

Economic Experiments for the Analysis of the Compliance Behavior of Polluters with Environmental Regulation

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1. What will we do¹

General Objective: To design and conduct laboratory experiments to test hypotheses about the compliance behavior of polluting firms facing different environmental regulations. Testing these hypotheses will allow us to produce policy recommendations on (i) the design of cost-effective enforcement strategies, and (ii) the cost-effective choice of policy instruments to cap emissions of a certain pollutant.

Specific Objectives: To test two groups of hypotheses. A first group consists of hypotheses regarding the behavior of firms under different structures of the penalties for non-complying (linear or quadratic in the level of violation), and under different policy instruments (a system of emissions standards and a competitive market for tradable pollution permits). Based on the observed behavior, a second group of hypotheses will be answered. These relate to the relative cost-effectiveness of tradable permits versus emission standards.

2. Methodology

As said, we will design and conduct economic experiments. These are a relatively new but consolidated tool used to test behaviors in economics and other social sciences. They simulate real situations in a controlled environment in which actual persons take economic decisions. In the case of our project, the experiments will be computer based simulations of different regulatory scenarios, arising from combinations of different enforcement strategies and policy instruments (emission standards and tradable pollution permits). The decisions that the persons participating in the experiments will have to take will be basically how much to pollute and how much to comply with the regulation, given that this is costly.

In order to assure that the persons take the decisions seriously, as an actual polluter would, the persons participating in the experiments earn actual money at the end of the experiment, depending on their level of profits in the simulated regulatory game. We have a two-year grant from the national agency for innovation and research of Uruguay (Agencia Nacional de Investigación e Innovación, ANII) to finance these experiments.

The core of the project aims to test the hypotheses with students in the city of Montevideo in a computer lab at the Universidad de Montevideo, my home institution. Nevertheless, we are also considering performing some rounds of these experiments in “the field”, with actual businessmen, recruited from the National Chamber of Commerce and the Uruguayan Industry Chamber.

¹ Although I am individually applying for this scholarship, this is a collaborative research project with my colleague Prof. Carlos Chávez, from the Universidad de Concepción, Chile.

3. Time frame

We will start the project in March 1st. We plan to work on the design of the experiments for six months, from March to August 2011. This will include the calibration of the parameters of the different regulatory games (such as the benefit functions, the penalty functions, etc.), but also determining the number treatments, the number of sessions, etc. This phase also consist of designing and writing the instructions for the participants, and a possible survey.

After this phase we plan to work on the design of the software for another two months, with the help of a programmer we are going to hire at this stage with funds from the ANII grant.

This phase is followed by another two month phase (November – December) in which we are going to run some pilot experiments to do the fine tuning of the design (testing the software, the instructions, etc.) and recruit the students for the actual experiments.

Finally, we are planning to train the students and run the experiments during January – March 2012.

4. Why the project needs to be done

Significance for my discipline: One of the most important aspects behind any policy is its economic cost. An emissions control policy is no exception. Environmental economists have been giving a clear recommendation on this regard for a long time: when possible, a regulator must cap aggregate emissions by creating a competitive market for pollution permits because this policy instrument minimizes the aggregate abatement costs of reaching any chosen cap with minimum information requirements for regulators.

This policy recommendation has had its impact. The European Union adopted an Emissions Trading Scheme as an important tool to limit emissions of greenhouse gases. Until the introduction of this scheme, the United States were home to the largest cap and trade scheme: the Federal Sulfur Dioxide (SO₂) Allowance Trading Program to control acid rain. The United States is also home of some well known regional markets, such as the NO_x and SO_x Regional Clean Air Incentives Market (RECLAIM) Program, of the South Coast Air Basin of California. Other regulatory programs based on transferable emission permits have been implemented in other countries too. A nearby example is the Emission Offset Program of Santiago de Chile, a market for Total Suspended Particles' emissions capacity.

Finally, both a “cap and trade” scheme and a tax on carbon emissions, remain at center stage among the possible policy instruments to control global emissions of greenhouse gases.

This impact of the policy recommendation in favor of tradable permits in particular and economic instruments in general can be seen as surprising because the costs of abatement are not the only social cost of reducing emissions. There are other relevant costs such as the costs of monitoring the regulated sources and sanctioning noncompliance. Nevertheless, until the work of Cafferata and Chavez (2010), the literature had not given an answer to the question of the relative cost - effectiveness of a system of tradable emission permits versus a system of emission standards when not only the abatement costs of the firms but also the enforcement costs of the regulator are included in the equation. Moreover, the theoretical results available in the literature have not been tested in the laboratory or the field. (See bibliography).

