Preemptive Bidding, Target Resistance and Takeover Premia: An Empirical Investigation*

Stefano Sacchetto
London Business School†

Theodosios Dimopoulos
London Business School††

Job Market Paper

This version: November 2008

Abstract

This paper proposes an empirical framework to evaluate two sources of large takeover premia that have been advanced in the literature: preemptive bidding and target resistance. We develop an auction model that features costly sequential entry of bidders in takeover contests and encompasses both explanations. The parameters of the model are estimated using a structural approach for a sample of US target firms in the period 1988-2006. We find that takeover premia are mainly determined by target resistance rather than preemptive bidding. The paper also quantifies the benefits of preemption for an initial bidder and the effects of target resistance and costs of entry on bidders' participation decisions.

JEL Classifications: D44, G34

Keywords: Merger, tender offer, auctions, preemptive bidding, structural estimation

---

*We are grateful to Eva Ascarza, Jean-Pierre Benoit, Patrick Bolton, Julian Franks, Vassilis Hajivassiliou, Christopher Hennessy, Emeric Henry, Denis Gromb, Margaret Kyle, Tracy Lewis, Marco Ottaviani, Robert Porter, Paolo Volpin and seminar participants at Kellogg School of Management and the Santander Corporate Governance Summer School for useful comments and suggestions. All remaining errors are our responsibility.

† Department of Economics, London Business School, Sussex Place, Regent's Park, London NW14SA, England. Phone:+44-20-7000-8454. Fax:+44-20-7000-8401. E-mail: ssacchetto.phd2004@london.edu. Web: http://phd.london.edu/ssacchetto.phd2004.

†† Department of Finance, London Business School, Sussex Place, Regent's Park, London NW14SA, England. Phone:+44-20-7000-8246. E-mail: tdimopoulos.phd2004@london.edu.

1. Introduction

Only a limited fraction of takeovers involves more than one potential acquirer bidding for the target company, but at the same time the average premium paid for control is substantial. Thus, in a sample of takeover contests for US target firms between 1988 and 2006 we find that 94% feature only one bidder, but the average premium offered over the target pre-announcement stock price is 51%.[1] This paper investigates two leading theories that have been advanced in the literature to explain this fact: preemptive bidding and target resistance.

The preemptive bidding theory suggests that takeover premia are determined not only by actual, but also by potential competition. If entry into takeover contests is costly, an initial bidder may deter the entry of a rival by making a bid that signals a high enough valuation for the target. Premia paid in single bidder takeovers then reflect the cost of deterring rival bidders from entry (Fishman (1988)).

According to the target resistance theory, target shareholders may resist takeover proposals if the premium offered is not high enough. This resistance may reflect information on future takeover opportunities (Bradley Desai and Kim (1983)); the value of private benefits of large shareholders (Bebchuk (1994)); or job security considerations of employee shareholders (Chaplinsky and Niehaus (1994)).[2]

The main contribution of our paper is to quantify the role of these two factors, preemptive bidding and target resistance, in the determination of takeover premia. In order to do so, we develop an auction-theoretic model of takeover competition that encompasses both explanations, and estimate its underlying parameters using a structural approach.

Our model of the takeover process consists of two phases. The first builds on Fishman (1988). An initial bidder decides whether to pay a cost in order to learn his valuation for the target and then initiate the takeover contest by making a bid. Having observed the value of this bid, a second bidder decides whether to learn his valuation for the target by also paying an entry cost. After entry decisions are undertaken, an English auction for the target ensues.

[1] Other papers report similar figures. For example, Betton, Eckbo and Thorburn (2008b) in a sample of US target firms in the period 1980-2006 find that single bidder contests account for 96.6% of the cases.

[2] Grossman and Hart (1980) propose a free riding explanation for the extraction of takeover surplus by target shareholders in tender offers. However, high premia are also paid in merger deals, which account for 78% of takeover offers in our sample.

The second phase extends Fishman's model to account for target shareholder resistance. More precisely, the winner of the auction learns the minimum takeover offer acceptable by target shareholders and may top up the winning bid. Finally, target shareholders decide whether to accept or reject the highest standing offer.

In the signalling equilibrium of the game, the initial bidder deters the rival bidder from entry with a high enough bid whenever his valuation for the target is higher than a threshold. Otherwise, a multiple bidder contest takes place. In either case, the highest valuation participant bidder acquires the target if his valuation exceeds the minimum acceptable offer.

An empirical investigation of the effects of preemptive bidding and target resistance on takeover premia has to address several issues. The first is an omitted variables problem: the characteristics of deterred bidders and their costs of entry are unobservable to the researcher. The second concerns sample selectivity arising from the endogenous entry decisions of the bidders. Only bidders with a high enough valuation for the target and a relatively low cost of entry participate the contest. Thirdly, the estimation framework needs to take into account a simultaneity problem: the probability that a bidder acquires the target is jointly determined with the premium he offers.

This paper follows a structural estimation approach to overcome these empirical challenges. More precisely, our methodology exploits the equilibrium predictions of the model and the information included in final takeover bids, the number of participating bidders and the outcome of takeover contests to estimate the parameters governing the distributions of costs of entry and bidders' valuations, and the level of target resistance.

The implications of the model about observable aspects of takeover activity form the basis for identification. On the one hand, higher target resistance (captured by the minimum acceptable price) deters entry by the bidders, produces a higher frequency of contests in which the target remains independent and increases the premia paid in successful takeovers. On the other hand, the threshold for preemption and the value of the preemptive bid are decreasing in the second bidder's cost of entry and increasing in his expected valuation. Thus, higher costs of entry and a lower expected valuation for the second bidder are both factors that increase the fraction of single bidder contests and reduce takeover premia.

These two factors can be separated empirically since an increase in the second bidder's expected valuation that causes an equal change in the preemption threshold as a decrease in his cost of entry, induces higher takeover premia and higher probability that the second bidder acquires the target.

The estimation is based on a sample of takeover bids for US public companies in the period 1988-2006. Successive bids for the same target are grouped into takeover contests. These contests are classified according to the number of participating bidders (single or multiple bidder contests) and the final outcome of the takeover (the party controlling the target at the end of the contest). The estimation is performed using the indirect inference method of Gourieroux, Monfort and Renault (1993) allowing for observed and unobserved heterogeneity across takeover contests as well as asymmetry in bidders' valuations.

The main results of the paper are the following. First, despite the high fraction of single bidder takeovers, the estimated costs of entry are relatively small and average only 1.96% of the target pre-acquisition market capitalization. Second, bidders are found to be very asymmetric with respect to their valuation for the target, with the initial and the second bidder valuing the target on average 97% and 58% respectively above the pre-acquisition stock price. The fact that the second bidder is ex-ante a much weaker competitor means that, even if costs of entry are small, the initial bidder can deter him from entry with a relatively low initial bid. This implies that the high premia offered in single bidder contests reflect to a larger extent the need to overcome target resistance rather than potential competition. Indeed, the results indicate that even in the absence of an entry threat by a second bidder the premium in single bidder contests would average 48%. Given that the respective premium observed empirically is 51%, this leaves a small contribution of preemptive bidding to single bidder takeover premia compared to target resistance. Our simulation analysis suggests that the probability that the acquisition price in successful single bidder contests is determined by target resistance is 70%.

We further quantify the trade-off associated with preemption for an initial bidder. We find that the probability that an initial bidder deters the entry of a stronger rival and eventually acquires the target is 9%. Furthermore, preemption reduces the premium paid by an initial bidder to acquire the target with probability 47% and by 7.3% on average.

However, in 10% of the cases in which there is preemption, the initial bidder ends up paying more than would be necessary to acquire the target in an auction, with an average overpayment of 34%.

The paper proceeds as follows. Section 2 reviews the related literature. Section 3 presents the model of takeover contests which forms the basis for structural estimation, and discusses its main predictions. Section 4 outlines our empirical strategy and describes the construction of takeover contests. Section 5 provides the results of the estimation and the simulation experiments. Section 6 concludes.

2. Literature

This paper develops and estimates an auction model of takeover contests. There is a large literature that applies auction theory to model competition in takeovers.[3] Our model is most closely related to Fishman (1988), who studies bidding in English auctions with costly sequential entry and shows that preemptive bidding can arise in equilibrium.[4] We expand his framework by introducing a shareholder approval stage. This allows us to account for target resistance and to rationalize takeovers in which all bids are rejected and the target eventually remains independent.[5]

Despite the theoretical interest, the empirical evidence on preemptive bidding is scarce. In a sample of takeover bids from 1979 to 1987, Jennings and Mazzeo (1993) find that higher initial bid premia are more likely to deter competing offers and overcome target management resistance. More recently, Betton and Eckbo (2000) as well as Betton, Eckbo and Thorburn (2008b) find that the initial bid in contests which eventually see entry by other bidders is lower than the final price in single bidder contests. They interpret this finding as consistent with the preemptive bidding hypothesis.

Our empirical framework is related to the literature on structural estimation of auction

[3] Some contributions to this literature are by Bulow and Klemperer (1996) and Jehiel and Moldovanu (1996). Spatt (1989) and Dasgupta and Hansen (2008) provide extensive reviews of the field.

[4] Other models that build upon this framework are Fishman (1989), in which bidders can use cash or debt as a medium of payment for the takeover and Che and Lewis (2007) who allow target management to award termination fees and stock lockups to potential acquirers. Hirschleifer and Png (1989) and Daniel and Hirschleifer (1998) provide related models in which bidding is costly.

[5] Alternative models of takeover bidding with target resistance can be found in Giammarino and Heinkel (1986) and Betton, Eckbo and Thorburn (2008a).

models (see Paarsch and Hong (2006), Hendricks and Porter (2007) and Athey and Haile (2008)).[6] The approach pursued by these papers is to use the equilibrium conditions of the auction model in order to retrieve information about bidders' valuations from observed bids. To the best of our knowledge, the only other paper that uses a structural auction approach for takeovers is Ivaldi and Motis (2007). They model competition for a target as a first-price sealed-bid auction among bidders with independent private values in order to infer bidders' gains from merging. Our paper instead focuses on endogenous bidder participation to rationalize single bidder contests and accommodates preemptive bidding and target resistance.

This paper relates more generally to the growing literature that applies structural methods to the analysis of takeover activity. Hackbarth and Morellec (2008) employ a real options framework to study stock returns in mergers and acquisitions. Albuquerque and Schroth (2008) estimate the model of block pricing proposed by Burkart, Gromb and Panunzi (2000) to analyze the determinants of private benefits of control in negotiated block transactions. Rhodes-Kropf and Robinson (2008) develop and test a model of investment and takeover activity that explains empirical regularities in the matching of bidders and targets.

3. Model

This section analyzes a model of takeover contests in an auction framework with costly sequential entry along the lines of Fishman (1988). The model forms the basis of the structural estimation procedure.

3.1. Setting

The takeover game involves two bidders (B_1 and B_2) competing for the control of a target company, and the target shareholders (S).

Bidder B_i's valuation for the target is $V_i = qv_i$, where $q \in \{0, 1\}$ is a common value component and $v_i > 0$ is a private component. Valuations are measured in terms of premium

[6] Papers in this literature that account for endogenous entry decisions by bidders are, for example, Bajari and Hortacsu (2003), who employ a model of endogenous entry and bidding in eBay coin auctions, and Levin, Athey and Seira (2004), who study the effect of different auction formats on the entry decisions of bidders in timber auctions.

over the target standalone value which is normalized to zero. The common value component reflects macro or industry-wide factors of takeover profitability, such as regulation and technological changes or market liquidity shocks. The private value component represents operational synergies that would result from the takeover of the target, as well as bidder specific takeover motives like risk-diversification or empire building. We assume that $q = 1$ with probability $0 < \lambda < 1$ and that $\{v_1, v_2\}$ are mutually statistically independent. B_i's private valuation is drawn from a distribution function $F_i(\cdot)$ with density function $f_i(\cdot)$ and monotonically increasing hazard rate $h_i(v_i) = \frac{f_i(v_i)}{1-F_i(v_i)}$. The valuation of target shareholders if the firm eventually remains independent is v_0. This valuation has density function $f_0(\cdot)$ and is independent of v_1 and v_2.[7] At the start of the game players' valuations are unknown and each bidder can privately learn v_i by paying an entry cost $c_i > 0$. Following Fishman (1988), we assume that c_i is upper bounded by $\overline{c} = E(\max\{v_2 - \max\{v_0, v_1\}, 0\})$. Payment of the entry cost is mandatory for a bidder in order to submit a bid. Costs of entry as well as densities $f_i(\cdot)$, $i = 0, 1, 2$, are common knowledge. After entry costs are sunk, bidding is public, non-retractable and costless, with minimum permissible bid equal to zero.

