

The application of economic instruments in environmental policy: the Brazilian case

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Summary: 1. Introduction; 2. Environmental policies; 3. The use of economic instruments in environmental policy-making; 4. Lessons and prospects.

1. Introduction

This paper surveys the Brazilian experience with market based instruments (MBI) in environmental policies. This section introduces the concepts of MBI and the Polluter Pays Principle (PPP). The next section describes the background and institutional framework of environmental policies in Brazil. The third section analyzes the Brazilian experience with MBI. The fourth section concludes with a discussion of the prospects for and the lessons of the application of MBI to environmental policies in Brazil.

The Polluters Pay Principle

Environmental externalities in production or consumption lead to market failures which, on efficiency grounds, justify government intervention in these economic activities. Traditionally, this intervention has been based upon on a command and control (CC) or regulatory approach: legislation set standards that are enforced by environmental protection agencies (EPA) and those who do not comply with them are subject to sanctions (OECD, 1989).

The alternative to CC approach is to use economic or market based instruments — charges, subsidies, tradeable permits, non-compliance fees etc. — to alter the price system in the direction required by environmental standards and objectives. Thus, individual costs and benefits as perceived in market prices are altered in such a way as to induce producers and consumer's towards an efficient use of environmental goods and services.

The essence of the MBI approach is the Polluter/User Pays Principle (PPP), which means the application of charges, taxes, or any other mechanism to make market prices reflect the actual scarcity of natural resources. In this way, economic agents will pay for the full social costs of the pollution or the depletion of natural resources they cause.

MBI can be implemented either via prices — through charges, tariffs, taxes, and subsidies, deposit refund systems etc. — or through market creating mechanisms — e. g. trade-

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Paper presented at Seminar on the Use of Economic Instruments in Environmental Policies, OECD, Paris, May 1992. Financial support from the Environmental Directorate of OECD is acknowledge. The authors are grateful to Carolina Dubeux and Armando Mendes, from Sosp, Fernanda Gabriela Borges, from Cobrape, Elias Mundim, from the DNPM, Suzi M. Santos, from the DNAEE, Mario Gaia, from Petrobrás, Lisbon A. do Nascimento, from Finance, Elizabeth Lima, from Feema, and Ana Lúcia Soares and Gustavo Albergaria, from Ipea, who helped them with the survey of legislation and data collection.

able permits and liability insurance (OECD, 1989). In the first case, MBI directly alter output and input prices to internalize environmental costs. The effects are to change relative prices and to generate government revenues.

In contrast, market creating mechanism are made via quantity or value restrictions. In the case of tradeable permits, for instance, the environmental authorities set up the maximum accepted level of resource degradation for all users and assign to each of them a portion of the total allowance. Users are then encouraged to trade their individual permits in specific markets under supervision of the authorities. Consequently, trade will take place according to each user's marginal abatement cost curve. In this case, government revenues can be raised from permit auctions, fees, or taxation of permit transactions.

The key argument in favor of MBI is that CCI require that environmental authorities acquire extensive and expensive information on the differences in abatement costs among producers and/or consumers (OECD, 1992). Otherwise, environmental standards are equally enforced on every economic agent, implying no incentive to get larger abatement control from those producers/consumers with lower abatement costs, and therefore, the same environmental quality could be achieved in a more cost-effective way.

Other advantages of MBI are, firstly, the continuous incentives for "dynamic efficiency", that is, to induce technological innovations which lead to the employment of cleaner (or less natural resource intensive) production techniques. In contrast, with CCI, once standards are met, economic agents are not stimulated to continuously develop cleaner technologies.

Secondly, government revenues generated by the government are less likely to be vulnerable to "regulatory capture" through bribery, corruption, and lobbying activities. These revenues are particularly important as sources of funds for further environmental actions.

Thirdly, MBI create opportunities to offset other economic incentives arising from sectorial policies programs which leads to unsustainable activities.

