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Capacity constraints and the winner's curse in multi-unit common value auctions

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ABSTRACT

We explore the role of capacity constraints in establishing efficient pricing in multi-unit common value auctions in a setting relevant to auction-based equity IPOs. The method of inquiry is experimental economics. We find that sufficiently large capacity constraints mitigate the overbidding that plagues single-unit auctions and is one of the most robust laboratory findings. We also uncover a puzzling propensity for most bidders to place a portion of their bids at prices above their signals. This disequilibrium behavior persists with experience and in cases with substantial losses in previous auctions. Our results suggest caution is warranted in promoting auction based IPOs that allow unrestricted access by the non-professional investing public.

1. Introduction

Auctions have a long history as an efficient mechanism for the pricing and allocation of Treasury securities. They are widely employed in the issuance of Treasury securities throughout the world and are the dominant mechanism in countries with well-developed financial markets. A characteristic feature of these auctions is relatively little uncertainty with respect to intrinsic value due to the trading of similar securities in active secondary markets, thus diminishing the price discovery role of the auction.

Auctions have been much less widely used to issue new securities when there is significant uncertainty with respect to intrinsic value. For example, although auctions have also been used in equity initial public offerings (IPOs) in many countries, the dominant practice is the investment bank driven bookbuilding procedure. At present, a variant of an auction is only used in a handful of countries, such as the U.S., Israel, Vietnam, and India.[1] In the U.S., the auction method received much publicity when Google employed it for its August 2004 IPO, but during the period of 1999–2011, there have been only 22 U.S. IPO auctions.

Consistent and economically significant underpricing as an outcome of IPOs completed via bookbuilding has led some researchers to conclude that the dominance of bookbuilding is maintained because of conflicts of interest between investment banks and issuers. For example, Ausubel and Cramton (1998) speculate: "Indeed, the incumbent corporate underwriters possess a strong profit motive in discouraging the advent of auctions, as they are the beneficiaries of today's substantial underpricing." They argue for the widespread use of carefully designed auctions. Many auction advocates also argue that auctions can be designed to be more democratic, opening up IPO access to the general public.

Other research has focused on the superiority of the bookbuilding process because of its facility in price discovery in a setting where potential investors would have little incentive to engage in costly information acquisition and truthfully reveal their preferences in an auction setting.[2] In this literature, auctions are criticized as producing inaccurate prices. Sherman (2005) models costly

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[1] See Jagannathan et al. (2010) for a summary of equity IPO methods used in various countries.

[2] The seminal paper in the large theoretical literature that examines the role of bookbuilding in solving the informational problem in new issues is Benveniste and Spindt (1989).

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information production in both uniform and discriminatory auctions and demonstrates that bookbuilding allows underwriters to reduce risk for both issuers and investors, and to control spending on information acquisition.

In this paper, we investigate the performance of uniform price multi-unit common value auctions by conducting a controlled experiment. In a uniform-price auction, units of the good are awarded for bids at or above the market clearing price. Bidders pay the market clearing price for all units awarded. The choice over pricing rules (discriminatory versus uniform) in multi-unit auctions is an open issue. We employ uniform pricing in this study because it is the only method that has been employed in U.S. equity auctions, although discriminatory auctions have been used in many countries.[3]

Part of the motivation for this study is to help understand whether non-professional investors can achieve efficient outcomes in multi-unit auctions when there is considerable uncertainty with respect to intrinsic value: an issue that is relevant to the calls for open-access equity IPOs. A large experimental literature finds that the winner's curse (pricing above intrinsic value) is pervasive in single-unit common value auctions.[4] This occurs because although bidders tend to shade their bids relative to their signals, they consistently bid above the expected value conditional on having the highest signal, failing to fully account for the inherent adverse selection problem. Persistent over-pricing might be particularly damaging in equity auctions if it were to discourage the participation of the institutional investors whose participation is critical for efficient price discovery and secondary market trading. In fact, Jagannathan, Jirnyi, and Sherman (2010) show that in many countries, over-pricing in IPO auctions has been followed by under-subscription, and the subsequent abandonment of auction methods.