As shown in Figure (1), the game unfolds in two main stages: Bidder competition and target shareholders' approval. In the first stage, B_1 observes the value of q and then decides whether to incur c_1 in order to learn v_1; the realizations of q and v_1 are private information to B_1. Next, B_1 decides whether and how much to bid for the target. If B_1 does not make an offer for the target, we assume that the contest terminates and the target remains independent.[8] If instead B_1 submits an initial offer, B_2 decides whether to pay c_2 in order to privately learn his valuation. An English auction ensues for the target with minimum price equal to the initial bid made by B_1.[9]

In the second stage, the auction winning offer goes through shareholders' approval. At this point, the shareholders' valuation v_0 is revealed to the winner of the auction $B_w \in$

[7] The model assumes that there are always two bidders interested in a target, but it does not require that they actually participate the contest. This assumption implies that there are two bidders in the economy that would be interested in acquiring the target for an arbitrarily small premium.

[8] This allows us to uniquely interpret single bidder contests in the data as cases in which only the *initial* bidder makes a public bid.

[9] Even though normally no formal auction is held for takeover targets, the *fiduciary out* rule mandates that target directors have to consider rival bids submitted in the period between a merger offer and its final approval. This implies that rival bidders cannot be precluded from participating a merger contest. In the case of tender offers, the Williams Act (1968) requires the offer to remain open for at least 20 business days on the grounds that the delay facilitates bidding competition.

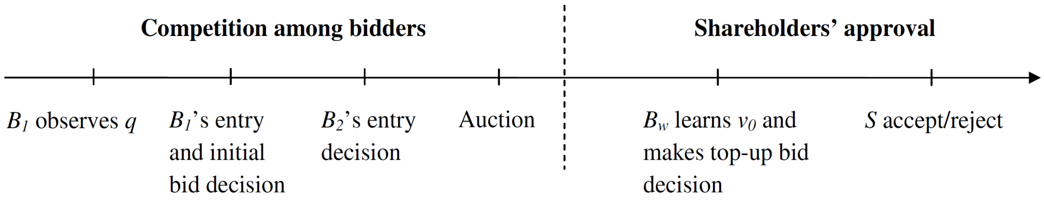

Figure 1: *Timing of the game. The players are bidders B_1 and B_2 and target shareholders S. q represents the common component of bidders' valuations; v_0 denotes target shareholders' valuation; B_w is the winner of the auction.*

$\{B_1, B_2\}$. If the winning bid in the auction b_w is below v_0, B_w can top it up to v_0. Finally, target shareholders decide whether to accept or reject the highest standing offer.

3.2. Equilibrium

We describe the equilibrium of the model proceeding by backward induction.

In the shareholders approval stage, the winner of the auction knows the valuation of target shareholders, and tops up the winning bid in the auction only if it is necessary ($b_w < v_0$) and profitable for him to do so ($v_w \geq v_0$). Target shareholders accept the highest standing bid if this is at least v_0 and reject it otherwise.

The strategies at the auction stage are standard. If both bidders participate the auction, bidder B_i exits when the price reaches v_i. If only B_1 participates, he exits as soon as the auction starts, and the highest standing bid is equal to the initial bid.

Consider now the entry decisions and the choice of the initial bid. The following proposition describes the unique sequential equilibrium with credible beliefs refinement.[10]

Proposition 1 *There exists a valuation threshold $\widehat{v}(\cdot) : (0, \overline{c}) \longrightarrow \mathbb{R}_+$, a bidding function $\widehat{b}(\cdot) : \mathbb{R}_+ \longrightarrow \mathbb{R}_+$ and a cost of entry threshold $\widehat{c}_1(\cdot) : \mathbb{R}_+ \longrightarrow \mathbb{R}_+$ such that:*

i) B_1 enters the contest (pays c_1) if and only if $c_1 \leq \widehat{c}_1(c_2)$ and $q = 1$.

ii) If B_1 enters, he makes an initial bid $b^I = \widehat{b}(\widehat{v}(c_2))$ if $v_1 \geq \widehat{v}(c_2)$ and $b^I = 0$ when $v_1 < \widehat{v}(c_2)$.

[10] This refinement was introduced by Grossman and Perry (1986) and is used by Fishman (1988).

iii) If B_1 does not make an initial bid, B_2 infers that $q = 0$ and the game terminates. If instead an initial bid b^I is made, B_2 infers that $q = 1$ and forms beliefs on v_1:

$$\mu^*\left(v|b^I\right) = \begin{cases} \frac{f_1(v)}{1-F_1(\widehat{v}(c_2))},\ v \in [\widehat{v}(c_2), \infty) & \text{if } b^I \geq \widehat{b}(\widehat{v}(c_2)) \\ \frac{f_1(v)}{F_1(\widehat{v}(c_2))},\ v \in [0, \widehat{v}(c_2)) & \text{if } b^I < \widehat{b}(\widehat{v}(c_2)) \end{cases}.$$

B_2 enters the contest (pays c_2) if and only if $b^I < \widehat{b}(\widehat{v}(c_2))$.

Proof. (See Appendix)

The intuition for the equilibrium can be explained as follows. Consider B_1's decision concerning the value of the initial bid once he has entered the contest. At this stage, B_1 can preempt B_2 by signalling a high valuation for the target. In a signalling equilibrium, any weakly increasing bidding schedule is informative with respect to B_1's valuation. In other words, a higher initial bid signals a weakly higher valuation for B_1. If the initial bid is high enough, B_2 infers that B_1 would be too strong a competitor in an auction, and would not break even in expectation on his cost of entry c_2. Not every type of B_1 can benefit from preemption though. Indeed, making such a bid would be unprofitable for low valuation types, as preemption requires that the initial bidder submits an initial bid of at least $\widehat{b}$. Since the gains from entry deterrence increase in B_1's valuation[11], the equilibrium predicts that there will be a threshold valuation above which all B_1 types choose to preempt B_2.

Notice that there is a continuum of signalling equilibria. Following Fishman (1988), we use the *credible beliefs* refinement which selects the most profitable equilibrium for B_1. In this equilibrium, $\widehat{v}$ is the threshold B_1 valuation that makes B_2 indifferent between entering or not the contest if B_2 believes that $v_1 \geq \widehat{v}$. The preemptive bid $\widehat{b}$ is the one that equalizes B_1's expected gains when B_2 does not enter to his expected gains when he makes a zero-premium initial bid and B_2 enters. Every type $v_1 \geq \widehat{v}$ offers the minimum preemptive bid $\widehat{b}$ and every type $v_1 < \widehat{v}$ submits the minimum admissible bid, zero.[12]

At the initial stage, B_1 enters the takeover contest and makes an initial bid only if the common value for the target is positive ($q = 1$) and his expected gains from initiating the

[11] This follows by the monotonicity assumption of the valuations' hazard rate.

[12] Although any bid lower than $\widehat{b}$ would not preempt B_2, if B_1's valuation is less than $\widehat{v}$, he would only submit a zero premium initial bid, as bids are non-retractable.

contest, $\widehat{c}_1$, weakly exceed the cost c_1. If B_1 does not submit an initial bid, B_2 infers that $q = 0$ and the game terminates with the target remaining independent.

3.3. Discussion

Our model expands the framework of Fishman (1988) to endogenize failed takeover contests. There are at least three reasons why target shareholders may reject a positive premium takeover offer. The first is associated with new information on the standalone value of the firm revealed after the initiation of the contest. Dodd and Ruback (1977) and Bradley (1980) document positive permanent revaluation of target shares in *unsuccessful* takeovers. Bradley Desai and Kim (1983) attribute this effect primarily to the anticipation of a future takeover bid. The second reason is related to the potential loss of private benefits of control enjoyed by the target's large shareholders in the event of a takeover. These benefits may include value diversion for controlling shareholders by means of self-dealing, synergies or market power accruing to other firms controlled by the target's blockholders (Bebchuck 1994). A third reason is that employee shareholders have high reservation value when considering tendering their shares to a bidder, because of job security considerations (Stulz 1988). Relatedly, Chaplinsky and Niehaus (2004) find empirical evidence that employee stock option plans perform a defensive role against takeover offers comparable in magnitude with the one of poison pills.

In the model we assume that the winner of the auction learns the target shareholder's own valuation if the company remains independent (v_0). This information can be revealed, for example, by the reaction of target blockholders and employee shareholders to the takeover offer, or by the voting recommendation of target management to its shareholders. The bidder can then infer whether the takeover project remains a profitable investment opportunity or not. An alternative approach to modelling failed takeover contests would be to allow target shareholders to participate the auction as large toehold bidders.[13] In that case, the preemption argument of the model would remain, but the functional form of the bidding and entry strategies would impose a high computational burden on the estimation

[13] Models of toehold bidding in takeover contests can be found in Burkart(1995), Bulow, Huang and Klemperer(1999) and Singh(1998).

procedure.

4. Empirical Strategy

An empirical assessment of the effects of preemptive bidding and target resistance on takeover premia faces several challenges. The first is an omitted variables problem. As Betton, Eckbo and Thorburn (2008b) point out, "testing preemption arguments is difficult since one obviously cannot observe deterred bids". In addition, the costs of entry in a takeover contest can involve components unobservable to a researcher. Examples of such components include investment opportunity costs as well as transaction costs in securing the financing of the deal[14]. A second problem arises from sample selectivity. The estimation needs to take into account that only bidders with a high enough valuation for the target and a relatively low cost of entry participate the contest. A third issue is simultaneity: The distributions of players' valuations and costs of entry need to rationalize at the same time the premia offered, the number of participant bidders and the takeover outcomes.

In order to overcome these difficulties, we employ a structural estimation approach. The analysis of our empirical strategy starts with a description of the dataset of takeover bids used in the estimation. We then proceed to discuss the mapping between model predictions and observable takeover outcomes. Finally, we outline our parameterization assumptions, explain the estimation method and discuss the identification of the structural parameters.

4.1. Construction of takeover contests

This section describes our data sample and outlines the criteria used to classify bids for the same target into takeover contests. Our main data source is Thomson's Financial SDC Platinum database, which for each takeover bid provides information on the date of announcement, the price per target share offered by the bidder, the percentage of target shares sought in the transaction and the date of takeover completion or withdrawal of the

[14] Observable entry costs are legal and advisory fees, typically ranging 1-2% of the deal value, and the cost of preparing a proxy fight. For instance, the proxy fight cost in the Microsoft-Yahoo takeover attempt was estimated to be in the range of 20-30 mil USD. These costs included the production of persuasive mailings to Yahoo shareholders and the fees charged by the advisor to manage preparations for and the execution of a proxy battle. (*The New York Times*, February 20, 2008.)

offer. From SDC we also collect a number of contest characteristics, which are described below.

We select a sample of disclosed value control bids for US public companies with date of announcement between January 1^{st} 1988 and December 31^{st} 2006.[15] In control bids, an acquirer with less than 50% of the target shares is seeking to raise his shareholdings to more than 50% after completion of the takeover. In order to classify bids into takeover contests, we start grouping bids by target firm. Within each group, a bid initiates a new contest for the target if any of the following criteria is met:

i) there has been no bid for the same target over the previous six months;

ii) the bid is announced after the takeover completion date of a previous successful offer;

iii) the bid is made at least 90 days after all previous bids were withdrawn.

We only consider contests for which we can identify the final outcome in SDC[16]; only one bid is made at the initiation date; and at most two bidders submit public offers for the target. This produces a sample of 7905 single bidder and 467 double bidder contests.

Offer premia are measured as $\omega\,(p_b/p_{-42} - 1)$, where ω is the percentage of target shares sought by the bidder; p_b is the price per target share offered; and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid in the contest, as reported in the Center for Research in Security Prices (CRSP) database.[17] The choice of a 42 day lag reflects the following tradeoff. On the one hand, target stock prices close to the announcement date are more likely to reflect anticipation of a takeover offer. On the other hand, prices at large lags are less informative on the standalone value of the target at the offer date. This may produce negative measures of takeover premia, which are not economically meaningful. To address these concerns, we follow Schwert (1996) who shows evidence of little takeover anticipation in the stock price around 42 days prior to the announcement of the initial bid,

[15] Deal types included are mergers and acquisitions of majority interest. We exclude spinoffs, recapitalizations, self-tenders, exchange offers, repurchases and transactions in which a company is acquiring a minority stake or remaining interest in the target.