In this context, the project will make a contribution to the discipline and to policy design by providing experimental evidence on the effect that different designs of the enforcement strategy has on the behavior of the polluter firms, and therefore the possibility of designing cost-effective pollution control programs based on both emission standards and tradable permits. By doing this, the ultimate contribution of the project will be to provide experimental evidence on the relative costs of emission standards versus tradable permits when both instruments are optimally designed (as in Stranlund (2007) and Caffera and Chavez, 2010).

Significance for the country and the region:

One of the major impediments to the successful implementation of environmental policy in less developed countries is their lack of institutional capacity. The lack of skilled personnel at the environmental protection agencies is among these lacking capacities. This is particularly true in the case of the personnel trained in environmental economics. Most of the countries in the region lack these personnel in sufficient quantity and/or quality. As a result, it is more difficult to correctly design and support the implementation of pollution control programs based on economic instruments. As a result, the region misses the opportunity of protecting the environment at lower social cost. Our project will contribute to start correcting this by disseminating the results of the research and the policy recommendations (on the design of cost-effective enforcement strategies and policy instruments for pollution control), among the regulatory community at the national and municipal levels.

Other Expected Results: We plan to hire two graduate students from the pool of students of the Master in Economics Program at the University of Montevideo. These students will be able to produce their thesis based on this project.

5. How my results will be disseminated

The results of the project will be disseminated in seminars in Montevideo, Maldonado and other possible cities in the country, yet to be determined. These activities will be complemented by previous presentations on the economic theory of environmental policy and its applications. I have also made preliminary contacts to replicate these activities among interested legislators.

Finally, I am also exploring collaborative activities with the national “environmental protection agency” (Dirección Nacional de Medio Ambiente, DINAMA). I had an interview with the Director of DINAMA, Jorge Rucks, who has expressed its interest in several possible collaborations including specifically the help in the design of new economic instruments for environmental protection that the agency is planning under a new institutional reform and new challenges, such as those arising from climate change. (See attached letter of reference by Jorge Rucks).

6. The nature of the proposed project in terms of the NEXUS program themes and the relevance of the project to the overall objectives of the program

As said, with these activities the project aims to start filling the environmental economics capacity gap of the country. This is important in terms of the NEXUS program objectives. Why? To put the global economy in a sustainable path we need to foster energy innovation. In other words, we need investment in research and development of new technologies that can exploit new sources of energy that are free of carbon emissions. A fundamental incentive to induce this kind of investment is to increase the relative cost of the technologies that burn fossil fuels, particularly those that

do it inefficiently. This is what economic instruments do, in a cost-effective manner, by correctly pricing the emissions of greenhouse gases. In this way, economics instruments are a fundamental tool in the transition to a low carbon economy in a timely fashion. In the absence these instruments the incentives to invest in alternative energy technologies will be lower. But in order to implement economic instruments regulators and legislators need to at least understand how they worked and what they can accomplish. The project will help to start building this understanding.

7. What research facilities and resources are found in the Department of Resource Economics at UMass

John Stranlund, a Professor at the Resource Economics Department at UMass, is one of the leading scholars in the field of the economic theory of enforcing environmental policy. He is the author of several seminal articles in this field, including one directly related to this project (Stranlund, 2007). Prof. Stranlund, together with Prof. James Murphy, previously at the University of Massachusetts – Amherst, now at the University of Alaska – Anchorage, is also the author of one the articles in experimental economics that are closely related to the objectives of this research (Stranlund and Murphy, 2007). In fact, pursuing comparability, we are considering building the design of our experiments in the design of the experiments ran by Prof. Stranlund and Prof. Murphy.

The Department of resource Economics at the University of Massachusetts homes the Experimental Economics Program. Apart from Prof. Stranlund, the Department has four more members of the Faculty working on experimental economics, and another faculty member, IT and computer programming expert, who has designed software very similar to the software we are planning to use in our experiments

The Department is also home of the Cleve E. Willis Experimental Economics Laboratory, a state of the art facility to conduct economic experiments.

For all these reasons, the Department of Resource Economics at the University of Massachusetts – Amherst provides the ideal environment to work on the design of our experiments.