Auction Design for the Rescue Plan

Lawrence M. Ausubel
Peter Cramton
University of Maryland

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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

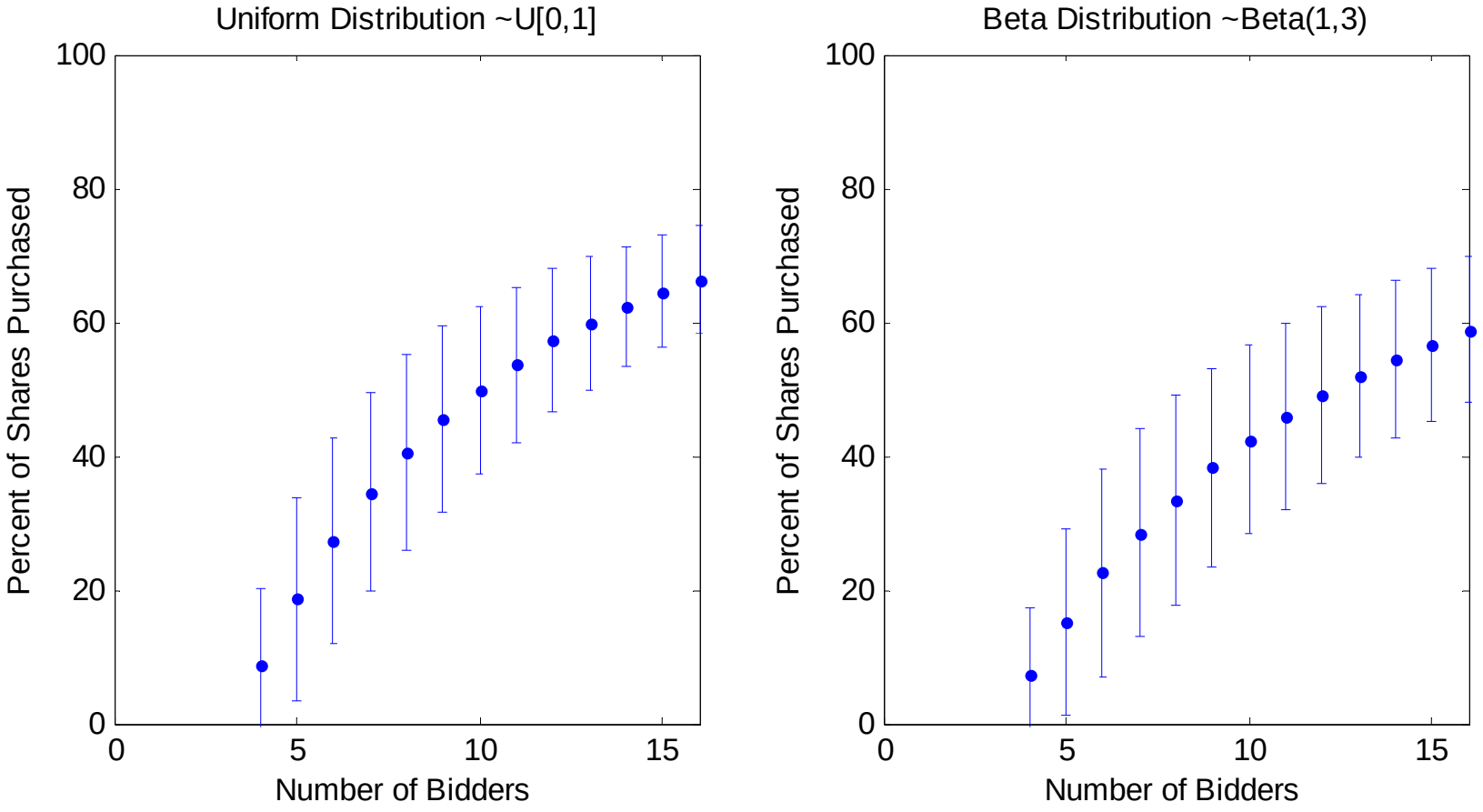
- Based on three pivotal supplier test used in largest US electricity market (PJM) since 2005
  - Auction viewed as competitive whenever demand can be fully satisfied by bidders other than three largest
  - Applied in daily uniform-price auctions where number of bidders is limited by transmission constraints