[16] The status of the takeover bid is either "completed" or "withdrawn" as reported in SDC.

[17] The price p_{-42} is collected for common shares of the target company and it is adjusted for stock splits and dividends. We performed our estimation analysis for the subsample of cases in which all bids in the contest are for 100% of the target shares, and the results are comparable.

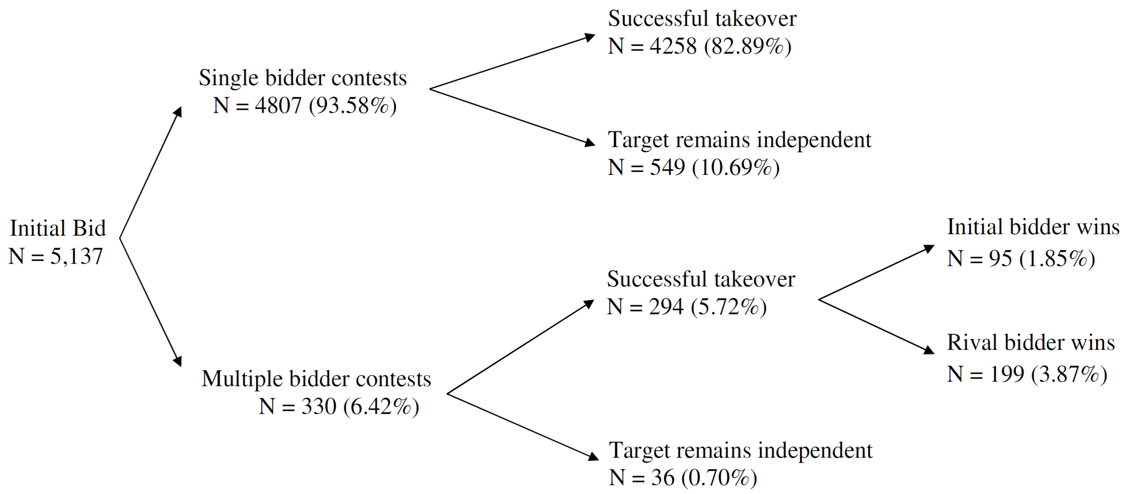

Figure 2: *Takeover outcomes in the sample of US public targets between 1988 and 2006.*

and furthermore we exclude from our sample contests in which the measured premium is negative.

In the estimation, for each contest we only use the premium corresponding to the *final offer*. This is defined as the winning bid in *successful* takeover contests (the target is acquired by one of the bidders) and the last withdrawn bid in *unsuccessful* ones (the target eventually remains independent). In order to be able to compute final offer premia we require targets to have stock price data listed in CRSP. Our final sample consists of 5,478 bids for control and 5137 contests[18]. Contests may have single or multiple bidders, and there may be multiple bids for each bidder.

4.2. Sample description

We classify each contest according to the number of participant bidders (single or multiple bidder contests) and the final outcome (successful or unsuccessful contest, and the identity of the winning bidder) in Figure (2). The great majority of contests (94%) features only one potential acquirer publicly bidding for the company. The model implies that the probability of an initial bidder acquiring the target reduces when a rival bidder enters the

[18] To account for extreme positive outliers we exclude contests in which at least one bid lies in the 99th percentile of the final offer premium.

contest. Consistently, Figure (2) shows that the bidder initiating the contest acquires the target with probability 88% in single bidder and 29% in multiple bidder contests. Entry of the second bidder does not affect the probability that the target remains independent, since this occurs in 12% of single bidder and 11% of multiple bidder contests.

As Table (1) shows, the average final offer premium is substantially higher in multiple bidder contests (64%) than in single bidder contests (50%). Moreover, the average premium that an initial bidder pays when he acquires the target is 8% higher if a second bidder participates. The premium increases even more to 69% when the rival bidder wins the contest. These figures provide preliminary evidence that competition by a rival bidder reduces the probability of success and increases the cost of acquisition for the initial bidder.

Takeover activity shows substantial variation across industries and years. A classification of takeover contests according to the primary industry by SIC code in which targets operate (Table (2)) shows that the majority of takeover activity (51%) is concentrated in the financial, business services, and supply of machinery and equipment industries. Aggregate takeover activity is cyclical over the sample period with high number of transactions taking place between 1995 and 2002 (Table (3)). Recent years have seen an increase in the fraction of successful takeovers and a decrease in the average premium offered.

In order to control for heterogeneity across takeovers, we incorporate in our analysis a number of variables related to contest characteristics. These covariates include: return on assets of the target, which accounts for pre-acquisition performance; log of target market capitalization, a measure of the size of the target company; target market to book ratio, which proxies for growth opportunities; a measure of takeover activity for the target industry at the year of the offer, which captures merger cyclicality at the industry level; and dummies for financial, insurance and real-estate target companies, targets operating in high tech industries, contests in which the initial bid is a tender offer and contests in which the management attitude towards the initial bid is friendly. Table (4) details the construction of these variables and Table(5) provides relevant summary statistics. In our sample, 21% of contests are initiated by a tender offer, with the final offer premium averaging 11% higher than in contests initiated by a merger bid. The difference is especially large (24%) for multiple bidder contests. The target management is hostile towards an initial bidder in

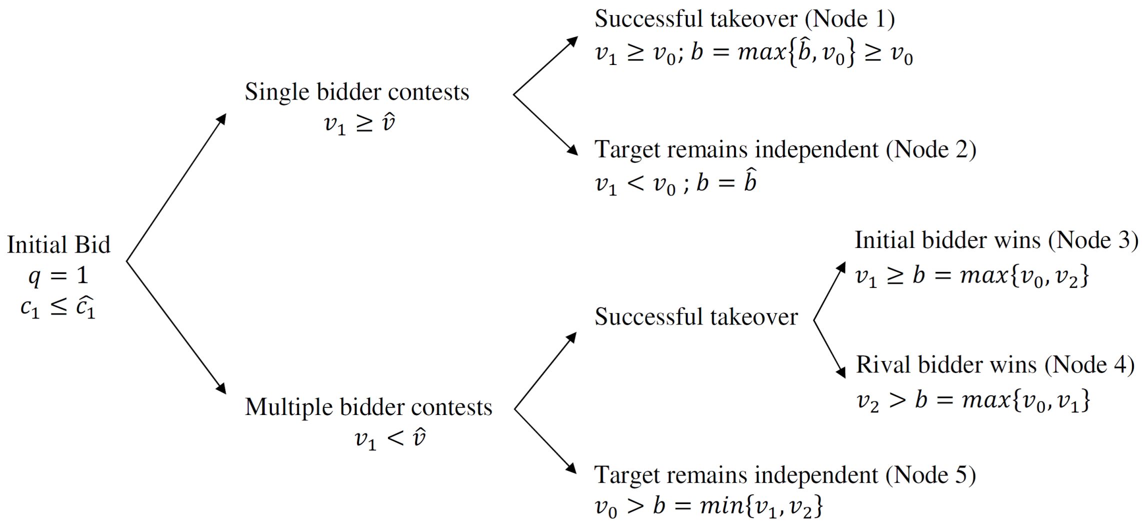

Figure 3: *Observable contest outcomes as predicted by the model. Final bids are denoted by b; $\widehat{c}_1$, $\widehat{v}$ and $\widehat{b}$ are, respectively, the entry cost threshold, the preemption valuation threshold and the value of the preemptive bid for the initial bidder; c_i is the cost of entry for bidder B_i; v_1, v_2 and v_0 are, respectively, the valuation of the initial and the second bidder and that of target shareholders.*

8% of the contests. In these cases, if a rival bidder enters the competition, the average final premium increases by 17%. Finally, premia paid are on average 7.7% lower for targets belonging to the financial sector and 8% larger for high tech firms.

4.3. Interpretation of takeover outcomes

The first step of the structural estimation approach that we follow consists in specifying the mapping between model predictions and takeover outcomes observed in the sample. In order to do so, we produce the theoretical counterpart of Figure (2) in Figure (3), which provides the interpretation according to the model of each possible outcome of a takeover contest and the associated final offer premium.

For all takeover contests observed in the data, the model implies that the initial bidder expects the target to be a profitable takeover opportunity ($q = 1$ and $c_1 \leq \widehat{c}_1$). Contests in which only one bidder makes a public bid for the target arise when the initial bidder has a valuation that exceeds the preemption threshold ($v_1 \geq \widehat{v}$) and preempts his rival. If that valuation also exceeds that of target shareholders ($v_1 \geq v_0$), the acquisition is successful (*Node 1*). In this case, the observed winning bid equals the maximum between the preemptive bid and the target shareholder's valuation. When the target instead remains independent (*Node 2*), the model implies that the initial bidder's valuation lies below the shareholder's valuation ($v_1 < v_0$). Furthermore, the final observed bid is equal to the preemptive bid, as the initial bidder refuses to top up.

Multiple bidder contests are interpreted as cases in which the initial bidder's valuation does not exceed the preemption threshold ($v_1 < \widehat{v}$). According to the model, the target is then allocated to the highest valuation player. If the target is acquired by one of the bidders (*Node 3* and *Node 4*), the final observed bid equals the maximum between the rival bidder's exit point in the auction and the target shareholder's valuation. If, instead, the target remains independent (*Node 5*), the winner does not top up and the final bid equals the winning bid at the auction stage.

4.4. Parameterization

A structural estimation of the model requires distributional assumptions for the players' valuations and the bidders' costs of entry. Conditional on target characteristics, we allow bidders to be ex-ante asymmetric in their valuations, but treat them as symmetric with respect to the costs of entry.

Players' valuations v_i, $i = 0, 1, 2$, are measured in percentage premium over the target stock price before the announcement of the initial bid in the contest. We assume that v_i follows a Weibull distribution with location parameter l_i and shape parameter a: $F_i(v) = 1 - \exp(-l_i v^a)$. This yields density function $f_i(v) = a l_i v^{a-1} \exp(-l_i v^a)$, mean valuation $E(v_i) = \frac{1}{a l_i^{1/a}} \Gamma\left(\frac{1}{a}\right)$ *decreasing* in l_i and variance $Var(v_i) = \frac{2a\Gamma\left(\frac{2}{a}\right) - \Gamma^2\left(\frac{1}{a}\right)}{l_i^{2/a} a^2}$ decreasing in a. Hazard rates, $h_i(v) = a l_i v^{a-1}$, are required by the model to be increasing in v, which implies that $a > 1$. The Weibull distribution is chosen because the simple form of its hazard rate allows closed-form derivation of extremum value statistics under valuation censoring.[19]

Contest heterogeneity is incorporated in the estimation through the location parameter l_i, which statisfies $\log(l_i) = \phi_i^I + (\boldsymbol{\phi}^o)' \mathbf{z}^o + \phi_i^U z^U$, where $\mathbf{z}^o$ is a $K \times 1$ target-specific vector

[19] This assumption is common in structural auction estimation literature (cfr. Paarsch (2006), Hendricks and Porter (2007)).

of covariates and z^U is an unobserved valuation component. The latter controls for target characteristics unobservable to the econometrician, but observable to the players and it is assumed to be standard normally distributed. To account for asymmetry in players' valuations we allow the coefficient related to unobserved heterogeneity ϕ_i^U and the intercept ϕ_i^I to vary across players.

Recall that costs of entry are upper bounded by $\bar{c}$. We assume that $c_i \equiv k_i\bar{c}$, where $k_i \in (0,1)$ follows a Beta distribution with parameters (β_1, β_2) and density $f_k(k) = \frac{k^{\beta_1-1}(1-k)^{\beta_2-1}}{\mathcal{B}(\beta_1,\beta_2)}$. This distribution features great shape flexibility, which facilitates moment matching as well as estimation robustness.

Finally, we assume that z^U and $\left(v_0, v_1, v_2, c_1, c_2 | \left(\mathbf{z}^o, z^U\right)\right)$ are identically and independently distributed across all takeover contests. Altogether, the assumptions yield a $(K+9) \times 1$ vector of structural parameters $\boldsymbol{\theta} = \left(\boldsymbol{\phi}^I, \boldsymbol{\phi}^o, \boldsymbol{\phi}^U, a, \beta_1, \beta_2\right)'$ defined over the parameter space $\Theta = \mathbb{R}^{K+6} \times (1,\infty) \times \mathbb{R}_+^2$.

