relevant information

The consequences of overall uncertainty in auction have been considerably examined by prior literature. The main conclusion is that sellers have incentives to disclose (when costless) information that refines buyers' valuation of the target, in both private and common value settings. the intuition is presented in Figure 1B.

In common value setting, full disclosure comes from the "Linkage Principle", a very significant result in auction theory documented by Milgrom and Weber [1982]. Disclosure of relevant information from the seller to symmetric buyers when costless is value increasing. The benefits from disclosure comes from mitigating the negative effect of uncertainty, namely, buyers bidding more conservatively due to higher likelihood of overpayment (winner's curse).

Benefits of mitigating uncertainty was also examined in private value setting. In a model where the seller can release, without observing, certain additional signals that affect the buyers' valuations, Eso and Szentes [2007] show that the seller makes available all the information that she can in a dynamic auction. In line with Eso and

[9]Information whose release would affect the prices of their firms, but not the distribution of their firms' future earnings (Dye [1986])

Szentes [2007], Gershkov [2009] characterizes properties of optimal auctions if the seller may disclose information about the quality of the object for sale. He shows that the seller maximizes her expected revenue by revealing all information to all bidders and implementing a second price auction with appropriate reservation price.

Mitigating uncertainty through disclosure

As in prior research (Cohen [2008]), I assume that target's disclosure level prior to the transaction is optimal. Therefore, if relevant information was chosen to be withheld by target's managers prior to the takeover transaction, chances are that disclosing it during the transaction is value-decreasing, unless some changes take place.

The net benefit from disclosing proprietary information is significantly affected in a takeover transaction compared to before the transaction. First because competitive information is likely to have a first order effect on the estimation of valuation, that is, large benefits from disclosure. Second, the size of the audience that has access to the information is smaller. I.e. unlike before the takeover, where disclosure reaches all market participants, including firm's competitors, during takeovers the audience is restricted to bidders[10], and proprietary costs are directly associated to the size of the audience. Findings in Bhattacharya and Chisea [1995] and Bharath, Sunder and Sunder [2008] are consistent with firms being relatively more willing to share their proprietary information with small groups. The intuition is that as the size of the audience increases, the likelihood of information leakage increases as well as the proprietary costs. Dye and Sridhar [2003] provide some examples of costs due to information leakage to a firm: allow rivals to more readily compete with the firm regarding eventual strategic plans; decrease in customers' purchases

[10]Furthermore, during takeover targets have (limited) protection from confidentiality agreements, even though I assume here they are not completely enforceable.

of the firm's existing products in anticipation of the additional/improved features associated with new products.

On the other hand, the net benefit of information disclosure related to agency problems and private benefits enjoyed by the manager on outsiders' valuation of the target is, at most, weakly affected by the takeover. Exceptions could be an increase in litigation risks or an increase in outsiders' assessment of the probability that manager has the information and is withholding it - a signal of endowment of bad news. So, it seems plausible that releasing it to buyers remains still value-decreasing to sellers and that the negative net benefit from disclosure does not change across mechanisms.

3 Related literature and hypotheses development

3.1 Choice of selling mechanism

Selling mechanism has been a topic of long-standing interest to researchers. The literature ranges from theoretical studies on mechanism design such as Myerson [1981] and Riley and Samuelson [1981] to more applied work that incorporate homogeneous products in commodity market to very heterogeneous corporate firms. The lack of empirical support for auction superiority over bilateral negotiation, a relevant finding of mechanism design theory documented by Bulow and Klemperer [1996], represents an interesting puzzle to be examined.

I investigate this puzzle by arguing that negotiation provides a better environment for sellers to disclose relevant information intended to mitigate buyer's valuation uncertainty. I hypothesize that lower disclosure costs in one-to-one negotiation may offset, in some situations, the benefits from competition among bidders induced

by an auction.

As the effect of disclosure to mitigate valuation uncertainty and the differences in disclosure costs across mechanisms are incorporated into the selling mechanism choice, I explain reasons that auction superiority does not hold in corporate takeovers. I also discuss drivers that would lead sellers to deviation from the expected shareholders' value-maximizing option. This includes (i) target low attractiveness ultimately forcing the target to negotiate with the only interested buyer, and (ii) target CEO private interests, such as bargaining for a position in the combined firm, or a decision aiming to minimize litigation risks. The remaining assumptions employed , namely, players' risk neutrality, optimality of reserve price, independent private values[11] and symmetry of bidders are neglected since they are basic tools for modeling.

3.1.1 Tradeoff in Net Benefits

Induced-bidder-competition benefits

The takeover premium in M&A transaction is bounded below by seller's optimal reserve price and from above by the buyers' valuation of the target. I.e., in the same way that sellers would refuse to accept a price lower than their reserve price, buyers are not willing to offer more than their estimate of valuation. The difference between upper bound of buyers' valuation and the lower bound of seller's reserve price is called the "surplus of the transaction" and it is somehow split between the target and the winner. Sellers should choose the selling mechanism that maximizes in expectation their share of the transaction surplus.

[11] Bulow and Klemperer [1996] results are extended to private values, common values, and something intermediate.

Buyers privately know their own valuation of the target, or at least a noisy signal of it, and they also know the seller's reserve price stated at the beginning of the takeover deal. Without any revelation mechanism, a buyer that knows the potential transaction surplus would be able to explore this superior knowledge to extract most of the surplus, if not all, to him.

Auction is a mechanism designed to create incentives to buyers to provide information regarding their private valuation to the seller. The competition induced by auctions forces bidders to give up some of the surplus to the seller up to the point that the expected gain from the transaction conditional on winning the auction is maximized. As discussed by Dasgupta and Hansen [2006] auction process is extremely efficient at extracting value from the high valuation bidder, more so than even an optimally conducted negotiation. And the main reason is the induced competition that is created among bidders.

Thus the benefit from choosing auctions comes from the greater expected revenue for the seller compared to the one from bilateral negotiation (induced-bidder-competition benefits) derived from the simpler model without frictions.

Net benefits from Disclosure

The level of uncertainty embedded in buyers' valuation is a function of the quality and completeness of the information set available to outsiders regarding the target. In friendly takeover transactions, targets are requested to move as much as possible towards a full disclosure to bidders. The benefits to sellers from releasing information that increases accuracy in symmetric buyers' valuation have been documented by prior literature (Milgrom and Weber [1982], Eso and Szentes [2007], and Gershkov [2009]) when disclosure is costless. The intuition is that bidders with more precise valuations bid more aggressively since the likelihood of overpayment

is lower, therefore, not only the efficiency of the auction increases but also seller's expected revenue. Raman, Shivakumar, and Tamayo [2008] illustrate this effect by citing the example of BASF, one of the largest chemicals groups in the world that on January 4, 2006 launched a takeover bid for Engelhard Corp., a US specialty chemicals producer. Although the bid by BASF represented a 23% premium over Engelhard's closing stock price, the CEO of BASF wrote in a letter to the CEO of Engelhard that BASF would be prepared to raise its bid "by as much as $1 per share" if Engelhard was ready to open its books.

As discussed in the previous section, OU_PROP is the fraction of uncertainty more likely to be resolved in an M&A transaction. The direct benefit from refining valuation and the reduction in disclosure costs due to the small audience, after entering the transaction, may make the disclosure of proprietary information to change from value-decreasing (before the transaction) to value-increasing decision (during the transaction). Indeed, this increase in net benefits in disclosure of proprietary costs from before compared to during takeovers may be enhanced in negotiations, since in a one-to-one transaction only the new owner has access to the information, reducing considerably disclosure costs related to leakage of information. Unlike in auctions, where a positive number of underbidders gain access to the strategic information and end up not being the new owner. Despite the small size of the audience, in auctions with some chance, the proprietary information will become available to third parties, including competitors and this may trigger undesirable reaction on their part. On the other hand, a negotiation entails less, possibly zero, leakage of information (Yosha [1995]).