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)

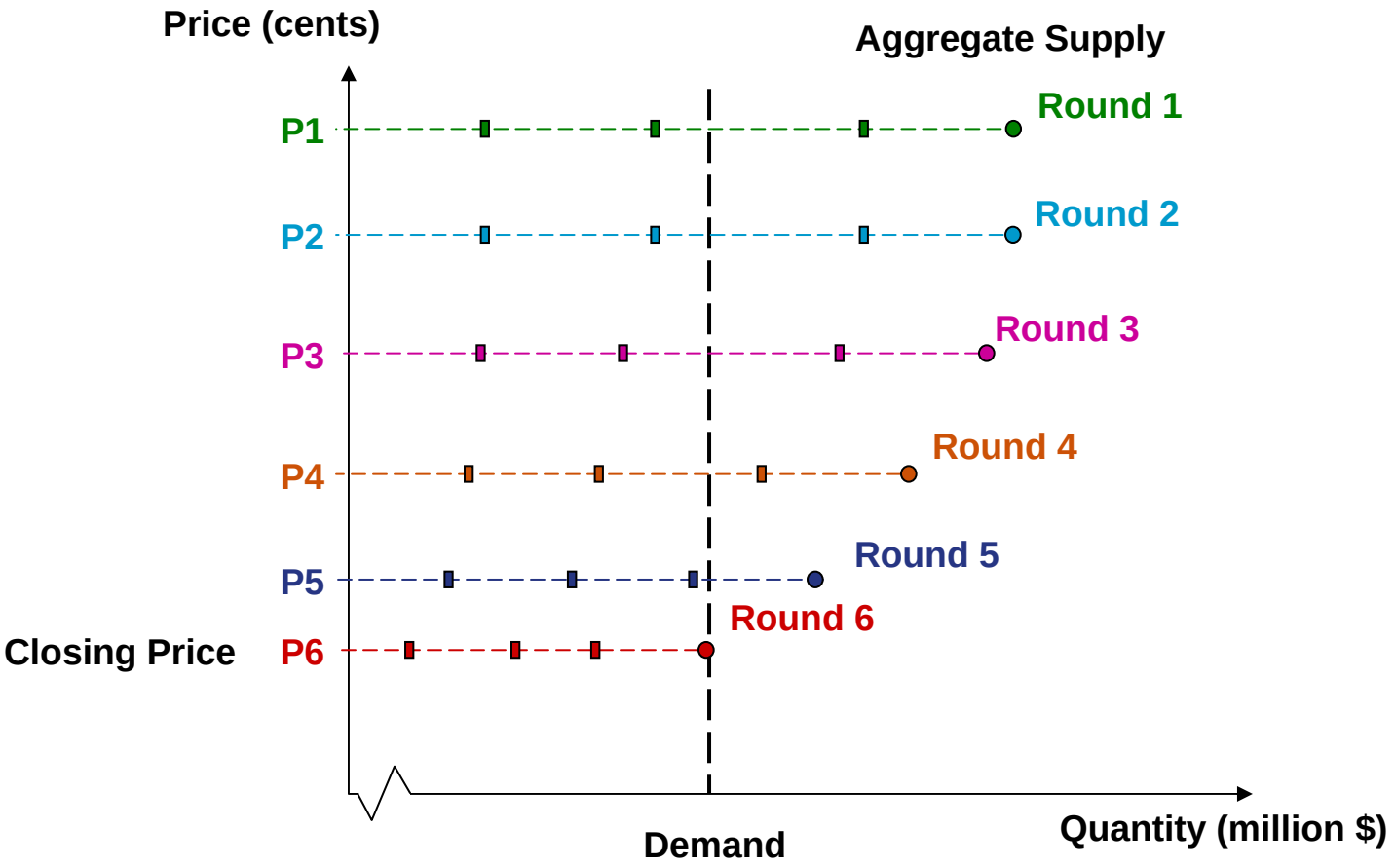
Percent of shares purchased by number of bidders
(mean ± 2 standard deviations)



