Auction Design for the Rescue Plan

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Problem: Illiquidity

- Trillions of $ in mortgage-backed securities and other assets that have little or no liquidity
- Financial companies that hold the assets have little ability to lend
Legislation

- Treasury purchases $700 billion of assets
- Key questions
  - What to buy?
  - At what price?
Objectives

- Provide quick and effective means to purchase troubled assets and increase liquidity
- Get price related to value (i.e. protect the taxpayer)
- Use transparent rules-based process with minimal scope for discretion and favoritism
One approach: single auction for many securities

- Government buys many securities together
- Price starts high; holders offer securities
- Price falls as long as excess supply
- Clearing price is say 30 cents on dollar
- Government has just bought worst-of-the-worst
  - Paid 30 cents for all securities worth between 0 and 30 cents
Problem

• The securities differ
  ▪ Some are good; some are okay; some are worthless

• Can’t treat them as if they are the same, with single price
  ▪ Severe adverse selection problem

• Problem can be ameliorated if values can be reliably scored
  ▪ But there exists no reliable data or methodology to assess value
  ▪ Any effort to determine reference prices may take a long time

• Inaccurate scores create a similar adverse selection
  ▪ Government buys the securities that are worth the least relative to their scored values
A two-part reverse auction plan

• First, simultaneous descending CUSIP-by-CUSIP auctions are run for each feasible security
  ▪ “Feasible” means holdings are sufficiently diffuse to support a reasonably competitive auction
  ▪ Only some, but not all, of each security is auctioned (e.g. 50%)

• Prices from the auctioned securities are regressed on all available characteristics, and are used to develop reference prices for the remaining securities

• Second, pooled auctions are run for the remaining securities
  ▪ Bidding occurs on discounts or premiums to the reference prices derived from the initial auctions
  ▪ Bidders with greatest need for liquidity are most likely to win
Advantages of two-part plan

- CUSIP-by-CUSIP auctions, when feasible, do not require any value information or other external information.
- Hence, they can be run when needed (October!)
- Prices developed for individual securities can help to unfreeze the market (if government purchases 50%, private parties may assist with the remainder).
- There is a built-in methodology for determining reference prices.
- Competition between CUSIPs is exerted for securities where within-CUSIP competition is inadequate.
Preliminaries

• Treasury announces auction for a class of securities
• Holders nominate quantities of each
  ▪ Bidders forbidden to sell nominated quantities until auction
• Treasury announces demand for each security
  ▪ Quantity demanded capped to assure competition

_Last two steps done shortly before auction_
Part I: Separate auction for each security

• To create competition, Treasury buys only a fraction of security (e.g. 50%)
  ▪ If Treasury instead bought close to 100%, bidders would have strong incentive to reduce their quantities strategically and thereby obtain 100 cents on dollar

• Clearing price is such that some owners willing to sell, but some owners willing to hold. Thus, price is related to value, and the cost to Treasury is minimized

• The “winners” are those who value the security the least (or value liquidity the most)
Multiple benefits

- Liquidity goes directly to those who value it most
- Price revelation improves liquidity for everyone
- Secondary market is restored
- Creates information that Treasury can use in subsequent auctions
How much to buy of each security?

- Cap demand to assure a competitive auction
- Cap demand so don’t buy too much of any particular security
Three pivotal seller rule

To assure a competitive auction, *cap demand at sum of nominated quantities other than the three largest*

- Guarantees at least four bidders competing for every share
- Demand does not reveal much about concentration

- Based on three pivotal supplier test used in largest US electricity market (PJM) since 2005
  - Auction viewed as competitive whenever demand can be fully satisfied by bidders other than three largest
  - Applied in daily uniform-price auctions where number of bidders is limited by transmission constraints
Three pivotal seller rule

- All quantities in million dollars of security face value
- Cap demand to assure a competitive auction
  - Nominated quantity of bidder \( i = q_i, \ i = 1, \ldots, n \)
  - Listed in descending order: \( q_1 \geq q_2 \geq \ldots \geq q_n \)
  - Total nominated quantity = \( Q = q_1 + q_2 + \ldots + q_n \)
  - Demand for a competitive auction = \( Q - q_1 - q_2 - q_3 \)
- Cap demand so don’t buy too much of any particular security
  - Issued face-value quantity = \( F \geq Q \)
  - Demand no more than fraction \( x \) of \( F \) (e.g., \( x = 50\% \))
- Demand = \( D = \min \{Q - q_1 - q_2 - q_3, xF\} \)
Simulation of quantity purchased  
(holdings drawn from either uniform or beta distributions)

Percent of shares purchased by number of bidders  
(mean $\pm 2$ standard deviations)