Finally, MBI allow the introduction of equity issues based on progressive taxation, charges, tariff and permit distribution where ability to pay is also taken into account.

Summing up, at least in principle, when compared to CCI, MBI represent an improvement in terms of static and dynamic efficiency, equity, as well as of revenue raising objectives.

Implementation issues

In principle, MBI should be set to equate the marginal abatement costs to marginal avoided damage costs. In practice, however, the application of this optimum rule is extremely difficult to implement. There are significant uncertainties about marginal damage costs and marginal abatement costs, due to the lack of knowledge with respect to the assimilative or carrying capacity of the environment, as well as to the response of economic agents to MBI. Moreover, in most cases, the costs of acquiring knowledge are prohibitively high.

As a consequence, to assure that pollution (or natural resources depletion) does not exceed legally accepted levels with the concern for cost-effectiveness, environmental policies usually mix MBI and CCI. In this way, ambient standards are (or should be) set for total emission and not for each individual polluter thus allowing that changes in total emissions are distributed among them according to abatement costs.

Mention should also be made to the fact that very few attempts have been made to introduce MBI purely on efficiency grounds. According to OECD (1991), the great majority

of the international experiences with MBI were made with the explicit purpose of raising revenue to finance or subsidize pollution control activities. Though this can be regarded as a step forward, it does not grasp the entire benefits of MBI in terms of efficiency.

The crucial requirement for both CCI and MBI is enforcement capability, which means, on the one hand, effective monitoring and clear criteria for identifying violations, and on the other, adequate administrative and judicial structures to ensure compliance (OECD 1992).

In terms of monitoring, one could argue that MBI present some advantage to the extent that it stimulates self-monitoring. In this way, charges are previously determined by EPAs and are afterwards modified only if a polluter can prove to have reduced his emission level.

The introduction of MBI, however, will certainly require additional technical capabilities from EPAs. Therefore, before radical changes are made, an adequate assessment of the environmental problem at hand *vis-à-vis* EPAs capability to control it should be carried out. Thus, for example, in cases where there are only a few polluters to be monitored and damage costs are high, CCI may prove to be preferred to the extent that expected gains from resources allocation are not that significant.

When introducing MBI it is also important to take account the existing tax burden in order to avoid conflicting interests in terms of both fiscal revenue, distributive and competitiveness effects. In this way, government agencies responsible for fiscal, industrial, trade and regional policies should be, as far as possible, integrated in the design of MBI.

Attention must also be paid to the public reluctance to accept the non-discretionary nature of MBI. Since CCI can be more easily overcome by lobbying activities and juridical litigations, they tend to be regarded as a more "flexible" instruments. In the same way, some environmentalist groups tend mistakenly to consider MBI as payments which give "rights to pollute or deplete". It should be reminded that MBI is intended to help enforcement of ambient standards, not their violation. Thus, through a mixed approach it is possible to assure the same ambient standards for total pollution or depletion with a distribution of individual emissions implying smaller abatement costs.

Another important issue is that a successfully designed and implemented MBI results in a rapid decline of the real revenue it generates since it will induce economic agents to reduce their emission or depletion rates by abatement or adoption of clean technologies. Therefore, where revenue raising is an important aspect for the monitoring and controlling activities of EPAs, MBI should charge emission levels lower than standards. In inflationary contexts, erosion of real values are equal for MBI revenues and those derived from the application of fines and fees of CCI. In both cases, the solution is price indexation of charges and fees.

2. Environmental policies

The policy background

The post-war Brazilian model of development is a typical case of import substitution industrialization. Growth strategies based upon protectionist trade policies penalized agriculture and exports. In recent decades, however, these activities were overcompensated by the generous subsidies granted to both of them.

Another important characteristic of the model is a strong government intervention both in the regulation of the economy and in the supply of goods and services.¹ The paternalistic character of government intervention implied perverse effects for efficiency, equity, and fiscal balance.

