

Notes on a World Climate Assembly and the World Efficiency-Price of Carbon Emissions

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Seminar

The climate system is an angry beast and we are poking it with sticks.
–Wallace Broecker

Climate change is the biggest market failure the world has ever seen.
–Nicholas Stern

2016

Where Does Public Goods Problem Stand After COP21?

- COP21 Paris is a genuine positive achievement! However ...
- It is completely voluntary with no penalties – either for low ambition targets or for under-fulfillment of voluntary targets – other than "blame and shame." Based on INDCs = (1) **Independent**; (2) **Nationally-Determined**; (3) **Contributions**. (flows or stocks?)
- I revisit solution in prices vs. quantities, using fiction of a "World Climate Assembly" (WCA) voting on emissions via majority rule, as allegory for thinking about outcomes of climate negotiations.
- My approach here is ***futuristic***. If/when there is widespread perception of impending climate-change catastrophes, nations may/will be ready to forego sovereignty and volunteerism in favor of a binding international agreement with "teeth". In such a situation, what is the best form of an international agreement that "bites"?
- Opportunities for comprehensive solutions will likely arise (probably in response to future perceptions of climate-linked catastrophes) and we should be ready beforehand by thinking through consequences now.

Three Desirable Properties for Negotiation Instruments

Back to basics. Revisit P vs Q. My arguments throughout are mix of “art” and “science.” Desirable properties include:

- 1. *Induce cost effectiveness.*
- 2. Be of *one dimension based on a “natural” focal point* to facilitate finding an agreement with *relatively low transactions costs*. [Spirit of: Schelling (natural focal point); Coase (low transactions costs); Black (median voter); Arrow (avoid impossibility theorem).]
- 3. *Embody “countervailing force” against free riding* by automatically incentivizing parties to *internalize the externality* via a simple understandable formula that embodies a *common climate commitment* based on principles of *reciprocity, quid-pro-quo* and *I-will-if-you-will*. (Maybe most important property?)
- Using above three criteria, compare and contrast idealized binding harmonized price with idealized binding cap-and-trade system.

Negotiating One Price vs. Negotiating Multiple Quantities

Note: 'price' here operates like 'tax' whose revenues are domestically retained and internally redistributed. Assume no net welfare impact *per se*. (double dividend='+'; inefficient redistribution ='-')

- *First Pass*: negotiating one price vs. negotiating n quantity caps. Focal points and transactions costs. Externality internalization via one price vs. free riding incentives via n quantity caps.
- Critical distinction between **intra-national assignment** of n caps and **inter-national negotiation** of n caps, which breaks symmetry of PvQ.
- Suppose that, in U.S. clean air amendments (1990), EPA had allowed states or power plants to negotiate between themselves their own voluntary SO₂ target caps, with no penalties for either under-ambitious targets or under-fulfillment of under-ambitious targets. Is this a fair comparison with Paris COP21 agreement?

The Model and its Efficiency-Price of Carbon Emissions P^*

- For convenience, fundamental unit is *person*, everything normalized *per capita*. World population is m people, indexed $i = 1, 2, \dots, m$. Nation acts on behalf of its (identical) citizen-agents and recycles carbon-price revenues efficiently.
- X_i is abatement of i , with cost $C_i(X_i)$. Universal price of emissions is P . Then $X_i(P)$ satisfies:

$$C'_i(X_i(P)) = P. \quad (1)$$

World total abatement:

$$X(P) = \sum_{i=1}^m X_i(P). \quad (2)$$

- Benefit to i of X is $B_i(X)$. Public goods Pareto optimality condition:

$$P^* = \sum_{i=1}^m B'_i(X(P^*)), \quad (3)$$

where P^* satisfies (1) for all i (Samuelson-like solution).

What Price Would i Most Prefer?

P^* is world efficiency-price aka “social cost of carbon.” However ...

- Uniform emissions-price P_i that i would most prefer solves

$$\max_P \{B_i(X(P)) - C_i(X_i(P))\}, \quad (4)$$

which satisfies first-order condition

$$B'_i(X(P_i)) X'(P_i) = C'_i(X_i(P_i)) X'_i(P_i). \quad (5)$$

- Use condition (1) to rewrite (5) as

$$P_i [= C'_i(X_i(P_i))] = B'_i(X(P_i)) \times \left(\frac{X'(P_i)}{X'_i(P_i)} \right), \quad (6)$$

- Now analyze (6), What story is it trying to tell about golden-rule-like scaling up imputation? Difficult to go further without simplifying assumptions. Next make basic linearity assumptions.

Further Linearity Assumptions and a Result

$$B_i(X) = \beta_i + b_i X, \quad (7)$$

$$X_i(P) = \alpha_i + a_i P. \quad (8)$$

Eq. (8) equivalent to

$$C'_i(X_i) = \frac{X_i - \alpha_i}{a_i} \quad (9)$$

- Give some “justification” for simplifying linearity assumptions (7), (8).
- Derive basic result

$$P_i = P^* \times \left(\frac{b_i}{\bar{b}} \right) \times \left(\frac{\bar{a}}{a_i} \right). \quad (10)$$

where $\bar{b} \equiv \sum b_i / m$ and $\bar{a} \equiv \sum a_i / m$.

- Interpretation: agent i makes partial-golden-rule-like imputation of what *would be* the corresponding world efficiency-price of carbon if all other agents had same parameter values b_i, a_i . Some special cases. (I can **not** get analogous satisfying result for voting on quantities.)

Implications for WCA Majority Voting Outcome

Notation: Let Z represent a collection of $\{Z_i\}$. The *median* value of $\{Z_i\}$ will be denoted \tilde{Z} .

- From (10) and median voter theorem, WCA majority vote is

$$\tilde{P} = P^* \times \left(\frac{\bar{a}}{\bar{b}} \right) \times \left(\frac{\tilde{b}}{\tilde{a}} \right). \quad (11)$$

(Imperfect) heuristic argument why two (imperfect) measures of central tendency on rhs of (11) may multiply to ≈ 1 , implying $\tilde{P} \approx P^*$.

- Special case all $\{a_i\}$ identical gives

$$\tilde{P} = P^* \times \left(\frac{\tilde{b}}{\bar{b}} \right). \quad (12)$$

- Special case $b_i = k a_i$ for all i some k yields $\tilde{P} = P^*$. Give story.
- Rough empirical application gives $P^* = \$40/\text{tCO}_2$ and $\tilde{P} = \$51/\text{tCO}_2$.

Some Questions and Comments (Incomplete)

- *Would serious side payments be required for acceptance of a uniform price? Does this spoil argument? Is my comparison between one negotiated price vs. multiple negotiated quantities really legitimate? Does one price really make distributional issues less explicitly central? Would not “green fund” transfer payments be required for participation in both systems, thereby leading to symmetric multi-dimensional negotiation difficulties?*
- I am thinking that a uniform price is a more “natural” focal point requiring less “greenfund transfers” than any quantity sub-division assignment, even with “naturally symmetric” quantity assignments. Is the median voter story in favor of price relevant?
- Emphasize *minimum* price on carbon, however attained (cap and trade or tax). Country could go beyond. Examples.
- My tentative conclusion: It is difficult to get nations to agree to *anything* on climate change, but negotiating one price is *relatively* easier than negotiating n quantities.

“Climate Club” Extended to a “Climate Assembly” [?]

- William Nordhaus introduced the basic idea of a “climate club” to overcome free riding.
- I want to extend his idea to accommodate a “climate assembly.”
- Members agree to impose the same price of carbon on themselves. They vote on their preferred uniform club-carbon price via one-person one-vote as in this paper and agree to abide by majority rule.
- Members of the climate club agree to free trade among themselves but each one also agrees to charge an ad valorem border tariff of, say, 5% on goods imported from any non-member country.
- Membership is voluntary, but members must agree to abide by above conditions.
- Nordhaus shows promising outcomes. WCA=“World Climate Assembly” extension gives a (voting) rule for flexible adjustments of the uniform price as changing conditions warrant.
- To me, this package of WCA with climate club seems like a constructive approach and promising set of ideas.