

## PRE-TESTING INTERNATIONAL CLIMATE CHANGE POLICIES: METHODS AND RESULTS

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Under certain circumstances, experimental methods can be used to evaluate public policies. Laboratory tests may be designed to check various properties of a specific policy (see, e.g., [Plott, 1987](#); [Cason and Plott, 1996](#)). Field testing of new policies is conceivable when policymakers actually want to have such tests carried out before a policy change is made permanent and when relevant, e.g., regional, control groups can be formed. (For an example, see ‘Quasi-experimental Evaluation of Regional Employment Subsidies’ in this volume or [Bohm and Lind, 1993](#)).

For obvious reasons, field tests with real decision makers are particularly hard to carry out concerning international policy options. Here, where international climate change policy is the object of study, there is one particular policy option – internationally tradable (carbon) emission quotas – which, although efficient and capable of addressing distributional concerns in theory, has met with strong opposition from several countries, in particular in the developing world. The policy amounts to (1) allocating, by international agreement, acceptable emission quotas to individual countries and (2) attaining cost effectiveness by allowing trade of quota units among the signatories. (The opposition seems to stem mainly from a lack of understanding of the flexibility in the design of this policy.)

Since there are no real precedents to this type of international agreement and since arguments based on theory or lab tests alone are unlikely to convince suspicious governments, the question is, what could provide them with relevant and possibly convincing information? For example, can field-like tests, capable of improving the level of information, be designed for subjects who could respond in a relevant fashion? The principal results and, in particular, the designs of two such tests are reported here. In the first test, the purpose was to identify and use a field-like experimental design to investigate the cost effectiveness of international emissions trade within a small group of countries. In the second test, which examined the international acceptability of a specific take-it-or-leave-it tradable-quota proposal, the primary task was to identify, and solicit the participation of, subjects who had the information required and could be furnished with incentives to respond in a relevant fashion to the question of what position a given country could be expected to take.

In both tests, the crucial points were to solicit relevant subjects and to provide them with incentives to respond in a well-considered fashion to the, unavoidably hypothetical, questions posed. Monetary incentives were not relevant to use here since the recruited subjects participated in their capacity as public officials.

## 1. Testing Gains from Emissions Quota Trade among a Few Countries (Bohm, 1997a)

A subset of the world's countries may wish to commit themselves to stringent emission targets in an attempt to influence other countries to follow suit, thereby bringing about a significant reduction in the threat to the global climate. Moreover, if the pioneering countries were to connect a tradable quota system to these commitments, they would be in a position to provide information not only about the practicability and efficiency properties of this policy instrument but also about the general economic implications of the commitments made. If the set of countries were small, which seems quite likely in the case of pioneering agreements, this action could reveal, in particular, how efficient a small market for quota trade would be. Furthermore, it could also show, for a set of similarly *developed* countries as the only participants, whether the common presumption that their costs would be too similar for any significant amount of trade gains to arise were in fact correct.

Second best to this approach could be to let such a set of countries conduct a hypothetical quota-trade experiment with real-world government traders provided that incentives similar to those of a real trade environment could be created. Such a test was carried out in 1996 for Denmark, Finland, Norway and Sweden, four countries that already had implemented unilateral carbon emission reduction policies by introducing significant domestic carbon taxes, and also had been advocating a more stringent international climate change policy.

### 1.1. Test Design

The energy ministries of the four countries agreed to appoint negotiating teams of experienced public officials or experts, who would act *as if* each country

- had committed itself to keeping its year 2000 emissions at its 1990 level (in line with the 1992 Framework Convention on Climate Change, FCCC), and
- could exceed its target emissions level to the extent that another country among them had (hypothetically) committed itself to an additional reduction of its emissions, which amounts to a tradable-quota arrangement.

In the real world, this kind of intergovernmental trade would most likely be guided by relative emissions abatement costs, politically adjusted for unwanted employment and income distribution effects. Earlier cooperation among the four countries had made them familiar with their partners' estimated technical emissions abatement costs and business-as-usual (BAU) emission levels, as would be likely before any international agreement of this type could be implemented. Thus, such information could be taken to be more or less common knowledge, whereas the additional political considerations and hence, the directly negotiation-relevant 'social' abatement costs would more likely be private information.