The policy framework was genuinely mixed. Industrial policies in particular, complemented MBI with a heavy reliance on a CC approach which included, among other instruments, state monopoly in some industries (energy and basic inputs), import licensing, export targeting, rationed access to government subsidies, and government procurement agreements.

Up to the 80s, the economy showed a quite successful growth performance. The costs, however, were an autarchic and inefficient industrial structure coupled with severe imbalances on the distribution of income, as well as on the spatial distribution of economic activity. Moreover, the growing fiscal imbalances led to the debt crisis in the beginning of the 80s and to the persistent threat of hyperinflation since then.

The demise of the military dictatorship in the mid-80s brought out with full strength repressed social demands. The latter overshooted in the Constitutional Reform of 1988 reinforcing some the paternalistic and protectionist traits of the economic order. The return to democracy also meant stronger pressures for political power decentralization and for new fiscal arrangements more beneficial to states and municipalities which embedded in the 1988 Constitution gave rise to enlarged fiscal difficulties.

Strongly resisted at first, only after the presidential succession of 1990 state divestiture and deregulation became accepted as necessary ingredients of the adjustment policies. The new Administration inherited the economy in a state of complete fiscal disarray, at the verge of hyperinflation, and took decisive measures to enhance a market based policy framework. Table 1 summarizes major initiatives in this way.

Despite the boldness of reforms, deregulation and state divestiture in the Brazilian case — differently from the OECD experience — is not a deep rooted political choice but results from the *de facto* recognition of government failure, as well as from the pressures exercised by multilateral institutions. To that extent, the issue is far from settled (Birch & Primo Braga, 1993). In particular because economic policies to eradicate hyperinflation will certainly require further strategic decisions concerning both the regulatory framework and state ownership.

Barriers affecting environmental policy

Concerning the environment, the most important outcomes of Brazilian model of development were, first, the extreme degrees of income concentration and poverty which accompanied the accelerated processes of industrialization and urbanization; second, the spatial concentration of economic activity which led to the emergence of severe urban pollution

¹ In 1980, the share of public enterprises in the gross value added was, approximately, 25 percent in basic raw materials, 95 percent in public utilities, 20 percent in transportation, 82 percent in communication, and 15 percent, finally, in the non-financial corporate sector as a whole. Among the 500 largest in the non-financial sectors of the Brazilian economy, in 1991, there were 80 public enterprises which represented 37.2 percent of gross revenues, 63.6 percent of net worth, and 75.6 percent of profits.

Table 1
Regulatory reform, privatization, and trade liberalization in Brazil, 1987-93

Regulatory reform:

- Most price controls (with exception of those applying to natural rubber and public tariffs) were eliminated.
- Air transportation, insurance, car dealerships, fuel commercialization were deregulated. In particular, fuel price differentiation within a 12 percent range was allowed; subsidies to alcohol were significantly reduced.
- Since the early 80s, the emphasis of agricultural policies has shifted from subsidies to credit and modern inputs to support prices. In relation to agricultural output rural credit decreased from 120 to 15 percent between 1979 and 1993. Fiscal subsidies and tax rebates to plantation forest were gradually abolished.
- Subsidies for domestic production of coal were gradually abolished in the late 80s and domestic content requirements were finally abolished in 1990.
- Financial markets, and in particular the access of foreign investors to capital markets, were liberalized.
- More than a 100,000 governmental decrees were revoked over the 1990-92 period.

Privatization:

- Since 1991, the value of privatization proceeds were US\$6.45 billion, figure which compares with the US\$76 billion of net assets which, in 1991, belonged to the 80 largest state owned enterprises of the economy. Major privatizations took place in the steel and petrochemical industries.