Based on this intuition, although the benefits from disclosure are similar across mechanisms, costs are not. More specifically, the lower cost to refine buyers' valuation estimate favors the choice of negotiation as selling mechanism over auctions

(Net Benefits from Disclosure).

Induced-bidder-competition benefits x Disclosure net benefits

The effect of seller's mechanism choice is based on the net effect between the benefits from the competition induced by auction versus the benefits to resolve uncertainty in valuation estimate at lower costs in negotiation. In particular, I hypothesize that as the level of uncertainty in buyers' valuation increases, the effect of uncertainty on bidding function increases, and therefore the benefits to refine valuation estimate increases increasing the likelihood of negotiation. This intuition leads to my first testable hypothesis:

H1 (Tradeoff in net benefits): The valuation uncertainty related to proprietary information (OU_PROP) is positively associated with the likelihood of choosing private negotiation

It is worth reinforcing that the hypothesis $H1$ restricts the predictions to (i) the set of information that is known by target insiders which excludes information about underlying business characteristics (OU_SYMM), and (ii) information whose net benefit from disclosure changed when entered into a takeover transaction - it rules out OU_NONPROP. In this sense, $H1$ predictions apply only to OU_PROP, management private information related to proprietary information. The reason is that it is the set of information that is more likely to be disclosed during the transaction.

3.1.2 Further predictions from the Tradeoff in Net Benefits

Having established the theory (Tradeoff of Net Benefits) behind the association between OU_PROP and mechanism choice, I focus now on searching for evidences against the theory presented in $H1$.

Joint effect of OU_NONPROP and OU_SYMM on mechanism choice

From the Tradeoff in Net Benefits, only the fraction of uncertainty related to proprietary information (OU_PROP) should affect mechanism choice because proprietary information is likely to be the type of information which its disclosure becomes value-increasing after entering the transaction. However, some alternative hypotheses would also be consistent with the expected results from H1. For instance, buyers with high uncertainty in valuation estimate prefer to not participate in the auction, that is, targets with poor information and consequently high uncertainty in buyers' valuation have low attractiveness. I.e., negotiation is the only feasible choice due to the lack of interested bidders.

If it is the case that buyers are "uncertainty intolerant" then I expect that any type of uncertainty should affect the choice of mechanism, unlike in $H1$, where only OU_PROP should affect. This leads to the next challenging hypothesis stated in alternative form

H2 (uncertainty intolerance) OU_NONPROP and OU_SYMM jointly are associated with the likelihood of negotiation

Effect of uncertainty on takeover premium

The impact of OU_PROP on the choice of selling mechanism is based on the intuition that pre-transaction uncertainty in estimate will be resolved through disclosure during the transaction if negotiation is chosen. As a consequence, OU_PROP should have no effect on takeover premium for negotiations, since although the valuation uncertainty exists pre-transaction, at the time the takeover premium is determined, uncertainty has been resolved already.

The general effect of uncertainty on premium can only be negative but after being resolved, uncertainty should have no affect on premium. Therefore, finding

a negative impact of OU_PROP on takeover premium would suggest that there was no disclosure of proprietary information during the transaction enough to resolve the uncertainty, and therefore, it would represent an inconsistency with the tradeoff-in-net-benefits theory. This leads to my next challenging hypothesis stated in alternative form:

H3a (unresolved uncertainty): OU_PROP has a negative effect on takeover premium for negotiations

In terms of auctions, there is no theory specifying whether it is optimal to resolve uncertainty through costly disclosure or not. The only prediction is that as valuation uncertainty increases, bidding discount due to non-disclosure or proprietary costs because of disclosure[12] also increase. That is, disclosing or not, in auctions there is a negative effect of OU_PROP on premium. Testable null hypothesis to address this question is

H3b (similar effect prop. information) there is no difference between the effect of OU_PROP on premium in auctions or negotiations

Further, investigating the impact of OU_NONPROP and OU_SYMM may also help challenge the Tradeoff-in-Net-Benefits theory. As a complementary result of *H3b*, a comparison between the differences in the impact of OU_NONPROP and OU_SYMM jointly on premium for each mechanism may also be interesting. That is, according to the theory, since the same level of disclosure is made unconditional on the choice of mechanism, I expect to find no difference in the jointly effect of OU_NONPROP and OU_SYMM on premium across mechanisms. If a difference is found, then there is some other consequence of uncertainty unrelated to proprietary

[12] Proprietary costs would cause lower premium because of loss in competitive advantage due to potential leakage of proprietary information to rivals.

information, and it would be inconsistent with the Tradeoff-in-Net-Benefits theory. In this sense, the next null hypothesis is

H3c (similar effect others) the jointly effect of OU_NONPROP and OU_SYMM varies across mechanisms

3.1.3 Deviations from shareholders' expected-value maximizing

Self-interested CEO

The idea that managers do not act in the best interest of the shareholders has been investigated by prior literature and mixed evidences are documented. In particular, the conflict of interest where the CEO can bargain to be retained by the acquirer and for private benefits rather than for a higher premium to be paid to the shareholders was examined by Bargeron et al [2009]. They find no evidence that the premium paid is lower when the CEO is retained by the acquirer. On the other hand, Hartzell et al [2004] document that target shareholders receive lower acquisition premium in transactions involving extraordinary personal treatment of the CEO, such as payment of special cash bonuses.

In terms of the role of self-interest managers in the choice of selling mechanism, Boone and Mulherin [2007] show that the likelihood that the target CEO maintains a position in the combined firm is significantly associated with the use of negotiation, but they also find that the likelihood that the target CEO maintains a position is not significantly related to target announcement returns. I re-examine the effect of CEO on the selling mechanism and takeover outcomes. I expect a positive relation between CEO position in the combined firm and the choice of negotiation.

Litigation Risks

Litigation concern is another potential explanation for target's managers to deviate from an shareholders' expected-value-maximizing choice negotiation. For instance, "Revlon duty" says that when it becomes clear that a target corporation will be sold, the Board has a duty to run a fair auction for the corporation to maximize the price received by the shareholders. The decision is on the grounds that auctions maximize shareholder returns, promote efficiency by placing corporate assets into the hands of those that value them most highly and mitigate the collective action problem of target shareholders by requiring the target board to hunt for the highest bid. That is, targets may forego benefits from negotiation because of litigation concerns. Inthis sense, I expect a negative relation between litigation risks and the propensity to choose negotiation.

4 Sample and Descriptive Statistics

The analysis is restricted to friendly takeover transaction between publicly-traded institutions covered by SDC Thompson from 2002 to 2007. To be included in the sample, the takeover transactions status must be completed and the acquirer must have 100% of the target control at the end of the transaction. The initial sample consists of 889 observations, but only for 400 there is information regarding the background of the merger, required to classify the sale method as auction or negotiation[13].

Due to the high demand from the required hand collection, I randomly selected 250 observations out of the 400 to perform my analysis. Finally, I excluded tar-

[13] "Background of the Merger" is a section inside proxy statement that conceptually details all steps related to the transaction, including which part initiated the transaction, date of the first meeting, description of the topics of discussions in all meetings, the number of buyers with access to confidential information, the number of parties who signed confidentially agreements, among others. For a complete explanation of the information contained in the section "Background of the Merger", please refer to Boone and Mulherin [2007].

get firms with insufficient data in CRSP and COMPUSTAT necessary to estimate uncertainty and premium, which leaves a final sample of 221 observations.