Furthermore, in the real world, incentives could be expected to be provided by the fact that the negotiators' performance – e.g., cost savings achieved as compared to po-

Table 1

Gains from hypothetical carbon emissions trading involving four countries represented by realistic negotiating teams. Emission reductions in million tons and carbon emission abatement costs in million U.S. dollars; net gains are net of trade payments, at prices that differ between trades, but all close to a perfectly competitive price; fully efficient trade in parentheses

Country	Unilateral		Trade	Ex post TQ trade		
	Em. red. (Mton)	Cost (M\$)	Exp./Imp. (–) (Mton)	Em. red. (Mton)	Cost (M\$)	Net gain M(\$)
Denmark	1.7	61	0.5 (1.19)	2.2 (2.9)	83 (116)	6.7 (5.1)
Finland	6.0	94	5 (5.76)	11 (11.8)	212 (251)	136 (132.2)
Norway	5.4	456	–3.5 (–4.4)	1.9 (1.0)	91 (40)	178 (194.5)
Sweden	1.6	102	–2 (–2.55)	–0.4 (–1.0)	–22 (–51)	24.4 (25.1)
Total	14.7	713	Gross 5.5 (6.95)	14.7	368 (356)	345 (357)

Implications:

- 1. Quota trade reduced aggregate abatement costs by 50%, realizing 97% of potential maximum cost savings.
- 2. Net gain relative to unilateral costs: 11% (DK), 145% (SF), 39% (N), and 24% (S).
- 3. All four negotiating teams attained similar percentages of potential cost savings (= cost savings under perfect competition).

tential cost savings – could be evaluated by their peers in their respective countries. In the test, these incentives were mimicked by an agreement among the negotiating teams to disclose, prior to the negotiations, their negotiation-relevant marginal social cost schedules to an evaluation group of non-Nordic economic experts. After the bilateral trade negotiations were completed (by fax over a four-day period), a report where this group evaluated the performance of each country would be published (see Appendix 1 in Bohm, 1997a).

1.2. Test Results

The results are shown in Figures 1, 2 and Table 1. The required emission reductions, if unilateral, are shown in Figure 1 as the distance between the estimated BAU level and the target level for each country. In that figure, the negotiation-relevant cost curves are drawn with the target level at the origin. Ex post quota trade, the required emission levels for year 2000 were shifted from the origin to the levels ( $Em_i$ ) indicated in Figure 2. As is suggested in that figure and more clearly shown in Table 1, quota trade reduced the four countries' aggregate abatement costs by 50%. Although there were only four countries trading bilaterally, trade achieved 97% of the trade gains that would have been attained had market behaved as if perfectly competitive; see Figure 2 and Table 1. (Similar efficiency rates were obtained in eleven pilot tests, using monetary incentives and graduate students in economics as subjects; see Bohm and Carlén, 1999.) The performance of the negotiating teams, defined as the individual country's attained

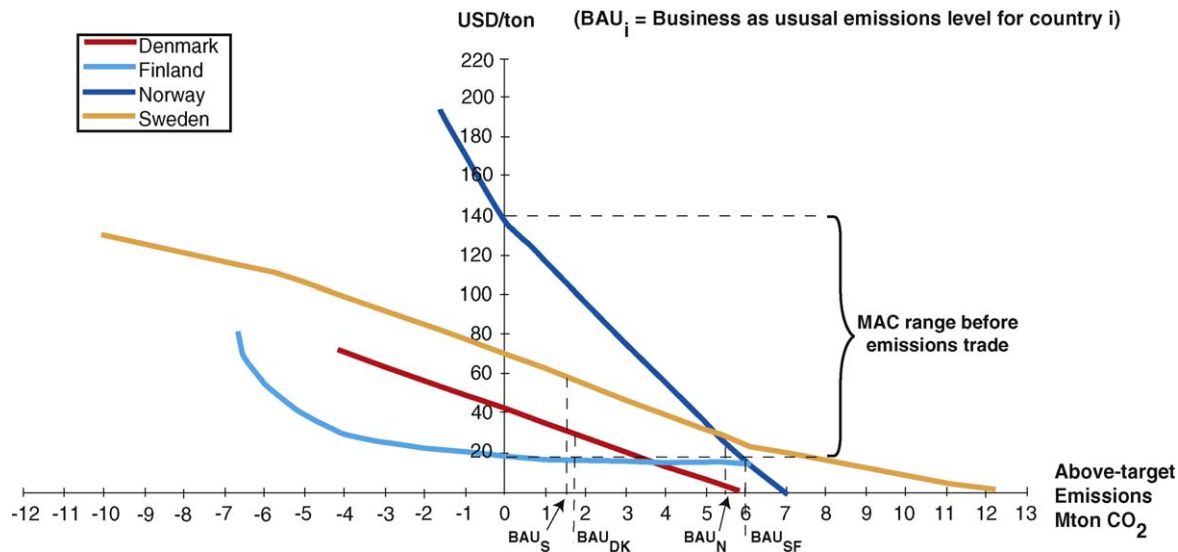


Figure 1. Marginal social carbon emissions abatement costs (MAC) for four Nordic countries. Cost curves centered at quota levels in year 2000 = FCCC target levels (1990 emissions); business-as-usual (BAU) emissions for year 2000 estimated at present domestic carbon tax levels; abatement costs to unilaterally reach target = the area below cost curves from BAU to target (at origin).