The results from single-unit common value auctions do not generalize directly to multi-unit auctions for a number of reasons. First, work in the theory of multi-unit auctions shows that these auctions have strategic dimensions not present in the single-unit case and there exist non-cooperative equilibria under the uniform-price format in which the auction's stop-out price is much lower than the value of the asset offered for sale.[5] The intuition is that in a uniform-price auction, bidders are able to submit "steep" (inelastic) bid schedules that result in their sharing the total quantity at a price far below the true value of the good. In this type of equilibrium, the steep bid schedules submitted by the other bidders make marginal cost higher than the price for additional units, thus inhibiting price competition among the bidders in equilibrium. Key here is that in a uniform-price auction the high infra-marginal bids that support the equilibrium are "costless" to the bidders, since all bidders that receive an allocation pay the lower stop-out price. Theoretical results show that there may be many "collusive like" equilibria. A barrier to achieving any particular equilibrium is the precise coordination in strategies among bidders that would be difficult to attain in the absence of overt cooperation.[6] Nevertheless, the possibility of locking in an allocation with a small bid at a high price with the expectation of paying a much lower price due to large bids at lower price raises the possibility of a range of outcomes not observed in the single-unit case.[7]

A behavioral difference between single-unit and multi-unit common value auctions arises if some bidders receive utility from winning an allocation.[8] In a single-unit auction, winning a share requires submitting the highest bid. Since in a multi-unit auction bidders can be aggressive with a portion of their bid schedules, the potential for a bidder to mix speculative bids with conservative bids may have important implications for information aggregation and pricing accuracy.

Given these significant differences between single and multi-unit common value auctions, our focus in this paper is on how these differences affect the degree of information aggregation and the facility with which bidders avoid the pervasive losses which characterize comparable single-unit auctions. In single-unit auctions it is well established that the number of bidders affects the adverse selection problem faced by the winning bidder. In multiple-unit auctions it is plausible that the number of units each bidder is permitted to bid for (capacity constraints)[9] would have an analogous effect. In our experimental markets we therefore consider three settings. In our first treatment (C7 treatment) each of six bidders is allowed to bid for seven units with a market supply of 20 units. In the second treatment (C14 treatment) we reduce the capacity constraint and allow bidders to bid for 14 units, holding constant market supply at 20. This comparison shows the effect of increasing demand, holding constant the number of bidders. In the third treatment (UC treatment) we eliminate the capacity constraint, allowing each bidder to bid for all 20 units but reduce the number of bidders to four, approximately equalizing total potential demand to the second treatment, but with a smaller number of bidders. The experimental design is meant to be exploratory for three reasons: (1) extant theory provides limited guidance due to the existence of multiple equilibria; (2) the behavioral factors discussed above may have an impact on bidder behavior; and (3) it is unclear if the pervasive evidence of failure to account for the winner's curse from single-unit auction experiments will extend to a multi-unit setting. This combination of settings allows us to examine the importance of the number of bidders on outcomes holding constant total potential demand, and the importance of the level of total demand, holding constant the number of bidders.

An important aspect of our experimental design is the interaction between the information structure and the capacity

[3] The multi-unit auction literature has identified a tradeoff between a less severe winner's curse and equilibrium collusive-looking behavior (more prominent in the uniform-price auction) as a primary consideration in the revenue comparison for these auction types. IPO auctions are unusual in that bidders frequently have paid strictly less than the market clearing price. These are known as "dirty Dutch" auctions and have been employed in many countries including the United States. Jagannathan et al. (2010) provide extensive evidence on auction methods that have been employed around the world.

[4] Reviews of relevant experimental papers are found in Kagel (1995) and Kagel and Levin (2010).

[5] See, for example, Back and Zender (1993), Ausubel and Cramton (2002) or Wang and Zender (2002) for theoretical results on strategic bidding in multi-unit auctions in which bidders are permitted to bid for multiple shares. Collusive-like equilibria may be particularly relevant if bidding is restricted to a small number of potential bidders, but are unlikely to be a major concern in an IPO auction with unrestricted access across a large population.

[6] Morales-Camargo et al. (2012) find that in 775 auctions over 39 experimental sessions with a uniform pricing rule, "collusive-like" equilibria never obtain. Goswami et al. (1996) and Sade et al. (2006a, 2006b) show that even when bidders are allowed to communicate prior to submitting bids in multi-unit common value auctions with no uncertainty with respect to resale value they have difficulty achieving a collusive outcome.

[7] See Back and Zender (1993).

[8] Holt and Sherman (1994) study this possibility in single-unit auctions.

[9] IPO auctions are large multi-unit auctions that usually have restrictions preventing any one bidder from buying more than a certain proportion of the shares, plus the large investors (mutual funds, pension funds, hedge funds and other institutional investors) usually have restrictions preventing them from owning more than a certain percent of the company. In addition, breadth of ownership is actively pursued. Evidence suggests underpricing is used to ensure oversubscription and rationing in the share allocation process so as to reduce the block size of new shareholdings which in turn reduces incentives for new shareholders to monitor management (Brennan & Franks, 1997). Booth and Chua (1996) point out that diffuse ownership promotes liquidity after the IPO, which is important to insiders that may wish to dispose of additional shares post-IPO.