Preemptive Bidding in Common Value Takeover Auctions:

Social Surplus and Seller’s Revenue

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Keywords: auction; acquisition; takeover; preemptive bidding; jump bidding; signalling

JEL: D44
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This paper develops a model of preemptive jump bidding in common value takeover auctions. It shows that in a case of common values jump bidding increases the social surplus, and, under certain conditions, can lead to higher expected seller’s revenue. It also demonstrates that an increase in investigation costs may improve social efficiency even if it leads to larger direct social costs. Based on its results, the paper provides several implications related to legal fees and the length of takeover auctions.

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1. Introduction

Jump bidding, defined as bidding in excess of a minimum bidding increment, is present in wide range of auctions (see, e.g., Easley and Tenorio, 2004; Raviv, 2008; Haile and Tamer, 2003; and Plott and Salmon, 2004). The most prominent example of jump bidding is bidding in takeover contests where the initial bid premium can be as high as 40% of the target firm’s pre-auction stock price (Bradley, 1980; Jenning and Mazzeo, 1993; Betton and Eckbo, 2000; and Eckbo, 2009). While there are several possible explanations for jump bidding, such as impatience (Isaak, Salmon, and Zillante, 2005, 2007; and Kwasnica and Katok, 2007), strategic bidding due to non-negligible minimum bidding increments (Rothkopf and Harstad, 1994) and the need for coordination among multiple equilibria (Avery, 1998), the generally accepted explanation for jump bidding in takeover auctions is the desire to preempt competition. Namely, in the presence of entry costs (such as legal fees or investigation costs required to learn target’s value with better precision), the first bidder with high valuation of the target places a jump bid in order to signal his valuation to other potential bidder and preempt competition.

Fishman (1988) develops a model of preemptive jump bidding in private value takeover auctions with entry costs. It shows that jump bidding affects neither the expected profit of the second bidder nor the social surplus but reallocates the expected profit from the seller to the first bidder. Consistent with Fishman (1988), Jenning and Mazzeo (1993) and Betton and Eckbo (2000) find that larger initial bid reduces the probability of another potential acquirer entering the auction. Khoroshilov and Dodonova (2014) and Khoroshilov (2015) provide an experimental support for some of the Fishman’s (1988) predictions for auctions with entry fees.
In this paper we extend Fishman’s (1988) model to common value takeover auctions. Khoroshilov (2012) develops a takeover auction model in which potential acquirer have either identical or different plans for the target firm, and, as a result, the auction is either common or private value auction with some exogenous probability. Based on this assumption, the model predicts that the effect of preemptive bidding is amplified and the first bidder can extract almost the entire seller’s surplus. Dodonova (2017) considers affiliated value takeover auctions and show that, in the presence of common value component, jump bidding may lead to ex-ante Pareto improvement. In this paper we consider a classical common value auction setup in which the value of the target firm is the same for all bidders and all bidders receive private noisy information about this value.

The main contribution of this paper is in investigation of the effects that jump bidding has on the expected seller’s revenue and on the social welfare, how these effects depend on the relative informativeness of the bidder’s signals. Since there are no item misallocation problem in common value auctions, the only potential inefficiency of the takeover process comes from the wasteful investigation costs incurred by rival bidders. As a result, in contrast to the Fishman’s (1988) private value takeover auction where the social welfare is not affected by jump bidding, preemptive bidding can lead to higher social surplus. Arguing that only a portion of the investigation costs are social costs while another portion of these costs are legal fees (that are just a wealth transfer from the firm to the government) or such costs can be recovered either through income taxes levied on the employees involved in the takeover preparation activities or through the positive effects the increase in personal income of such employees can have on the economy,
we divide the investigation costs into two parts: private costs that only the potential acquirer (but not the society) incurs and the social costs that represent the net decrease in the social welfare due to wasteful investigation costs before taking into account any effect these costs may have on the outcome of the takeover contest. The total investigation costs buried by a bidder are the sum of the private and social costs. We show that an increase in private costs increases the pre-emption rate, and, since such costs have no direct effect on the social welfare, they increase the social surplus. Since legal fees are one of the examples of such costs, an increase in any government-imposed fees required to make a tender offer in takeover contests improves social efficiency. We also show that even an increase in direct social costs may, under certain conditions, improve social efficiency. The government can affect such costs by reducing the minimum time allowed for the target firm to respond to the current offer, which will lead to higher investigation costs for the rival acquirer and makes investigation process less efficient. In case of a uniform distribution, we show that this response time should be shorter when the original offer is made by a friendly acquirer or by the target’s management itself, which implies that the minimum time that the shareholders of the target firm must have to accept the offer should be shorter when the management approves it.