4.5. Estimation methodology

In order to estimate the structural parameters of the model, we use the indirect inference method of Gourieroux, Monfort and Renault (1993) and Gourieroux and Monfort (1997). This approach involves matching a set of actual and simulated moments and consists of the following steps. First, we simulate data according to our *postulated model* in Section 3 at a given value of the structural parameter vector. Second, we specify an *auxiliary model* whose parameters can be easily estimated. Two estimates of the auxiliary parameter vector are then obtained, using the actual and the simulated data. The indirect inference estimation method selects the structural parameter vector that minimizes a metric of the distance between these two sets of estimates. The intuition for the validity of this approach is that even though the auxiliary model is misspecified, the misspecification error affects the estimates based on the sample and those based on the simulated data in the same way, provided that the postulated model reflects the true data generating process.

Let $\mathbf{b}$ be the vector of final offer premia in the actual sample of $N = 5137$ contests and $\mathbf{Z}^o = (\mathbf{z}_1^o, ..., \mathbf{z}_N^o)'$ an $N \times K$ matrix of observable covariates. Furthermore, define as $\mathbf{D}$ a

$N \times 5$ matrix of dummies whose n, j element equals one when the takeover outcome of contest $n \in \{1, ..., N\}$ is *Node* $j \in \{1, ..., 5\}$ (Figure (3)). We simulate $S = 80$ samples[20] of size N preserving in each the observables matrix $\mathbf{Z}^o$ and drawing independently z^U and $(v_0, v_1, v_2, c_1, c_2) \mid (\mathbf{z}^o, z^U)$ from their respective marginal distributions. Let $\mathbf{b}(\boldsymbol{\theta})$ and $\mathbf{D}(\boldsymbol{\theta})$ be, respectively, the pooled vector of final premia and the matrix of outcome dummies for all simulated samples.

The auxiliary model that we employ computes, for a given (actual or simulated) dataset of takeover contests, the following moments:

a) The fraction $\overline{\rho}_j$ of contests whose outcome *Node* is $j = 1, .., 4$;

b) OLS coefficients $\boldsymbol{\gamma} = (\boldsymbol{\gamma}_{\mathbf{D}}, \boldsymbol{\gamma}_Z)$ from a regression of final offer premia $\mathbf{b}$ on the outcome node dummies $\mathbf{D}$ and target characteristics $\mathbf{Z}^o$;

c) The variance $\overline{\sigma}_j^2$ of final offer premia in outcome *Node* $j = 1, ..5$.

More formally, the *auxiliary* parameter vector $\boldsymbol{\eta} = (\boldsymbol{\gamma}_{\mathbf{D}}, \boldsymbol{\gamma}_Z, \boldsymbol{\rho}, \boldsymbol{\sigma}^2)$ is defined on $\mathbf{H} = \mathbb{R}^5 \times \mathbb{R}^{K-1} \times [0,1]^4 \times \mathbb{R}^5_+$ and is estimated by minimizing:

$$Q(\mathbf{b}, \mathbf{D}, \mathbf{Z}^o; \boldsymbol{\eta}) := \sum_{j=1}^{4} (\rho_j - \overline{\rho}_j)^2 + \mathbf{u}'\mathbf{u} + \sum_{j=1}^{5} (\sigma_j^2 - \overline{\sigma}_j^2)^2$$

where $\mathbf{u} = \mathbf{b} - (\mathbf{D}\boldsymbol{\gamma}_{\mathbf{D}} + \mathbf{Z}^o \boldsymbol{\gamma}_Z)$. Denote by $\widehat{\boldsymbol{\eta}}_N = \widehat{\boldsymbol{\eta}}(\mathbf{b}, \mathbf{D}, \mathbf{Z}^o)$ the estimated vector of auxiliary parameters using actual data and by $\widehat{\boldsymbol{\eta}}_{NS}(\boldsymbol{\theta}) = \widehat{\boldsymbol{\eta}}(\mathbf{b}(\boldsymbol{\theta}), \mathbf{D}(\boldsymbol{\theta}), \mathbf{Z}^o)$ the corresponding vector using simulated data. The indirect *structural* paremeter estimator is given by:

$$\widehat{\boldsymbol{\theta}} = \arg\min_{\boldsymbol{\theta} \in \boldsymbol{\Theta}} (\widehat{\boldsymbol{\eta}}_{NS}(\boldsymbol{\theta}) - \widehat{\boldsymbol{\eta}}_N)' \mathbf{W}_N (\widehat{\boldsymbol{\eta}}_{NS}(\boldsymbol{\theta}) - \widehat{\boldsymbol{\eta}}_N)$$

where $\mathbf{W}_N$ is an optimally chosen weighting matrix[21]. Inference on the structural parame-

[20] We simulate a large number of samples in order to reduce simulation variance, which is especially relevant for outcome nodes occurring with low probability. Analytical formulas relevant for the simulation of $\widehat{v}(\cdot)$, $\widehat{b}(\cdot)$, $\widehat{c}_1(\cdot)$ and outcome probabilties are available upon request from the authors.

[21] The optimal weighting matrix is equal to $\frac{1}{N}\widehat{\boldsymbol{\Sigma}}^{-1}$ where $\boldsymbol{\Sigma} = var(\widehat{\boldsymbol{\eta}}_N)$. The estimate $\widehat{\boldsymbol{\Sigma}}$ is based on actual data and is obtained by computing the average inner product of the stacked influence functions of the elements in $\widehat{\boldsymbol{\eta}}$ (cf. Hennessy and Whited (2005), Erickson and Whited (2000).

ters obtains from the asymptotic distribution $\sqrt{N}\left(\widehat{\boldsymbol{\theta}}\left(\mathbf{b},\mathbf{z}^{o}\right)-\boldsymbol{\theta}\right)\xrightarrow{d}\mathcal{N}\left(0,\Omega\right)$ where

$$\Omega=\left(1+\frac{1}{S}\right)\operatorname*{plim}_{N\to\infty}\left(\frac{\partial^{2}Q}{\partial\boldsymbol{\theta}\partial\boldsymbol{\eta}'}\left(\frac{\partial Q}{\partial\boldsymbol{\eta}}\frac{\partial Q}{\partial\boldsymbol{\eta}'}\right)^{-1}\frac{\partial^{2}Q}{\partial\boldsymbol{\theta}'\partial\boldsymbol{\eta}}\right)^{-1}.$$

4.6. Identification

This section discusses identification of the structural parameters of the model. These parameters characterize the distributions of costs of entry and players' valuations, which jointly affect outcome probabilities and takeover premia.

We start by describing the effect of the structural parameters on key endogenous variables of the model: The preemption threshold $\widehat{v}$, the value of the preemptive bid $\widehat{b}$ and the threshold cost of entry $\widehat{c}_1$. The preemption threshold $\widehat{v}$ is the initial bidder's type that equalizes B_2's cost and expected gains from entry if B_2 believes that $v_1 \geq \widehat{v}$. Therefore, $\widehat{v}$ decreases with c_2 (Figure 4), as the higher the cost of entry for B_2, the easier it is for B_1 to preempt him. Furthermore, $\widehat{v}$ is higher when B_2 is a relatively stronger competitor (low l_2 or high l_1, see Figure 5) and when the expected target resistance is weaker (l_0 higher). The threshold $\widehat{v}$ determines the probability that a multiple bidder contest takes place for the target (Figure 6) and ultimately the fraction of single bidder contests observed in the data. Furthermore, it positively affects the value of the preemptive bid (Figure 7), as it is more costly for B_1 to preempt a rival bidder with low cost of entry or high expected valuation. Implicitly, higher costs of entry for B_2 promote entry by B_1 by effectively increasing $\widehat{c}_1$.

The structural parameters of the model are identified through the differential effect they have on final outcome probabilities and takeover premia. Consider first an increase in target shareholders' resistance (l_0 becomes lower). The expected gains from entry for the second bidder decline and preemption becomes easier for the initial bidder ($\widehat{v}$ decreases). At the same time, bidders have to pay on average a higher premium in order to overcome target resistance. Thus, we should expect to observe a larger fraction of unsuccessful contests, a lower frequency of multiple bidder contests and higher premia paid in successful takeovers.

Consider now an increase in the threat posed by the second bidder. This obtains when B_2 has a higher expected valuation for the target (lower l_2) or a lower cost of entry c_2.

Both forces make preemption less likely ($\widehat{v}$ increases) and more costly for the initial bidder ($\widehat{b}$ increases). Overall, an increase in the preemption threshold has a positive effect both on premia and on the probability of a multiple bidder contest taking place. The effects of a change in B_2's expected valuation can be separated empirically from changes in his cost of entry in the following way. For a decrease in l_2 that causes an equal change in $\widehat{v}$ as a decrease in c_2, we should observe a higher probability that B_2 acquires the target and higher offered premia.

An important aspect that needs to be taken into account in the estimation is contest heterogeneity. The model predicts that the preemptive bid can never exceed the price B_1 would expect to pay when competing with B_2: $\widehat{b} < E(\max(v_0, v_2))$. Ignoring contest heterogeneity would necessitate this inequality to hold for the maximum preemptive bid across *all* contests. As a consequence, B_2 would be treated as a very strong competitor and the estimation would yield implausibly high values of c_2 in order to rationalize high preemption rates. This can be seen in Figure 8, which compares the relation between c_2 and $\widehat{b}$ when contest heterogeneity is taken into account to the case when it is neglected. As not all of the contest heterogeneity is observable by the econometrician, this also highlights the importance of accounting for unobserved heterogeneity.

5. Estimation results

The first step of our estimation approach requires obtaining at least as many sample moments as structural parameters. As discussed in Section 4.5, the moments that we choose to match are the probabilities of takeover outcomes (*Nodes* 1 to 4), the variance of the final offer premium for each takeover outcome, and coefficients from an OLS regression of the final offer premium on outcome dummies and observable contest characteristics. Overall, 17 structural parameters are estimated by matching 22 sample moments, meaning that our model is overidentified.

Least squares coefficients of the final offer premium regression, based on the actual data sample, are shown in Table (6). All covariates are significantly correlated with final offer premia and their signs are consistent with findings in prior literature (see Officer (2003)).

Premia are on average lower for contests initiated with a merger or a friendly bid and higher for targets operating in high tech industries or outside the financial sector. Larger takeover premia are also associated with lower target profitability and market to book ratios, smaller targets and targets whose sector exhibits high takeover activity in the year of the offer.

The second step of the indirect inference method estimates the structural parameters by matching simulated and actual moments. The results are presented in Table (7). The coefficients corresponding to the cost of entry distribution, β_1 and β_2, are significant at the 5% and 1% level respectively. In order to interpret the valuation parameters, recall that a higher location parameter $l_i = \exp\left\{\phi_i^I + (\boldsymbol{\phi}^o)' \mathbf{z}^o + \phi_i^U z^U\right\}$ is associated with a lower expected valuation for player i. Not surprisingly, observable target characteristics positively correlated with final offer premia in Table (6) are also associated with higher expected valuations for the players. A 10% increase in mean ROA, market to book ratios, target size and sector takeover activity produces respectively a -0.124%, -1.05%, -5.33% and 3.89% change in expected valuations. We also find that players' valuations are 8.26% lower when the target is a financial firm, and higher by 8.91% when the target operates is a high tech industry, 11.61% when the contest is initiated by a tender offer and 8.77% when it is initiated with a hostile bid. All coefficients related to observable contest heterogeneity are significant at the 5% level, except those associated with sector takeover activity and high tech industry, which are significant at the 10% level.

Panel A of Table (8) shows that the actual moments (Column 1) are matched reasonably well by simulated moments (Column 2). In particular, the OLS regression coefficients from simulated data closely follow their actual data counterparts. Probabilities of takeover outcomes (*Nodes* 1 to 4) and the corresponding premium variances are matched with less than two percent error. The only simulated moment that deviates substantially from its empirical counterpart is the variance of final premia in unsuccessful multiple bidder contests, probably due to a low number of observations in the sample. The model is also quite successful in matching average premia across outcome subsamples (Table (8), Panel B). In summary, the model does a good job in terms of accommodating high preemption rates, high takeover premia and the observed frequency of unsuccessful takeover contests.

These results allow us to quantify the distributions of costs of entry and bidders' valuations. First, the mean cost of entry is estimated to be 1.96% of the target pre-acquisition market capitalization. Thus, in constant 2000 dollar terms, costs of entry are on average 10.3 million, with a median value of 1.43 million whereas the 25th and 75th percentile are 0.43 and 5.12 million respectively. The distribution of simulated costs of entry is provided in Figure (10).

