

## **CHAPTER 9**

### **CONCLUSIONS**

This dissertation consisted of two different research efforts. In the first one I described the institutional framework, policy instruments, and the enforcement process that characterizes industrial water pollution regulation in Montevideo, Uruguay, aiming to identify and weigh institutional and political economy factors that may help to explain the present choice of command and control instruments over more cost-effective economic instruments. The identification of these factors allowed me to evaluate the possibilities that the country has of implementing an industrial effluents charge.

The motivation behind this first part of my dissertation was given by the puzzle that while less developed countries should be particularly interested in the implementation of economic instruments as a cost-effective way to control pollution, environmental regulation in Latin America has been based on command and control instruments. Answers to this puzzle have come from the political economy of instrument choice and the institutional capacities literature. But most of this work has been theoretical.

This dissertation tests the empirical validation of these arguments. This is vital because when the issue of instrument choice for pollution regulation in Latin American countries is addressed, the region (or even the broader category of Less Developed Countries) is commonly treated as a homogeneous unit of analysis. But useful answers demand empirical research on the institutional and political economy characteristics of

each case study as a specific unit of analysis, since the appropriateness of regulatory systems "will vary across countries, across regions within countries and also across pollutants" (Blackman and Harrington, 2000). In the second research effort of this dissertation I empirically examined the determinants of the allocation of inspections by the municipal and national governments among industrial plants in Montevideo, and tested the effects of these inspections- and other enforcement actions on the reported levels of Biological Oxygen Demand (BOD<sub>5</sub>) and the reported compliance status of industrial plants. A unique feature of this dissertation with respect to similar past empirical studies is the availability of four sources of information regarding levels of pollution. This allowed me to also explore the presence or absence of under-reporting.

The second part of my dissertation was motivated by the present lack of formal econometric studies evaluating regulators' effectiveness in enforcing pollution regulations in Latin America. In this respect, this work is valuable because previous empirical analyses in the U.S., Canada and China are of little guidance for a Latin American country, given the obvious differences in institutional and political systems. This is important because new regulations are being developed and implemented in many countries of Latin America, but no effort has been made to empirically test the capacity of these countries to enforce them.

The following facts give additional value to the formal econometric study of this dissertation. First, it is illustrative of the effectiveness of regulatory approaches by which regulators negotiate gradual abatement with firms instead of just applying penalties to violators. Second, it examines regulators' and firms' interactions during hard economic times. The importance of these two facts is enhanced in the less-developed country

context, in which regulators are more sensitive to the trade-off between environmental quality protection and its potential economic and social costs. Third, the research also allows conclusions about the effects of multilateral institutions (the Inter American Development Bank in this case) on environmental policy in less developed countries. This issue has not been addressed before but it is nevertheless extremely important given the lack of public resources in these countries, which frequently make them dependent on the funds provided by these institutions to implement environmental policies.

This dissertation has identified two factors as the most important determinants of the present choice by Uruguayan authorities of cost-ineffective instruments for controlling industrial water pollution. First, there exists an important lack of knowledge regarding this type of instrument on the part of legislators and policy makers. This could be explained by the lack of environmental economists in regulatory offices or advisory groups of policy makers and legislators. Second, given the economic situation of the country, policy makers and legislators are very sensitive to imposing costs on production activities.

Apart from these two factors, others are also identified. The most important are that the regulatory offices are under-staffed, the legal system is “immature” and there is a lack of coordination between the municipal and national governments. But the choice of environmental policy instruments by Uruguayan policy makers was not the result of a discussion on the grounds of the relative cost-effectiveness of alternative instruments when taking into consideration monitoring costs, as suggested by the institutional capacity literature. Otherwise, they could not have chosen a mix of command and control policy instruments that do not have any monitoring advantage over direct incentive based

instruments. Nevertheless, Uruguayan institutions play a much more important explanatory role in other respects. Under the present normative framework, any emissions tax proposed by municipal governments would be unconstitutional. This casts doubts on whether municipal governments will ever be able to implement such instruments. Municipal governments may need to look for another type of incentive-based instrument, or emissions taxes will have to wait to be implemented by the national government. In this sense it is the Uruguayan legal framework (more specifically the Uruguayan Constitution) that has prevented the implementation of incentive-based instruments for pollution control.

In spite of this, I think that the amount of information presently managed by the Uruguayan regulators would allow them to implement an emissions charge if the political will existed and the legal framework allowed.

