The Effect of Allowance Allocation on Cap-and-Trade System Performance

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Markets, Firms, and Property Rights:
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We begin with "The Problem of Social Cost" (1960) …

- **The Coase Theorem:**
  - Bilateral negotiation between the generator and recipient of an externality leads to the same efficient outcome *regardless* of the initial assignment of property rights (if no transaction costs, income effects, or third-party impacts)
- **The "Coase Lemma for Environmental Policy":**
  - The market equilibrium in a cap-and-trade system is *cost-effective* and is *independent* of the initial allocation of tradable allowances
  - This *independence* of cap-and-trade performance (cost and emissions) from the initial allocation is of *great political importance*
  - *When* does this independence hold, when does it *not*?

Outline

- Purpose and Scope of the Paper
- Theory of Initial Allocation and Cap-and-Trade Performance
  - Central Finding in Partial and General Equilibrium
  - Conditions Under Which Independence Breaks Down
    1. Transaction Costs
    2. Uncertainty
    3. Conditional Allowance Allocations
    4. Market Power
    5. Non Cost-Minimizing Behavior by Firms
    6. Differential Regulatory Treatment of Firms
- Empirical Assessment of Cap-and-Trade Systems
  - Existing Systems
  - Proposed Systems
- Conclusion: The Coase Theorem After Fifty Years

Purpose and Scope

- Purpose
  - Identify practical (political) importance of the Coase lemma
  - Ask whether the Coase lemma has withstood the test of time
  - That is, examine presumed independence of cap-and-trade system performance from initial allowance allocation
- Scope
  - Environmental policy only
  - Within “environmental markets,” only cap-and-trade, *not* offsets
  - Examining free allocations only, *not* free allocation versus auction
  - Not considering external effects, such as correlated pollutants

Cap-and-Trade: Central Findings from Theory

- Cap-and-trade system will result in post-trading equilibrium with cost-effective allocation of emissions-abatement responsibility (marginal costs equated among all sources)
  - Partial Equilibrium (Coase 1960, Crocker 1966, Dales 1968)
- Post-trade equilibrium independent from initial allocation
  - General Equilibrium (Montgomery 1972)
- Independence property is of central political importance in a representative democracy
  - In principle, legislature can use allowance allocation to build support, without reducing environmental performance or driving up cost
  - Experience has validated this

Transaction Costs

- Arise from exchanges of allowances in cap-and-trade system
- Transaction costs *can* lead to violation of independence
  - Coase: outcome is affected by identity of exclusive property-right recipient in bilateral negotiation in presence of transaction costs
  - But is outcome independent when *quantity* of allocation changes? (Stavins 1995)
    - With *constant* marginal transaction costs, *independence* exists (except with discontinuous marginal costs, i.e., discrete technologies – Montero 1998)
    - With *increasing* marginal transaction costs, independence violated, but marginal transaction costs *not* sustainable (unless there are significant fixed transaction costs)
    - With *decreasing* marginal transaction costs (volume discounts), independence *violated*

Uncertainty

- Uncertainty regarding future allowance price can lead to *violation* of independence –
  - if firms are *risk-averse*
  - and there are *limits* to transferability (transaction costs)

- Consequences (Badlursson and von dehr Fehr 2004)
  - Firms with small allocations *over-invest in abatement* technology – to hedge against possible high future allowance prices
  - Firms with large allocations *under-invest in abatement* technology – to hedge against possible low future allowance prices

Conditional Allowance Allocations

- *Output-based updating allocation* ties quantity of allowances to firm's production in previous period
  - Functions as a production subsidy (Fischer 2001)
  - Affects post-trading allocation, and drives up aggregate abatement costs
  - Used in Waxman-Markey and Kerry-Boxer legislation for firms in energy-intensive trade-exposed sectors to *protect* their "international competitiveness"
    - Unlike attempts to use *ordinary free allocation* to protect regulated sector,
    - This mechanism not only compensates firms, but affects their marginal production cost, and thus can *protect* their international competitiveness.
    - But it reduces overall efficiency (cost-effectiveness) of policy.
    - Nevertheless, may be better (from an economic perspective) than border adjustments (Houser *et al*., 2008)