Second, bidders are very asymmetric with respect to their valuations for the target. The maximum premium over the target pre-acquisition stock price that an initial bidder is willing to pay is on average 97%, while that of a potential rival is 58%.[22] Target resistance, quantified in terms of the minimum premium acceptable by target shareholders, is estimated to be 57% on average over the pre-acquisition stock price (Figure (11)).

The estimation results provide the following key economic insight: even small costs of entry are sufficient to generate high preemption rates. This is because of the effect of two concurrent economic forces. First, the initial bidder has a much higher valuation for the target compared to other players. For this reason, the average preemption threshold $\widehat{v}$ corresponds to a 41% premium and it lies in the first quintile of the initial bidder's valuation distribution. This results in a relatively low cost of preemption, since the average preemptive bid is at a 37% premium (see Table (8)). Second, the valuation of target shareholders and that of a second bidder are very close in expectation. Therefore, the estimated costs of entry are sufficient to limit the odds of the second bidder acquiring the target to one third of the odds that the target remains independent.

Another interesting point that emerges from the estimation is that the difference in observed premium distributions, as shown in Figure (9), can reflect a much larger asymmetry in the valuations of the players. This follows by the fact that the preemptive bid is determined not on the basis of the initial bidder's realized valuation, but on the expected valuations of the other players. Therefore, even if the initial bidder has a much higher expected valuation that the second bidder, he only needs to offer a low premium in order to preempt him.

[22] The difference in the mean valuations between the initial and the second bidder is significant at the 1% level.

5.1. *Simulation Analysis*

We now return to our main economic question: To what extent can each of the two factors, preemptive bidding and target resistance, explain the high premia paid in single bidder contests? In order to answer this question we perform a Monte Carlo simulation of takeover contests, using the estimated structural parameters of Table (7).

The results suggest that premia in successful single bidder contests are mainly determined by target resistance. To see this, recall that in these contests the premium paid equals the maximum between the shareholders' valuation v_0 and the value of the preemptive bid $\widehat{b}$. The simulation shows that the target shareholders' valuation exceeds the value of the preemptive bid in 70.12% of successful single bidder contests. For these contests, we find that even in the absence of an entry threat from a rival bidder (i.e. if c_2 is set to infinity), the initial bidder would still have to pay on average a 48% premium in order to acquire the target, compared with the 50.55% premium observed empirically.

The benefits and costs of preemption for the initial bidder can be quantified by means of a counterfactual analysis. We start by simulating a sample of takeover contests using the structural parameters in Table (7). We then consider successful single bidder contests and investigate the potential takeover outcome, had the initial bidder not preempted his rival. The benefits of preemption for the initial bidder arise from two sources. First, by making a preemptive bid the initial bidder can acquire the target even if his rival has a higher realized valuation, that is if $v_2 > v_1 > v_0$. This event occurs in our simulation in 8.6% of successful single bidder contests. Secondly, even when $v_1 > v_2$, the initial bidder would have to pay a higher premium if the rival bidder's valuation exceeds both the value of the preemptive bid and the target shareholders' valuation, i.e. if $v_2 > \max\left(v_0, \widehat{b}\right)$. This obtains with probability 47% in our simulation and results in an average premium increase of 7.3%. The cost of preempting a rival arises from the fact that the initial bidder may end up paying more than would be necessary to acquire the target in an auction, i.e. when $\widehat{b} > \max(v_0, v_2)$. Our simulation analysis suggests that this event takes place with probability 9.9% and results in an ex-post overpayment of 34%.

In order to gain deeper intuition regarding the effects of target resistance and costs of entry on takeover outcomes, we perform two experiments. In the first, we assume that costs of entry decrease from an average of 1.96% in the base case scenario to 1%. This may occur, for example, in case of a reduction in legal and advisory fees for merger deals, or if stricter disclosure standards make it easier for a potential acquirer to obtain information about the target. Comparing this scenario (Column 3, Table (8)) to the base case (Column 2), we find that the fraction of contests in which a second bidder enters increases from 8% to 19%. Moreover, the probability that a second bidder has the highest valuation for the target but is deterred from entry reduces from 10.3%, to 6.2%. At the same time, the premium in successful single bidder contests increases by 5% and is determined by the value of the preemptive bid in 58% of such cases.

The second experiment investigates the consequences of an increase in target resistance. Causes that can lead to this event are, for instance, an accumulation of large blocks in the ownership structure of the target[23], or a rise of corporate cross-holdings or employee stock ownership. We analyze a scenario in which the expected valuation of target shareholders increases by 20%, from 57% to 69% on average (Column 4 of Table (8)). In this case, as the gains from entry for the second bidder decrease, the fraction of single bidder contests rises by 2.5% and the average premium paid in such contests is reduced by 3.31% compared to the base case scenario (Column 2). Unlike the first experiment, the probability the target remains independent increases substantially from 13% to 21%. Target resistance determines the premium paid in single bidder contests with probability 85%.

Overall, these two experiments show that the probability that multiple bidders publicly compete over a target is highly sensitive to costs of entry, and that target resistance critically affects the likelihood that the takeover is consummated.

6. Conclusions

This paper evaluates empirically two of the theories that have been advanced in the literature to explain the high premia paid in single bidder takeovers: preemptive bidding and target resistance. A direct test of preemptive bidding would require the researcher

[23]On private benefits of control and the effects of large shareholders ownership on firm performance see for instance Morck, Shleifer and Vishny 1988, Shleifer and Vishny (1997).

to control for the characteristics of deterred acquirers and to account for simultaneity of premia and takeover outcomes. To overcome these empirical challenges, we develop and estimate a structural auction model of takeover competition with costly sequential entry and target resistance. The model delivers predictions for bidding strategies and takeover outcomes that form the basis for estimation. Using a sample of takeover offers for US public companies between 1988 and 2006, we find that small costs of entry are sufficient to rationalize high preemption rates, but takeover premia are to a large extent determined by target resistance rather than preemptive bidding. This result obtains since bidders are very asymmetric with respect to their valuations for the target. The maximum premium over the target pre-acquisition stock price that an initial bidder is willing to pay is on average 97%, while that of a potential rival is 58%.

Overall, our paper contributes to a recent stream of literature that uses structural methods to investigate takeover decisions and highlights their potential in addressing complex endogeneity issues resulting from the strategic interactions between bidders and target shareholders.

References

[1] Albuquerque, Rui and Enrique Schroth, 2008, Determinants of the block premium and of private benefits of control, *CEPR* discussion paper.

[2] Athey, Susan, and Philip Haile, 2008, Nonparametric approaches to auctions, in Heckman, J., Leamer, E. (eds.), *Handbook of Econometrics*, Vol. 6, Elsevier, Amsterdam.

[3] Bajari, Patrick, and Ali Hortacsu, 2003, The winner's curse, reserve prices, and endogenous entry: Empirical insights from eBay auctions, *RAND Journal of Economics*, 34, 329-355.

[4] Bebchuk, Lucian, 1994, Efficient and inefficient sales of corporate control, *Quarterly Journal of Economics*, 109, 957-993.

[5] Betton, Sandra, and B. Espen Eckbo, 2000, Toeholds, bid jumps, and expected payoff in takeovers, *Review of Financial Studies*, 13, 841-882.

[6] Betton, Sandra, B. Espen Eckbo and Karin S. Thorburn, 2008a, Merger negotiations and the toehold puzzle, *Journal of Financial Economics*, forthcoming.

[7] Betton, Sandra, B. Espen Eckbo and Karin S. Thorburn, 2008b, Corporate takeovers, in B.E. Eckbo (eds.), *Handbook of Corporate Finance: Empirical Corporate Finance,* Vol. 2, Elsevier.

[8] Bradley, Michael, 1980, Interfirm tender offers and the market for corporate control, *Journal of Business,* 53 (4), 345-376.

[9] Bradley, Michael, Anand Desai and Han Kim, 1983, The rationale behind interfirm tender offers: Information or synergy?, *Journal of Financial Economics*, 11 (1-4), 183-206.

[10] Bulow, Jeremy, and Paul Klemperer, 1996, Auctions versus negotiations, *American Economic Review*, 86, 180-194.

[11] Bulow, Jeremy, Ming Huang and Paul Klemperer, 1999, Toeholds and takeovers, *Journal of Political Economy*, 107(3), 427-454.

[12] Burkart, Mike, 1995, Initial shareholdings and overbidding in takeover contests, *Journal of Finance*, 50(5), 1491-1515.

[13] Burkart, Mike, Denis Gromb and Fausto Panunzi, 2000, Agency conflicts in public and negotiated transfers of corporate control, *Journal of Finance*, 55, 647–677.

[14] Chaplinsky, Susan, and Greg Niehaus, 1994, The role of ESOPs in Takeover Contests, *Journal of Finance*, 49 (4), 1451-1470.

[15] Che, Yeon-Koo, and Tracy R. Lewis, 2007, The role of lockups in takeover contests, *RAND Journal of Economics*, 38, 648-669.

[16] Daniel, Kent D., and David Hirshleifer, 1998, A theory of costly sequential bidding, University of Michigan Business School Working Paper.

[17] Dasgupta, Sudipto, and Robert G. Hansen, 2006, Auctions in corporate finance, in B. E. Eckbo (ed.), *Handbook of Corporate Finance: Empirical Corporate Finance*, Vol. 2, Elsevier.

[18] Dodd, Peter and Richard Ruback, 1977, Tender offers and stockholder returns, *Journal of Financial Economics*, 5 (4), 351-373.

[19] Erickson, Timothy and Toni Whited, 2000, Measurement error and the relationship between investment and q, *Journal of Political Economy*, 108(5), 1027-1057.

[20] Fishman, Michael J., 1988, A theory of preemptive bidding, *RAND Journal of Economics*, 19, 88-101.

[21] Fishman, Michael J., 1989, Preemptive bidding and the role of the medium of exchange in acquisitions, *Journal of Finance,* 44, 41-57.

[22] Giammarino, Ronald M., and Robert L. Heinkel, 1986, A Model of Dynamic Takeover Behavior, *Journal of Finance*, 41(2), 465-480.

[23] Gouriéroux, Christian, Alain Monfort and Eric Renault, 1993, Indirect Inference, *Journal of Applied Econometrics*, 8(S1), S85-S118.

[24] Gouriéroux, Christian, and Alain Monfort, 1997, Simulation-based econometric methods, CORE Lecture, Oxford University Press.

[25] Grossman, Sanford, and Oliver Hart, 1980, Takeover bids, the free rider problem and the theory of the corporation, *Bell Journal of Economics*, 11, 42-64.

[26] Hackbarth, Dirk, and Erwan Morellec, 2008, Stock returns in mergers and acquisitions, *Journal of Finance*, 63(3), 1213-1252.

[27] Hendricks, Ken, and Robert H. Porter, 2007, An empirical perspective an auctions, in M. Armstrong and R. Porter (eds.), *Handbook of Industrial Organization*, Vol. 3, Elsevier.

[28] Hennessy, Christopher and Toni Whited, 2005, Debt Dynamics, *Journal of Finance*, 60(3), 1129-1165.

[29] Hirshleifer, David, and Ivan P. L. Png, 1989, Facilitation of Competing Bids and the Price of a Takeover Target, *The Review of Financial Studies*, 2 (4), 587-606.

[30] Ivaldi, Marc, and Jrissy Motis, 2007, Mergers as auctions, *CEPR* discussion paper.

[31] Jehiel, Philippe, and Benny Moldovanu, 1996, Strategic non-participation, *RAND Journal of Economics*, 27, 84-98.

[32] Jennings, Robert H., and Michael A. Mazzeo, 1993, Competing bids, target management resistance, and the structure of takeover bids, *The Review of Financial Studies*, 6 (4), 883-909.

[33] Levin, Jonathan D., Susan Athey and Enrique Seira, 2004, Comparing open and sealed bid auctions: Theory and evidence from timber auctions, *FEEM* Working Paper.

[34] Morck, Randall, Andrei Shleifer and Robert W. Vishny, 1988, Management ownership and market valuation. An empirical analysis, *Journal of Financial Economics*, 20, 293-315.

[35] Officer, Micah S., 2003, Termination fees in mergers and acquisitions, *Journal of Financial Economics*, 69, 431-467.

[36] Paarsch, Harry J., and Han Hong, 2006, An introduction to the structural econometrics of auction data, MIT Press, Cambridge, MA.

[37] Rhodes-Kropf, Matthew, and David T. Robinson, 2008, The market for mergers and the boundaries of the firm, *Journal of Finance*, 63, 1169-1211.

[38] Robert, Christian P., and George Casella, 2004, Monte Carlo statistical methods, Springer.

