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Introduction

This paper considers situations in which the auctioneer can conduct an auction and not inform all other participants if this auction is forward (auctioneer sells the good) or reverse (auctioneer buys the good). We consider an auctioneer deciding whether to inform bidders the type of auction being conducted or withholding this information. We assess how this specific auction design affects the dispersion of winning bids and the expected profit for all participants when compared to forward and reverse auctions. We denominate this auction by *buy-or-sell auction* henceforth. This term was first used by Carvalho (2004), who studies auctions carrying this structure in the context of speculative attacks. Bidders are identical *ex-ante*, that is, before observing their signal. Private signals are affiliated and each bidder places a single bid and demand/supply a single unit, although the auctioneer might buy or sell multiple units on the same auction. If the bidder wins the forward (reverse) auction, he pays his bid minus (plus) a *spread*. This spread represents the difference of bids and payments for each kind of auction and plays a fundamental role in the equilibrium derivation. In this paper, we consider the spread as a parameter.

The central characteristic of a buy-or-sell auctions is that bidders face conflicting incentives (the uncertainty of buying or selling). For instance, if a participant bids a value that is too high (with the intention to sell at this price), he might have to buy the good at a high value. In this sense, the trade-off faced on a buy-or-sell auction by a bidder is related to a problem of dissolution of partnerships, where the participants have uncertainty on whether they are acting as buyers or sellers in the transaction (as introduced in Myerson and Satterwhite(1983) and Cremton, Gibbons and Klempeper (1987)).

This uncertainty between buying and selling causes a phenomenon that we will denote as *Double Sided Winner's Curse*, since bidders face the winner curse on the forward and reverse ends of the auction. On the other hand, bidders also have informational rent, given that the auctioneer is not informed about their private types. In particular, bidders that are only competitive on one side of the auction (that present extreme private signals) have the greatest amount of informational rent. For these bidders, the expected profit tends to be positive, even in the presence of the double sided winner's curse. For intermediate bidders, however, the expected profit might be negative (depending on the value of the spread defined by the auctioneer).

The focus of this paper is to develop a symmetric equilibrium characterization for a buy-or-sell auction. We show that if the spread is zero, then there is no symmetric equilibrium with all bidders having non-negative *ex-post* expected payoffs, even if the support of the distribution of types changes. Moreover, if the spread is smaller than a threshold defined on the paper, then there is a unique symmetric Bayes-Nash equilibrium in a buy-or-sell auction, which is fully characterized on this paper.

We investigate the effect of revealing the direction of the trade, that is, we compare the expected profit of the buy-or-sell auction with the forward and reverse auctions. We conclude that revealing the type of auction reduces the expected profit for the auctioneer. Additionally, we establish how the money transfers made by bidders change when parameters of the model are changed. If the spread changes, the optimal bidding strategy changes in a non-trivial way. The payments, however, have a well defined change: if the spread increases, payments in the forward (reverse) auction decrease (increase).

We also explore the expected profit of bidders on this setting. If the spread is positive but sufficiently small, there is no symmetric equilibrium with all agents having an *ex ante* (i.e., before observing their private signal) non-negative expected profit. Moreover, there is a set of possible spreads that guarantees the existence of a symmetric equilibrium and that all bidders have an interim non-negative expected profit (i.e., after observing their private signal but before the auction actually occurring).

Two applications inspired our analysis. The first is the exchange rate auction performed by the Brazilian Central Bank (BCB) during the 90's. Starting in 1995, the BCB institutionalized the exchange rate intraband (already used before in other countries to prevent volatility of the exchange rate) together with the buy-or-sell auctions (a distinct intervention technology adopted by the BCB). In terms of the magnitude of this mechanism, there were 60 buy-or-sell auctions during 1995, through which the BCB bought USD 1.5 billion and sold USD 3.6 billion, with a growing trend in the subsequent years (Franco, 2000). This is the focus of Carvalho (2004), that was particularly interested on investigating whether this mechanism was more effective than standard auctions to reduce the probability of speculative attacks. The second application that inspires this research is the market dealing activity. In Brazil, some over-the counter-contracts have a mechanism close to the buy-or-sell auction. A market dealer approaches potential buyers or sellers and, defining an spread, asks for a bid and ask prices. Since the dealer does this to a large number of potential buyers, we consider this situation close to an implicit auction.

In terms of related auction literature to this specific design we are approaching, forward and reverse auctions have been extensively studied from a theoretical point of view (Myerson (1981), Riley and Samuelson (1981), Holt (1990), Compte and Jehiel (2002) etc.). On the other hand, to the extent of our knowledge, no paper articulates clearly the incentive structure when these two types of auctions are concomitantly conducted or the effect of revealing the type of auction. This paper addresses specifically these topics. It is noteworthy that the literature of double auctions is not particularly useful in our framework, since the main specificity of the *buy-or-sell* design is that bidders are not informed if their acting as buyers or sellers, what changes completely the structure of incentives.

A more related literature associated with our study is reviewed at Moldovanu (2002), where different versions of models of partnership dissolution with interdependent values are explored and reviewed. This literature is concerned with the existence and characteristics (efficiency and fairness) of a dissolution mechanism, while we focus on the changes on the bidding structure of agents (mainly when the *ex-ante* spread changes). In terms of literature closely related to our paper, Morgan (2004) focuses on the use of auctions in a partnership dissolution.

Morgan (2004) uses four simple mechanisms to evaluate the fairness of allocation of dissolutions of partnerships. The mechanisms are the divide and choose, first price auction, second price auction and a simultaneous binding arbitration mechanism. Although the paper applies similar concepts of this paper (the uncertainty of buying or selling goods in auctions, for instance), the methodology and objectives are substantially different. In terms of objectives, Morgan (2004) is concerned about the fairness (*ex-ante* and *ex-post*) of the mechanisms (and concludes that only the arbitration mechanism provides fair allocations), while we are focusing on deriving an equilibrium of a buy-or-sell auction and assessing if it is profitable for the auctioneer to reveal the type of auction (forward or reverse) is being conducted. In terms of methodology, while Morgan (2004) focuses on different mechanisms, we focus only in a mechanism comparable to a first price auction. In the buy-or-sell auction we explore, both operations (buying and selling) are done actively. This leads to a crucial characteristic of our model: the worst type (that defines the boundary condition of the equilibrium) is an intermediate type. In Morgan (2004) and the other papers cited, one of the operations is passive, in a way that this phenomenon does not appear. This difference that might seem at first glance insignificant changes completely the analysis and the optimal bidding functions on an equilibrium.

In this context, we believe that our research may provide answers to an unexplored and intriguing auction model, that was extensively used in the Brazilian Economic History and has some applications on the current OTC operations. The rest of the paper is organized as follows: in section 2, we present the basic framework of the model. In section 3, we derive the equilibrium. In sections 4, we explore the properties of the equilibrium of the paper. Finally, section 5 concludes the paper. All proofs for the lemmas and propositions are in the appendix.