

Appendix 1: Evaluation Report

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Evaluation Objective

The objective of the evaluation is to determine how well the negotiating teams performed in their transactions, both collectively and individually. Our primary concern is thus with the outcome of the experiment. However, toward the end of this report we also comment briefly on the design and implementation of the experiment.

Evaluating Potential Aggregate JI Gains

The potential gains from trade can be defined as the difference between the cost of meeting the emission targets unilaterally and the minimum cost of meeting the same collective target. For the former case, marginal abatement costs will typically differ among the countries. For the latter case they will be equalized. The allocation of abatement which minimizes the aggregate cost of meeting the collective target will be identical to that in the perfectly competitive equilibrium. At this equilibrium, all potential gains from trade are exhausted, and all transactions take place at the same price — a price which is equal to the marginal cost of abatement for every country.

Using the cost information supplied by the negotiators, we have calculated the costs of meeting their national emission targets unilaterally as well as the perfectly competitive abatement levels and associated costs, for details see the Appendix.

The potential gains from trade amount to 357 million USD (MUSD). In other words, efficient abatement lowers the cost of achieving the collective emissions target by about half (the cost of meeting the targets unilaterally is MUSD 713 while the minimum cost of meeting the collective target is MUSD 356). This indicates that marginal abatement costs differ substantially between the countries, evaluated at the level of abatement needed to meet the abatement targets unilaterally.

Evaluating the Aggregate Gains from JI Actually Achieved

The JI experiment achieved the same collective abatement target at a total cost of MUSD 368, representing a net gain of MUSD 345 as compared with the outcome where the national emissions targets are met unilaterally. Our calculations indicate that 96.6% of the potential gains from trade were

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Bohm, Peter. "A Joint Implementation as Emission Quota Trade: An Experiment Among Four Nordic Countries." Nord 1997:4

actually realized by the JI experiment. This is a striking result. Actual trading in the United States has resulted in gains from trade on the order of about 50% -- and this in the more successful emissions trading programs (see Hahn and Stavins, "Incentive-Based Environmental Regulation: A new era from an old idea?", *Ecology Law Quarterly*, 18, 1991).

We cannot explain why this result occurred. To understand this would require that the experiment be replicated under varying circumstances. However, we suspect that among the factors that have led to this high realization in the gains from trade are that the technical costs of abatement were to a certain extent common knowledge, transactions costs were zero, and the abatement levels for the "business-as-usual" scenarios were taken as given by the countries.

A related observation is that the prices at which the JI trades took place were very close to the competitive price. The experimental trades took place at prices within 15% of the perfectly competitive price.

It is interesting to note that marginal abatement costs vary substantially even after trading (from 39 to 69 USD per ton), despite the fact that trading realized almost all of the potential gains from trade. The reason for this is that the cost curves were fairly steep at the post-trading abatement levels.

We should also note that there are other benchmark outcomes with which we could compare the experimental results. For example, we have calculated the trading that would result were Denmark and Finland able to cooperate as a monopolist in the abatement market. This scenario results in a somewhat smaller gain from trade, resulting from the inefficiency of a monopoly market. However, we note that if the monopolist were able to practice first degree price discrimination, then the total gains from trade would be equal to that associated with the perfectly competitive solution; all that would change would be the distribution of the gains from trade and not the aggregate level. In our view, the perfectly competitive solution is the obvious one to use for purposes of comparison.

Evaluating Individual Country Gains from JI Trading

The first and perhaps most important observation is that all countries gain from JI trading. Of course, some countries gain more than others. However, care must be taken in interpreting these individual country gains. We have calculated the gains from trade for each of the countries associated with the perfectly competitive solution, and these are very similar to the actual gains from trade realized by each of the countries. This indicates that the differences in the gains realized by the countries mainly reflect differences in the marginal abatement cost functions and levels, not the negotiating skills of the individual countries. Each of the countries realizes at least 91% of its potential gains from trade as defined by the perfectly competitive solution. Nevertheless, there is substantial variation among countries in their percentage cost savings, which range from about 11% in the case of Denmark to 145% in the case of Finland (the latter indicating that engaging in the JI program not only saved on costs for Finland, but was actually profitable).

Comments on the Design and Implementation of the Experiment

Though we are not experts in experimental economics, we believe that the results may depend on the context of the negotiation experiment. As noted earlier, the parties to the bargaining were broadly knowledgeable about each nation's abatement costs, especially their technical abatement costs. We believe that it was commonly known that the marginal abatement costs for Sweden and Norway were "high", and that these costs for Finland and Denmark were "low". Furthermore, there was some indication about the magnitudes of these costs. The fact that the countries involved interact repeatedly over a large range of issues implies that they may share a certain degree of "trust". Individual members of the country teams may also have known each other personally. To be sure, this is not a failure of design. To the contrary, the above circumstances may reflect the situation that may arise if trading were actually to be carried out.