Lessons Learned from Sub-National Emissions Trading Systems

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Lessons from Design, Implementation & Performance of Cap-and-Trade (and TPS) Policies

The Basics

- Cap-and-trade proven to be environmentally effective & cost-effective [Lead, SO_2]
- Economy-wide systems shown to be feasible [AB-32], but downstream, sectoral systems more common [RGGI, EU ETS]
  - For CO_2, downstream/midstream emissions trading used, not upstream carbon rights
- Transaction costs low, particularly with homogeneous compliance entities [Lead, SO_2]
  - Avoid requirements for prior government approval of trades [Lead, SO_2]
- Cap significantly below BAU yields robust market [SO_2, RECLAIM]
- Good monitoring & enforcement plus penalties yield high level of compliance [SO_2]
- Final rules in place before beginning of first compliance period can avoid price volatility [SO_2, NO_x, EU ETS]

Lessons from Design, Implementation & Performance of Cap-and-Trade (and TPS) Policies (continued)

Specific Elements of Design

- *Banking* very important economically – large share of gains from trade [Lead, SO_2]
  - Absence of banking can lead to price spikes & price collapse [RECLAIM, EU ETS]
- *Price collars* are valuable
  - Changing economy can render cap non-binding [RGGI, EU ETS] or drive prices to excessive level [RECLAIM]
  - Price collar feasible via auction price floor & allowance reserve [RGGI, AB-32]
  - Price collar also feasible with *tradable performance standard* (Wang, Pizer, & Munnings 2021)
- *Constraints on offset use* → thin market → ineffective cost containment [RGGI, AB-32]

Lessons from Design, Implementation & Performance of Cap-and-Trade (and TPS) Policies (continued)

Allowance Allocation

- Very significant *distributional* issue, hence *important politically*
- *Free allowances* foster valuable *political support*, …
  - … but opportunity forgone to cut program's social *cost* by *using auction revenue to cut distortionary taxes* or use revenue for other purposes [SO_2, AB-32]
- Empirical experience *reveals political pressure* to use *auction revenue* to fund new or existing government programs or relieve deficits [AB-32, RGGI]
  - *Political attraction* of auctioning has been *revenue* for governments [AB-32, RGGI]
  - Globally, *70%* of CAT revenue *earmarked for green spending* (but 72% of carbon tax revenue refunded or dedicated to general funds – Carl and Fedor 2016)

Lessons from Design, Implementation & Performance of Cap-and-Trade (and TPS) Policies (continued)

Leakage and Competitiveness

- *Political concerns* re emissions & economic leakage and related competitiveness impacts
- *Reality* can range from non-existent [Lead] to potentially serious [RGGI]
  - Most likely to be *serious* if limited geographic scope, particularly in power sector due to interconnected electricity markets [RGGI, AB-32]
- Although free allocation *fosters political support,* free allocation *per se* does *not* address leakage/competitiveness (inframarginal) [EU ETS, but changes going forward]
  - But *output-based updating* system makes allocations *marginal* [AB-32]
- But, ultimately, *only way to eliminate* leakage/competitiveness risk is through broader (national & international) coalitions of action

Interaction of National Cap-and-Trade Policy with a Sub-National Policy

- **Examples:**
  - EU ETS member state puts in place a more ambitious CO_2 policy
  - Province or state in a country with a national cap-and-trade system puts in place a more ambitious CO_2 policy
- **Interaction can yield perverse outcomes**
- **But will these perverse outcomes necessarily arise?**
  - No, the interactions can be *problematic*, *benign*, or *positive*, …
  - *depending* on relative scope and stringency, and policy instruments used

Problematic Interactions

- If national policy limits emissions *quantities* or uses nationwide *averaging* of performance, …
  - Then, emission *reduction* by province with more stringent policy than national policy reduces pressure on other provinces,
    - thereby allowing – indeed, *encouraging* (such as through lower allowance price) – emission *increases* in other provinces
- Result: 100% leakage, and loss of cost-effectiveness nationally
- Potential examples
  - State limits in USA on GHGs/mile *and* Federal CAFE standards
  - British CO_2 policies if under umbrella of EU ETS
- Partial solution: carve-out from broader policy (eliminates the 100% leakage, but still not cost-effective!)