The preemptive bidding can affect the seller’s expected revenue in two ways. On one hand, it guarantees the minimum final price level regardless of the information the other bidders have. On the other hand, it preempts the other bidders from entering and does not allow for high selling price in case two bidders have high expected valuations. While most of the existing models of preemptive bidding predict that the second effect dominates the first one and preemptive bidding reduces the expected seller’s revenue, in case of a common value the relative strength of these
two effects depends on the relative (in comparison to the second bidder) precision of the first bidder’s information about the common value of the target. When such precision is low, preemption becomes more difficult and much higher jump bids are required to preempt. As a result, it may be possible for the first effect to dominate the second, which, as we show in the case of a uniform distribution, allows jump bidding to increase the expected seller’s revenue. One of the examples when the second bidder’s information is more precise than the information of the first bidder is a situation when the first acquirer is hostile while the second one is a “white knight” supported by the current management. As a result, the model predicts that in such “white knight” scenario shareholders of the target firm benefit from preemptive jump bidding.

Following Fishman (1988), there are several papers that were aimed to explain jump bidding in takeover auctions. Hirshleifer and P’ng (1989) argue that bidding process itself is costly and, as a result, the jump bidding can be used as a signalling device not only for the original but also for the consequent bids. Hörner and Sahaguet (2007), using signalling arguments, show that signalling is not necessary monotonic and high original offer does not necessary reveal high valuation. Dodonova (2012) and Dodonova and Khoroshilov (2014) investigate preemptive jump bidding in auctions with toeholds (a partial ownership of the target form by potential acquirers), first studied by Burkart (1995), Singh (1998), and Bullow, Huang and Klemperer (1999). Khoroshilov (2015a) develops a signalling model in takeover auctions with actively participating targets in which the target firm can adjust its reserve price based on the course of the auction, and, in particular, based on the information it learns from jump bidding. Ettinger and Michelucci (2016) show that when bidders valuation depend on the rivals’ private information, jump bidding can be used to make some bidders to drop out of the auction earlier preventing the learning that
can exist in standard clock-style English auctions. At and Morand (2008) argue that jump bidding is not necessary a signalling device and can exist because of free-riding problem among the target firm’s shareholders.

The rest of the paper is organized as follows. In Part 2 we develop a common value takeover auction model with two bidders and solve for the signalling preemptive jump bidding equilibrium. We then analyze how the relative information precision of rival bidders and the costs of information acquisition affect preemption rate, size of jump bids, and the expected profit of the bidders. We also show that jump bidding increases the social surplus and that an increase in private component of the second bidder’s investigation costs improves social welfare. In Part 3 we solve the model for the case of uniform distribution and show that, depending on the model parameters, jump bidding can increase or decrease the seller’s expected revenue. Finally, we show that an increase in the social component of the second bidder’s investigation costs may lead to higher social surplus. In Part 4 we conclude.

2. The Model

Consider a takeover auctions modelled as an auction with two bidders (acquirer) who bid for an object (target firm) with common value \( V = \alpha S_1 + (1-\alpha)S_2 \), where \( S_i \in [0,1] \) is the private information of bidder \( i \), independent and identically distributed with probability distribution function \( f(x) \) and \( \alpha \in [0,1] \) is a constant representing relative precision of the first bidder’s information. Let also \( E(S_i)=\mu \). Following Fishman (1988), assume that the first bidder incurs investigation cost \( C_1 \) to learn \( S_1 \) and then places an opening bid \( B_1 \in [0,1] \). After observing \( B_1 \),
the second bidder decides if he wants to enter the auction. If he decides to enter, then he must spend investigation cost $C_2$ which will allow him to learn $S_2$. If both bidders enter, the auction continues as a standard clock-style English auction in which bidder $i$ bids up to $S_i$ and the bidder with the highest information value $S_i$ wins the auction with a winning bid of $\max\{B_i, \min\{S_1, S_2\}\}$.