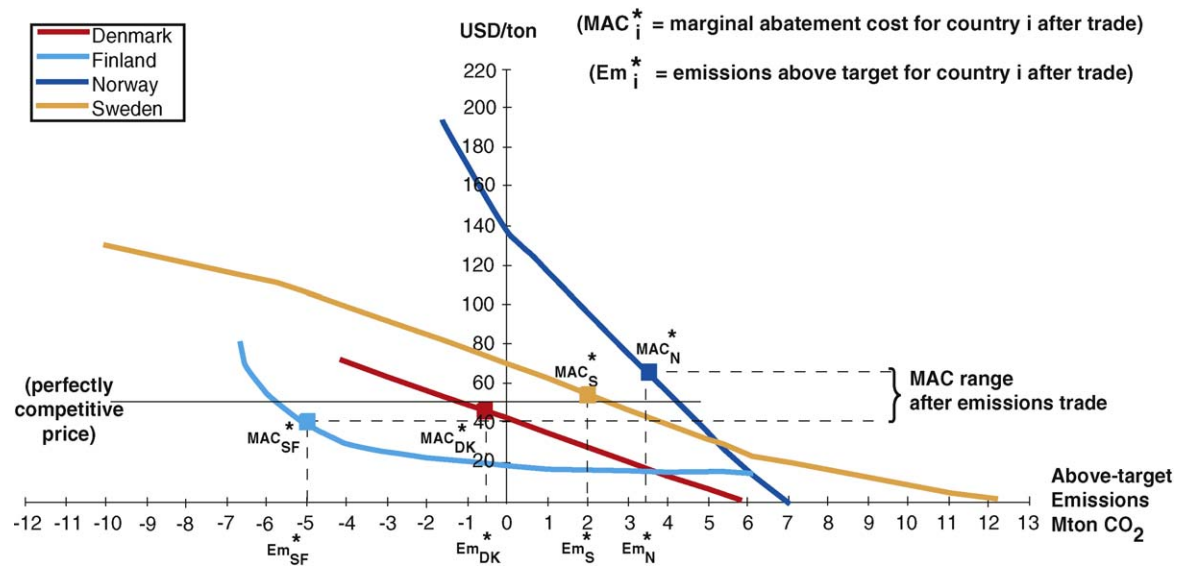


Figure 2. Emissions and marginal abatement cost range after emissions quota trade. Quota imports given by emissions ( $Em_i^*$ ) in excess of target (at origin) where total imports (by Norway and Sweden) equal total exports (by Denmark and Finland); perfectly competitive equilibrium price inserted for comparison.

share of potential gains under perfect competition, was quite similar. Still, quota trade gains deviated considerably among the countries (see implication 2 in Table 1).

These results could provide politicians with the insights (1) that differences in abatement costs may be large even between seemingly similar developed countries, hence that potential gains from emissions trade among such countries may be significant, and (2) that these trade gains may be considerable even when only a few countries participate.

## 2. Testing International Acceptability of a 'Global' Tradable-quota Treaty with Diplomats as Subjects (Bohm, 1997b)

The topic of the second test was to investigate how subjects, knowledgeable about the general policies of the government in each of a selected set of 29 countries, would respond to a proposed, allegedly 'fair,' global tradable-quota treaty. (In this test, the world was taken to consist of only this selection of 29 countries covering 90% of the true global carbon emissions.) Would the responses to this particular proposal be as negative as the initial reactions of most countries (except the U.S.) have been? If not, an implication could be that more effort should be devoted to analyzing and evaluating the potentially cost-effective tradable-quota solution than had so far (1996) seemed called for. Here, as well as in the test reported above, the relevance of the results hinges on the qualifications of the experimental subjects and the incentives presented to them.