Trade liberalization:

- Average tariffs were 51 percent in 1987, 35.5 percent in 1989 and are scheduled to reach 14.5 percent by July 1993.
- Import permits were reduced from 4,441 to 1,165 items between 1987 and 1988. In 1990 they were completely eliminated.
- The requirement for company of sector-specific annual import budgets was eliminated in 1990.
- Market-reserve in the microcomputer industry was abolished in October 1992.
- Government monopoly of wheat imports was abolished (1990).

Source: Birch & Primo Braga, 1993, p. 122.

problems in São Paulo and a few other metropolitan areas. Finally, some of the strategic choices made in energy, exports, and regional development policies.

The outcomes above are at the root of major environmental problems in Brazil, and their implications for the design and implementation of future environmental policies are overwhelming. In addition to them, environment policies are also constrained by structural and cyclical features of the country. Chiefly among them are the legislative structure, the current Brazilian economic crisis, and the priorities and focus of environmental policies at the present stage.

Poverty

By any standard, equity problems and poverty incidence in Brazil are alarming. In 1989, the top 20 percent received 67.5 percent of total income, while the bottom 20 percent received only 2.1 percent. (World Bank, 1992). At least 22 percent of the population, in 1990, was below the poverty line (income was not sufficient to acquire the basic nutritional

requirements recommended by FAO). Obviously, in both cases there are important regional, and urban/rural cleavages (Peliano, 1994).

The most important environmental consequence of poverty in Brazil is, perhaps, inadequate housing conditions and the limited access to potable water, as well as to sanitation infrastructure. Urban encroachments in unhealthy or unsafe areas (like steep hills, riverbanks, shorelines, freshpond reserves etc.) increase significantly the risks of catastrophes and of dissemination of communicable diseases.

According to the 1991 Census at least 1 million households are located in “favelas” or shanty towns (IBGE apud *O Globo* 13-4-1993). At least 10 percent of the urban population have not potable water supply and only 34 percent are served by public sewerage system. Moreover, only 10 percent of the sewage discharged into the public system had installations for treatment. Drainage of solid wastes in urban areas was estimated to be 40 percent (Serôa da Motta, 1993a; Estache & Zheng, 1992; Gusmão & Branco, 1990). As a consequence, the infant mortality rate (per thousand live births) reached 58, far above the 34 observed for countries with similar levels of income per capita (World Bank, 1992).

Rural poverty and landownership concentration also have utmost environmental consequences. On the one hand, urban/rural per capita income differential causes the accelerated process of urbanization, and on the other hand, the limited access to landownership — in 1980, 80 percent of the farm area were owned by 10 percent of the farmers — is an important push factor of the agricultural frontier.

Poverty and income concentration impose severe restrictions on the design and implementation of Brazilian environmental policies. Above all because, confronted with widespread economic deprivation, authorities at different government levels tend to relegate environmental objectives — especially the green ones — to a low priority rank (World Bank, 1992).² Technically, the problem is how to determine the proper weight to be given to environmental vis-à-vis equity objectives.

Inequality and poverty tend to legitimate government interventions in the market mechanisms either through CCI or indirectly through taxes differentiation and price discrimination. Thus, poverty alleviation is often used as a justification of underpricing of and subsidies to goods and services directly provided by or under control of the government. Examples in case are preferential credit rates, public tariffs in electricity and water supply, prices of fuels, pesticides and fertilizers, as well as all kind of charges on the use of public infrastructure like transportation, and colonization projects.

This kind of intervention is, most of the times, detrimental to the environmental since they introduce incentives to inefficient uses of natural resources or to polluting activities. Moreover, to the extent that they benefit privileged segments, they tend to aggravate the problems they intended to solve, as well as to reduce the sources of government finance.