The information acquisition cost $C_i$ consists of resources the bidder needs to allocate toward investigation of the value of the target firm as well as toward paying any government-imposed fees. Not all of these expenses become social costs. For example, a portion of the government-imposed fees, income taxes paid by the employees involved in the investigation activities, as well as the effect of an increased income of these employees on the economy are not part of the social costs. As a result, we can divide $C_i$ into two components: $C_i = C_{i,p} + C_{i,s}$, where $C_{i,s}$ is the decrease in the social surplus due to wasteful information investigation (“social costs”) and $C_{i,p}$ is the extra investigation costs incurred by the bidder that do not directly affect the social surplus (“private costs”).

If jump bidding is not allowed, i.e., $B_1$ must be equal to zero regardless of $S_1$, the auction becomes a standard clock-style English auction. We will refer to such auction as “no jump bidding” auction or NJB. Assuming that $C_1$ and $C_2$ are small enough so that both bidders are willing to enter the auction, the expected profit of the first bidder, the second bidder, the seller, and the expected social welfare in NJB auction can be written as:
\[
\pi_{1,NJB} = \frac{1}{1} \int_{0}^{1} (V - S_2) f(S_1) f(S_2) dS_1 dS_2 - C_1 = \alpha \int_{0}^{1} (x - y) f(y) f(x) dy dx - C_1
\]  

(1)

\[
\pi_{2,NJB} = \frac{1}{1} \int_{0}^{1} (V - S_1) f(S_2) f(S_1) dS_1 dS_2 - C_2 = (1 - \alpha) \int_{0}^{1} (x - y) f(y) f(x) dy dx - C_2
\]  

(2)

\[
\pi_{S,NJB} = \frac{1}{1} \int_{0}^{1} \min \{S_1, S_2\} f(S_1) f(S_2) dS_1 dS_2
\]  

(3)

\[
W_{NJB} = \mu - C_{1,s} - C_{2,r}
\]

(4)

The assumption that \( C_1 \) and \( C_2 \) are small enough to guarantee a positive expected profit for both bidders can be written as

\[
\begin{cases}
\frac{C_1}{\alpha} < \int_{0}^{1} (x - y) f(y) f(x) dy dx \\
\frac{C_2}{1 - \alpha} < \int_{0}^{1} (x - y) f(y) f(x) dy dx
\end{cases}
\]  

(5)

In an auction when jump bidding is allowed (denote it by JBA auction), we will be looking for a signalling jump bidding equilibrium in which the first bidder submits opening bid \( B_1 = \bar{B} > 0 \) if and only if \( S_1 \geq \bar{S} > 0 \) and bids \( B_1 = 0 \) otherwise, while the second bidder enters the auction if and only if he observes \( B_1 < \bar{B} \). Following Fishman (1988), we will limit our attention to the signalling equilibrium with the lowest \( \bar{S} > 0 \). To solve for \( \bar{S} \) and \( \bar{B} \), note that the increase in the profit of the first bidder with information \( S_1 \) from making a jump bid \( B_1 = \bar{B} \) instead of bidding \( B_1 = 0 \) is equal to:
\[ \Delta_1(S_1) = (\alpha S_1 + (1-\alpha)\mu - \overline{B} - C_1) - \left[ \int_0^S (\alpha S_1 + (1-\alpha)S_2 - S_2) f(S_2) dS_2 - C_1 \right] = \]
\[ = \alpha \int_0^1 \min(S_1, S_2) f(S_2) dS_2 + (1-\alpha)\mu - \overline{B} \tag{6} \]

