Games and Economic Behavior 76 (2012) 611–635

Contents lists available at SciVerse ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

Efficiency and synergy in a multi-unit auction with and without package bidding: An experimental study

Kirill Chernomaz [a,*], Dan Levin [b]

[a] Department of Economics, San Francisco State University, 1600 Holloway Ave, HSS 142, San Francisco, CA 94132, United States
[b] Department of Economics, The Ohio State University, 443B Arps Hall, 1945 North High Street, Columbus, OH 43210-1172, United States

ARTICLE INFO

Article history:
Received 4 January 2011
Available online 8 August 2012

JEL classification:
C72
C91
D44

Keywords:
Combinatorial auctions
Package bidding
Free-riding
Asymmetric auctions
Independent private value
First-price auctions
Experimental economics

ABSTRACT

We study, theoretically and experimentally, sealed-bid first-price auctions with and without package bidding. In the model, a global bidder bids for multiple items and can benefit from synergies, while local bidders bid for a single item. In the equilibrium, package bidding improves (hurts) efficiency at high (low) levels of synergies. Package bidding introduces free-riding incentives for local bidders resulting in asymmetric bidding that reduces efficiency when synergies are low but increases it with high synergies. The free ridding incentive lowers bidding of local and global bidders reducing revenues at all levels of synergies. We conduct experiments varying auction rules and the degree of synergies. Observed efficiencies are qualitatively consistent with the theory. The effect of package bidding on revenues is negative when global bidders are not allowed to bid on single items (a feature of the equilibrium) and positive when the restriction is relaxed and synergies are high.

© 2012 Elsevier Inc. All rights reserved.

1. Introduction

Recent years have seen a surge of interest in auction procedures that handle multiple objects. Many large-stake auctions, recently conducted, involved a seller simultaneously auctioning off multiple items or a buyer simultaneously procuring several objects. Examples range from auctions that allocate airwave spectrum licenses (Ausubel et al., 1997; Klemperer, 2002), to procurement auctions for selecting operators of bus routes in London (Cantillon and Pesendorfer, 2007) and for determining providers of school meals in Chile (Epstein et al., 2002).

Selling multiple objects simultaneously can be advantageous when the value of a package of several objects is higher than the sum of the standalone values of its components. Such value "synergies" (or complementarities) can be lost if a bidder fails to acquire all parts of a package. This possibility prompts bidders to bid cautiously to prevent financial exposure, i.e. obtaining only a part of the package and paying more for the acquired items than their value. To improve outcomes package bidding can be used whereby bidders can specify bids for packages of items. Such mechanisms are usually referred to as combinatorial, or package, auctions. To determine the winner(s) of a combinatorial auction, the auctioneer considers all possible allocations of the objects and chooses the one that maximizes the revenue.

Package bidding also has a downside, the so-called threshold problem (Milgrom, 2000; Bykowsky et al., 2000). Suppose bidder 1 submits a bid for the package XY while bidders 2 and 3 submit bids for its components, X and Y. In this situation,

* Corresponding author. Fax: +1 (415) 338 1057.
E-mail addresses: kirillch@sfsu.edu (K. Chernomaz), levin.36@osu.edu (D. Levin).

0899-8256/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.geb.2012.07.008

the single-item bidders face a coordination problem. They have an incentive to free-ride as either of their bids could be the one to push their sum above the threshold necessary to top the package bid.[1] As a result, the single-item bidders may lose the auction even when they place a higher value on the items than bidder 1. Thus, by solving one problem (financial exposure), package bidding may introduce another problem (threshold).[2] There is a trade-off involved as either problem can have a negative effect on the level of submitted bids, the seller's revenue and economic efficiency depending on the environment.

This paper attempts to further our understanding of the costs and benefits of using package bidding in the context of sealed-bid first-price auctions (FPA). FPAs have a number of attractive features such as their resistance to collusive behavior, encouragement of participation, and transparency with respect to determination of payments since winners pay their own bids (Cramton, 1998). A type of combinatorial FPA was used to determine operators for bus routes in the London area (Cantillon and Pesendorfer, 2007).

Our specific focus is on the interaction between the threshold problem and bidder asymmetries in FPAs. We present a tractable model which demonstrates that the interaction can produce an efficiency trade-off similar to the trade-off that may arise from the interplay between the threshold and the financial exposure problems. In our model, when synergies are high package bidding improves the efficiency of allocation. The result obtains even though the financial exposure threat is absent in the equilibrium. At the same time, when synergies are low, an auction that allows package bidding becomes less efficient compared to an auction that only allows single-item bids, a consequence of the threshold problem.