Urban concentration

Industrialization and urbanization were highly concentrated in the Metropolitan Area of São Paulo which, in 1980, had 8.5 percent of Brazilian population and 45 percent of

² It is interesting to note that according to Dunlap et al. (1993), Brazil gives very little salience to environmental problems.

the industrial value added in the country. In that same year, this area had 6,215 establishments with a high potential of air pollution and 9,364 with some potential of water pollution. As a consequence, the assimilative capacity of the environment in the area reached critical limits and São Paulo has experienced acute pollution problems.³

The velocity and the intensity of the environmental crisis in São Paulo — and in a few other metropolitan areas — required prompt actions and immediate results. The consequences for environmental policies were, on the one hand, the municipalization of the design, enforcement, and monitoring capabilities as concerns pollution control policies. On the other hand, the critical situation in specific areas pushed the balanced towards CCI, which are considered to be more effective instruments to deal with critical situations (OECD, 1993).

Sectorial conflicts

Brazilian development was largely based upon road transportation which, at present, is responsible for 75 percent of total volume of shipped goods. In addition to pervasive subsidies to motor fuel, the use of road of infrastructure is, with very few exceptions, free of charges.

The oil crisis, in the 70s, led Brazilian policies to overshoot in the direction of self-sufficiency in energy which, since then, became a permanent strategic objective. Major policy instruments were the massive public investment programs in the production of oil, hydroelectricity, and nuclear energy, which were coupled to the subsidies to all kinds of domestically produced energy.

The results were the increase in the share of the domestic supply of oil from 20 to 55 percent, mainly due to deep offshore production; the significant expansion in hydroelectricity generation; and the successful alcohol program which led the share of alcohol-fueled vehicles to reach 90 percent of car sales by 1990. The ambitious nuclear program, however, up to the present, failed to bring effective results.

Closely associated, Brazilian export promotion policies were heavily based upon subsidies to energy (e.g., electricity in the case of aluminum) and to natural resources intensive inputs (e.g. iron ore for steel, wood for pulp and paper, and nafta for petrochemicals etc.).

Broadly speaking, despite the lack of environmental concern, these strategies resulted in the containment of fossil fuel combustion at relatively small costs in terms of natural resource depletion. However, there are significant economic costs derived from both the inefficient allocation of energetic resources and its implications for the public sector deficit.

For the future, environment management, and in particular, the role to be played by MBI, will be strongly conditioned by the strategic choices made in relation to deregulation, trade liberalization and privatization in the energy sector.

As an illustration, the environmental management of oil activities, as well as the ability of MBI to control them, will depend, among others, on the choices between state monopoly versus competition in oil supply, and between imports versus domestic oil production (Rodrigues & Dias, 1994).

³ Serôa da Motta (1993a and 1994) presents estimates of health costs associated with water and air pollution in major urban areas in Brazil.

Finally, since the mid-60s, regional development policies stimulated the settlement of the Amazon region through a plethora of fiscal and credit incentives to agriculture, industry, and mining. Since the 1970s, growth rates of regional population were 4.1 percent p. a. and at least 30 million hectares of tropical forests were cleared (Reis & Margulis, 1991; Schneider, 1992; and Serôa da Motta, 1993b).

In recent years, these regional incentives were drastically curtailed due to the imposition of environmental restriction in their implementation, but also to the emergence of the fiscal crisis of the country, and closely related, to its economic stagnation.

In a eventual recovery, however, the open access to natural resources of the Amazon region will make the implementation of a sustainable development strategy extremely difficult. Major environmental problems derive from global externalities which are of little concern for local and regional interests. This is complemented by the complete lack of enforcement ability for both MBI and CCI.

The constitutional constraints

For various reasons Brazilian environmental policies are biased against MBI. Among them, juridical reasons go back to the Roman Law tradition where Brazilian constitutional principles are deeply rooted. In contrast with the Common Law, the Roman tradition confers a more limited constitutional role to the notion of economic rationality and efficiency.

Illustrative in this way is the treatment of damages to the environment as unbailable crimes which appears in the Brazilian constitution. This is anathema to the concept of the Polluters Pay Principle, notwithstanding the fact that the NEP "obliges polluters to compensate damages caused to the environment".