Several insights emerge from the empirical analysis of the second part of this dissertation. First, results of difference of means tests between reported and sampled BOD<sub>5</sub> suggest that under-reporting may be present. But it is impossible to conclude about the under-reporting strategy of plants based only on these simple tests.

Second, the IMM inspectors did not react to the economic situation of the industrial sector by decreasing their inspections. To the contrary, they increased inspections after the Pollution Reduction Plan, exactly when the economy was in recession. This monitoring strategy, apparently immune to political considerations, has nevertheless another possible explanation. Since the IMM promised the Inter American Development Bank to curb industrial pollution as part of the Urban Sanitary Plan, IMM

regulators may have kept monitoring firms in order to not risk the funds on which the sanitary works depend.

Third, the national government inspectors seemed to have reacted more than the municipal inspectors to the economic situation of the firms. Since it is the national government that is politically responsible for economic policy, not the municipal government, DCA officials could have received more pressure against inspecting and fining firms. It is also true that the national government does not have any agreement with the Inter American Development Bank like the IMM.

Fourth, SEINCO seems to have acted independently of IMM inspectors when deciding who and when to inspect. On the other hand, it probably targeted the same plants as the DCA.

Fifth, when allowed to differ during and after the Pollution Reduction Plan, the threat of an IMM inspection seems to have decreased the plants' incentives to under-report considerably. This result is important because it suggests that IMM inspections were effective means of discovering unreported violations. Of course uncovering violations is not enough to increase compliance. Uncovered violations need to be punished. But the number of fines applied by the IMM during the study period clearly suggests that regulators were not willing to impose punishment on firms. Consequently, in spite of the effectiveness that the threat of inspections had in the short run, the cumulative number of inspections did not have any effect in the longer run.

Sixth, the DCA monitoring and enforcement activity was not very effective in deterring BOD<sub>5</sub> pollution levels of industrial emissions in Montevideo.

Seventh, the plants may have used SEINCO inspections to under-report to the IMM after they learned that SEINCO inspections were substitutes for IMM's. This explanation requires the assumption that plants believed that the IMM inspectors would not use SEINCO information to check for the truthfulness of the reports, which was true.

Eighth, diluting probably took place unless it is true that the largest industrial plants are also those with the best treatment plants. Although explicitly prohibited by law, diluting is an easy, cheap, and at the same time very difficult-to-detect compliance strategy.

Ninth, the Pollution Reduction Plan seems to have been successful in reducing BOD<sub>5</sub> levels in emissions. But the problem with this interpretation is that the period after-the-Plan coincided with a deep recession of the Uruguayan economy and this recession could be the explanation for the fall in the levels of BOD<sub>5</sub>, not the Plan.

Tenth, the enforcement actions of the Uruguayan authorities in controlling loads with respect to BOD<sub>5</sub> concentrations are not significantly different in their effectiveness, except that the probability of being inspected by SEINCO turned insignificant. The strategic behavior just described regarding the reports of BOD<sub>5</sub> concentrations did not seem to operate with respect to loads because the standards do not limit flows, so plants do not need to worry about them.

Eleventh, the monitoring and enforcement activities of the Uruguayan authorities do not seem to have any clear effect on the reported compliance status of industrial plants when only the intercept of the violation equation is allowed to differ during and after the Pollution Reduction Plan. When this is allowed, the probability of being inspected by the IMM negatively affected the probability of violating during the Plan, when the standards

were laxer, but positively affected it after the end of the Plan, when the standards got stricter and under-reporting became an important issue according to SEINCO samples. Also, the significance levels of the cumulative number of past inspections and fines performed by the IMM increased in this second specification, although the coefficients remained insignificant. However, one has to take into account that, because of the estimation technique, plants included in this regression are those that changed compliance status during the period at least once. Leaving aside plants that did not change compliance status in the whole period, either because they were always complying or always violating, with the latter the most common case, obviously biases upward the estimated effectiveness of the monitoring and enforcement variables. The conclusions on the effect of the monitoring and enforcement activities on the probability of being in violation are similar for the DCA.

Finally, and very interestingly, with the inclusion of interaction effects the Pollution Reduction Plan did not have any effect on the compliance status of firms. The result is important because the increase in the levels of compliance of industrial firms with effluent standards was the main objective of the program undertaken by the IMM with funds from the Inter American Development Bank. According to this result, the program failed to accomplish this.