Benign Interactions

- **Provincial climate policy less stringent than national policy**
  - Result: Provincial policy is non-binding and largely irrelevant

- **National carbon-pricing policy sets *price* with a tax (not quantity via cap-and-trade system)**
  - A carbon tax (or binding safety-valve/price collar in cap-and-trade)
  - More stringent actions in green provinces *do not lead* to offsetting emissions in other provinces induced by a changing carbon price.
  - So, potential for 100% leakage eliminated if policy at higher jurisdictional level is a price instrument – tax.
  - *However*, marginal abatement costs vary across provinces, and so aggregate reductions are *not* achieved *cost-effectively*.

Positive Interactions

- **Provinces can address *market failures* not addressed by national "carbon-pricing" policy (or sectors not addressed by national policy)**
  - Example: principal-agent problem re. energy-efficiency investments in renter-occupied properties → provincial or local building codes; public-good nature of information (innovation market failure) → technology policy
- **Provinces can be "laboratories" for policy design**
  - Seven Chinese pilot systems can provide useful information for development of national policy
  - But will provincial authorities want their "laboratories" to be closed after experiment has been completed and the information delivered?
- **Provinces can create pressure for more stringent national policy**
  - Important example in USA: California motor-vehicle fuel efficiency standards and subsequent changes in national CAFE
  - Desirable if previous national policy is insufficiently stringent, … but that is an empirical question

What About *Sub-National* Policies Nested within a National *Tradable Performance Standard* (TPS)?

- China's *national* emissions trading system is *not* cap-and-trade, but *TPS*
- Abundant *experience* with TPS:
  - U.S. lead phasedown
  - Corporate Average Fuel Economy (CAFE) standards
  - renewable portfolio standards
  - low carbon fuel standards
- Electric power industry sources (65) originally part of Guangdong carbon trading market to be *shifted* to the national system – so no overlap?
- But for future reference (possibly for other sectors), what are consequences of *interactions* between *national TPS* and *sub-national policies if scopes of coverage do overlap*?

Sub-National Policies Nested within a National Tradable Performance Standard (TPS)

- Consequences similar to cap-and-trade system, but more complex!
  - Same consequences for cases leading to Benign and Positive Interactions
  - Somewhat different consequences for cases leading to "Problematic" Interactions
- Reminder: With cap-and-trade, if nested (sub-national or sectoral) policy is more stringent, there is 100% leakage
- But under TPS, leakage due to complementary policy can exceed 100%.
  - How can this be?
  - Fundamental reason: Under TPS system, quantity of allowances distributed is endogenous to the compliance entities' outputs.
  - In general, stringent sub-national policy causes a reduction in intended output of affected compliance entities, because of increase in marginal cost (if firms are π-maximizer, i.e. *not* state-owned enterprise or restricted by regulation)
  - But attendant increase in output price can lead to greater output more broadly, …
  - … and so total number of allowances and emissions can increase in aggregate.

Consequences of More Stringent Sub-National Climate Policy within National TPS

- If sub-national policy is more stringent for compliance entity (firm) than what national TPS would have done,
  - Firm must *reduce emissions intensity and/or purchase more allowances* per output unit
  - Either way, firm's *marginal cost* (of producing its output) increases, …
  - … and so if a profit-maximizing firm, its *output is reduced*.
- Reduction in output by the sub-national source can lead to an *increase in price of output* (throughout the economy, depending upon scope of market for the relevant commodity).
- And in national market, this output price increase can lead to *greater aggregate output* – and so, given TPS constraint – *greater aggregate emissions.*

Key Take-Aways

1. Sub-national climate policies are prominent in several countries
2. Sub-national policy can interact with national cap-and-trade in perverse ways:
   - No incremental (aggregate) emissions reduction (100% leakage)
   - Increased costs
   - Suppressed allowance price
3. In tradable performance standard system, policy interactions can result in emissions leakage greater than or less than 100%, …
   - .. because allocation of allowances is endogenous (not fixed) under TPS.
4. Sub-national carbon-pricing policies can interact with a national policy in ways that are problematic, benign, or positive

Thank You!

For More Information

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