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
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, \textit{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 ± 2 standard deviations)

Uniform Distribution ~U[0,1]

Beta Distribution ~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)

Aggregate Supply

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

Closing Price

Demand

Quantity (million $)
Closing with overshoot

Price (cents)

Aggregate Supply

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

Overshoot

Closing Price

Demand

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

Price (cents)

Quantity offered by a Bidder

Quantity (million $)
Intraround bidding – aggregate supply

- **Price (cents)**
  - $P_{\text{start}}$ (50 cts)
  - $P_1$
  - $P_2$
  - $P_3$
  - $P_4$
  - $P_5$
  - Closing Price (31 cts)
  - $P_6$ (30 cts)

- **Aggregate Supply**
  - Round 1
  - Round 2
  - Round 3
  - Round 4
  - Round 5
  - Round 6

- **Demand**

- **Quantity (million $)**
Demand may depend on price

Price (cents)

Aggregate Supply

P<sub>start</sub> (50 cts)

P<sub>1</sub>

P<sub>2</sub>

P<sub>3</sub>

P<sub>4</sub>

Closing Price

P<sub>5</sub>

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
An example with 8 securities

**Security-by-Security Auction**

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

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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**

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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