Following prior research, I classify the sale method as negotiation (NEGOTIATION=1) if only one potential buyer signed a confidentiality agreement with the target. In the case in which more than one buyer signed the agreement, the transaction is marked as auction[14] (NEGOTIATION=0).

In the final sample consisting of 221 observations, 123 target firms (52%) were sold via negotiation. Panel A and B of Table 1 present the sample distribution by industry and by year respectively. Based on Fama and French [1997] 12-industry classification, Panel A indicates that takeover transactions occurred in a variety of industries, mainly in the Business and Equipment which had the highest frequency, namely, 27.23%, followed by the Finance industry accounting for 25.96%. The industries of Consumer Durables and Utilities had the lowest frequency, 0.85%, and Chemicals and allied products registered no takeover transaction in the sample. From Panel B, takeover transactions have been increasing from 2002, 8.9%, reaching a peak in 2006, 28.1% and then falling to 6.8% in 2007. And Table 2 presents the summary statistics.

4.1 Empirical measure of overall uncertainty

There is no consensus on measures for (information) uncertainty used in prior empirical research. Potential candidates are dispersion in analysts' earnings forecasts (Zhang [2006a], Zhang [2006b]), firm age (Jiang et al [2005]), return volatility (Jiang

[14]Denoting several buyers with access to confidential information as auction is not precise, even though it is in line with prior literature (Boone and Mulherin [2007]). I have only 6 cases in my sample of targets that employed a formal auction, with rules stated upfront. The remaining cases can be considered as informal auction. The intuition is that in both cases there exists competition among investors and others, besides the winner, have access to disclosure.

et al [2005]), turnover (Jiang et al [2005]), equity duration (Jiang et al [2005]), and accruals quality (Francis et al [2007]).

Critics exist for almost all of them. Moeller et al [2007] argue that dispersion captures mostly information asymmetry across analysts (investors), that is, diversity-of-opinion, and not information incompleteness. Even though, it could be argued that without uncertainty, that is, with complete information, there would be low dispersion.

Schultz [2005] discusses the measures employed by Jiang et al. He argues that firm age is likely to be a proxy for recent IPOs, high turnover could proxy for many things besides information uncertainty, equity duration was also not appropriate. However, he claims that return volatility is "certainly a plausible proxy for information uncertainty".

On the other hand, Francis et al [2007] note that idiosyncratic returns volatility is an outcome measure of firm-specific information uncertainty. So, employing Dechow and Dichev's [2002] measure of earnings quality as the proxy for information uncertainty, they show that idiosyncratic returns volatility loses their effect as a determinant of post-earnings announcement drift when controlled for Dechow and Dichev's [2002].

Recall that uncertainty in the pre-transaction valuation estimate is decreasing in the degree to which a firm's value can be reasonably estimated by even the most knowledgeable investors at reasonable costs. In this sense, overall uncertainty is related to information incompleteness. I focus on the quality of the sources of information, namely, financial reporting and external sources.

For the quality of financial reporting, I consider two dimensions. First, I use Dechow and Dichev [2002] measure (DD2002_ind) which posits a relation between current period working capital accruals and operating cash flows in the prior, current

and future periods. That is, this measure captures the mapping of the current accruals portion of earnings into cash flows: the weaker the mapping, the poorer is the information quality of earnings (Francis et al [2007]) and, therefore, the greater is the uncertainty in valuation. Dechow and Dichev's [2002] measure has been widely used by accounting literature as a measure of accruals quality, information risk, (Cohen [2008], Bharath, Sunder and Sunder [2008], Francis et al [2005] among many others), and information uncertainty (Francis et al [2007]).

As discussed by Schipper and Vincent [2003], the original firm-specific time-series estimation of DD2002 assumes over-time stationarity in the estimated relations, and more importantly, requires long time-series of data. Due to limitation in the data availability, I estimate DD2002_ind cross-sectionally assuming implicitly across-firm (within the same industry for a specific year) homogeneity. The details are provided in Appendix B.

Under this methodology, the DD2002_ind captures industry-specific characteristics that affect the link between cash flows and current accruals, such as the volatility of underlying fundamentals, complexities related to the nature of the business, and operating environment. On the other hand, firm-specific characteristics that affect the mapping of accruals on cash flow are disregarded.

To complement DD2002_ind, I incorporate a firm-specific measure for the complexity of the accounting transactions of the target. The idea is that to better explore the richness of the information inside financial statements, bidders will have to carefully understand the main accounting issues of the targets' financial books. Doing that, buyers will be able to collect relevant information to estimate synergies, such as the contribution of each segment on the total revenue, and marginal costs. To measure the complexity and riskiness in accounting books, I use a raw measure of excess audit fees (x_AUDITFEE). The details of the calculation are provided

in Appendix B. The intuition is that as the complexity and/or riskiness increase compared to industry peers, auditor will require a higher fee to compensate for the extra effort and risk.

The first two measures of uncertainty do not capture much in terms of forward-looking information. Yet, for valuation purposes, this type of information is very relevant. So, I need to estimate the level of relevant information produced by outsiders, that is, the relative amount of firm-specific, industry-level, and market level information impounded into stock prices. To do that, I use stock return synchronicity (SYNCH) following prior research by Bushman et al. [2004] and Roulstone and Piotroski [2004].

Stock return synchronicity is conceptually related to idiosyncratic return volatility, in the sense that both are supposed to capture the information content in price. However, Francis et al. [2007] show that prior evidence of greater PEAD profitability for higher idiosyncratic volatility securities is explained by the greater information uncertainty (earnings quality) associated with these securities. That is, in a comparison between the measures, earnings quality seems to incorporate most of the effect of idiosyncratic volatility on uncertainty. More importantly, Durnev et al. [2003] document that firms and industries with lower market model R^2 statistics (low SYNCH) exhibit higher association between current returns and future earnings, indicating more information about future earnings in current stock returns. Therefore, I employ SYNCH as my measure of availability of firm-specific information to outsiders impounded in stock price. The details of the calculation are provided in Appendix B.

The above methodologies generate three measures (DD2002_ind, x_AUDITFEE, and SYNCH) that are all conceptually related to the level information completeness about targets available to outsiders. However, I am interested in a parsimonious

measure of overall uncertainty that allows me to examine cross-sectional differences across targets. I therefore use principal components analysis (PCA) to isolate the common component of firm-level overall uncertainty in my three proxies.

Decomposition of overall uncertainty

Finally, because I am interested in the fraction of the overall uncertainty that could be resolved by disclosure (OU_PROP), i.e. the component that is known by insiders, I decompose the overall uncertainty into two subgroups: one associated with proxies of the level of proprietary information and the other, the residuals or the remaining part. That is, I regress my aggregated measure of UNCERTAINTY on an estimate of market competition, HERF, measured as the weighted (by segment sales) average Herfindahl-Hirschman Index for the industries (defined by the two-digit SIC code) in which the firm reports business segment sales, R&D, research and development expenses for the previous year deflated by sales at the beginning of the previous year, a measure of entry costs, ENTRY measured as total capital expenditure deflated by total sales in an industry, and product substitutability, PRODSUBS, measured as total sales of the industry divided by the sum of total costs of goods sold and selling, general, and administrative expenses incurred by the industry.

Table 3 reports the decomposition of overall precision that was implemented as follows:

$$\begin{aligned} UNCERTAINTY &= \alpha + \beta_1 HERF + \beta_2 R\&D + \beta_3 ENTRY + \beta_4 PRODSUBS + \nu \\ UNC\_PROPINFO &= \widehat{\beta}_1 HERF + \widehat{\beta}_2 R\&D + \widehat{\beta}_3 ENTRY + \widehat{\beta}_4 PRODSUBS \\ UNC\_RESIDUAL &= UNCERTAINTY - COMP\_PROPCOST \end{aligned} \tag{1}$$

The link between the measures and the theoretical variables is as follows:

- $UNCERTAINTY$ is a proxy for OU

- $UNC\_PROPINFO$ for OU_PROP, and

- $UNC\_RESIDUAL$ for OU_NONPROP + OU_SYMM.