Since the right hand side of (6) increases with \( S_1 \), for the first bidder to be willing to place a jump bid \( B_1 = \overline{B} \) if and only if \( S_1 \geq \overline{S} \), the following condition must be satisfied

\[ \overline{B} = \alpha \int_0^1 \min(S_1, S_2) f(S_2) dS_2 + (1-\alpha)\mu \tag{7} \]

If the second bidder observes \( B_1 = 0 \), condition (5) implies that he earns positive expected profit from entering. If, however, \( B_1 = \overline{B} \), his expected profit from entering the auction is equal to

\[ \Delta_2 = \frac{1-\alpha}{1-F(S)} \int_{S_1}^1 \int_{S_1}^1 (S_2 - S_1) f(S_2) f(S_1) dS_2 dS_1 - C_2 \tag{8} \]

The minimum \( \overline{S} > 0 \) that guarantee that, after observing \( B_1 = \overline{B} \), the second bidder does not enter the auction, can be found from

\[ \frac{1}{1-F(S)} \int_{S_1}^1 \int_{S_1}^1 (S_2 - S_1) f(S_2) f(S_1) dS_2 dS_1 = \frac{C_2}{1-\alpha} \tag{9} \]
Note that the left hand side of (9) decreases with $\bar{S}$, converges to zero when $\bar{S}$ converges to 1, and, according to (5), is less than $\frac{C_2}{1-\alpha}$ when $\bar{S}$ converges to 0. As a result, there is a unique solution $\bar{S} \in (0,1)$ to (9). Furthermore, Equation (7) implies that $\bar{B} \in (0,1)$. The discussion above can be summarized in the following theorem:

**Theorem 1:** If (5) is satisfied and $\bar{S}$ and $\bar{B}$ are given by (7) and (9), then there is an equilibrium in which the first bidder bids $B_1 = \bar{B} > 0$ if and only if $S_1 \geq \bar{S} > 0$ and bids $B_1 = 0$ otherwise. The second bidder believes that $S_1 \geq \bar{S}$ when $B_1 \geq \bar{B}$ and that $S_1 < \bar{S}$ when $B_1 < \bar{B}$, and he enters the auction if and only if $B_1 < \bar{B}$.

An increase in the second bidder’s information acquisition cost $C_2$ makes him less willing to enter and makes it easier for the first bidder to deter the competition. Indeed, from equation (9), an increase in $C_2$ leads to lower $\bar{S}$, higher probability of jump bidding $\left(1 - F(\bar{S})\right)$, and, from equation (7), lower $\bar{S}$ leads to a reduction in the size of the equilibrium jump bid $\bar{B}$. Hence, consistent with Fishman’s (1988) predictions, we can state the following result:

**Result 1:** An increase in the second bidder’s information acquisition cost increases the frequency of jump bidding but decreases the size of jump bids.

Similarly, higher relative precision of the first bidder’s information $\alpha$ (and, hence, lower relative precision of the information of the second bidder), makes it easier for the first bidder to preempt. Indeed, since in a regular English auction bidders bid up to the value of their information, lower
information precision makes expected profit from entering relatively small. Equation (9) implies that an increase in $\alpha$ leads to lower $S$. Equation (7) states that $B$ is a weighted average of 
\[ \int_{0}^{1} \min(S, S_2) f(S_2) dS_2 \text{ and } \mu. \]
Using the fact that $\mu = \int_{0}^{1} S f(S_2) dS_2 > \int_{0}^{1} \min(S, S_2) f(S_2) dS_2$, an increase in $\alpha$ leads to a decrease in $B$. Hence, the following result is true:

**Result 2:** An increase in the first bidder’s relative information precision increases the frequency of jump bidding but decreases the size of jump bids.

