The Market for Pollution Permits:
A Review of Allocation Considerations

Daniel Goldberg

Why Cap and Trade?

- Command and Control vs. Tax vs. Cap and Trade
  - Economically efficient
  - Simple
  - Politically easy

Types of Cap and Trade Systems

- Pollution offsets
- Banking and borrowing
- Auctioning versus grandfathering

I will examine a market in which there are no offsets or banking allowed. Auctioning and grandfathering will both be discussed.

The Independence Property

- Neither the final allocation of permits nor the final permit price will be affected by the initial allocation of permits.

In reality, the independence principle doesn't always hold.

- There are six conditions in which the independence principle can be violated in theory (Stavins and Hahn):
  - Transaction costs
  - Market power
  - Uncertainty
  - Conditional allowance allocations
  - Non-cost-minimizing behavior by firms
  - Differential regulatory treatment of firms

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Market Power

- "Market Power and Transferable Property Rights" (Hahn 1984)
  - There are m firms. Firm 1 has market power.
  - There are L permits.
  - Q_i^0: the number of permits allocated to firm i.
  - Q_i: the number of permits that firm i holds after trading.
  - The equilibrium permit price is P.
  - Each firm has a downward sloping demand curve, $P_i(Q_i)$, where P_i is the firm's WTP.
  - $C_i(Q_i)$ is the abatement cost of emitting (Q_i) units. Marginal abatement costs are positive and increasing.

The problem for firms 2-m (without market power):

- Choose the number of permits that minimizes costs on abatement and permits.
  - Mathematically, min: $C_i(Q_i) + P(Q_i - Q_i^0)$ for Q_i
  - FOC: $C_i'(Q_i) + P = 0$
- The firm will adjust the quantity of permits demanded until marginal abatement cost equals price.

The problem for firm 1 (with market power):

- Choose a price that minimizes costs on abatement and permits such that the market clears.
  - min: $C_1(Q_1) + P(Q_1 - Q_1^0)$ for P
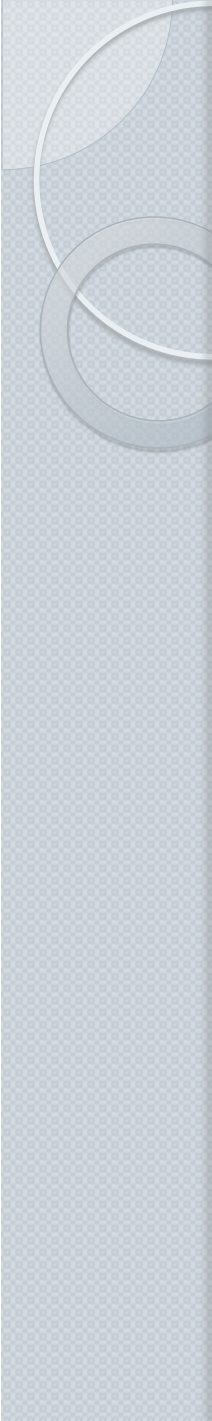 - Subject to $Q_1 = L - \sum_{i=2}^{m} Q_i(P)$

  - FOC $\left(-C_1' - P\right)\sum_{i=2}^{m} Q_i' + \left(L - \sum_{i=2}^{m} Q_i(P) - Q_1^0\right) = 0$

- Firm 1's MAC will equal the equilibrium price only when its initial allocation of permits equals what it chooses to use. That is, if firm 1 doesn't receive the perfect number of permits, the total expenditure will exceed the cost minimizing solution.

Is market power a problem in real actual markets for pollution permits?

- CFC allowances
- SO_2 allowances
- Lab experiments

Can using auctions or grandfathered allocations prevent firms from developing market power?

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Auctions vs. Grandfathering

- "An Experimental Study of Auctions versus Grandfathering to Assign Pollution Permits," Goeree et al (2009).
  - Lab experiment comparing the results of grandfathering permits to auctioning permits
  - Found that grandfathering led to monopolistic behavior and raised overall compliance costs

Experimental Procedure

- Three stages: assignment stage, spot market, product market
- Subjects played in groups of 6. Each group had three "high emitters" and three "low emitters"
  - High emitters had higher costs
  - When permits were grandfathered, they were awarded in a 2:1 ratio to high emitters
- Half of the rounds had grandfathered permits, half had auctions

