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Bidding behavior in a symmetric Chinese auction

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Abstract

This paper purposes a symmetric all-pay auction where the bidders compete neither for an object nor the object itself but for a lottery on receive. That lottery is determined endogenously through the bids. This auction is known as chance auction or more popularly as Chinese auction. The model considers the possibility that for some bidders the optimal strategy is to bid zero and to rely on luck. It showed that bidders become less aggressive when the lottery satisfies a variational condition. It was also shown that luck factor is decisive to determine if the expected payoff in Chinese auction is bigger or smaller than expected payoff in standard all-pay auction.
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JEL classification: D01; D44; D82

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Keywords: Chinese auction; All-pay auction; Lottery; Bayesian equilibrium

Resumo

Este trabalho propõe um modelo de leilão chinês, ou seja, um leilão all-pay sobre uma loteria. A loteria é determinada endogenamente através dos lances. O modelo considera a possibilidade de que, para alguns participantes a estratégia ótima é oferecer um lance nulo e esperar pela sorte. É mostrado que a introdução de aleatoriedade no resultado do leilão pode tornar os participantes menos agressivos caso a loteria satisfaça uma dada desigualdade variacional. Também é mostrado que o fator sorte é decisivo em determinar se os ganhos esperados são maiores ou menores no leilão chinês relativamente ao leilão all-pay padrão.
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Palavras-chave: leilão chinês; leilão all-pay; loteria; equilíbrio Bayesiano

1. Introduction

The design of market institutions has been considered as one of the most important research objects since the beginning of Economics. But it was when Game Theory emerged as an important analytical framework that the theme

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gained notoriety, since for the first time a series of important tools made possible a better understanding about this subject.

Mechanism design and implementation theory made possible an approach such that virtually all allocation forms could be understood through formal mathematical models. Auction theory, for example, is undisputedly considered as a successful case in designing new market institutions.[1] The applications of auction theory surpassed its basic purposes, which are the understanding of allocation rules and price formation, as examples like first- and second-price all-pay auctions,[2] double auctions and score auctions indicate.

Two key results from auction theory, the Revenue Equivalence Theorem and the Linkage Principle, connect several different types of auction mechanisms[3] through their expected revenues. Amongst the conditions that support the validity of these results, one is particularly important to this study: the auction mechanisms are standard in the sense that the winner is the person bidding the highest amount.

There are, however, countless interesting situations where agents allocate their resources and the results are not deterministically reached, i.e., a participant offers the highest bid and yet he is not the winner of the auction. This is the case, e.g., of elections and patent races. In the first example, the candidate that spends more money is not necessarily the one that is elected. In the case of patent races the prototype with the highest investment is not necessarily chosen. These situations are usually treated as a contest where the probability of winning is proportional to the participant's bid.[4]

There are other situations subtly related to auction theory. For example, in Brazil, public sector jobs are fulfilled through public contests. More specifically, a public institution announces the availability of one or more jobs which require a well-defined and non-discriminatory selective process. In general, the referred selective process includes general and specific exams according to job available. This type of mechanism has been adopted in Brazil since the 1950s and it is estimated that nowadays more than five million candidates apply for these contests every year. Generally, the classification of the candidates depends on their performances in the exams; being hired are the ones with the highest scores. Hence, an important question emerges: does higher effort lead to certain success in such mechanisms?

Suppose that all resources allocated by a candidate in a public contest (time, discipline, educational background, etc.) can be evaluated in monetary terms. This value may be interpreted as a bid that is paid at any contingency.[5] The bids do not guarantee success but only a probability of success. Therefore, a public contest may be specifically viewed as a first-price all-pay auction whose object being auctioned is not a good but a lottery where the bidder may either win or lose the good. It is reasonable to assume that this lottery establishes a given probability of winning that depends on the participant's bid (effort). More specifically, one may assume that the probability of winning follows a stochastic order where higher bids are associated with higher probabilities of winning.

This type of auction is also used in charitable events in order to raise funds and is popularly known as the Chinese auction or, more formally, a chance auction.[6]

The main objective of this paper is to build a model to represent the Chinese auction, where its characteristics are represented and its equilibrium is derived. First a general version is proposed where the probability of winning is a continuous and increasing function of the bid. Afterwards, in order to derive some additional properties of the equilibrium bid, it is supposed that this probability is a linear function of the bid. In both versions an exogenous and common-knowledge probability of winning is assumed that will be referred to as the "luck factor". This probability is positive even when the bid is zero.

In addition to the luck factor a realization defined as the threshold of the effective competitors is assumed. This realization is also common knowledge. The idea is to allow the possibility of a partial pooling equilibrium where the bidders with smaller values (below the threshold) rely on luck, choosing as an optimal strategy a zero bid.

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[1] Maskin (2004).

[2] Second-price all-pay auctions are also known as "War of Attrition". In Krishna and Morgan (1997), these two types of auctions are analyzed in detail.

[3] In fact, these results are independent of the type of the auction. For further details, see Krishna (2005) or Menezes and Monteiro (2008).

[4] The literature about contests is vast and has its origins linked with the seminal works of Gordon Tullock about rent seeking. See Tullock (1967, 1980) and Konrad (2009).

[5] Another way to describe the problem is to enquire about the monetary value that the candidate would be willing to pay in order to avoid the effort, i.e., the amount that he or she will be indifferent either to pay or to effort.

[6] The origin of the term is unclear.

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