5 Research design

Choice of selling mechanism

I begin the analysis by studying the determinants of the choice between auction and negotiation. As outlined in $H1$, I expect that high OU_PROP targets prefer negotiation since they have more incentives to mitigate the negative effect of uncertainty and resolving uncertainty is less costly in negotiation than it is in an auction. I model the choice of selling mechanism preferred by targets using a probit estimation where the dependent variable (NEG) takes on the value 1 if the target chooses negotiation, and 0 if the target uses auction, for each takeover observation in the sample. The control variables used for the choice estimation and their construction are described in Appendix A and follow the existing literature.

I estimate the following Probit regression[15]

$$\begin{aligned}\Pr(NEG &= 1) = \alpha_0 + \alpha_1 UNC\_PROPINFO + \alpha_2 UNC\_RESIDUAL + \\ &\alpha_3 LIT\_ind + \alpha_4 CEO\_CHAIR + controls + \xi \end{aligned} \quad (2)$$

[15] Standard errors are adjusted to control for cross-sectional and time-series dependence (Petersen (2008), Gow, Ormazabal and Taylor (2009)).

where $UNC\_PROPINFO$ and $UNC\_RESIDUAL$ are the of components of overall uncertainty[16], and CEO_CHAIR is also a dummy that takes 1 if the CEO is also the chair of the board, and 0 otherwise.

The set of controls are related to characteristics of the transaction, information environment, synergy, attractiveness, and operational risks as follows:

Characteristics of the transaction

I follow prior literature (Boone and Mulherin [2007]) and use, as controls for characteristics of the transaction, RELATIVE SIZE as the natural log of the equity value of the target divided by the equity value of the bidder, both measured 20 days prior to the initial announcement date, TARGET MKT SIZE as the equity value of the target measured 20 days prior the announcement, UNSOLICITED as a dummy variable assuming the value of 1 if the target firm initiated the transaction and 0, otherwise, and REGULATED as a dummy variable equal to 1 for targets in regulated industries and 0, otherwise.

Information environment

To control for the existence of outsiders that generate information about the target, I use INST HOLDINGS as the fraction of the shares outstanding of the target held by institutional investors, BOND RATING as a dummy variable equal to 1 if the target is rated by a rating agency. Finally, variable FOLLOWED BY ANALYST is a dummy variable equal to 1 for targets followed by equity analyst.

Synergy

[16] I also use Bid-Ask spread as alternative measure of uncertainty. It relates to the information asymmetry or diversity of opinions across investors, and not directly information asymmetry between insiders and outsiders. Even though the measure impacts the choice of selling mechanism, I find that it is not priced in takeover premium.

Because potential synergy in takeover transactions can affect the sale method choice, I use as control N# OF SEGMENTS, that is the number of geographic segments of a firm as presented in COMPUSTAT.

Attractiveness

The main point in this study is to understand why a target firm would not hold an auction. A straightforward reason is that only one acquirer is interested in the business combination, and therefore, private negotiation remains as the only option. I control for target's attractiveness in two ways. First, I examine the M&A disclosure trying to learn whether the target planned or not to deal with several acquirers. I find eight targets directly stating their intention to attract several buyers, but having only one buyer showing interest. Since these targets look to attract more buyers upfront the process< their selling method is classified as auction. However, I also perform the analysis excluding these targets, and find that the results are quite similar.

Second, I use the determinants as in Palepu [1986] to predict takeover targets. The idea is that the higher the probability of becoming targets the greater the attractiveness, and therefore, greater the expected number of potential acquirers. The determinants are: TARGET BETA - computed using market model and daily returns between (-316, -64), P/E RATIO - the price-earnings ratio as defined as the ratio of a firm's stock price per share to its earnings per share. Compustat data items #24 and #58 are employed in the computations. The P/E ratio is computed as of the fiscal year end preceding the observation year. AGE is the number of years, with data available in CRSP, the target had at the time of the announcement, GROWTH of a firm is defined as the annual rate of change in the firm's net sales, LIQUIDITY is defined as the ratio of the net liquid assets of a firm to its total assets, and ACUM EXCESS RET is the difference between the target's actual return and the

expected return from a two-parameter market model, measured over 3 years prior the transaction.

Operating risk

SALES SD is the standard deviation of Sales on the previous 3 years. LOSS is the incidence of negative earnings over the past 3 years, and MARGIN is target's gross margin percentage, calculated as the year t net sales (Compustat annual data item #12) less cost of goods sold for the year (Compustat annual data item #41).

Litigation Risks

LIT_ind is a dummy variable equals 1 if the target is in a high-litigation-risk industry[17] (Rogers and Stocken [2005]).

Impact of valuation uncertainty on takeover premium

The objective here is to investigate the impact of the components of overall uncertainty on takeover premium. The analysis needs to take into account that the choice of selling mechanism is endogenous. That is, some unobserved characteristics that influence the probability to choose a particular selling mechanism could also influence the premium agreed after engaging in the transaction. Neglecting these selectivity effects is likely to give a false picture of the premium in both auction and negotiation.

I apply the endogenous switching model of Lee [1978], as outlined by Maddala [1983]. In this model, a switching equation sorts firms over two different states with one regime being observed for any given firm. Here, the choice of private negotiation or auction is the selection equation, followed by two equations for the two regimes—one equation on premium for negotiation and one equation on premium for auction.

[17] The high-litigation-risk industry are Bio-technology (SIC 2833 to 2836), Computer Hardware (SIC 3570 to 3577), Electronics (SIC 3600 to 3674), Retailing (SIC 5200 to 5961), and Computer Software (SIC 7371 to 7379).

The model is described using two regression equations (one for auction and the other for negotiation) and a criterion function, I_i, that determines which regime the firm faces:

$$
\begin{aligned}
I_i &= 0 \ \ (Auction) \qquad if \ \alpha Z_i + \xi \leq 0 \\
I_i &= 1 \ \ (Negotiation) \ if \ \alpha Z_i + \xi > 0 \\
\text{Regime 1 (Auction)} &: \ premium_{1,i} = \beta X_{1,i} + \vartheta_{1,i} \ \text{ if } I_i = 0; \text{ and} \\
\text{Regime 2(Negotiation)} &: \ premium_{2,i} = \gamma X_{2,i} + \kappa_{1,i} \ \text{ if } I_i = 1; \qquad (3)
\end{aligned}
$$

The three error terms are assumed to have a trivariate normal distribution. With this joint normality assumption, a full information maximum likelihood estimation can be used to fit the model and obtain consistent standard errors. It is not necessary for the vector Z_i in the selection equation to be different from the $X_{1,i}$ and $X_{2i,}$ vectors of independent variables for identification of the system. While the model could be identified by nonlinearities, I include exogenous variables that are unique to the selection equation and the second-stage regressions. In the selection stage, I include an indicator variable litigation risks (LIT_ind) and another for corporate governance (CEO_Chair). In the second stage, I include dummy variables for means of payment, CEO position in the combined firm, and synergies represented by 1 if target and acquirer are in the same industry[18]. These exogenous variables ensure that the model is well identified and increases the reliability of our estimates.