In the context of multi-object auctions with synergies a typical asymmetry arises when not all bidders can take advantage of complementarities among objects. For example, some smaller bidders (henceforth local) may be financially constrained or geographically restricted to purchase more than one object. At the same time, larger bidders (global) are likely to be able to acquire packages of objects and enjoy potential synergies.[3] We adopt this setup as the basis for our theoretical model. In the model a single item is auctioned off in each of two markets where one local bidder with a unit demand bids against the global bidder who demands one unit in each market. If the global bidder obtains the items in both markets, his or her value increases by a multiplicative factor depending on the degree of synergies. Such an asymmetry is not important when complementarities are absent. In this case, the objects can be auctioned off separately with no detrimental effect on efficiency. However, as we illustrate, when synergies are present, selling the objects separately may result in an inefficient allocation. The expected inefficiency increases with the degree of synergies. Roughly speaking, when synergies are present each auction between a local and the global bidder becomes an asymmetric auction in the sense of Maskin and Riley (2000) where the value distribution of the global bidder is more advantageous than the value distribution of the local bidder. As a result, the local bidders sometimes win the auction when the global bidder could have obtained a higher value due to synergies. In this environment, allowing package bidding improves the efficiency of allocation when synergies are sufficiently high.

When synergies are minor or do not exist, an auction without package bidding is quite efficient in our model. However, allowing package bidding in this case reduces efficiency by making the "geographic" asymmetry relevant when it should not be. The exact mechanism is based on a strategic incentive identified in Cantillon and Pesendorfer (2007). With synergies, it is efficient for the global bidder to submit a "non-trivial" package bid, i.e. a package bid higher than the sum of his or her bids for individual items. Such a pattern is exactly the motivation for allowing package bids. Using a result from the bundling literature, Cantillon and Pesendorfer (2007) show that a bidder has a strategic incentive to submit a "non-trivial" package bid even when there are no synergies between the items. In other words, auction rules that allow package bidding may be "abused" to gain a strategic advantage. Such bidding patterns can cause inefficient allocations when synergies are absent. In the setting of our model, we show that under an auction rule with package bidding, the global bidder finds it optimal to submit only the package bid for both items while submitting zero single-item bids. The consequence of such behavior on the part of the global bidder is the threshold problem faced by the local bidders. Consequently, the local bidders' bids are depressed relative to the bids of the global bidder. As a result, the global bidder sometimes wins the auction when the local bidders have a higher value. Such asymmetry is the source of inefficiency when synergies are absent, but it also improves the efficiency when synergies are sufficiently high.

Thus, our model shows that allowing package bidding in first-price sealed-bid auctions can involve an efficiency trade-off even when the exposure problem is absent: package bidding can improve efficiency if synergies are sufficiently high and hurt it when the synergies are absent or insignificant. The model is simple enough so that we can obtain numerical and in some cases analytical equilibrium bidding functions. We use these benchmarks to evaluate the theoretical predictions with a series of experiments. We collect data for six experimental conditions. In the conditions we vary the auction rule (with or

[1] Since in combinatorial auctions the auctioneer considers all the possible allocations of the items to the bidders and chooses the one that brings the highest revenue, a package bid for a certain set of objects can be viewed as competing against sums of bids for subsets that form its partition.

[2] Package bidding with Vickrey-type pricing (where the price a bidder pays is not determined by his or her bid but rather by the bids of other participants) provides incentives to reveal one's values and overcome the threshold problem.

[3] The distinction between global and local bidders has been used in a variety of settings. Krishna and Rosenthal (1996) characterize equilibrium in simultaneous sealed-bid second-price auctions where global bidders can participate in multiple auctions and obtain additive synergies from winning multiple objects. Albano et al. (2001) use a similar setup to derive optimal strategies for two global and two local bidders in a simultaneous ascending clock auction. Gerding et al. (2007) study simultaneous sealed-bid second-price auctions of perfect substitutes where global bidders demand a single unit but can participate in multiple auctions. Elmaghraby (2005) uses production capacity to distinguish between global and local bidders in a model of sequential second-price sealed-bid procurement auctions.

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات