Market-Based Environmental Regulation

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This is a different type of piece than most of the others in the volume, because it is focused on a particular regulatory instrument, rather than on a particular industry. I think it will still fit together well with the rest of the volume, but I would be interested in comments on that point. It's also narrower than the title suggests, since I haven't included any discussion of pollution taxes or other market-based instruments.

I. (Brief) Early history of tradable permit use
   A. Overview of environmental regulation prior to use of tradable permits
      1. Command-and-control regulation (mostly technology mandates)
      2. Cost substantially above efficient level
   B. First uses of tradable permits
      1. EPA "offset policy" for local air pollution (new source in nonattainment region must buy credits for 120% of its emissions, from existing sources)
      2. Leaded gasoline phaseout program (tradable rights to produce leaded gasoline, intended to reduce transition costs of phaseout)
      3. Phaseout of chlorofluorocarbons (CFCs) and other ozone-depleting chemicals
      4. "Offset policy" is a success, both phaseouts go smoothly

II. Principal advantages of tradable permits
   A. Early cases: flexibility for new entrants ("offset policy") or for problems in transition to new technology (leaded gas and CFC cases)
      1. These are not static cost-minimization problems
   B. Broader benefit of flexibility: lower costs, even in static case (equalize MC)
   C. Pollution tax has same benefits, but tradable permits:
      1. aren't as radical a departure from existing policy (just take existing permits and allow trading)
      2. make it easier to compensate (or perhaps overcompensate) firms
      3. ensure that pollution stays at or below existing (regulated) level
      4. (these are primarily political/distributional, not efficiency issues)

III. Basic questions in permit program design
   A. Pollution sources included in program
      1. by physical location?
      2. by industry?
      3. by firm size?
   B. Allocation of permits
      1. total quantity
      2. distribution of that quantity: auction? grandfather (allocate based on historical emissions)? based on output? some of each?
   C. Permit denomination: a quantity (e.g., tons) or a flow rate (tons/year)
   D. Property rights to permits?

E. Include a "safety valve" (price cap at which regulator will sell unlimited permits)?
F. Allow permit banking? Borrowing?

IV. Recent experience with tradable permits
A. Sulfur dioxide (SO_2) trading program
1. Nationwide program covering electric utilities' SO_2 emissions
2. Implemented in two phases: dirtiest plants in 1995, the rest in 2000
3. Most permits grandfathered; small fraction auctioned, but revenue goes to firms
4. Allows banking, but not borrowing, of permits
5. Results:
a. Permit prices are far less than *ex ante* predictions, so program is viewed as a huge success, but:
- Not all of the difference is due to trading. The costs of reducing emissions by burning low-sulfur coal fell sharply during this period.
- The social marginal cost substantially exceeds the permit price, because of interactions with tax-distorted factor markets
b. Still, even after taking those factors into account, cost savings are large
c. Allowance trading market appears to be fairly efficient—transaction costs and strategic behavior seem to have little effect on the market
d. Substantial allowance banking occurred in the early years of the program, in preparation for tighter standards to come
B. RECLAIM program: local air pollution (nitrogen and sulfur oxides) in the Los Angeles area
1. Started in 1994, number of credits is being gradually reduced
2. Credits are grandfathered. Banking and borrowing are not allowed.
3. Results:
a. Transaction costs appear to be significant
b. Some concerns about market power for large electric utilities
c. Still appears to be much more efficient than CAC regulation
C. EU greenhouse gas allowance trading program
1. Started at beginning of 2005, "warm-up" phase through end of 2007
2. Covers the 25 countries of the expanded EU, with each country having its own cap
3. Only four sectors (iron & steel, minerals, energy, and pulp & paper) included in trading program, but the rest of each country's economy is still covered by the national cap.
4. Each country independently decides how to divide it's national cap between the trading sectors and non-trading sectors
5. Most permits will be grandfathered, but countries can choose to auction up to 5% during the first phase, and up to 10% in the second phase (starting in 2008).
6. "Safety valve" price of 40 Euros/ton in first phase, 100 Euros/ton in second phase
7. Each country can choose whether to allow banking or not

V. Implementation problems (actual or potential)
A. Transaction costs
1. may prevent reaching least-cost allocation of emissions
2. potential solutions:
a. auction at least some permits, so market price is observable
b. denominate permits based on quantity, not on flow rate
B. Non-uniformly mixed pollutant (location of pollution matters, not just quantity)

1. in this case, trades may increase pollution damage ("hot spot" problem)
2. potential solutions:
    a. "Regulatory tiering": source must have permit and must not cause violation of local standard
    b. Permit trading zones: sources can only buy/sell permits within same zone
        - variant used in RECLAIM program (So. Cal.): two zones, coastal and inland; coastal sources can sell permits to inland sources, but not vice-versa
    c. Trading ratios: quantity of pollution equal to one credit varies by location
3. problems with potential solutions: regulatory tiering and trading zones each may prevent efficiency-improving trades, and worsen transaction costs and market power. Trading ratios avoid this if set properly, but to set them properly in general, need to know efficient pollution allocation.)

C. Temporal hot spots–analogous to spatial hot spots
1. potential solutions:
    a. Don't allow banking/borrowing of permits (but this prevents some cost-reducing trades–analogous to the trading zone approach for spatial hot spots)
    b. Banking/borrowing ratios, analogous to spatial trading ratios (and with the analogous advantages and disadvantages)

D. Market power:
1. in permit market: sell(buy) fewer permits in order to drive the price up(down)
2. in output market: manipulate permit price to drive up competitors' marginal costs
3. potential solutions:
    a. If permits are grandfathered, set initial permit allocations close to cost-minimizing pollution allocation
    b. Auction at least some of the permits
    c. Avoid setting up markets where concentration will be a problem (e.g., very small trading zones)

E. Inefficient and/or inequitable distribution of rents
1. Value of permit rents often exceeds cost of pollution emissions reduction. Furthermore, some of that cost is borne by consumers of the firm's output and suppliers of its inputs. So if all permits are grandfathered, firm receives substantial windfall profits
2. Auctioning permits provides revenue for the government. This generates an efficiency gain if the government would otherwise have to use distortionary taxes to raise revenue.
3. potential solutions:
    a. auction as large a share of the permits as is politically feasible
    b. impose tax to capture at least part of the permit rents (as U.S. did in the CFC case)

VI. Open Questions (a very incomplete list)

A. Practical importance of hot spots (spatial or temporal)? In theory, nontradable permits could be more efficient than tradable permits when pollution isn't perfectly mixed. But no clear empirical evidence yet.

B. Effect of tradable permits within a federal system (e.g., state- and national-level permit programs within the U.S., or national- and EU-level programs in Europe)
1. when different levels of government regulate the same pollutant, or regulate two closely-linked pollutants
2. when program is set by top-level government, but important details of implementation are left to lower-level government (as in the new EU carbon trading program)