The implementation of the model discussed in (5) has as the selection model,

[18] All three variables are assumed to not affect the selection model because they are unknown to the seller at the time of the choice of selling mechanism.

the estimation presented in (4) and the following two conditional regressions[19]

$$\begin{aligned} PREM \mid NEG_i &= \beta_0 + \beta_1 UNC\_PROPINFO_i + \beta_2 UNC\_RESIDUAL_i + \\ &\quad \beta_3 JOB\_RETAINED_i + \beta_4 CEO\_Chair_i + controls + \vartheta_i \\ PREM \mid AUCT_i &= \gamma_0 + \gamma_1 UNC\_PROPINFO_i + \gamma_2 UNC\_RESIDUAL_i + \\ &\quad \gamma_3 JOB\_RETAINED_i + \gamma_4 CEO\_Chair_i + controls + \kappa_i \end{aligned} \tag{4}$$

where PREMIUM is the takeover premium measured by the change in the offer price as recorded in SDC Thompson over target's share price, 42 (or 20) days prior to the announcement date, JOB_RETAINED is a dummy being equal to 1 if the CEO retained a job in the combined firm, ONLY_CASH is a dummy variable that equals 1 if the transaction is paid 100% in cash, and SAME_INDUSTRY is a dummy equal to 1 if target and acquirer have their main operation in the same industry as reported by Compustat, defined by two-digit SIC classification.

Single Equation Analysis

As discussed below, selectivity effects should not be disregarded. However, I present the results for the Single Equation Analysis, where it is disregarded the endogeneity in the mechanism choice, and a premium function for each mechanism is estimated using OLS.

[19] Standard errors are clustered by industry.

6 Empirical Results

Tradeoff in net benefits

Table 4 reports the Probit estimation of the model specified in equation 2. In line with hypothesis $H1$, I find a positive relation between uncertainty related to proprietary information ($UNC\_PROPINFO$) and the propensity to choose negotiation even after controlling for other determinants of the mechanism choice. That is, the greater the perceived uncertainty by targets, more likely they will choose privately negotiation. The results support the intuition that there exist benefits for targets with poor information quality available to outsiders to choose negotiation. This is consistent with negotiation providing greater possibility to resolve buyers' uncertainty in valuation at lower cost.

Specifically, the effect of $UNC\_PROPINFO$ in the choice selling method is significant, i.e. an increase in the target $UNC\_PROPINFO$ from the 1st to the 3rd quartile increases the probability of a negotiation by 21%. Given that the average probability of bilateral negotiation is 51%, this increase is substantial.

As predicted by $H2$, only the fraction of uncertainty that is more likely to be resolved through disclosure impacts the choice of selling mechanism. This reinforces that the information flow is playing an important role and the effect is not just a consequence of the presence of valuation uncertainty.

Having documented the impact of disclosure on the mechanism choice, I test the consequence of each component of uncertainty on takeover premium. Table 5 presents the estimation of the complete model[20], taking into account all determinants discussed in the paper and results are consistent with the Tradeoff of net

[20]Equation (2) was also estimated restricting the set of control variables, to be consistent with prior literature (Boone and Mulherin [2007]). Results remained invariant.

benefits. In line with $H3$, $UNC\_RESIDUAL$ has a statistically significant negative effect on premium in both mechanisms, negotiation and auction. However, $UNC\_PROPINFO$ only impacts negatively premium in auctions. In negotiation, $UNC\_PROPINFO$ effect is positive, although not statistically significant.

The empirial analysis of the tradeoff in net benefit can be illustrated by a comparison of takeover premium for each mechanism as a function of the level of $UNC\_PROPINFO$. Figure 2 shows that the selling mechanism choice is not obvious towards auction when the importance of disclosure is incorporated. There exists a threshold level of $UNC\_PROPINFO$ greater than that, targets that selected negotiation ended up with higher premium. Figure 2 also suggests that the results presented in this paper are in line with prior research. That is, the average premium does not vary across mechanism when $UNC\_PROPINFO$ is not taken into account as documented by Boone and Mulherin [2007].

The findings are consistent with target firms with high uncertainty related to proprietary information realizing that resolving it in negotiation, at lower cost, is more beneficial than the gains from bidders' competition induced by auctions.

Self-interested CEO

The analysis of CEO's ex-ante objective is particular challenge because there is no proxy for that. Prior literature has used an ex-post outcome measure, namely, if CEO has or not a position in the merged firm, to proxy for CEO's ex-ante willingness to give up higher premium to extract private benefits. However, it is unclear whether retained the CEO was CEO's objective or it is a signal of high quality manager.

I do not include a dummy for CEO position in the combined firm in the estimation of equation (2), but in untabulated analysis, I include it and found a positive relation between JOB_RETAINED and the propensity of negotiation. In partic-

ular, the probability of negotiation increases by 21% when CEO is retained. The remaining results are invariant, in particular, the effect of $UNC\_PROPINFO$ goes from 0.478 to 0.470.

The more interesting question is whether the CEO is retained in the merged firm in exchange for a better deal in terms of premium, that is, at shareholders' expense. I do not find results consistent with lower premium, but intead, my results are actually with greater returns, even though not statistically significant from zero.

Finally, I investigate whether CEO position in the combined firm affects or not the impact of uncertainty on premium. I find that buyers in auction are willing to shade less their bid as a consequence of uncertainty in valuation, however, the difference in impact of uncertainty with and without retaining the CEO is not statistically significant, and results are presented in Table 6.

Litigation concerns

I document a strong result of the effect of litigation concerns on the choice of negative. Specifically, I find that the probability of negotiation decreases about 18% if the target is inside industries considered as of high litigation risk.

7 Summary and Conclusion

In this paper, I investigate the impact of target valuation uncertainty on the choice of selling mechanisms. Specifically, I examine target's choice of private negotiation versus auction, and then by contrasting the two sale methods with particular differences in terms of disclosure costs due to exposition of private information released, I shed light on the role of disclosure in the design of the choice of selling mechanism in response to variation in uncertainty. I measure valuation uncertainty using a com-

posite metric that utilizes the first principal component of the combination of two dimensions of information generation, namely, the quality of accounting information and the relative amount of firm-specific, industry-level, and market-level information impounded into stock prices. This parsimonious measure reduces the measurement error associated with the measurement of each dimension of uncertainty.

I find that differences in the information flow due to disclosure costs between negotiations and auctions play an important role in the choice of selling mechanism and in how valuation uncertainty is incorporated in takeover premium. In negotiation, only the winner has access to the proprietary information released in order to alleviate the risks of winner's curse, unlike in auction, where the information disclosed by the target will inevitably become available to third parties, in particular to target's competitors, and may trigger an undesirable reaction on their part. Further, I find that not only targets have the takeover premium deteriorated but also the market assessment of the acquirers' value creation in the transaction is also affected by valuation uncertainty. My results suggest that differences in the level and costs of information flow across mechanisms play an important role in the takeover transactions.

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9 Appendix A

Definition of Variable

ACQUIRER BETA is computed using market model and daily returns between (-316, -64)

ACQUIRER MKT SIZE is the equity value of the acquirer measured 20 days prior the announcement

T_AER is the difference between the target's actual return and the expected return from a market model, measured over 3 years prior the transaction"

AGE is the number of years with data available in CRSP the target had at the time of the announcement

BOND RATING is a dummy variable equal one if the target is rated by rating agency.

BIDASK_SPREAD is the target's average difference between closing bid and closing ask spread for the period of (-316, -64) available at CRSP daily files.

ENTRY measured as total capital expenditure deflated by total sales in an industry, and product substitutability

FOLLOWED BY ANALYST is a dummy variable equal to 1 for targets followed by equity analyst.

GROWTH of a firm is defined as the annual rate of change in the firm's net sales.

HERF measured as the weighted (by segment sales) average Herfindahl-Hirschman Index for the industries (defined by the two-digit SIC code) in which the firm reports business segment sales

INST HOLDINGS is the fraction of the shares outstanding of the target held by institutional investors.