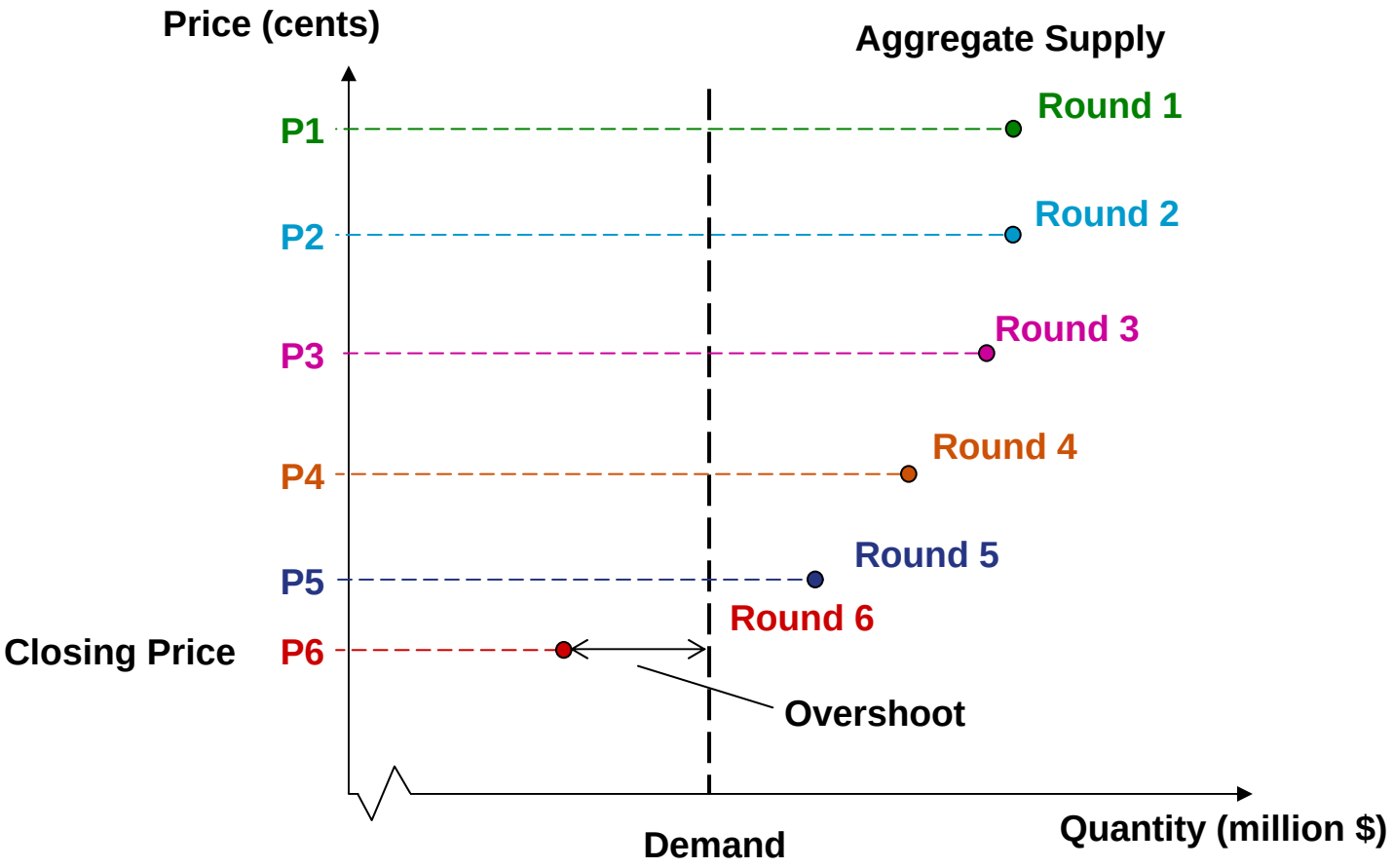
Descending-clock auction

- 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

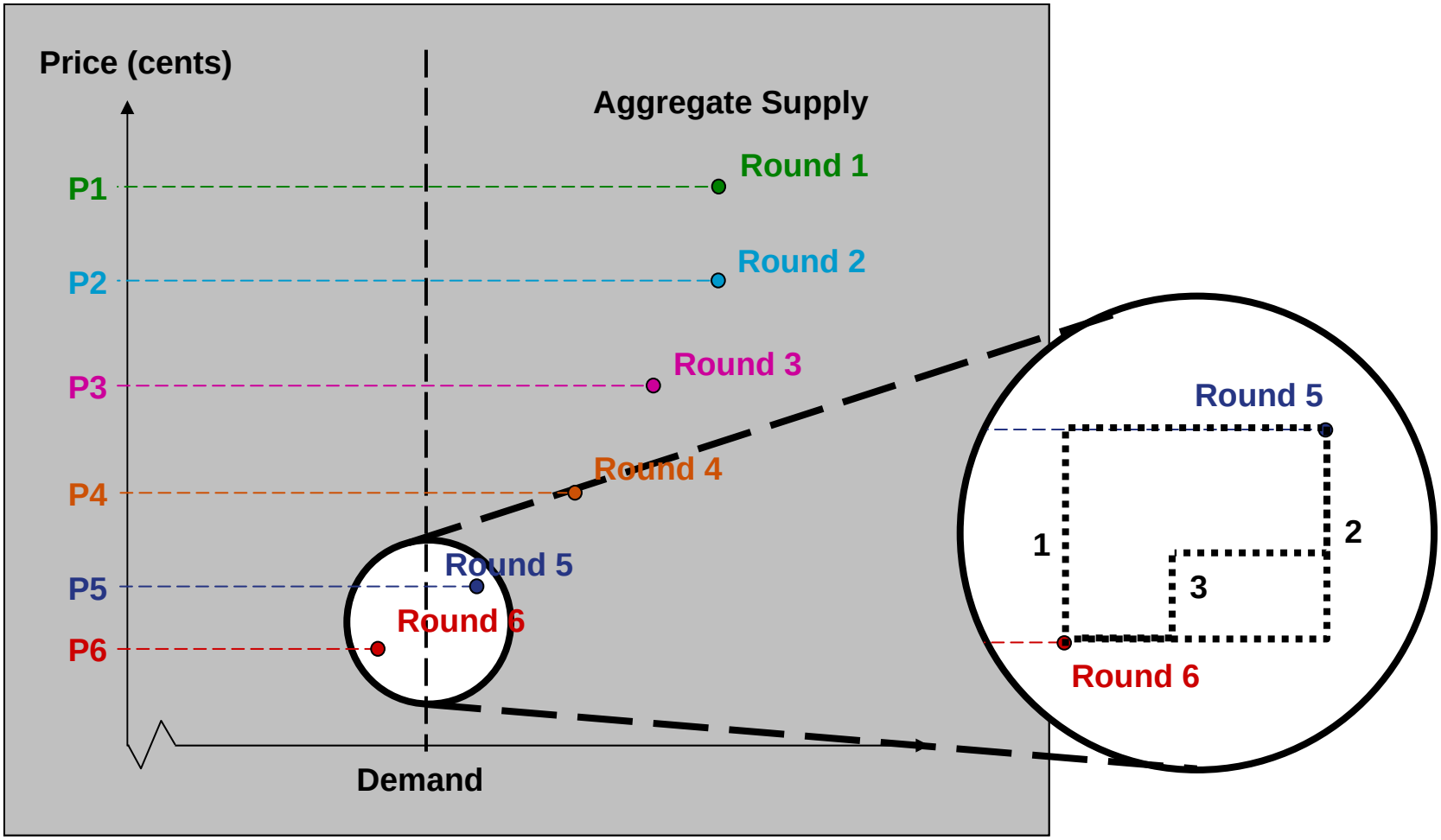
Auction mechanics



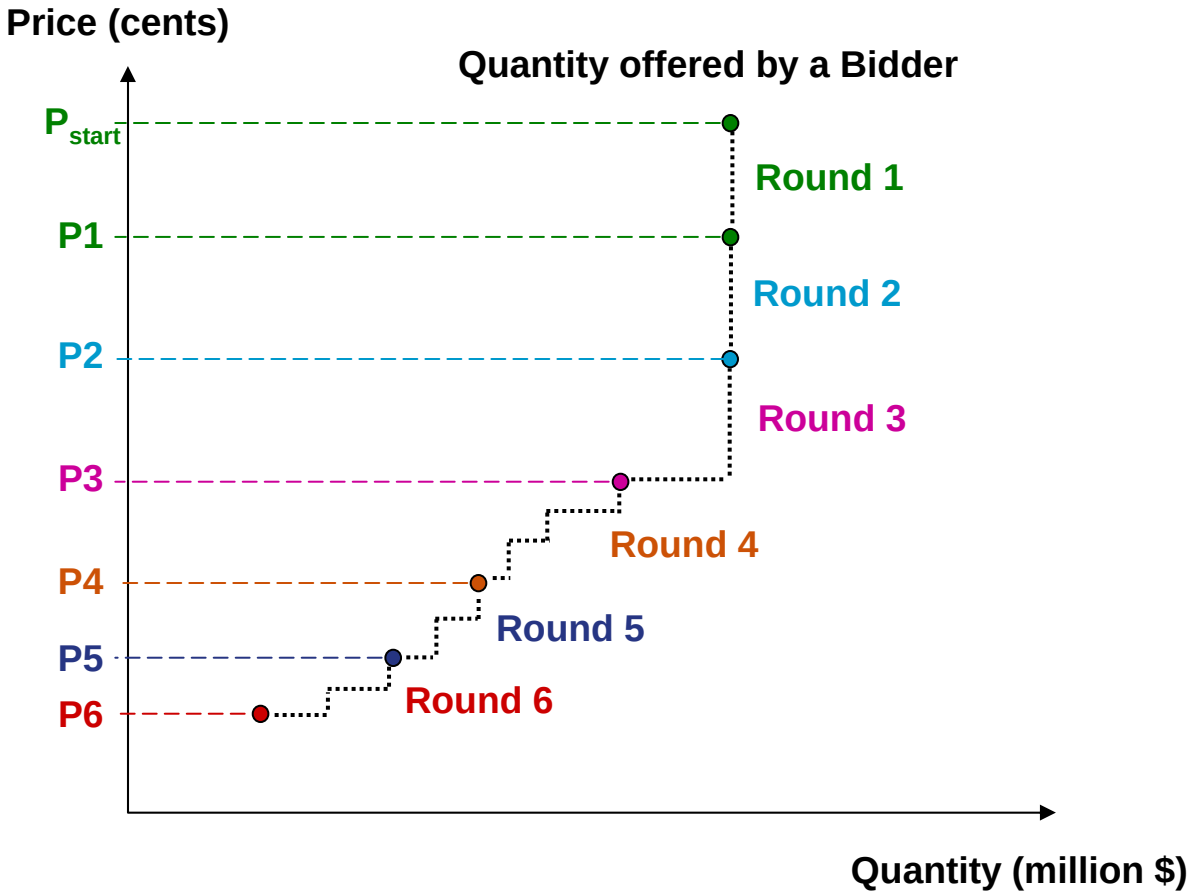
Closing with overshoot



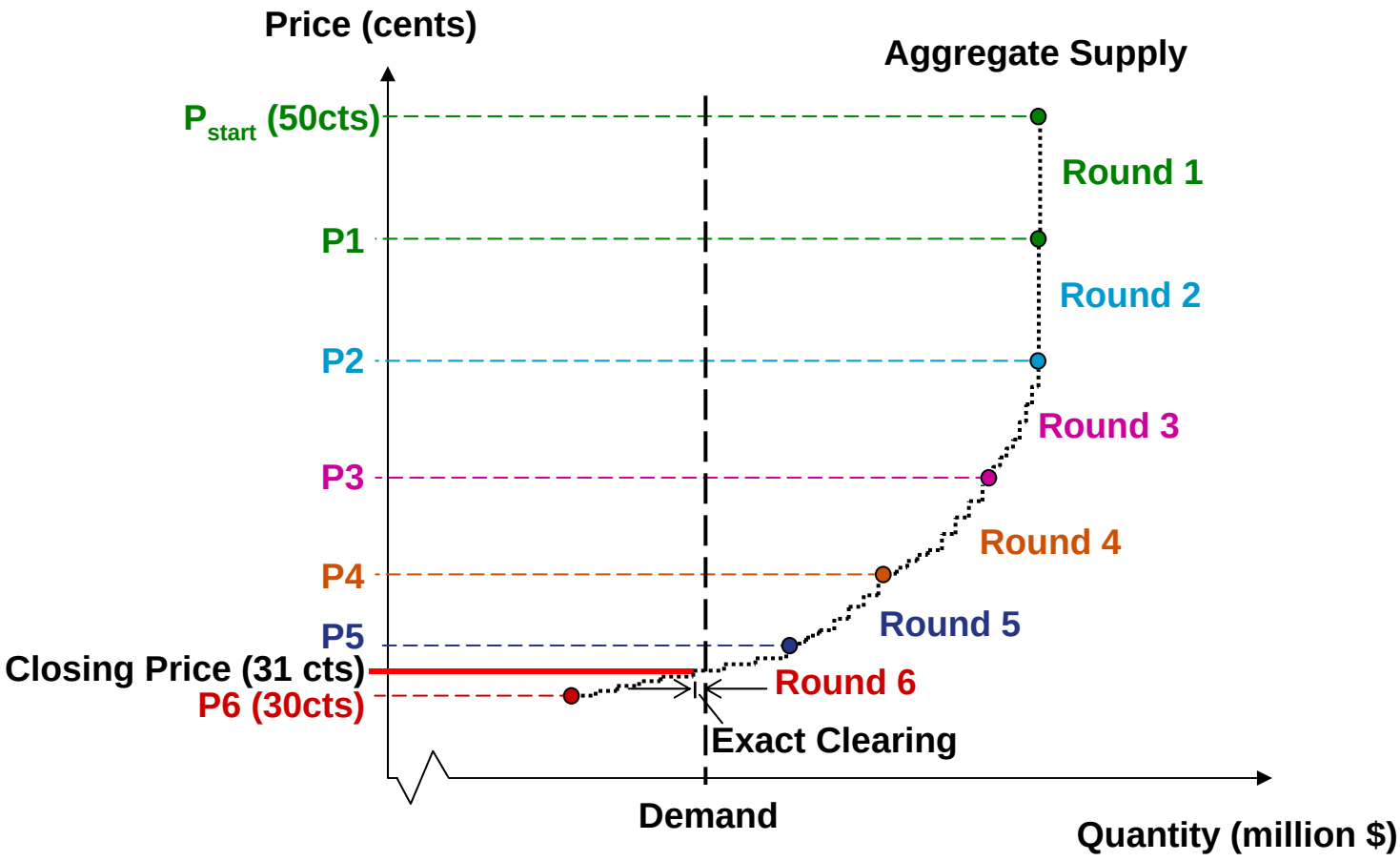
Intraround bids



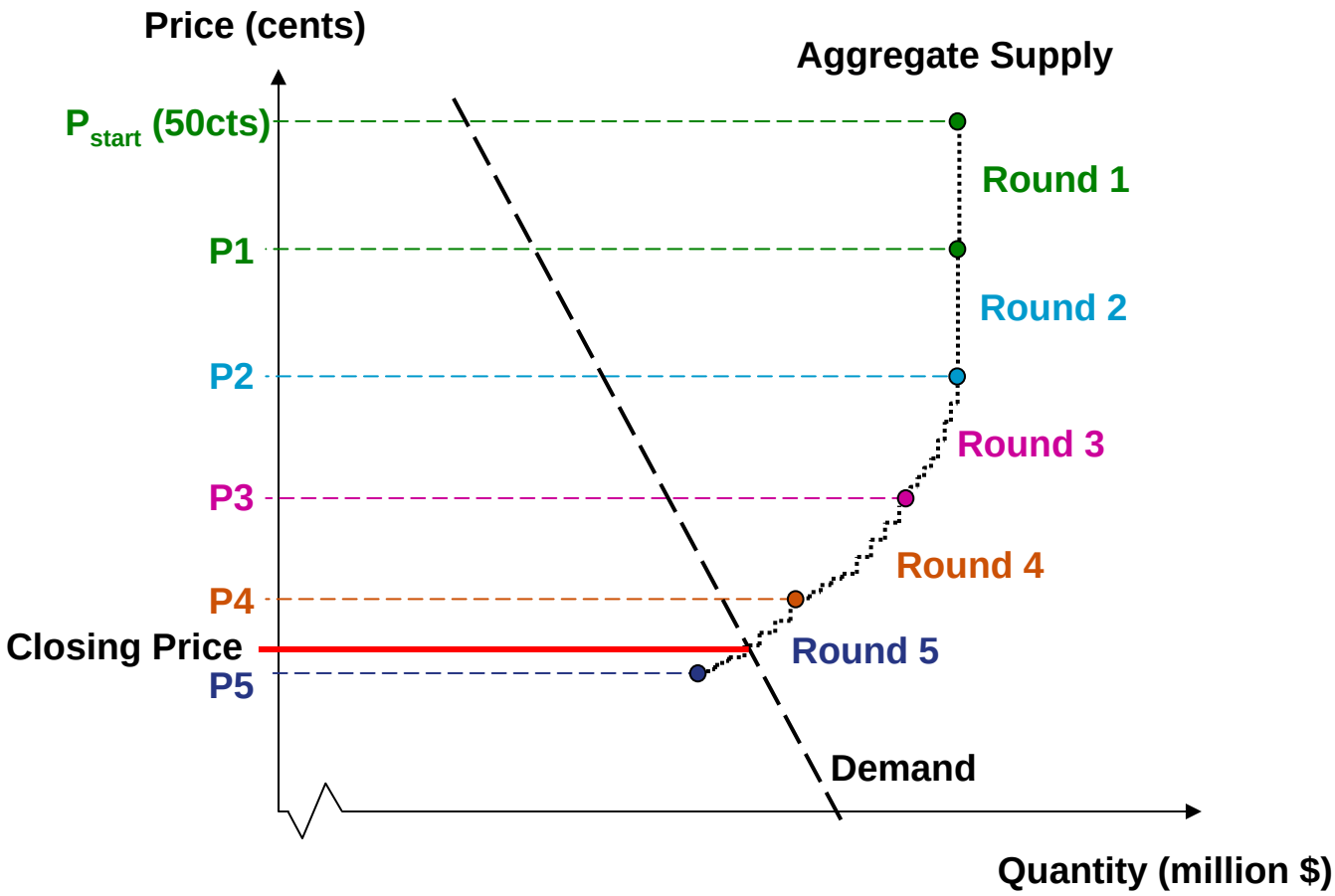
Intraround bidding – one bidder



Intraround bidding – aggregate supply



Demand may depend on price



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