[39] Singh, Rajdeep, 1998, Takeover bidding with toeholds: The case of the owner's curse, *Review of Financial Studies*, 11(4), 679–704.

[40] Shleifer, Andrei, and Robert W. Vishny, 1997, A Survey of corporate governance, *Journal of Finance*, 52(2), 737-783.

[41] Spatt, Chester S., 1989, Strategic analysis of takeover bids, in S. Bhattacharya and G. Constantinides (eds.), *Financial Markets and Incomplete Information*, Rowman and Littlefield.

[42] Stulz, Rene, 1988, Managerial control of voting rights: Financing policies and the market for corporate control, *Journal of Financial Economics*, 20, 25-54.

7. Appendix

7.1. Proof of Proposition 1

The expected gains from entry for B_2 conditional on $v_1 \geq v$ and when an initial bid b is made are:

$$\pi_2^A(v,b) = E\left(\max\{v_2 - \max\{v_0, v_1, b\}, 0\} | v_1 \geq v\right).$$

B_2 enters the takeover contest if only if $\pi_2^A(v,b) \geq c_2$. Notice that $\pi_2^A(v,b)$ is monotonically decreasing in v, $c_2 \leq \bar{c} = \pi_2^A(0,0)$, and that B_1 never chooses an initial bid higher than his valuation. Therefore B_2 enters the contest if and only if B_1's valuation is lower than the threshold

$$\widehat{v}(c_2) := \sup\left\{x | \pi_2^A(x,0) \geq c_2\right\}.$$

B_1's expected payoff if B_2 enters the contest is:

$$\pi_1^A(v_1,b) = E\left(\max(v_1 - \max(v_2, v_0, b), 0\right) = (v_1 - b) F_{\max}(b) + \int_b^{v_1} (v_1 - x) dF_{\max}(x). \quad (1)$$

where $F_{\max}(x) = F_2(x) F_0(x)$. When instead B_2 does not enter, B_1's expected gains are:

$$\pi_1^P(v_1,b) = E\left(\max\{v_1 - \max(v_0,b), 0\}\right) = (v_1 - b) F_0(b) + \int_b^{v_1} (v_1 - x) dF_0(x). \quad (2)$$

Consider the initial bidding strategy

$$b^I = \widehat{b} := \underset{x \geq 0}{\arg\text{solve}} \left\{\pi_1^P(\widehat{v}(c_2), x) = \pi_1^A(\widehat{v}(c_2), 0)\right\}$$

if $v_1 \geq \widehat{v}$ and $b^I = 0$ otherwise. B_2 can then infer whether $v_1 \geq \widehat{v}(c_2)$ or not by observing the initial bid and enters if and only if $b^I < \widehat{b}$. To verify the optimality of B_1's strategy notice first that, given beliefs $\mu^*\left(.|b^I\right)$ and B_2's response to b^I, no B_1 type would deviate to any $b > b^I$. Conditions (2), (1) and the monotonicity of the hazard rate imply that $\pi_1^P\left(0, \widehat{b}\right) < \pi_1^A(0,0)$ and $\frac{\partial \pi_1^P}{\partial v_1} \geq \frac{\partial \pi_1^A}{\partial v_1} \geq 0$. Type $v_1 = \widehat{v}$ is indifferent between preempting B_2 by bidding $\widehat{b}$ and competing in an auction. Types $v_1 > \widehat{v}$ strictly prefer to preempt and types $v_1 < \widehat{v}$ strictly prefer not to preempt and bid $b^I = 0$. Notice that any strategy $0 < b^I < \widehat{b}$ for $v_1 < \widehat{v}$ is weakly dominated by $b^I = 0$. This is because preemption does not take place and the initial bid constitutes a reservation price at the auction stage. Finally, noting that $\mu^*\left(.|b^I\right)$ satisfies Bayes rule given the bidders equilibrium actions completes the proof that the strategy/beliefs profile of the Proposition constitutes a Perfect Bayesian Equilibrium. As argued in Fishman(1988), there exist multiple signaling of the following form: for any valuation threshold $\widetilde{v} > \widehat{v}$, there exist beliefs such that B_2 is not preempted by any bid $b < b^I(\widetilde{v})$. However, type $v_1 \in (\widehat{v}, \infty)$ can profitably deviate to the out-of-equilibrium action $b^I(\widehat{v})$ if B_2 forms beliefs $\mu^*\left(v_1 | b^I(\widehat{v})\right)$ upon observing a bid $b^I(\widehat{v}) > 0$. Therefore, these equilibria do not survive the credible beliefs refinement of Grossman and Perry (1986).

Consider now the entry decision of B_1 and recall that no bid can be submitted unless the cost of entry is paid. If $q = 0$, B_1 strictly prefers not to submit a bid. When $q = 1$, B_1 enters the contest if and only if the cost of entry is not more than his equilibrium gains from entry:

$$\widehat{c}_1(c_2) = E\left(\max\left\{\pi_1^P\left(v_1, \widehat{b}(\widehat{v}(c_2))\right), \pi_1^A(v_1, 0)\right\}\right).$$

Figure 4: Valuation threshold $\widehat{v}$ as a function of the cost of entry for B_2. Parameter values: $(l_0, l_1, l_2, a) = (1, 0.5, 2, 1.5)$.

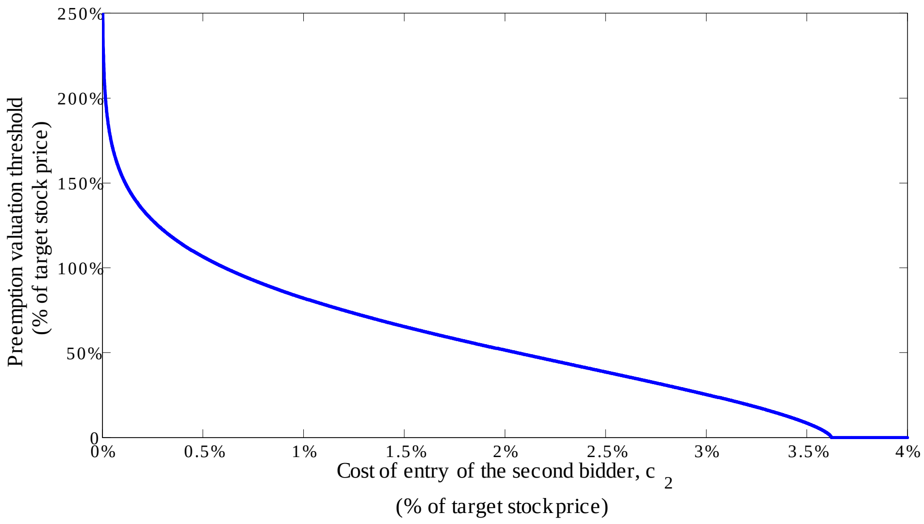

Figure 5: Valuation threshold $\widehat{v}$ as a function of the valuation parameters l_1 and l_2. Parameters values: $(l_0, a, c_2) = (1, 1.5, 0.02)$.

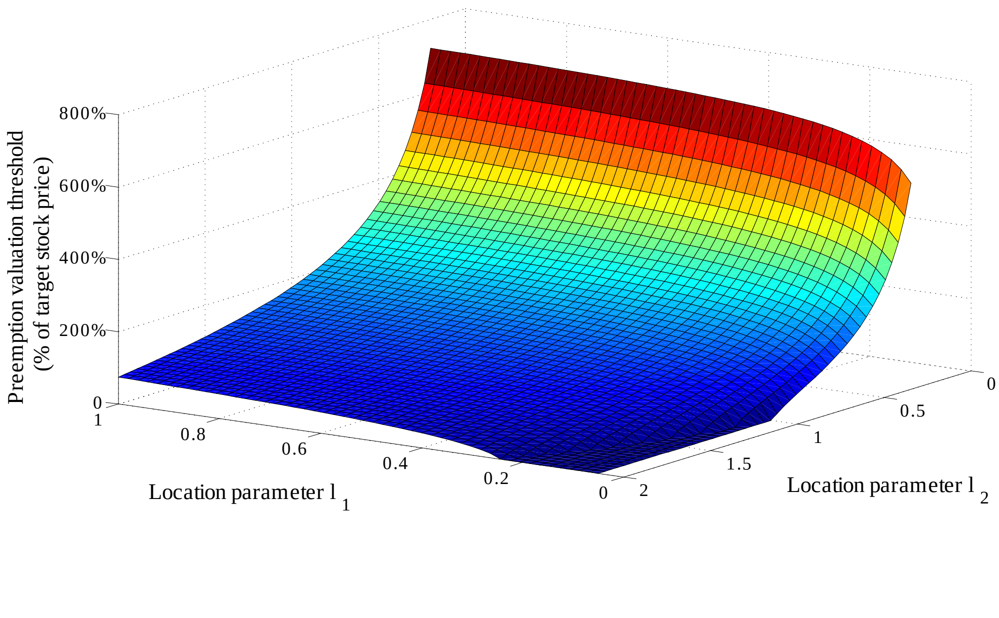

Figure 6: Probability of successful single bidder contests (Node 1) and probability of multiple bidder contests won by the initial bidder (Node 3) as a function of the preemption valuation threshold. Parameter values: $(l_0, l_1, l_2, a) = (1, 0.5, 2, 1.5)$.

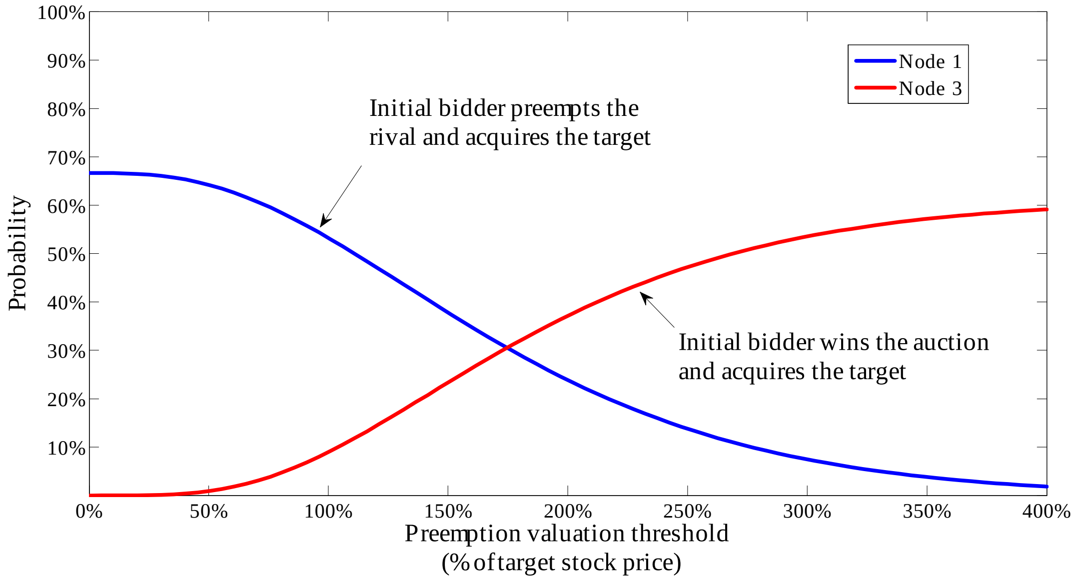

Figure 7: Preemptive bid $\widehat{b}$ as a function of the preemption valuation threshold $\widehat{v}$. Parameters values: $(l_0, l_1, l_2, a) = (1, 0.5, 2, 1.5)$.