Results

- Auctions
  - The permit price was too low (7.2 compared to 8.0).
  - Too few permits were won by low emitters (9.3 compared to 12).
  - Trading volume was very low in the spot market.
- Grandfathering
  - The permit price was too high (11.2 compared to 8.0)
  - Too few permits were won by low emitters (8.2 compared to 12)
  - Trading volume was higher in the spot market.
- "The reason that the spot market does not fully correct the initial misallocation under grandfathering is that high emitters exercise their market power in the permit market."
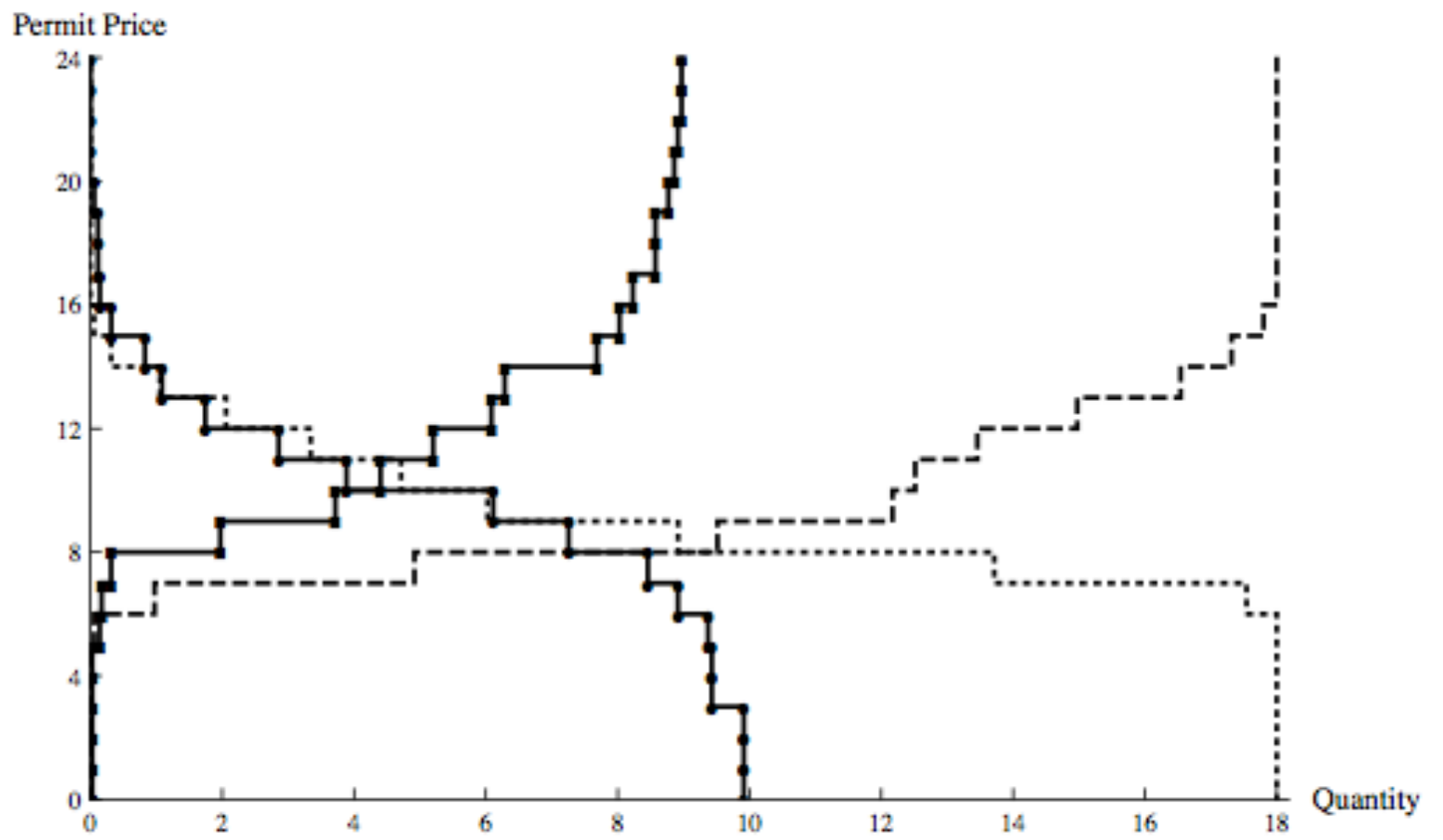
Auctions vs. Grandfathering