MBI are also circumscribed by the constitutional principle that only one tax can be imposed on a given transaction. The way out is the creation of fees for environmental services but they are subject to legal claims, and closely related, the values of rates charged are much more restricted.

The fiscal crisis

The second kind of constraints are those imposed by the present Brazilian economic crisis. Inflation and the need of fiscal adjustments severely restrict the ability of federal and local governments to make the additional current and capital expenditures required to design and to enforce the new policy instruments of environmental policies.

Table 2 presents evidence on the evolution of the federal government outlays on sanitation and environment protection up to 1991. Figures show the significant oscillation of these outlays in real values, in per capita terms, or as percent of GDP. They also show a drastic decline in more recent years, though there are evidences that, in 1992/93, ambitious clean-up programs in the Tietê River Basin, and Guanabara Bay, with significant sanitation component were initiated. It should be noted that the share of sanitation expenditures is more than

90 percent of the total. Finally, despite some growth in outlays, from 1990 to 1991, Ibama's budget was cut from US\$270 million to US\$106 million (Estache & Zheng, 1992).

Table 2
Federal government outlays on sanitation and environment protection, 1980-91
(values in 1991 US\$ billion)

Year	Value	1991 US\$ per capita	% social outlays	% of GDP
1980	1.37	11.3	15.6	0.33
1981	1.73	14.1	20.1	0.44
1982	1.61	12.8	18.3	0.38
1983	1.15	9.0	16.6	0.30
1984	0.71	5.4	10.5	0.18
1985	1.36	10.2	16.4	0.31
1986	1.20	8.9	14.0	0.25
1987	1.83	13.2	14.6	0.40
1988	1.64	11.7	14.0	0.38
1989	1.11	7.7	8.8	0.24
1990	1.02	7.0	9.6	0.25
1991	1.21	8.1	13.2	0.29

Source: Ipea/CPS apud Afonso, 1993.

Other consequences of the long lasting fiscal crisis are the complexity and "tax saturation" of the Brazilian tax system which counts more than 50 different taxes, and closely related, shows record high levels of tax evasion. These failures push current proposals for amendment in the national tax code towards simplification of the tax structure (fewer taxes and brackets) and administration, as well as to a non-discretionary enlargement of the tax base. To that extent, the creation of new taxes with environmental objectives are unlikely, in particular because their enforcement is relatively complex and apparently discriminatory. However, environmental considerations penetrate some tax proposals which will be discussed in the last section of this paper.

High inflation is another important hindrance to the introduction of MBI for environmental purposes. The main reasons are the variability and uncertainty it brings to the effects of charges and taxes on relative prices, as well as on the real budgets of EPAs. The real value of charges and taxes — most especially of the specific ones — is eroded depending upon the indexation rules to which they are subject to, as well as upon the collection lags of government charges and taxes. To a large extent, therefore, inflation undermine both the allocative and revenue raising effects of MBI.

The legal and institutional framework

The conscious design and coordination of environmental and natural resource policies in Brazil started in 1973 with the creation of the Special Secretariat for the Environment (Sema) at the Ministry of Internal Affairs. Before that, different government agencies with diverse objectives implicitly formulated and implemented environmental policies in an un-

coordinated way. The legal and institutional framework established since 1973 is briefly described below (World Bank, 1992; Serôa da Motta, 1991; and Davies, 1993).

During the 70s, pollution control laws were adopted and several state environmental agencies (Sepa) were created. Legal consolidation was made in the National Environment Policy (NEP), Law n^o 6.938, of August 31, 1981, which defines the objectives, priorities, guidelines, instruments, and duties of environmental policies.

The formulation and coordination of NEP is assigned to the National Environment System (Sisnama), composed by representative of all ministries, Sema, and also by an advisory and deliberative council (Conama) where participation is open to delegates from the states, worker unions, and NGOs, among others. Sinasma effectively started to function in 1984, when Conama had its rule first set up.