Recruiting real country representatives or country experts of an international organization like the World Bank as test subjects is hardly feasible, nor would it seem possible to present such subjects with relevant incentives. Instead, the subjects chosen were high-level diplomats in the service of one country (Sweden), each of whom had recently been stationed in a selected country, which they had now left, and which they were asked to represent. In the test, the world was assumed to consist of 29 countries (see the list in Table 2). The test was sanctioned by the Swedish State Department, where a chief official (No. 3 in command) asked the 29 diplomats (24 of whom were ambassadors) to invest a maximum of four hours and respond in two rounds to the set of questions posed to them. The subjects' identity was not revealed to anyone outside the Department. But since the responses were available for scrutiny by the chief official and others inside the Department, the responses could be peer reviewed. This was taken to provide an incentive for the subjects to consider the questions carefully before responding. All subjects responded (by fax) to the two rounds of questions within a period of four months.

In the first round, subjects were given 15 single-spaced pages of background information and instructions:

- presenting the policy issue, a review of common *pro* and *con* arguments regarding the type of treaty proposed and the information asked for;
- asking them to suggest how 'their' government would respond to a take-it-or-leave-it tradable-quota proposal to a world of 29 countries, where carbon emission quotas for 2010-14 were allocated so that, *ex post* quota trade, non-rich countries would

Table 2  
How experienced diplomats, each knowledgeable of a country’s policies, think ‘their’ country would respond to a ‘fair’ tradable carbon emissions quota treaty proposal

OECD countries (8 Yes, 4 No)		
Australia	Yes	
EU: Denmark		No
Belgium	Yes	
Finland		No
France	Yes	
Germany	Yes	
Spain		No
Italy	Yes	
United Kingdom	Yes	
Japan		No
Norway	Yes	
United States	Yes	
(Old) Non-OECD countries (9 Yes, 8 No)		
Brazil	Yes	
Chile	Yes	
Mexico		No
China		No
India		No
Indonesia	Yes	
Israel	Yes	
Republic of Korea	Yes	
Malaysia		No
Pakistan		No
Czech Republic		No
Poland		No
Russia		No
Ukraine	Yes	
Egypt	Yes	
Kenya	Yes	
Zambia	Yes	

remain economically unharmed and rich (OECD) countries would share the net costs of the treaty in the same proportion as their respective GDPs;

- asking them to consider 2005 as a ‘realistic’ date when this proposal would be made and to take for granted that at that time all the countries’ marginal abatement cost curves would in essence be common knowledge (which provided the basis for reliable estimates of the economic implications of the treaty, see the preceding point); and

- emphasizing that the basis for the responses would be the respondents' *present* knowledge of 'their' governments' policy attitudes.

The last two points implied that the time between 1996 (when the study was undertaken) and 2005 collapsed into a single point in time.

In the second round (not reported here), the No respondents were asked to explain why their government would say no.

As can be seen from the results of the first round listed in [Table 2](#):

- 17 of the 29 respondents said that their countries' governments would accept the proposal, which was
- true for 8 of the 12 rich countries, with all major countries (except Japan) saying yes, and
- true for 9 of the 17 non-rich countries, with the major countries – China, India and Russia – saying no.

Thus, according to this test and contrary to the views expressed by a large part of the global community, a considerable number of countries appear to find a tradable-quota treaty potentially acceptable. This seems to call for much more extensive analysis and evaluation of this policy option among climate-change policy negotiators than has so far taken place.

## References

- Bohm, P. (1997a). "Joint Implementation as Emission Quota Trade: An Experiment Among Four Nordic Countries, Nord 1997:4". Nordic Council of Ministers, Copenhagen.
- Bohm, P. (1997b). "Are Tradable Carbon Emission Quota Internationally Acceptable? An Inquiry with Diplomats as Country Representatives, Nord 1997:8". Nordic Council of Ministers, Copenhagen.
- Bohm, P., Carlén, B. (1999). "Emission quota trade among the few: Laboratory evidence of joint implementation among committed countries". *Resource and Energy Economics* 21 (1).
- Bohm, P., Lind, H. (1993). "Policy evaluation quality: A quasi-experimental study of regional employment subsidies in Sweden". *Regional Science and Urban Economics* 23, 51–65.
- Cason, T., Plott, C. (1996). "EPA's new emissions trading mechanism: A laboratory evaluation". *Journal of Environmental Economics and Management* 30 (2), 133–160.
- Plott, C. (1987). "Dimensions of parallelism: Some policy applications of experimental methods". In: Roth, A. (Ed.), *Laboratory Experimentation in Economics*. Cambridge University Press, Cambridge, UK.