To find the expected profits and social welfare in JBA auctions, note that in the equilibrium the second bidder who observes $B_i = B$ is indifferent between entering and not entering the auction and his expected profit from entering is the same as in NJB auction. Using simple algebra, the expected profits of all agents and the expected social surplus $W$ in JBA auction can be written as:

\[
\pi_{1,JBA} = \pi_{1,NJB} + \alpha \int_{\bar{S}}^{1} \left( \min\{ S_1, S_2 \} - \min\{ \bar{S}, S_2 \} \right) f(S_2) f(S_1) dS_2 dS_1 > \pi_{1,NJB}
\]

\[\pi_{2,JBA} = \pi_{2,NJB}\]

\[
\pi_{S,JBA} = \pi_{S,NJB} + \int_{\bar{S}}^{1} \left( S_2 - S_1 \right) f(S_2) f(S_1) dS_2 dS_1 - \alpha \int_{\bar{S}}^{1} \left( S_2 - \bar{S} \right) f(S_2) f(S_1) dS_2 dS_1
\]

\[W_{JBA} = W_{NJB} + C_{2,\alpha} \left( 1 - F(\bar{S}) \right) > W_{NJB}\]
The relationship between $\pi_{S,JAB}$ and $\pi_{S,NJB}$ is undetermined and depends on the probability distribution function $f(S_i)$ as well as on parameters $\alpha$ and $C_2$. Using equations (10)-(13), the following result can be stated:

**Result 3:** Jump bidding increases the expected profit of the first bidder and the expected social welfare and has no effect on the expected profit of the second bidder.

The effect of jump bidding on the expected bidders’ profits is consistent with Fishman’s (1988) predictions for private value takeover auctions. The result that jump bidding increases social surplus follows from the fact that jump bidding preempts the second bidder from entering the auction, thus, saving him investigation cost $C_2$. While in Fishman (1988) such saving was compensated by the loss from inefficient item allocation, in common value auctions there is no item misallocation problem, which implies that the saved social portion of investigation costs $C_{2,s}$ is added to the total social welfare. The effect of jump bidding on the seller’s expected revenue cannot be determined and will be studied later in Part 3.

Both higher $\alpha$ and higher $C_2$ makes preemption easier and lead to lower jump bids $\bar{B}$ and higher preemption rate $\left(1 - F(\bar{S})\right)$. Using equations (10) and (13), it immediately follows that:

**Result 4:** An increase in the second bidder’s entry costs $C_2$ or the first bidder’s relative information precision $\alpha$ increases the effect of jump bidding on the first bidder’s profit and social welfare.
An increase in investigation costs has dual effect on the social surplus in JBA equilibrium. On one hand, it increases the positive effect of jump bidding. On the other hand, an increase in social portion of the investigation cost $C_{2,s}$ reduces the social surplus in NJB auctions. At the same time, an increase in private component of the second bidder’s investigation cost has no direct effect on the social surplus in NJB equilibrium ($W_{NJB}$ does not depend on $C_{2,p}$), but amplifies the positive effect of the jump bidding, i.e.:

**Result 5:** In JBA equilibrium, an increase in the private component of the second bidder’s investigation cost increases the social welfare.

Since the private component of the investigation cost includes entry fees or, in case of takeover auctions, government-imposed registration fees, Result 5 leads to the following implication:

**Implication 1:** To increase the expected social surplus, the government should impose high registration fees for any potential acquirer wanting to make a tented offer to the target firm’s shareholders.

Another way the government can increase the investigation cost for the second bidder is by reducing the amount of time that the target firm has to respond to the original offer, thus, reducing the time (and, hence, increasing the costs) for the second potential acquirer to investigate the target’s value. However, such extra cost may also have a social component $C_{2,s}$ which may have a negative effect on $W_{NJB}$ due to lower $W_{JBA}$. 

14
Given a general form of probability distribution function \( f(S_i) \), it is not possible to analyze the
effect of jump bidding on the seller’s expected revenue or to investigate how the change in the
second bidder’s social component of the investigation costs \( C_{2,s} \) affects the social surplus. To
show that such effects, indeed, can be both positive and negative, Section 3 considers a special
case of uniform distributions.