Uniform Distribution $\sim U[0,1]$

Beta Distribution $\sim Beta(1,3)$
Descending-clock auction

- Since it’s an auction to buy rather than sell (a reverse auction), price descends
- Auction is conducted in discrete rounds
- Auctioneer announces price for each security
- Bidders submit quantities for each security
- Activity rule: Quantity cannot increase as the price falls
- Aggregate supply, but not individual bids, announced to bidders
- Auctioneer decrements price for each security
- Process continues until supply equals demand
Auction mechanics

Price (cents) vs. Aggregate Supply

- Round 1
- Round 2
- Round 3
- Round 4
- Round 5
- Round 6

Closing Price

Demand vs. Quantity (million $)

- P1
- P2
- P3
- P4
- P5
- P6

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Closing with overshoot

Price (cents) vs. Aggregate Supply

- Round 1
- Round 2
- Round 3
- Round 4
- Round 5
- Round 6

Closing Price

Demand

Quantity (million $)
Intraround bids
Intraround bidding – one bidder

Price (cents)

Quantity offered by a Bidder

P\text{start}
P1
P2
P3
P4
P5
P6

P1
P2
P3
P4
P5
P6

Round 1
Round 2
Round 3
Round 4
Round 5
Round 6

Quantity (million $)
Intraround bidding – aggregate supply

Price (cents)

P_{start} (50 cts)

P1

P2

P3

P4

P5

Closing Price (31 cts)
P6 (30 cts)

Aggregate Supply

Round 1
Round 2
Round 3
Round 4
Round 5
Round 6
Exact Clearing

Demand
Quantity (million $)
Demand may depend on price

Price (cents)

Aggregate Supply

$\text{P}_{\text{start}}$ (50 cts)

P1

P2

P3

P4

Closing Price

P5

Demand

Quantity (million $)

Round 1

Round 2

Round 3

Round 4

Round 5
Handling many securities

- Related securities grouped together in a single auction
- Simultaneous descending clock
- Price clock for each security
- Allows arbitrage across securities and better management of liquidity needs
- Can auction 100 (or more) securities simultaneously, completing all in a single day
  - No positions held open overnight
## Security-by-Security Auction

*quantity in $25,000 of face value; price in cents on the dollar*

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<td>2,000</td>
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<td>800</td>
<td>2,500</td>
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<td>2,400</td>
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<td>1,680</td>
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<td>77.00</td>
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<td>76.00</td>
<td>58.00</td>
<td>53.00</td>
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**Excess supply**

**Security clears**
Why open (vs. sealed-bid)?

- Information revealed during auction reduces winner’s curse
  - Strong common-value element means flatter supply curve with better information
  - Bidders respond by bidding more aggressively
- Bidders can condition their bids for one security on bidding that develops on other securities
  - Can better manage liquidity needs and portfolio risk
  - By contrast, bidders cannot do this in simultaneous sealed-bid auctions
- Transparency is paramount
Why uniform price (vs. pay-as-bid)?

- General assessment is that uniform price performs at least as well as pay-as-bid for financial instruments
  - That was the Treasury’s assessment, in changing the format of T-bill auctions
- Bidders hate pay-as-bid auctions, as they look foolish (or unemployed) after selling at unnecessarily low prices
  - Creates an extra reason for bidders to try to collude
- Uniform-price is ordinarily used in dynamic auctions
Why simultaneous?

- Different securities’ values are determined, in part, by the same factors (e.g. systemic risk). Hence, the bidding on one security is useful information for other securities.
- Bidders can condition their bids for one security on the bidding for other securities.
- Bidders can manage liquidity needs and portfolio risk.
- Generates better pricing information than sequential auctions.
  - Makes maximum information available to bidders.
  - Avoids pricing anomalies such as the “afternoon effect.”
Participation

- All holders of security can offer to sell
  - Small holders through proxy bid

- Can include buyers other than Treasury
  - Demand bids submitted in advance of auction
Part II: Pooled auction for other securities

- Securities with holdings too concentrated for separate auctions are pooled together
- Bidding occurs on discount or premium to reference prices for each security (price = % of reference price)
  - Reference prices estimated by regressing the results of CUSIP-by-CUSIP auctions on all available characteristics
- A single descending clock (same discount or premium applicable to all securities in auction)
- Clearing occurs when cost of purchasing securities bid in auction equals the allocated budget
- Otherwise, same as CUSIP-by-CUSIP auction
Example with 2 pools of 4 securities each

<table>
<thead>
<tr>
<th>Round</th>
<th>Budget</th>
<th>HQ Pool</th>
<th>Higher-Quality Pool</th>
<th>LQ Pool</th>
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<td>90.35</td>
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<td>Spend</td>
<td>$80</td>
<td>955</td>
<td>2,256</td>
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Pooled Auction

- Excess supply
- Pool clears

quantities in $25,000 of face value; price in % of reference price; spend in million $
Advantages of pooled auction as part II

- Pooled auction takes full advantage of information revealed in separate auctions
  - Improves accuracy of references prices
  - Reference prices determined from transparent market process
- With more accurate reference prices:
  - Taxpayer gets a better deal
  - Liquidity goes to those in greatest need
- Provides time for reference price model and data to be developed while single-security auctions are being held
Potential enhancements to pooled auction

- Sellers could be required to bundle securities in fixed proportions before learning the reference prices.