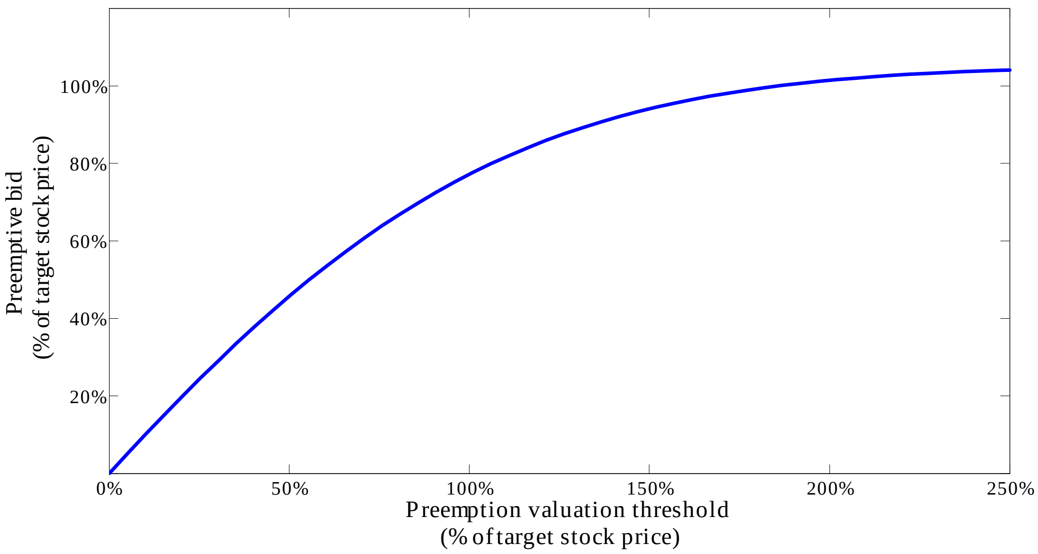

Figure 8: Preemptive bid $\widehat{b}$ as a function of the location parameter l_1 and cost of entry c_2. Parameter values: $(l_0, l_2, a) = (2l_1, 2l_1, 1.5)$. The red lines represent the c_2, $\widehat{b}$ envelope if l_1 is kept constant for all takeover contests.

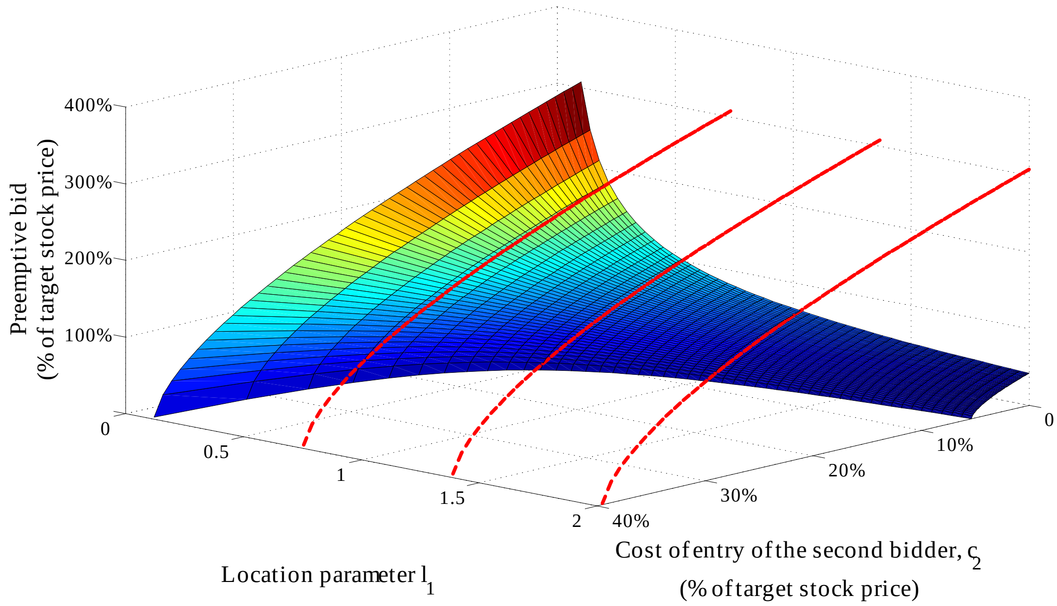

Figure 9: Empirical distributions of final offer premia in successful contests. The distributions are computed using a sample of 4,552 US public targets between 1988 and 2006.

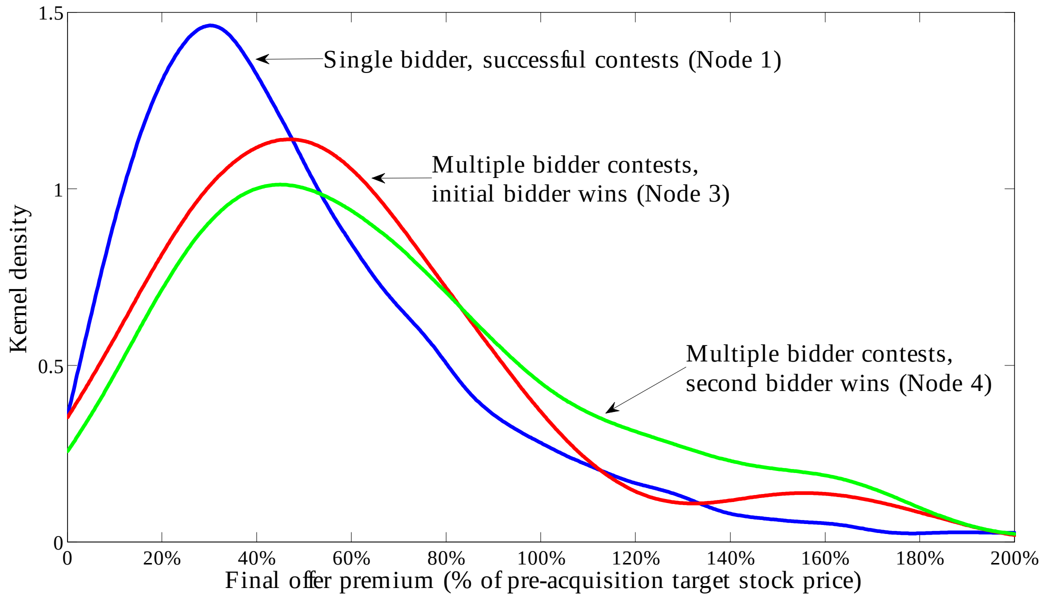

Figure 10: Empirical distribution of the costs of entry. This distribution is computed using the simulated sample of takeover contests at the structural parameters in Table (7). The mean cost of entry is 1.96% of the target preacquisition market capitalization.

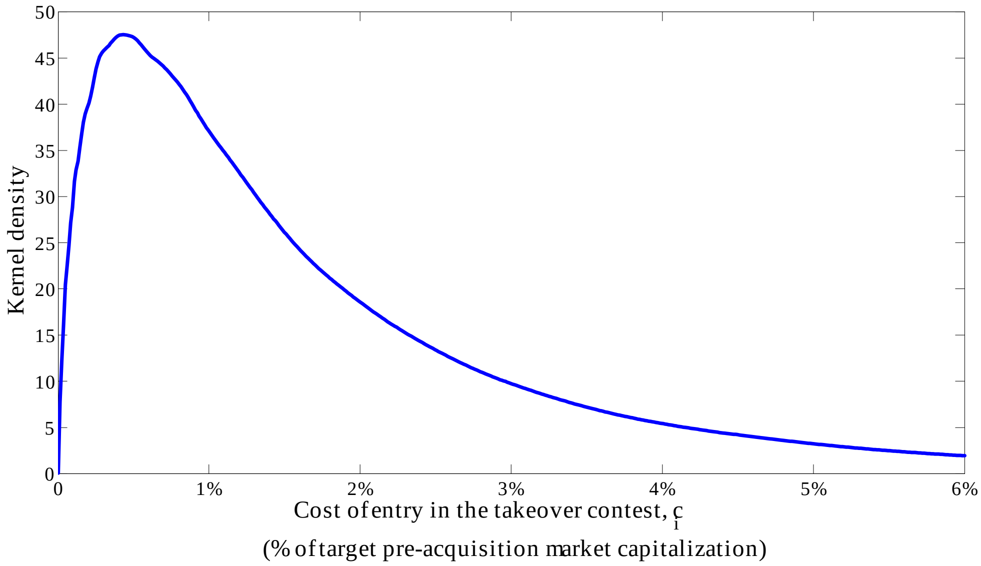

Figure 11: Empirical distribution of players' valuations. This distribution is computed using the simulated sample of takeover contests at the structural parameters in Table (7).

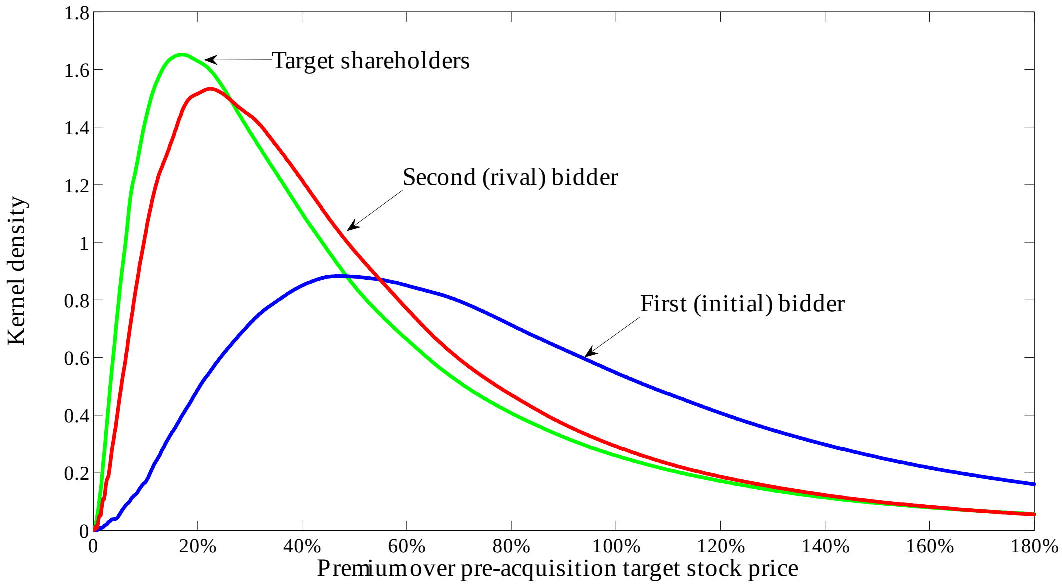

Table 1: Summary statistics for takeover outcomes and final offer premia

The table reports the fraction of takeover contests, the average and the variance of final offer premium for each takeover outcome. The sample consists of control bids for 5,137 US public targets between 1988 and 2006. Control bids are those in which an acquiror with less than 50% of the target shares is seeking to raise his shareholdings to more than 50% after completion of the takeover. Successive bids for the same target are grouped into takeover contests and classified according to the number of participating bidders and the final outcome of the takeover. Successful takeovers are those in which the target is acquired by one of the bidders. A final offer is defined as the winning bid in successful takeover contests, and as the last withdrawn bid in unsuccessful contests. The final offer premium is measured as $\omega(p_b/p_{-42}-1)$, where ω is the percentage of target shares sought by the bidder, p_b is the price per target share offered, and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid. Data sources: SDC Platinum and CRSP.

TAKEOVER OUTCOME	Probability	Average premium	Variance of premium
Single bidder contest, successful takeover (Node 1)	82.89%	50.55%	14.00%
Single bidder contest, target remains independent (Node 2)	10.69%	47.86%	13.42%
Multiple bidder contest, initial bidder wins (Node 3)	1.85%	58.43%	15.00%
Multiple bidder contest, rival bidder wins (Node 4)	3.87%	68.73%	19.84%
Multiple bidder contest, target remains independent (Node 5)	0.70%	56.30%	19.87%

Table 2: Takeover activity by industry

This table classifies takeover contests by the primary industry, defined as the 1-digit SIC code, in which the target operates. Deal value is the value of cash and securities offered to the target shareholders in constant 2000 dollars using the Consumer Price Index from the Bureau of Labor Statistics (Series CUUR0000SA0). Offer premia are measured as $\omega(p_b/p_{-42}-1)$, where ω is the percentage of target shares sought by the bidder; p_b is the price per target share offered; and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid in the contest, as reported in the Center for Research in Security Prices (CRSP) database.

