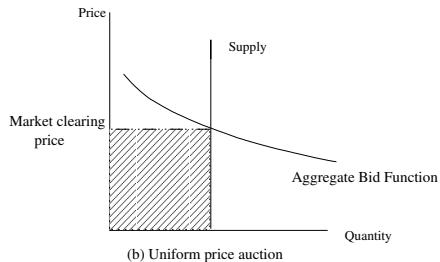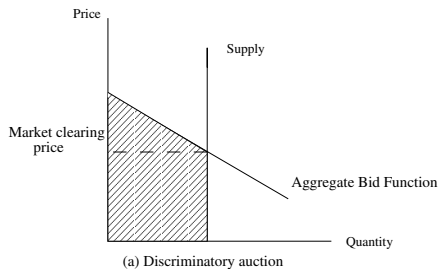# Academic Perspectives on The Design of Treasury Auctions

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Workshop on Auction Dynamics, November 16, 2012

Multiple (Discriminatory) vs. Uniform price auctions

(a) Discriminatory auction

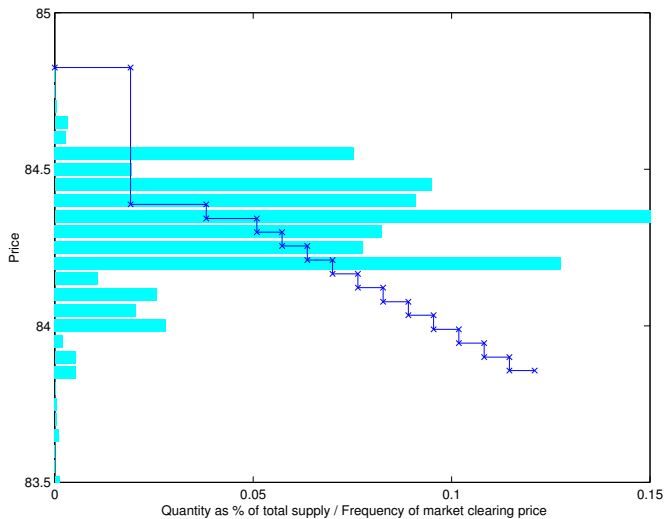(b) Uniform price auction

Different contexts....

- Most countries use multiple price (39 of 43)
- U.S. (as of Dec. 1998), Switzerland, Denmark, Nigeria use uniform
- 6 countries experimented with uniform but reverted to discriminatory (Mexico, France, Italy, Belgium, Gambia, Tanzania)

Source: Survey by Bartolini and Cottarelli (1997)

Different perspectives....

- "Uniform price auctions can allow the Treasury to make improvements in the efficiency of market operations and reduce the costs of financing the federal debt." Lawrence Summers, October 27, 1998.

- "California's deregulation scheme is a colossal and dangerous failure. (...) overhaul the crazy bidding process for electricity, which currently guarantees that every generator is paid according to the highest bid, rather than their own bid." Gov. Gray Davis, January 8, 2001.

Bidders don't know the price where market will clear

Equivalently, bidders don't know the residual supply curve

Residual supply faced by bidder 2
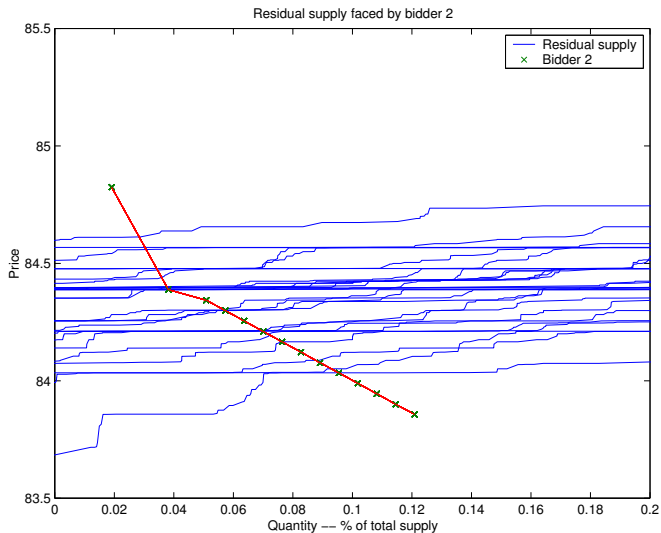
Wilson (1979) model of bidding

In *multiple price* auction:

$$\underbrace{p(q)}_{\text{bid for } q \text{ units}} = \underbrace{v(q)}_{\text{marginal val for } q \text{ units}} - \underbrace{\frac{H(p,q)}{\frac{\partial H(p,q)}{\partial p}}}_{\text{``shading'' factor}}$$

In *uniform price* auction:

$$\underbrace{p(q)}_{\text{bid for } q \text{ units}} = \underbrace{v(q)}_{\text{marginal val for } q \text{ units}} - q \underbrace{\left| \frac{\frac{\partial H(p,q)}{\partial y}}{\frac{\partial H(p,q)}{\partial p}} \right|}_{\text{``shading'' factor}}$$

Insights from Wilson (1979)

- In both auctions, bidders have incentive to "shade" their bids
- Shading depends on how "pivotal" a bidder thinks her bids are in terms of affecting market clearing price
- Both auction formats lead to inefficiencies in allocation (i.e. some winners will have lower value than some losers)
- If ability to shade optimally is costly, then larger, more sophisticated bidders are favored
- It is <u>not</u> possible to say which auction format is going to yield higher revenue based on theory alone