The Brazilian Institute of the Environment and Renewable Natural Resources (Ibama) was created as the executive agency of Sema, in 1989, bringing together the functions, resources and responsibilities of the Brazilian Institute of Forest Development (IBDF), the Superintendence of Fishery Development (Sudepe), the Superintendence of Rubber (Sudhevea). In 1990, Sema got full institutional and budgetary autonomy as a secretary directly linked to the Office of the President. Finally, in 1994, it became the Ministry of Environmental and Legal Amazônia (MMA).

In broad lines, the distribution of responsibilities in the implementation of the National Environment Policy among the different government levels is informally made as follows: Ibama, in addition to the duties related to budgetary and policy control issues (like license concession, standards setting, monitoring, and coordination), is mainly responsible for the renewable natural resources issues, in particular the Amazon ecosystems; state agencies for water pollution issues; and municipal agencies for drainage, solid waste and noise and air pollution issues.

Finally, mention should be made to the changes of environmental and natural resource legislation brought about by the 1988 Constitution. Thus, the possibility of making firms liable for environmental damages and of prosecuting managers on these grounds was introduced as a constitutional principle. Analogously, damages to flora and fauna were recognized as unbailable crimes. Finally, some ecosystems — like the Amazon rain forest and the Pantanal — are declared national patrimony, and as such, are subject to specific legislation in what concerns environmental preservation under direct jurisdiction of the Conama (Law n^o 7.804, 18-7-1989).

CC instruments

Up to the present, environmental policies in Brazil have relied almost exclusively on the command-and-control (CC) approach with little attention paid to the costs and the capacity of environmental agencies to enforce them (Margulis, 1993). Thus, the main policy instruments distinguished in the NEP (Law n^o 6.938, 31-8-1981) are environmental standards, environmental zoning, license requirements based upon environment impact assessments.

NEP relies also on fines and compensations, but there are very few environmental or natural resources policy areas which make effective use of them or any other MBI. Section 3 will discuss in greater length the pioneer experiences in the application of MBI to control water pollution and to preserve forest areas. It will be shown that, even in these cases, MBI

were usually introduced for non-environmental reasons and are applied with little concern for economic efficiency.

Zoning and licensing

Zoning and licensing are the main instruments of natural resource policies in Brazil, in particular when dealing with agrarian land use, forest and biodiversity preservation. They are also proposed as major instruments for coastal zone management and marine life preservation, though legislation in this way is still incipient (the Coastal Management Law dates from May 16, 1988). Finally, they have been widely used as instruments in the environmental management of urban areas.

Licensing from Ibama is required for forest-clearing, as well as for the economic exploitation of forest areas in private properties. In addition, there are regulations applied to logging, lumbering, and to the industrial uses of charcoal and firewood, which requires that natural forests used to generate forestry raw material should be replaced by equivalent areas of newly planted or managed forests. Large industrial consumers in particular are required to implement forest management plans (Pifi) to guarantee self-sufficiency in their consumption of forestry raw material within a given timetable (Forest Code 1965 and Decree n° 97.628/89). Specific regulations on targets, deadlines, and on exemptions keep continuously changing. At present, clearing without reforestation is allowed for small consumers subject to fines equivalent to the costs of planting four new trees per cubic meter of log (or six per cubic meter of charcoal). This is a movement towards MBI of questionable effectiveness, as will be discussed in section 3.

Zoning regulates the use of privately owned natural resources, as well as those under public domain in agrarian contexts. Thus, specific areas inside private properties (river springs and margins, vegetation in steep hills etc.) are considered by law as ecological reserves or areas of permanent preservation. The Law also requires that, at least, 20 percent of private properties (50 percent in the Amazon Region) should be publicly registered (Law n° 7.803, 18-7-1989) as areas of permanent forest cover preservation.

In addition, to regulate the use of natural resources in both private and public domain areas, the federal, state, and municipal government can create conservation unities, that is, integral areas where natural resources are preserved by strict regulations on the kind of economic activities allowed. Mention should also be made to the specific body of legislation dealing with Indian areas which has important implications for economic-ecological zoning.