Target Primary Industry	SIC codes	Number of contests	%	Deal value	Premium
Finance, Insurance and Real Estate	60 to 67	1,396	27.2%	991	45.6%
Business Services	73	670	13.0%	673	58.4%
Machinery and Equipment supply (incl. computers)	35 and 36	532	10.4%	891	56.7%
Wholesale and retail distributors	50 to 59	409	8.0%	684	50.9%
Utilities and Communication	48 and 49	302	5.9%	4193	43.0%
Precision instruments (incl. Clocks)	38	280	5.5%	706	56.3%
Chemicals	28	244	4.7%	1522	55.8%
Agriculture, Forestry, Fishing and Mining	1 to 14	181	3.5%	2097	39.2%
Health services	80	158	3.1%	1085	51.0%
Engineering, Management, and related services	87	112	2.2%	457	57.2%
Paper, Printing and Publishing	26 and 27	92	1.8%	1564	46.3%
Transportation	40 to 47	90	1.8%	719	55.2%
Food and Tobacco	20 and 21	68	1.3%	1544	62.7%
Textiles and Clothing	22 and 23	41	0.8%	356	60.9%
Construction	15 to 17	34	0.7%	424	69.6%
Petroleum	29	20	0.4%	6222	41.0%
Other		508	9.9%	1501	51.1%
Total		5137		1218	51.15%

Table 3: Takeover activity by year

This table shows the number of takeover contests, the takeover success probability, the mean deal value and the average final offer premium by year for a sample of 5,137 US public targets. Successful takeovers are those in which the target is acquired by one of the bidders. Success probability is the fraction of successful takeover contests in a given year. A final offer is defined as the winning bid in successful takeover contests, and as the last withdrawn bid in unsuccessful contests. Deal value is the value of cash and securities offered to the target shareholders in constant 2000 dollars using the Consumer Price Index from the Bureau of Labor Statistics (Series CUUR0000SA0). Offer premia are measured as $\omega(p_b/p_{-42}-1)$, where ω is the percentage of target shares sought by the bidder; p_b is the price per target share offered; and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid in the contest, as reported in the Center for Research in Security Prices (CRSP) database.

YEAR	No. of contests (%)	No. of successful contests (%)	Mean deal value ($ Million)	Average final offer premium (%)
1988	318 (6.2)	239 (75.2)	549	58.9
1989	224 (4.4)	176 (78.6)	555	52.0
1990	124 (2.4)	94 (75.8)	586	58.9
1991	119 (2.3)	90 (75.6)	330	65.3
1992	108 (2.1)	92 (85.2)	241	59.6
1993	168 (3.3)	142 (84.5)	602	51.0
1994	237 (4.6)	208 (87.8)	455	52.3
1995	325 (6.3)	288 (88.6)	732	48.5
1996	333 (6.5)	304 (91.3)	784	45.4
1997	444 (8.6)	413 (93.0)	745	45.7
1998	458 (8.9)	414 (90.4)	2168	48.9
1999	538 (10.5)	484 (90.0)	1615	59.9
2000	413 (8.0)	376 (91.0)	2344	60.0
2001	287 (5.6)	269 (93.7)	879	58.5
2002	163 (3.2)	146 (89.6)	805	50.0
2003	214 (4.2)	193 (90.2)	772	52.1
2004	186 (3.6)	171 (91.9)	2083	34.9
2005	220 (4.3)	208 (94.5)	2006	36.1
2006	258 (5.0)	245 (95.0)	2215	34.4
Total	5137 (100)	4552 (88.6%)	1218	51.15

Table 4: Definition of explanatory variables

Variable	Definition
ROA	Return on assets for the target, computed as the ratio of net income to total assets for the 12 month period ending on the date of the most current financial information prior to the announcement of the initial bid in the contest. Source: SDC Platinum.
Size	Natural logarithm of the target market capitalization in $ million on day -42 relative to the date of announcement of the initial bid in the contest. Market capitalization is computed as the price of the target common shares times the number of common shares outstanding. Market capitalization is in constant 2000 dollars using the Consumer Price Index from the Bureau of Labor Statistics (Series CUUR0000SA0). Source: CRSP.
Market to book	Ratio of target market capitalization in $ million 42 days before the date of announcement of the initial bid relative to the book value of the common equity. The latter is computed using the most current financial information prior to the announcement of the initial bid in the contest. Source: CRSP and SDC Platinum.
Financial sector	Dummy variable for financial companies. These are targets for which the primary 2-digit industry SIC code is between 60 and 67. Source: SDC Platinum.
High Tech	Dummy variable for target companies operating in a high tech industry. Source: SDC Platinum.
Tender offer	Dummy variable for contests in which the initial bid is a tender offer. Source: SDC Platinum.
Friendly	Dummy variable for contests in which the management declares a friendly attitude towards the initial bidder. Source: SDC Platinum.
Takeover activity	Ratio of the number of completed takeovers in industry-year relative to the average number of completed takeovers by industry. Industry is defined by the 1-digit SIC code. Source: SDC Platinum.

Table 5: Summary statistics for the sample

This table shows summary statistics for final offer premia and explanatory variables. Deal value is the value of cash and securities offered to the target shareholders in constant 2000 dollars using the Consumer Price Index from the Bureau of Labor Statistics (Series CUUR0000SA0). Final offer premia are measured as $\omega(p_b/p_{-42}-1)$, where ω is the percentage of target shares sought by the bidder; p_b is the price per target share offered; and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid in the contest, as reported in the Center for Research in Security Prices (CRSP) database. A final offer is defined as the winning bid in successful takeover contests, and as the last withdrawn bid in unsuccessful contests. All other variables are defined in Table 2. For return on assets and market to book, we substitute 1% outliers and missing values with the average of the respective variable.

	Mean	Median	25^{th} Percentile	75^{th} Percentile	St. Dev.
Deal value ($ Mil)	1218	180	62	619	5158
Final offer premium (%)	51.15	42.22	24.48	67.94	37.88
Size ($ Mil)	756	109	38	369	3233
Market to book ratio	2.18	1.62	1.04	2.42	2.24
Return on assets (%)	-0.45	1.28	-39.34	5.3	13.57

			Average final offer premium (%)		
	%		*Single bidder contests*	*Multiple bidder contests*	*Total*
Financial sector	27.18		45.28	53.41	45.56
Non-Financial sector	72.82		52.18	66.28	53.24
High tech industry	33.13		55.78	68.03	56.47
Non-High tech industry	66.87		47.46	62.93	48.52
Tender offer	21.41		57.93	81.98	59.81
Merger	78.59		48.19	58.22	48.80
Friendly	92.35		50.24	57.84	50.57
Hostile	7.65		50.24	74.79	58.23

Table 6: Sample moment estimates

This table contains the results of an OLS regression of final offer premia on outcome dummies and contest characteristics for a sample of 5,137 US public targets between 1988 and 2006. A final offer is defined as the winning bid in successful takeover contests, and as the last withdrawn bid in unsuccessful contests. Offer premia are measured as $\omega(p_b/p_{-42}-1)$, where ω is the percentage of target shares sought by the bidder; p_b is the price per target share offered; and p_{-42} is the target stock price 42 days prior to the announcement date of the initial bid in the contest, as reported in the Center for Research in Security Prices (CRSP) database. Node i is a dummy that assumes value one when the i-th of the following outcomes realizes: 1) Single bidder contest with the initial bidder acquiring the target; 2) Single bidder contest with the target remaining independent; 3) Multiple bidder contest with the initial bidder acquiring the target; 4) Multiple bidder contest with the second bidder acquiring the target; 5) Multiple bidder contest with the target remaining independent. All other variables are defined in previous tables. *, **, *** indicate significance at the 10%, 5%, 1% evel respectively. Standard errors are in parenthesis.

Variable	Coefficient	Variable	Coefficient
Node 1	0.750***	*Market to book*	-0.009***
	(0.031)		(0.002)
Node 2	0.687***	*Financial sector*	-0.036**
	(0.028)		(0.013)
Node 3	0.810***	*High Tech*	0.071***
	(0.046)		(0.012)
Node 4	0.893***	*Tender offer*	0.079***
	(0.035)		(0.013)
Node 5	0.780***	*Friendly*	-0.071**
	(0.064)		(0.022)
ROA	-0.001***	*Takeover activity*	0.032***
	(0.0004)		(0.009)
Size	-0.047***		
	(0.003)		
R^2	0.677		
Observations	5,137		

Table 7: Structural parameter estimates

This table shows the estimates of the structural parameters. Estimation follows the indirect inference approach of Gourieroux, Monfort and Renault (1993). Player $i = 0, 1, 2$ has valuation for the target in premium over the target pre-acquisition stock price $V_i = qv_i$ where $q \in \{0, 1\}$ and v_i follows a Weibull distribution with location parameter l_i and shape parameter α. The location parameter is given by $l_i = \exp\left\{\phi_i^I + (\phi^o)' \mathbf{z}^o + \phi_i^U z^U\right\}$ where $\mathbf{z}^o$ corresponds to observable covariates and z^U is a standard normally distributed unobserved heterogeneity component. The cost of entry for bidder $i = 1, 2$ is $c_i = k_i E\left(\max\left\{v_2 - \max\left\{v_0, v_1\right\}, 0\right\}\right)$ where k_i follows a $\mathcal{B}(\beta_1, \beta_2)$ distribution. Estimation is performed using final offer premia for a sample of 5,137 US public targets in the period 1988-2006. Definitions of observable covariates $\mathbf{z}^o$ are provided in previous tables. All other variables are defined in previous tables. *, **, *** indicate significance at the 10%, 5%, 1% evel respectively. Standard errors are in parenthesis.

	Coefficient	Standard Error	Elasticity
VALUATION PARAMETERS			
ϕ^o			
ROA	0.006***	(0.002)	-0.124%
Size	0.260**	(0.123)	-5.332%
Market to book	0.050**	(0.025)	-1.051%
Financial sector	0.204***	(0.077)	-8.260%
High Tech	-0.355*	(0.192)	8.910%
Tender offer	-0.391**	(0.195)	11.610%
Friendly	0.421**	(0.206)	-8.770%
Takeover activity	-0.185*	(0.097)	3.869%
ϕ_0^I	0.685	(0.588)	
ϕ_0^U	2.074**	(0.863)	
ϕ_1^I	-1.192	(0.762)	
ϕ_1^U	1.375	(1.315)	
ϕ_2^I	0.411	(0.529)	
ϕ_2^U	1.763	(1.088)	
a	2.725**	(1.249)	
COST PARAMETERS			
β_1	1.494**	(0.589)	
β_2	0.655***	(0.134)	

Table 8: Simulation Analysis

Panel A shows the estimates of the sample moments using actual data (Column 1) and simulated data at the structural parameter estimates (Column 2). Column 3 shows estimates when c_i is reduced by 50% compared to Column (2) and Column(4) sets $\phi_0^I = 0.1884$ (increase of average v_0 by 20%). Panel B reports average valuations, cost of entry, valuation threshold and preemptive bid across simulation experiments. Estimation is performed using final offer premia for a sample of 5,137 US public targets in the period 1988-2006. Definitions of variables is provided in Tables (2) and (6).

Panel A	ACTUAL DATA	SIMULATED DATA		
Moments	(1)	(2)	(3)	(4)
Node 1	0.750	0.767	0.851	0.783
Node 2	0.687	0.698	1.099	0.437
Node 3	0.810	0.811	0.854	0.802
Node 4	0.893	0.890	0.937	0.870
Node 5	0.780	0.752	0.837	0.716
ROA	-0.001	-0.002	-0.002	-0.001
Size	-0.047	-0.047	-0.054	-0.044
Market to book	-0.009	-0.010	-0.011	-0.009
Financial sector	-0.036	-0.032	-0.037	-0.030
High Tech	0.071	0.072	0.080	0.066
Tender offer	0.079	0.078	0.091	0.075
Friendly	-0.071	-0.084	-0.097	-0.078
Takeover activity	0.032	0.034	0.039	0.032
Probability of Node 1	82.89%	81.90%	76.54%	76.21%
Probability of Node 2	10.69%	9.82%	4.16%	18.05%
Probability of Node 3	1.85%	1.34%	4.13%	0.80%
Probability of Node 4	3.87%	3.74%	8.23%	2.04%
Variance of premium in Node 1	14.00%	14.38%	15.05%	16.47%
Variance of premium in Node 2	13.42%	11.78%	24.40%	8.75%
Variance of premium in Node 3	15.00%	15.28%	15.37%	16.11%
Variance of premium in Node 4	19.84%	21.26%	21.05%	21.62%
Variance of premium in Node 5	19.87%	14.02%	16.83%	12.88%
Panel B				
Average premium in Node 1	50.55%	51.57%	56.56%	54.88%
Average premium in Node 2	47.86%	44.60%	81.18%	20.28%
Average premium in Node 3	58.43%	56.01%	56.90%	56.78%
Average premium in Node 4	68.73%	64.03%	65.24%	63.65%
Average premium in Node 5	56.30%	50.02%	55.09%	48.19%
Mean target shareholder valuation v_0		57.22%	57.22%	68.64%
Mean valuation of initial bidder v_1		97.17%	97.17%	97.17%
Mean valuation of second bidder v_2		58.46%	58.46%	58.46%
Mean cost of entry c_i		1.96%	0.98%	1.96%
Mean preemption threshold $\widehat{v}$		41.26%	65.62%	24.84%
Mean preemptive bid $\widehat{b}$		37.34%	55.13%	22.16%