Excess supply

Security clears

		Security1	Security2	Security3	Security4	Security5	Security6	Security7	Security8
Reference price		94.35	80.22	72.58	92.11	62.14	54.77	56.11	63.17
Round	Demand	1,000	1,200	2,000	1,500	800	2,500	1,000	1,200
1	Price	98.00	96.00	87.00	98.00	75.00	66.00	67.00	76.00
	Supply	2,300	3,120	6,000	6,000	2,800	5,500	1,500	3,000
2	Price	90.00	88.00	80.00	90.00	69.00	61.00	63.00	70.00
	Supply	2,000	2,160	5,000	4,500	2,400	5,250	1,500	2,400
3	Price	83.00	82.00	74.00	83.00	63.00	56.00	60.00	64.00
	Supply	2,000	1,920	4,400	3,300	1,680	4,000	1,400	1,920
4	Price	76.00	77.00	68.00	76.00	58.00	53.00	57.00	60.00
	Supply	1,700	1,560	3,600	2,850	1,280	4,000	1,200	1,560
5	Price	71.00	74.01	63.00	70.00	55.00	50.00	55.71	57.00
	Supply	1,400	1,200	2,800	2,250	1,040	3,000	1,000	1,320
6	Price	67.00		60.00	66.00	53.24	48.78		55.15
	Supply	1,200		2,600	1,650	800	2,500		1,200
7	Price	64.72		57.32	63.75				
	Supply	1,000		2,000	1,500				

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

Pooled Auction