LIQUIDITY is defined as the ratio of the net liquid assets of a firm to its total assets.

LOSS incidence of negative earnings over the past 3 years.

BOND RATING is a dummy variable equal one if the target is rated by rating agency.

N# OF SEGMENTS is the number of geographic segments as presented in COMPUSTAT

NEGOTIATION is a dummy variable equal to 1 if only one potential acquirer signed confidentiality agreement with the target, and 0 otherwise

PE RATIO: The price-earnings ratio is defined as the ratio of a firm's stock price per share to its earnings per share. COMPUSTAT data items 24 and 58 are employed in the computations.

P/E ratio is computed as of the fiscal year end preceding the observation year.

PRODSUBS measured as total sales of the industry divided by the sum of total costs of goods sold and selling, general, and administrative expenses incurred by the industry

R&D research and development expenses for the previous year deflated by sales at the beginning of the previous year

REGULATED is a dummy variable equal to 1 for targets in regulated industries.

RELATIVE SIZE is the natural log of the equity value of the target divided by the equity value of the bidder, both 20 days prior to the initial announcement date.

RETURN SD is the standard deviation of target stock returns inside the period of (-317, -64) prior to the initial announcement date.

SALES SD is the standard deviation of Sales on the previous 3 years

SAME INDUSTRY is a dummy equal to 1 if the main business of the target and acquirer are the same, based on COMPUSTAT 2-digits SIC

TARGET BETA is computed using market model and daily returns between (-316, -64)

TARGET INITIATED is a dummy variable equal to 1 for deals that were initiated by the target firm.

TARGET MKT SIZE is the equity value of the target measured 20 days prior the announcement

10 Appendix B

DD2002_ind

To obtain DD2002, I follow Francis et al. (2007) and estimate the following cross-sectional regression for each of Fama and French (1997) 48 industry groups with at least 20 firms in fiscal year t

$$TCA_{i,t} = \phi_{0,i} + \phi_{1,i} CFO_{i,t} + \phi_{2,i} CFO_{i,t-1} + \phi_{3,i} CFO_{i,t-2} + \phi_{4,i} \Delta REV_{i,t} + \phi_{5,i} PPE_{i,t} + \varsigma_{i,t}$$

where $TCA_{i,t} = CA_{i,t} - CL_{i,t} - Cash_{i,t} + STDebt_{i,t} - Depn_{i,t}$ = total current accruals, $CFO_{i,t} = NIBE_{i,t} - TCA_{i,t}$ = cash flow from operations, $NIBE_{i,t}$ = net income before extraordinary items, $CA_{i,t}$ = change in current assets, $CL_{i,t}$ = change in current liabilities, $Cash_{i,t}$ = change in cash, $STDebt_{i,t}$ = change in debt in current liabilities, $Depn_{i,t}$ = depreciation and amortization expense, $REV_{i,t}$ = change in revenues, and $PPE_{i,t}$ = gross value of plant, property, and equipment. DD2002_ind is the standard deviation of the residuals of all firms in the same industry for the year before the takeover announcement.

x_Auditfee

I run the following cross-sectional regression for each of Fama and French (1997) 48 industry groups with at least 20 firms in fiscal year t

$$AUDIT\_FEE_{i,t} = \lambda_{1,i} + \lambda_{2,i}.SIZE_{i,t} + \lambda_{3,i}.EMP_{i,t} + \lambda_{4,i}.BIG4_{i,t} + \varepsilon_{i,t}$$

where $AUDIT\_FEE_{i,t}$ is the fees for the audit of financial statements, $SIZE_{i,t}$ is

the log of total assets, $EMP_{i,t}$ is the number of employees, and $BIG4_{i,t}$ is a dummy variable equals 1 is the auditor is PWC, Ernst & Young, Deloitte Touche Tohmatsu, or KPMG. $x\_AUDITFEE_{i,t}$ is the residual of the regression.

Although prior literature excludes from the excess audit fee the effects from return on investment, number of segments, foreign sale, among others to measure the abnormal fee (Cadman and Stein [2007]), I do not control for them because they also capture the riskness and complexity I am interested in capturing. Even disregarding the other controls, the adjusted R^2 of the regression is on average 0.69, and the median is 0.73.

Synch

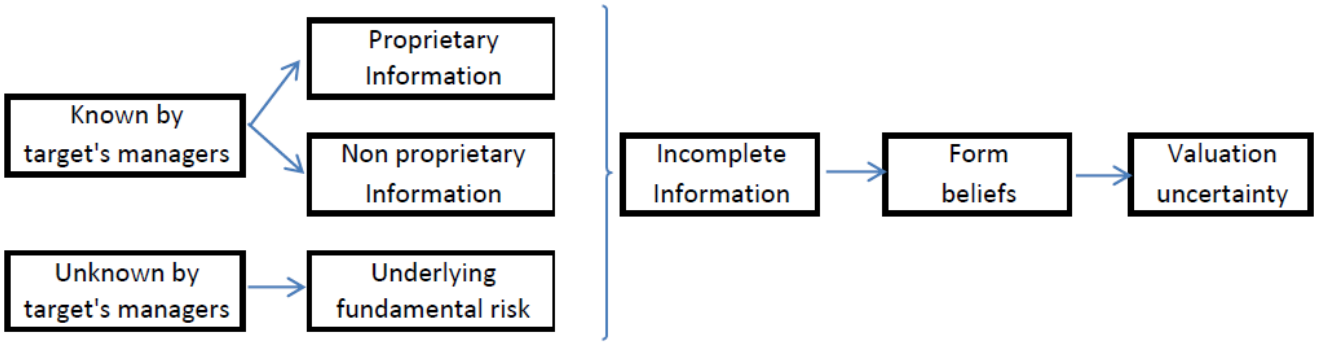
I estimate the following time-series regression for each target firm

$$STDret_{i,t} = a + b_1 STDindret_t + b_2 STDindret_{t-1} + b_3 SDTmktret_t + b_4 STDmktret_{t-1} + \epsilon$$

where $STDret_{i,t}$ stands for standard deviation of weekly returns for target i for the period of (-540, -180) where 0 in the transaction annoucement, $STDindret_{i,t}$, standard deviation of the weighted average (market value) of industry weekly returns (excluding the target firm), and $STDmktret_{i,t}$ is the standard deviation of the weighted average (market value) of the weekly returns for all firms except the target. $SYNCH = \left(\frac{1-R^2}{R^2}\right)$ where is the explained variability, R^2, of $STDret_{i,t}$

Figure 1: Effect of information incompleteness on seller's expected revenue

Part A: Creation of valuation uncertainty



Part B: Effect of valuation uncertainty on seller's revenue

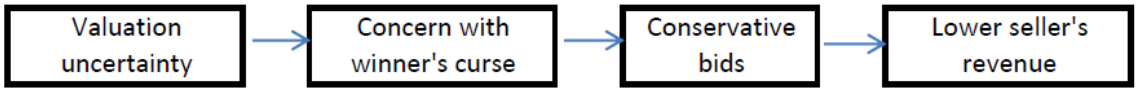


Figure 2: Effect of uncertainty related to proprietary information and premium

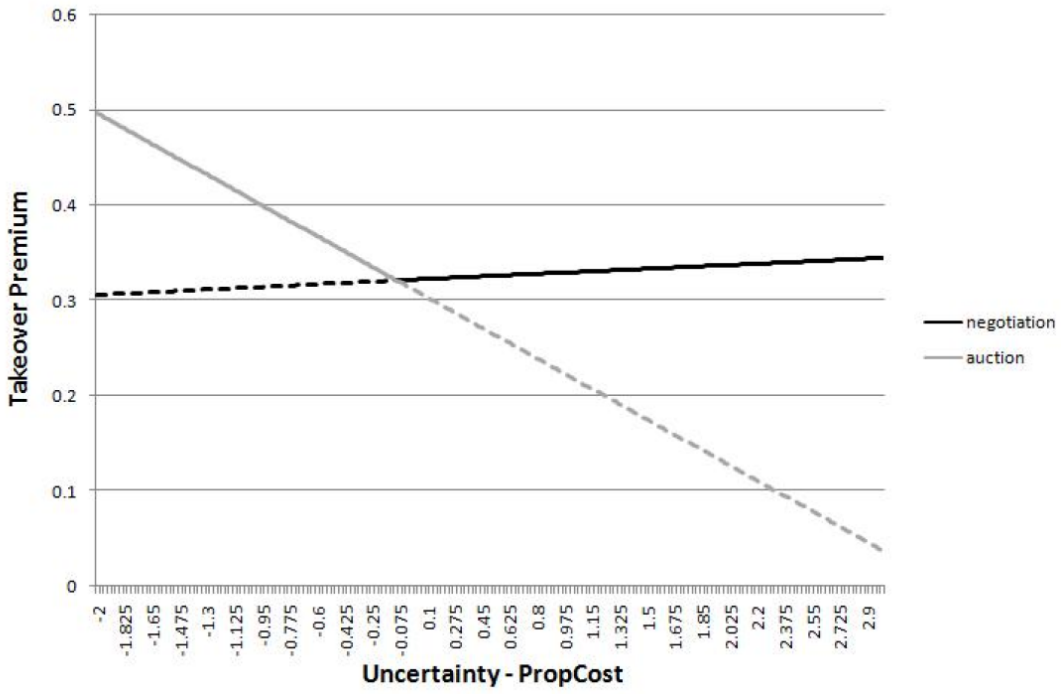


Table 1: Sample composition

Panel A: Takeover transactions by industry
Based on Fama and French [1997] 12-industry classification

	Full Sample	
	Freq.	**% total**
Consumer NonDurables	7	2.98%
Consumer Durables	2	0.85%
Manufacturing	21	8.94%
Oil, gas, and coal	14	5.96%
Chemicals and allied products	0	0.00%
Business Equipment	64	27.23%
Telephone and Television Transmission	5	2.13%
Utilities	2	0.85%
Wholesale, Retail, and Some Services	13	5.53%
Healthcare, Medical Equipment, and Drugs	23	9.79%
Finance	61	25.96%
Others	23	9.79%
Total	235	100%

Panel B: Takeover transactions by year

	Full Sample	
	Freq.	**% total**
2002	21	8.9%
2003	25	39.1%
2004	45	70.3%
2005	62	96.9%
2006	66	103.1%
2007	16	25.0%
Total	235	100%

Table 2 - Descriptive Statistics

	Full Sample		Auction			Negotiation			Difference		
	N	Mean	N	Mean	Median	N	Mean	Median	d		t
Lit_Ind	254	0.256	120	0.292	0.456	134	0.224	0.418	0.068		1.234
Job_Retained	256	0.723	120	0.125	0.332	136	0.169	0.376	-0.044		-0.989
Relative_size	248	1.911	119	1.945	1.291	129	1.880	1.406	0.065		0.759
T_Size	248	1.250	119	0.603	0.988	129	1.847	7.863	-1.244	*	-1.837
Only_cash	256	0.516	120	0.642	0.482	136	0.404	0.493	0.237	***	3.783
Target_initiated	256	0.566	120	0.592	0.494	136	0.544	0.500	0.048		0.765
Regulated	256	0.316	120	0.225	0.419	136	0.397	0.491	-0.172	***	-2.948
T_Beta	248	0.943	119	0.951	0.727	129	0.936	-0.707	0.016		0.123
Inst_holdings	256	0.538	120	0.553	0.292	136	0.525	0.294	0.029		0.798
Analyst	256	0.840	120	0.800	0.402	136	0.875	0.332	-0.075	*	-1.63
Rating	256	0.277	120	0.200	0.402	136	0.346	0.477	-0.146	***	-2.591
T_NSegments	256	1.258	120	1.300	0.656	136	1.221	0.554	0.079		1.311
Same_industry	256	0.637	120	0.650	0.545	136	0.625	0.620	0.025		0.597
T_Age	256	14.727	120	15.800	15.825	136	13.779	11.336	2.021		0.309
PE_Ratio	253	14.441	119	12.137	61.202	134	16.488	121.101	-4.350		1.033
T_Growth	254	0.144	120	0.112	0.263	134	0.173	0.329	-0.061		-0.922
T_Liquidity	255	0.459	120	0.455	0.259	135	0.463	0.255	-0.008		-0.466
T_AcumRet	255	0.006	120	0.004	-0.022	135	0.008	-0.019	-0.005	**	-2.354

Table 3: Decomposition of Uncertainty

This table presents the OLS estimation of overall Uncertainty on proxies of proprietary information.
Uncertainty is the first principal component from three measures of valuation uncertainty. Refer to Appendix A for definition of the other variables.

Robust z-statistics are presented in parentheses.
*** p<0.01, ** p<0.05, * p<0.1,

VARIABLES	Coef.	t
Herf_weighted	-0.744	(-0.683)
R&D_intensity	0.097***	(2.680)
Entrycost	-1.187***	(-5.072)
ProductSubs	3.238***	(6.218)
Constant	-4.139***	(-6.045)
Observations	235	
R-squared	0.43	

Table 4: Determinants of the Choice of Selling Mechanism

This table presents the estimation of the effect of valuation uncertainty on mechanism choice using PROBIT estimation.
The dependent variable in the selection model is a dummy variable equals 1 if a target chooses negotiation, and 0 otherwise. **Uncertainty** is the first principal component from three measures of valuation uncertainty. **CompPropCost and CompResidual** are the two components of the overall Uncertainty. **Bid-Ask Spread** is the target's average difference between closing bid and closing ask spread for the period of (-316, -64) available at CRSP daily files.
Refer to Appendix A for definition of the other variables.

	Model 1		Model 2			Model 3	
	Coef.	**z**	**Coef.**	**z**	**Mx Effect**	**Coef.**	**z**
Main determinants							
Uncertainty	0.104***	(2.977)					
CompPropCost			0.478**	(2.129)	0.188**		
CompResidual			0.002	(0.0135)	0.001		
Bid-Ask Spread						1.077**	-2.203
Other determinants							
Lit_Ind	-0.437***	(-4.209)	-0.459***	(-5.134)	-0.181***	-0.358*	(-1.927)
CEO_Chair	-0.129	(-0.495)	-0.172	(-0.653)	-0.067	-0.057	(-0.200)
Prior lit.							
Relative_size	0.044	(0.894)	0.040	(0.855)	0.016	-0.021	(-0.271)
T_Size	0.171*	(1.888)	0.178*	(1.893)	0.070*	0.220**	(2.283)
Target_initiated	0.021	-0.091	0.029	(0.122)	0.011	0.043	(0.171)
Regulated	0.302	(1.034)	-0.072	(-0.319)	-0.028	0.393	(1.269)
T_Beta	-0.138	(-0.840)	-0.136	(-0.798)	-0.053	-0.096	(-0.346)
Info. Evironment							
Inst_holdings	-0.202	(-0.475)	-0.133	(-0.309)	-0.052	-0.077	(-0.124)
Analyst	0.379	(1.288)	0.405	(1.319)	0.160	0.463	(0.538)
Rating	0.438	(1.139)	0.419	(1.131)	0.160	0.599	(1.565)
Synergy							
T_NSegments	-0.276**	(-2.324)	-0.268**	(-2.080)	-0.105	-0.281	(-1.454)
Attractiveness							
T_Age	0.000	(0.428)	0.000	(0.429)	0.000	0.000	(0.323)
PE_Ratio	-0.012*	(-1.653)	-0.010	(-1.640)	-0.004	-0.015***	(-3.698)
T_Growth	0.613**	(2.311)	0.499*	(1.819)	0.196	0.880***	(3.972)
T_Liquidity	-0.226	(-0.554)	-0.365	(-0.981)	-0.143	0.112	(0.675)
T_AcumRet	5.025	(1.121)	4.598	(1.066)	1.806	3.471	(0.685)
Inherent chrts							
T_SaleSD	0.000***	(4.435)	0.000	(1.372)	0.000	0.000	(0.0226)
T_Loss	0.190	(1.070)	0.316	(1.599)	0.124	0.169	(0.816)
T_Margin	-0.022	(-0.497)	0.016	(0.471)	0.006	-0.012	(-0.275)
Constant	0.548	(1.211)	0.702	(1.415)		-0.125	(-0.170)
Observations	221		221			195	
Pseudo R-squared	0.15		0.16			0.15	