Market Power

- Market power can lead to violation of independence
  - If a firm has market power in the allowance market,
    - and is an allowance seller, it has incentive to act as a monopolist and hold back allowances from market to drive up allowance price (Hahn 1984)
    - If it is an allowance buyer, it has incentive to act as a monopsonist and buy fewer allowances to keep down the price (Hahn 1984)
    - Similar results hold when price-taking firms are non-compliant (Malik 2002)
    - So, firms with market power have incentives to buy less or sell more allowances than would otherwise, and hence independence does not hold, and cost-effectiveness is not achieved
  - If firm with market power in allowance market can gain advantage in product market, then costs can be either more or less (Misiolek and Elder 1989)
  - If firm has market power in *both* allowance and product market, independence is violated (Eshel 2005)

Non-Cost-Minimizing Behavior

- If some market participants are not cost-minimizing (not equating their marginal abatement costs with allowance price), then …
  - Final allocation of allowances will likely be a function of initial allocation
- Potential Sources of Non-Cost-Minimizing Behavior
  - With endowment effect or status-quo bias, independence may not hold (Thaler 1980, Kahneman, *et al.* 1991)
  - Principal-agent problems or different objectives (Tschirhart 1984, Oates and Strassmann 1984)
  - Public entities as market participants: nations under Article 17 of the Kyoto Protocol (Hahn and Stavins 1999)

Differential Regulatory Treatment of Firms

- If firms receive different regulatory treatment, then initial allocation can affect equilibrium allocation, performance, and cost
  - State-level regulation of electricity producers, such as rate-of-return regulation, discourages or even prevents firms from cost-minimizing with respect to emissions (Hahn and Noll 1983; Tschirhart 1984; Oates and Strassman 1984)
  - If gains from sale of assets (allowances) must written into rate base, then producer is taxed 100% on any allowance revenue
  - Expenditures on abatement technologies may be allowed to earn higher rates of return than allowance expenditures (Bohi and Burtraw 1992)
  - If cap-and-trade system is interstate, then jurisdictions may be regulated differently
  - Regulators can actively and intentionally discourage trading, due to concern about local pollution (Fullerton *et al.* 1997)
- In all these cases, equilibrium allocation is *not independent* of initial allocation, and outcome is not cost-effective

Next Steps: Empirical Assessment (Methods)

- Has the equilibrium allocation of emission control responsibility been *independent* from the initial allowance allocation in practice?
  - This is an important question, at least partly because we claim that such independence is of great political importance.

- We examine this:
  - *Directly*, accounting for endogeneity of initial allocation decision (can be linked with anticipated compliance costs, historical production, or emissions)
  - *Indirectly*, by assessing presence of the various lemma caveats (transaction costs, market power, uncertainty, conditional allowance allocations, non-cost-minimizing behavior, differential regulatory treatment)

Next Steps: Empirical Assessment (Cases)

- EPA Leaded Gasoline Phasedown (1982-1987)
- CFC Trading Under Montreal Protocol (1987-present)
- SO_2 Allowance Trading Program for Acid Rain (1995-present)
- RECLAIM Program (1994-present)
- Northeast Ozone Transport (1999-present)
- European Union Emission Trading Scheme (2005-present)
- Kyoto Protocol Article 17 (2008-present)
- New Zealand GHG Cap-and-Trade (2010)
- Australia CO_2 Cap-and-Trade (2012?)
- U.S. CO_2 Cap-and-Trade (2012?)

Interim Findings

- After 50 years …
- Coase (1960) insight regarding insensitivity of bilateral-negotiation outcome to initial assignment of property rights is …
  - very *important* in the environmental policy domain
  - *frequently* – but *not always* – satisfied
  - and exceptionally important *politically*!