**Section 3: Uniform Probability Distribution Function**

To illustrate the effect of jump bidding on the seller’s expected revenue and the effect of the
investigation costs on the social surplus, consider a special case when \( S_i \) is uniformly distributed
on \([0,1]\) interval. In this case, condition (5) leads to \( \frac{C_2}{1-\alpha} < \frac{1}{6} \) and equation (9) yields
\[
\bar{S} = 1 - \sqrt[6]{\frac{6C_2}{1-\alpha}}.
\]
Using simple algebra, equation (13) results in the expected social surplus of
\[
W_{JBA} = \frac{1}{3} - C_{1,s} - C_{2,s} \left( 1 - \sqrt[6]{\frac{6C_2}{1-\alpha}} \right).
\]
If \( C_{2,s} = 0 \) or \( C_2 = \frac{(1-\alpha)}{6} \) (the maximum \( C_2 \) allowed by
condition (5)), then \( W_{JBA} = \frac{1}{3} - C_{1,s} \) while at all intermediate values of \( C_2 \) we have
\( W_{JBA} < \frac{1}{3} - C_{1,s} \) with a single local minimum in between. As a result, an increase in the social
component of the investigation cost has ambiguous effect on the social welfare and can be
described by the following result:
**Result 6:** In case of uniform distribution, an increase in the social component of the second bidder’s investigation costs improves social surplus when the total investigation costs are high and/or when the first bidder’s information has a high precision and it reduces the social surplus otherwise.

Saying it differently, Result 6 states that it is socially optimal to make it even easier to preempt the second bidder when such preemption is easy and to make it harder when preemption is difficult. One of the situations when preemption is difficult due to the relative precision of the second bidder’s information being much higher than that of the first bidder is when the second bidder is directly related to, or supported by, the current target’s management and behaves as a “white knight” when the hostile takeover bid is made by the first bidder. In such situations, it is socially optimal to make preemption even harder. Note that one of the ways to make preemption harder is to decrease the social component of investigation cost through the increase in the time allowed for the target firm to accept an offer: short time period makes it much costly and less efficient for the second bidder to investigate. At the same time, when the original offer is made by the friendly bidder or by a current management (e.g., through leveraged buy-out) with high information precision, shortening the target’s response time increases the social surplus. Thus, the following implication is true:

**Implication 2:** In order to increase the social surplus a shorter time period for the target’s shareholders accept the original takeover offer should be allowed in case the target’s management suggest shareholders to accept the offer.
Using equation (12), the expected seller’s revenue can be expressed as

\[ \pi_{S,JAB} = \pi_{S,NJB} + \frac{(1-S)^3}{6}(1-3\alpha), \]

where \( \frac{(1-S)^3}{6}(1-3\alpha) \) is positive for small \( \alpha \) and negative for large \( \alpha \). Hence, depending on how precise the information of the first bidder is, jump bidding can have either positive or negative effect on the seller’s expected revenue, i.e.:

**Result 7:** Jump bidding increases the sellers expected revenue if and only if the first bidder’s relative information precision is low \( \alpha < \frac{1}{3} \).

Since the second bidder’s information is more precise when such bidder is supported by the current target’s management, and behaves as a “white knight” when the hostile takeover bid is made by the first bidder, Result 7 leads to the following implication:

**Implication 3:** In a takeover contest when the first bidder is hostile and a potential competitor is a “white knight” supported by the current target’s management, preemptive jump bidding increases the expected revenue of the target firm’s shareholders.

### 3. Conclusion

This paper extends the Fishman (1988) model of preemptive jump bidding in takeover auctions to a case of common value auctions when the information precision about the target’s value differs across the bidders. Similar to Fishman (1988), it shows that jump bidding is beneficial to the first bidder while the second bidder is indifferent. Contrary to Fishman (1988), in case of
common value auctions jump bidding always leads to higher social surplus, and, under certain circumstances, may lead to higher seller’s revenue. The model developed in this paper suggest that when the original tender offer is made by a friendly bidder supported by the target’s management, shorter time period for the target shareholders’ decision will lead to a higher social surplus. It also shows that, when the original offer was made by a hostile bidder while the potential rival bidder is a “white knight” supported by the current management, preemptive jump bidding increase the expected profit of the target firm’s shareholders.
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