Table 5: Determinants of Takeover Premium

This table presents the estimation of the effect of valuation uncertainty on mechanism selection and on takeover premium conditional on the mechanism chosen, using OLS estimation for each mechanisms and an endogenous switching regression.
The dependent variable in the selection model is a dummy variable equals 1 if a target chooses negotiation, and 0 otherwise. In the 2nd stage, the dependent variable is the takeover premium for each mechanism, calculated as the percentage change from 42 days prior to the announcement and the offer price as reported in SDC Thompson. **CompPropCost** and **CompResidual** are the two components of the overall Uncertainty. Refer to Appendix A for definition of the other variables.

Robust z-statistics are presented in parentheses. *** p<0.01, ** p<0.05, * p<0.1,

VARIABLES	Single Equation				Endogenous Switching			
	Auction		Negotiation		Auction		Negotiation	
Main determinants								
CompPropCost	**-0.123*** **	**(-10.17)**	**-0.063**	**(-0.535)**	**-0.175*** **	**(-3.691)**	**0.015**	**(0.910)**
CompResidual	**-0.058*** **	**(-10.62)**	**0.004**	**(0.0793)**	**-0.077** **	**(-2.492)**	**-0.065***	**(-1.688)**
Job_Retained	**0.101**	**(1.550)**	**0.038**	**(1.127)**	**0.063**	**(1.516)**	**0.013**	**(0.233)**
Prior lit.								
Only_cash	-0.015	(-0.151)	0.051	(0.565)	0.037**	(2.411)	0.021	(0.347)
Relative_size	-0.012	(-1.329)	0.005	(0.251)	-0.028**	(-2.063)	0.008	(0.592)
T_Size	-0.010	(-0.278)	-0.003**	(-2.415)	0.002	(0.116)	0.001	(0.327)
Target_initiated	-0.088***	(-3.702)	-0.024	(-0.617)	-0.118***	(-2.708)	-0.007	(-0.160)
T_Beta	0.131***	(5.287)	0.109	()	0.114**	(2.072)	0.090*	(1.813)
Regulated	0.127***	(8.500)	0.008	(0.0632)	0.177**	(2.006)	0.044	(0.345)
Info. Evironment								
Inst_holdings	-0.309***	(-2.795)	-0.130	(-0.891)	-0.169*	(-1.795)	-0.111	(-0.832)
Analyst	-0.108**	(-2.200)	-0.174	(-1.261)	-0.227***	(-6.551)	-0.134	(-1.032)
Rating	-0.057	(-0.994)	0.031	(0.474)	-0.087	(-0.997)	0.121	(1.509)
Synergy								
T_NSegments	0.006	(0.243)	-0.004	(-0.057)	-0.016	(-0.546)	-0.057	(-0.976)
Same_industry	0.006	(0.129)	-0.018	(-0.228)	0.026	(0.932)	-0.009	(-0.174)
Attractiveness								
T_Age	-0.002	(-1.060)	-0.004	(-1.345)	0.002	(0.776)	-0.004**	(-2.556)
PE_Ratio	-0.001	(0.215)	0.000	(0.493)	-0.001***	(-7.423)	0.000	(1.218)
T_Growth	-0.273**	(-2.669)	-0.116	(-1.586)	-0.290**	(-2.181)	-0.170	(-1.339)
T_Liquidity	0.131	(0.643)	-0.056	(-0.354)	0.084	(0.573)	-0.199	(-1.416)
T_AcumRet	-0.384	(0.245)	-2.251***	(-8.703)	0.512	(0.305)	-1.907	(-0.926)
Constant	0.529**	(2.560)	0.555***	(2.945)	0.281*	(1.698)	0.599***	(3.247)
Year dummies	YES		YES		YES		YES	
lns0/lns1					-1.17***	(-12.60)	-1.20***	(-8.06)
r0/r1					-7.353	()	1.635***	(3.019)
Observations	106		115		221		221	
R-squared	0.42		0.20					
LR test statistic (p-value)					13.71 (0.00)			

Table 6: Switching Regression Estimates of Takeover Premium for Negotiation and Auction on Uncertainty and CEO retained in the combined firm

This table presents the estimation of the effect of valuation uncertainty on mechanism selection and on takeover premium conditional on the mechanism chosen, using an endogenous switching regression.
The dependent variable in the selection model is a dummy variable equals 1 if a target chooses negotiation, and 0 otherwise. In the 2nd stage, the dependent variable is the takeover premium for each mechanism, calculated as the percentage change from 42 days prior to the announcement and the offer price as reported in SDC Thompson. **CompPropCost** and **CompResidual** are the two components of the overall Uncertainty. Refer to Appendix A for definition of the other variables.

Robust z-statistics are presented in parentheses. *** p<0.01, ** p<0.05, * p<0.1,

VARIABLES	Auction		Negotiation	
Main determinants				
CompPropCost*(1-Job_Retained)	**-0.158*** **	**(-2.580)**	**-0.037**	**(-0.332)**
CompPropCost*Job_Retained	**-0.098**	**(-0.676)**	**-0.004**	**(-0.029)**
CompResidual	-0.079**	(-2.469)	-0.069*	(-1.850)
Job_Retained	0.065	(1.121)	0.008	(0.121)
Prior lit.				
Relative_size	-0.026	(-1.540)	0.008	(0.578)
T_Size	-0.000	(-0.007)	0.001	(0.339)
Only_cash	0.041*	(1.793)	0.018	(0.311)
Target_initiated	-0.117***	(-3.077)	-0.010	(-0.217)
Regulated	0.165	(1.396)	0.054	(0.417)
T_Beta	0.117**	(1.993)	0.091*	(1.785)
Info. Evironment				
Inst_holdings	-0.173*	(-1.693)	-0.115	(-0.909)
Analyst	-0.216***	(-5.593)	-0.135	(-1.168)
Rating	-0.083	(-0.758)	0.113	(1.576)
Synergy				
T_NSegments	-0.013	(-0.361)	-0.058	(-1.004)
Same_industry	0.036	(0.812)	-0.004	(-0.080)
Attractiveness				
T_Age	0.002	(0.727)	-0.004**	(-2.561)
PE_Ratio	-0.001***	(-4.606)	0.000	(1.403)
T_Growth	-0.291*	(-1.908)	-0.176	(-1.302)
T_Liquidity	0.076	(0.353)	-0.196*	(-1.697)
T_AcumRet	-0.003	(-0.002)	-2.001	(-0.922)
Constant	0.276		0.599***	
Year dummies	YES		YES	
lns0/lns1	-1.18***	-1.221***		
r0/r1	-6.811	1.560***		
Observations	221			
LR test statistic (p-value)	14.62 (0.00)			