quantity in $25,000 of face value; price in % of reference price; spend in million $

Excess supply

Pool clears

			Higher-Quality Pool					Lower-Quality Pool			
		HQ Pool	Security1	Security2	Security3	Security4	LQ Pool	Security5	Security6	Security7	Security8
Reference price			90.35	84.25	81.78	89.11		78.02	54.77	68.24	72.58
Round	Budget	$120					$80				
1	Price	110%	99.39	92.68	89.96	98.02	110%	85.82	60.25	75.06	79.84
	Spend	$176	1,703	2,343	1,978	1,433	$117	1,231	2,741	1,482	1,076
2	Price	107%	96.67	90.15	87.50	95.35	106%	82.70	58.06	72.33	76.93
	Spend	$155	1,647	2,145	1,837	1,133	$107	1,189	2,572	1,407	1,004
3	Price	104%	93.96	87.62	85.05	92.67	102%	79.58	55.87	69.60	74.03
	Spend	$146	1,603	2,121	1,801	1,023	$98	1,100	2,422	1,367	989
4	Price	102%	92.16	85.94	83.42	90.89	100%	78.02	54.77	68.24	72.58
	Spend	$136	1,521	1,945	1,777	984	$94	1,069	2,401	1,340	975
5	Price	100%	90.35	84.25	81.78	89.11	97%	75.68	53.13	66.19	70.40
	Spend	$131	1,489	1,922	1,733	975	$90	1,025	2,366	1,320	962
6	Price	98.20%	88.72	82.73	80.31	87.51	94%	73.34	51.48	64.15	68.23
	Spend	$120	1,475	1,744	1,521	945	$84	995	2,311	1,256	940
7	Price						93.68%	73.09	51.31	63.93	67.99
	Spend						$80	955	2,256	1,145	901

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

MDI
market design inc.

POWER 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)

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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
- EDF VPP Auction: http://capacityauctions.edf.fr
- ISO-NE FCM Auction: http://www.iso-ne.com
- Spanish VPP Auction: http://www.subasta-epe.com