Auction Design for Selling CO_2 Emission Allowances Under the Regional Greenhouse Gas Initiative

Environmental Monitoring, Evaluation, and Protection in New York: Linking Science and Policy

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Purpose

- To design an auction to be used by the RGGI states to sell CO2 allowances
- Research sponsored by NYSERDA

Design Team

- Charles Holt and William Shobe (UVA)
- Dallas Burtraw and Karen Palmer (RFF)
- Jacob Goeree (Caltech)

- RAs: Erica Myers, Anthony Paul, Danny Kahn, Susie Chung (all at RFF); Lindsay Osco, Ina Clark, Courtney Mallow, AJ Bostian, Angela Smith (all at UVA)

Methodologies for Evaluating Auction Designs

- Auction experiments
- Literature review
- Lessons from real world experience with allowance and other auctions

Auction Design Criteria

- Low administrative and transaction costs
- Fairness, openness, and transparency
- Economic efficiency
- Avoid collusion and market manipulation
- Reveal market prices (price discovery)
- Minimize price volatility
- Compatibility with electricity markets
- Promote a liquid allowance market

Examples of Previous Auctions

- **Title IV SO_2 auction** - discriminatory price, revenue neutral auction
- **Irish EPA** - uniform price auctions in EU ETS, 1% of allocation
- **Virginia NO_x auction** - a separate English clock auction for 8% of each of two vintages; supervised by design team member (Shobe)
- **Spectrum auctions** - countries selling rights to use radio spectrum
- **Others** - OCS oil leases, timber harvest rights, U.S. Treasury notes

Experimental Approach

- Student subjects (U.Va. undergrads)
  - 6 or 12 participants per ‘lab session’
  - Earn money by buying, trading, and using allowances
- Structured incentives
  - Capture key aspects of market
  - Simple enough to implement in the lab
- Used in many auction design applications

Experimental Approach - Additional Detail

- No communication allowed except where specifically provided through chat windows
- More than 100 sessions
- More than 1,000 experimental subjects
- More than 10,000 separate auctions