Multiple Price $<>$ Uniform Price

Winner's curse

- Fear of winning the auction because you made the most optimistic forecast
- Rational bidders shade against this possibility
- Probably a very important issue for IPO bidders (e.g. Groupon, Facebook)
- Are Treasury securities subject to a winner's curse?
- Theory gives some intuition that uniform price auctions may lower winner's curse
    - Less fear about bidding too high, because you do not pay your bid

Multiple Price $<$ Uniform Price

Theory bottomline

- Relative revenue/efficiency performance of multiple vs. uniform price is largely an empirical question
- Even if theory were to make clean predictions, results assume that bidders behave optimally
- "Behaving optimally" in both auction formats is a mathematically and computationally daunting task: thus both formats have a skew towards large/experienced bidders with the resources to optimize behavior

Empirical Studies I

- Ideal approach would be to randomly pick auction mechanism every time, and compare outcomes, especially revenues – controlling for external factors affecting demand.
- Feasible approach has been to analyze changes in auction mechanism
    - Umlauf (1993): Mexico, uniform ¿ multiple
    - Simon (1994): US Treasury, 1970s switch, uniform ¡ multiple
    - Nyborg and Sundaresan (1996), Malvey and Archibald (1998): US Treasury, 1990s switch, uniform ¿ multiple, but not statistically significant
- Due to idiosyncracies of each market, it is not easy to generalize the result of one empirical study to another setting

Empirical Studies II

- Unfortunately, in many other settings, we do not have a policy change to analyze
- However, we do have access to detailed data from current mechanism
- In the *structural* approach (Hortaçsu and McAdams (2010), Kastl (2010)), use bid data from current mechanism to fit model, then predict what bidders would do under the alternative mechanism
- Main assumption: bidders follow optimal strategies
- Main result: revenue differences across multiple price and uniform price auctions not large (data from Turkey, Czech Republic, South Korea)
    - Again, however, the result is context-dependent

Step 1: use Wilson equations to estimate marginal values from bids
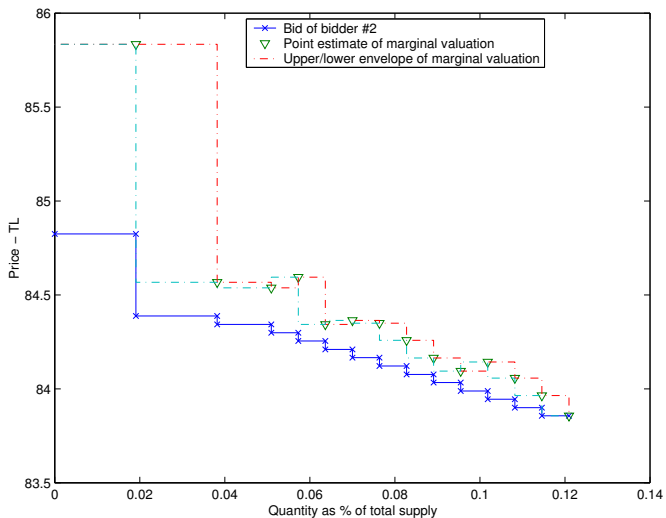
Step 2: predict revenue under alternative mechanism
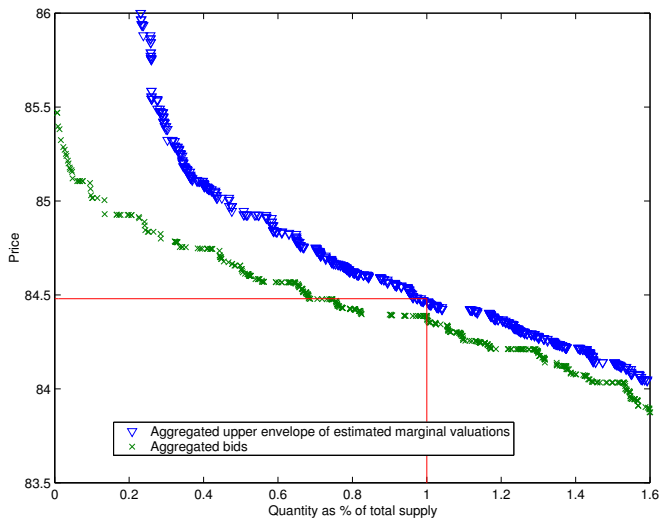
Best Practice?

- If data from policy experiment available, analyze that
- Otherwise, use data on bids to conduct structural analysis
    - Do bidders follow economic theory: large bidders get very close; but smaller bidders depart from theory (Hortaçsu and Puller (2008))

Primary Dealership Model

- Not much systematic analysis in the Treasury auction context

- We know from other industrial settings that retailers/distributors can add considerable value esp. through knowledge of local demand, but downstream margins restrict the market

- To the extent that large customers (e.g. institutional investors, sovereigns) have to bid through PDs, PDs also have informational advantage

- Hortacsu and Kastl (2012) find that in Canada about a third of PD profits attributable to information flow from large customers

- For further analysis of PD mechanisms we need data on both PD bids/allocations, and what they do in the aftermarket

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