- Cumulative purchases of each security could be capped at a fixed percentage of face value (e.g. 50%).

- Ex-post performance measures:
  - Contract could require seller to repay the difference if Treasury takes a loss on securities.
  - Backed by stock warrants or senior debt instruments.

- Self-selecting tariff: Sellers could be offered choice, e.g., of selling half of a security at 40 cents on dollar or all of a security at 30 cents on dollar.
Feasibility

• Over last ten years, there is extensive experience with auctions of this form
  ▪ Electricity contracts
  ▪ Gas contracts
  ▪ Telecom spectrum
  ▪ Emission allowances
• Can be implemented in short time-frame
• Many examples of success
Conclusion

• A well-designed auction process can:
  ▪ Provide quick and effective means to purchase securities and increase liquidity
  ▪ Get best prices for taxpayers
  ▪ Use transparent rules with minimal scope for discretion and favoritism
Appendix:
Examples of Similar Auctions
Electricity Auctions

- EDF generation capacity auctions
  - Virtual power plants — 6 GW of French electricity
  - 29 quarterly auctions (Sept 2001 – present) totaling over €9 billion
- Electrabel VPP capacity auctions
  - Virtual power plants — 1.2 GW of Belgian electricity
  - 7 quarterly auctions (Dec 2003 – May 2005)
- Endesa-Iberdrola VPP auctions
  - For the two dominant Spanish electricity companies
  - 5 quarterly auctions and 1 biannual auction (June 2007 – present)
- ISO-New England Forward Capacity Auction
  - Very large auction: $1.75 billion in value annually; more than 100 bidders
  - Procurement of generating capacity in six-state New England region
  - First auction was in February 2008; under contract for four years
Gas Auctions

- German gas release program (E.ON Ruhrgas)
  - Series of six annual auctions (2003 – 2008)
- Gaz de France gas release program
  - Single auction (Oct 2004)
- Total gas release program
  - Single auction (Oct 2004)
- Gaz de France gas storage auction
  - Single auction (Feb 2006)
- Hungary gas release program (E.ON Ruhrgas)
  - Series of five annual auctions (2006 – 2010)
- Danish Oil and Natural Gas gas release program
  - Series of six annual auctions (2006 – 2011)
Other Auctions

- Internet Corporation for Assignment of Names and Numbers (ICANN)
  - Single letter second level domains, global top level domains (2008)
- Federal Aviation Administration airport slot auction
  - Demonstration auction for industry (2005)
- Trinidad and Tobago spectrum auction
  - Clock followed by combinatorial auction (2005)
- UK emissions trading scheme auction
  - World’s first auction for greenhouse gas emission reductions (2002)
- Spectrum Exchange auction for clearing spectrum
  - Prototype auction for US spectrum (2000)
EDF Generation Capacity Auctions
Typical EDF VPP Auction

- Number of products
  - Two to four groups (baseload, peakload, etc.)
  - 20 products (various durations and start-dates)
- Number of bidders
  - 40 bidders
  - 15 to 20 winners
- Duration
  - Eight to ten rounds (one day)
- €300 million in value transacted in a typical quarterly auction
German Gas Release Programme Auctions (E.ON Ruhrgas)
E.ON Ruhrgas Auction

- Single product
- Number of bidders
  - 30 to 40 bidders
  - 7 winners
- Duration
  - Seven rounds (one day)
- Reserve price (binding in early years)
- In excess of €500 million in value transacted in a single annual auction
Typical Auction Related Activities

- Information Release: Documentation, Web-site, Conference etc.
- Product design
- Auction methodology
- Definition of detailed Auction Rules
- Auction software specification, development and testing
- Bidder qualification
- Bidder training: user guide and practice run
- Establishment of auction ‘war room’
- Operation of auction
- Post-auction reports on success of auction and possible improvements for future auctions
Further Information on Similar Auctions

- Power Auctions LLC: http://www.powerauction.com
- Market Design Inc: http://www.marketdesign.com
- ISO-NE FCM Auction: http://www.iso-ne.com
- Spanish VPP Auction: http://www.subasta-epe.com