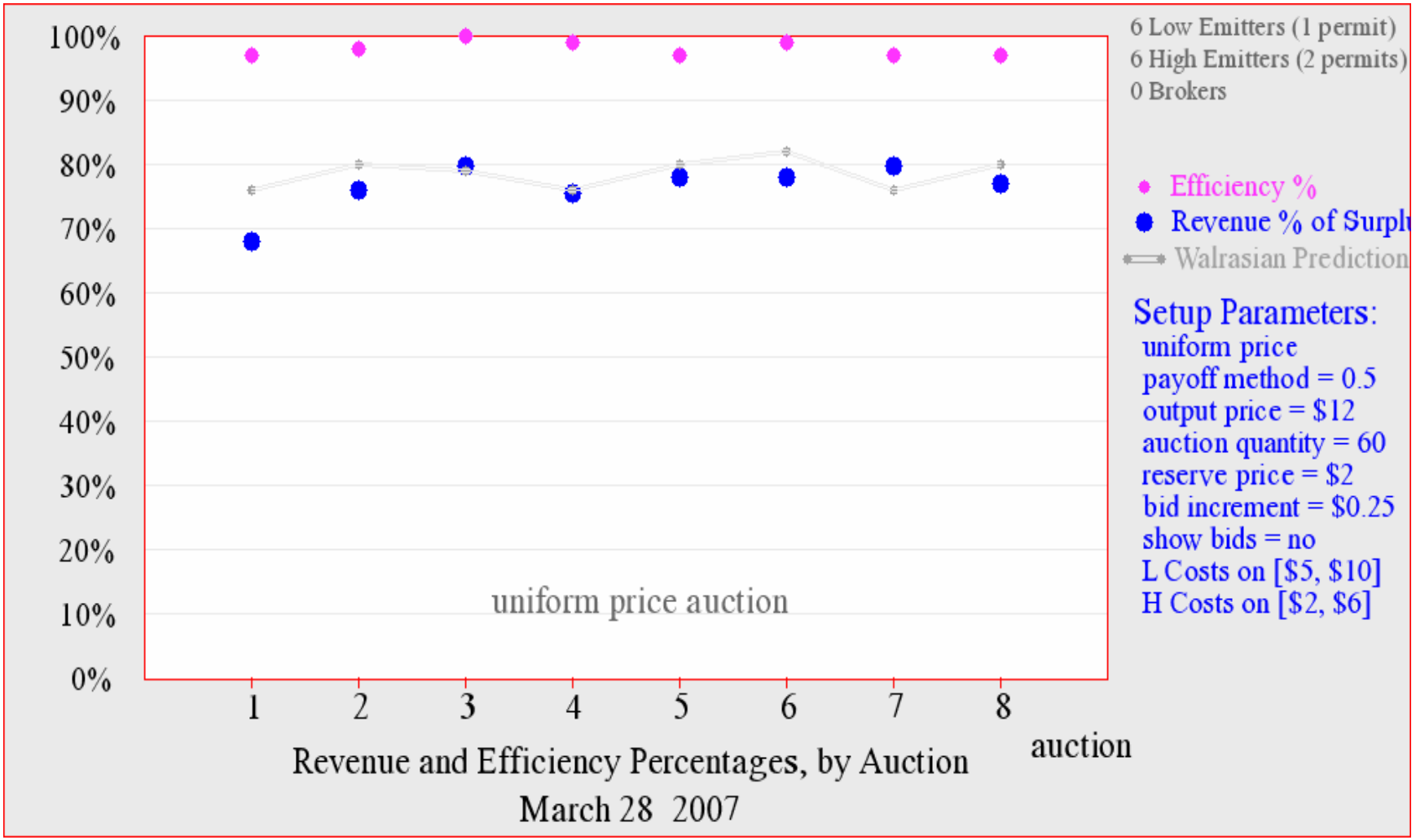
Key Auction Formats Considered

- **Sealed Bid Discriminatory** – high bids win and pay prices bid
- **Sealed Bid Uniform Price** – high bids win and pay highest rejected bid
- **English Clock** – multi-round ascending prices, bidders state demand quantities, uniform price
- **Dutch Clock** – multi-round descending price clock, with Buy Now button, discriminatory price

Performance Criteria in Experiments

- Absence of collusive behavior
- Actual clearing price close to theoretical clearing price
- Bidders bidding their value

Efficiency and Receipts:
A Series of Uniform Price Auctions



Institutional Factors Examined

- Spot markets and banking
- Compliance penalties
- Brokers
- Online chat sessions to allow explicit collusion

Other Considerations

- Loose cap versus tight cap
- Price discovery with uncertainty about demand conditions
- Partial grandfathering

Recommendations

Format and Timing

Reserve Prices

Participation

Implementation and Oversight

Recommendations: Format

- Joint and uniform auction for allowances from all states
- Sealed bid, uniform price auction
  - Accept the bids from high to low until allowances are sold or until reserve price is hit
  - The value of the *first rejected bid* is the price that all winning bidders pay
  - No bids below the reserve price are accepted

Recommendations: Sealed bid, uniform price

- Clock was expected to provide price discovery to balance higher probability of collusion
  - no improved price discovery in experiments
  - tendency for increased collusion
- SB-UP had most consistent performance
  - Outperformed disc. price, sealed bid and clock
- SB-UP encourages high bids on high value units
  - Buy-it-now feature
- SB-UP is familiar and has low costs

Recommendations: Timing

- Separate auctions for allowances from different years
- Quarterly auctions
- Auction future vintages in advance

Recommendations: Reserve Price

- Reserve price at each auction
  - reserve based on recent market activity
  - minimum reserve price
- No allowances sold at prices below reserve price
- Unsold allowances
  - rolled into contingency bank
  - or, possibly, sold in next auction

Reserve Price

- A reserve price is essential to good design
  - clear support in auction design theory
  - ample evidence from actual auctions
- Combined with contingency bank helps reduce costly price volatility

Recommendations: Participation

- Auction open to all financially qualified bidders
- Single bidder's purchases limited to 33% of auction total volume
- Accepted bid is a binding contract
- Lot size of 1,000 (possibly larger, but not too large)

Recommendations: Implementation

- Announce clearing price, identity of winners and, (only if necessary) quantity they won
- Do not announce *any* bids, nor the identity of losing bidders
- Ties at the clearing price are determined randomly *by bidder*

Recommendations: Oversight

- Require disclosure of party benefiting from allowance purchases *but do not make this public*
- Coordinate with existing efforts by federal and state agencies
- Ongoing evaluation of auction performance

Recommendations: Important Corollary

- The performance of any auction design used in RGGI will be improved by enhancing competitiveness
- Wide participation helps ensure competitiveness

For a Copy of Study

- Go to http://www.coopercenter.org/econ/index.php or
- www.rff.org