- "An Experiment on Emissions Trading: The Effect of Different Allocation Mechanisms," Grimm et al (2010).
  - Similar experimental design to Goeree et al
  - Allocative efficiency of grandfathering was exogenously set to be equal to that of auctions
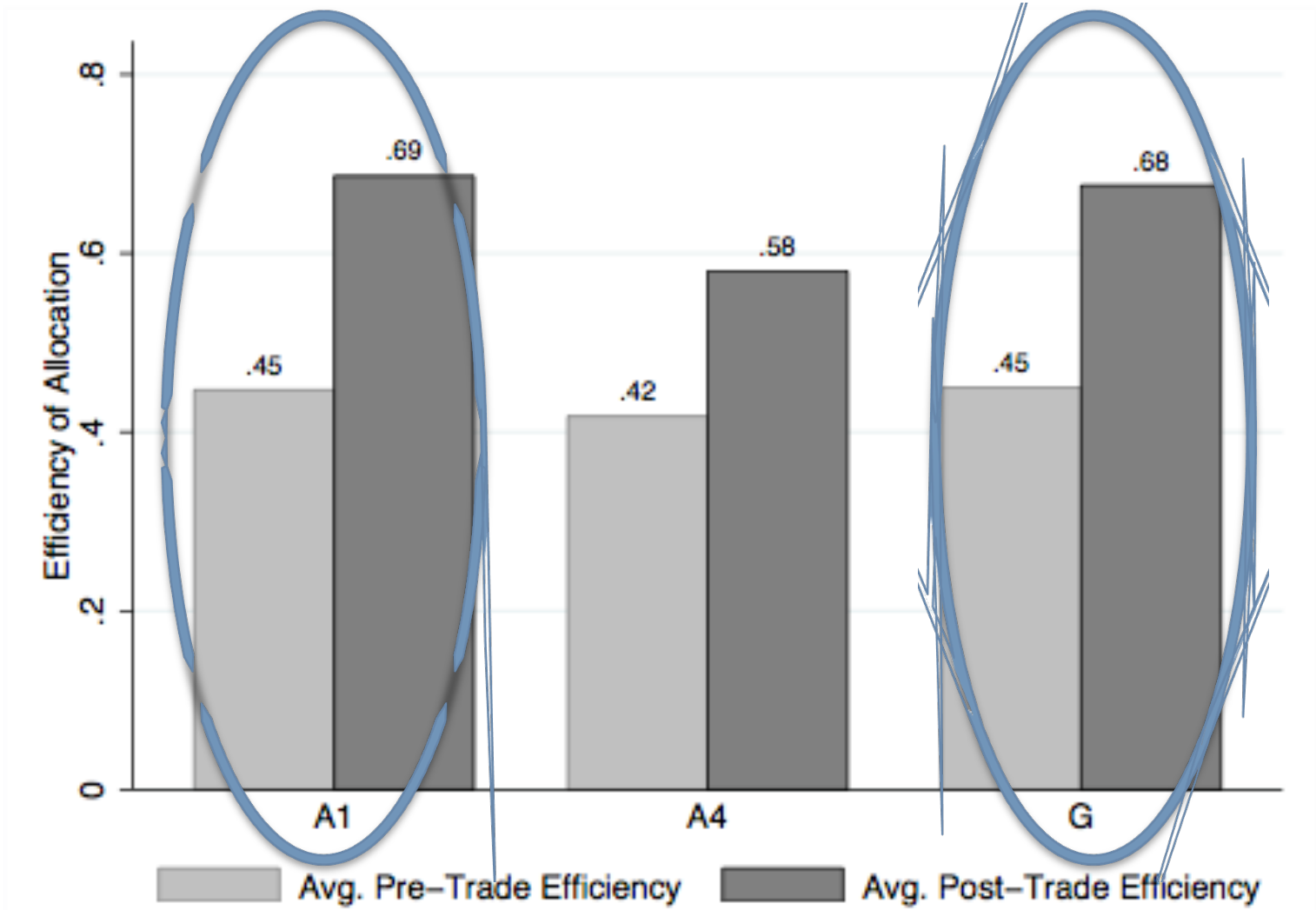
Future Research

- What is the effect of auctions in the field?
  - EU ETS rule changes (2012)
- Political considerations:
  - Which markets are at a greater risk of developing market power?
  - When grandfathering, what are the right proxies for high MAC?