Table 3 presents evidence on the distribution of conservation unities according to their government jurisdiction both in Brazil and the Amazon Region. The figures show that the great majority of these areas are under federal jurisdictions. They also show that, in terms of area, they concentrate in the Amazon Region. Though legislation dates back to the 30s, most of the conservation unities were established after 1980

The recent expansion of the conservation unities is, particularly in what concerns the Amazon ecosystem, a recognition of the market failures inherent to the open access to the natural resources of the region. The environmental policy implications are a stronger government role with heavy reliance on command and control instruments, in clear contrast

with the emphasis placed on private property and market incentives by the regional development plans of the 60s and 70s (Nascimento, 1992).

Table 3
Number and geographic area of conservation unities, Brazil and Amazon Region
according to the level of government jurisdiction, June 1990

	Brazil			Amazon Region		
	Nº	Area Km ²	Geog. area (%)	Nº	Area Km ²	Geog. area (%)
Federal	167	448,062	5.26	76	413,529	8.27
State	218	38,195	0.45	7	25,872	0.52
Municipal	40	179	...	-	-	-
Private	4	765	...	-	-	-
Total	429	487,201	5.72	83	439,401	8.79

Source: Bacha, 1992, p. 346.

Note: Indian areas or conservation unities based upon cultural or historical patrimony are excluded. Amazon Region includes the North Region, Maranhão and Mato Grosso. ... = negligible.

In terms of effective results, both licensing and zoning of natural resources are, up to now, disappointing. The explanation lies on the institutional failures related to the lack of government administrative capacity in what respects monitoring, enforcement of regulations, prosecution, and punishment of violators.

In what concern Conservation Unities these problems are reflected in the lack of fiscalization and management plans, as well as the delay of governments to regulate property rights, which make the legislation irrelevant for all practical purposes. Thus, in the past, some unities were *de facto* extinguished by the inability of governments to regulate the private uses of agrarian lands, when not government uses themselves as in the case of the hydroelectric projects of Paulo Afonso and Sete Quedas (Bacha, 1992).

With growing environmental policy awareness, it is expected that conservation unities will be more effective in the future. Administrative costs, however, are not negligible. Thus, estimates of investments (including land acquisition) to implant 279,646km² of the existing federal conservation unities in Legal Amazonia are US\$374 million and of the costs of annual maintenance are US\$17.8 million (Funatura, 1992).

Environmental Impact Assessment

Environmental Impact Assessments (EIA) in Brazil are a constitutional requirement imposed for licensing new investment projects with potential effects on the environment. The regulatory power is delegated to state environmental agencies.

The introduction of legislation on EIA in 1986 is a landmark of environmental management in Brazil. A large part of the Brazilian corporate sector — in particular government enterprises — were first exposed to environmental issues by the requirement of EIA (Serôa da Motta, 1991). Another beneficial spin-off from EIA was the emergence of a market for environmental consultancy and the consequent creation of some technical capability in environmental issues.

In terms of specific objectives, however, results are considered frustrating. Up to the present, except for a few big investment projects, EIA have been mere bureaucratic require-

ments with no effective result in terms of assessment, monitoring, valuation, and mitigation of environmental impacts (Agra Filho, 1993).

Though EIA are essentially CCI, their requirement by the government agencies responsible for fiscal and credit incentives could make them a powerful complement to MBI. Up to the present, however, this kind of policy coordination is completely absent in the Brazilian institutional context.

Finally, the systematic information provided by EIA — in particular those necessary for the valuation of environmental impacts — can become important subsidies for the design of MBI.

Despite the frustrations with EIA, proposals for even more ambitious legislation requiring environmental auditing for any firm and/or activity with significant environmental impacts have been recently submitted to the Congress.⁴

Priorities of environmental policies

Finally, there are obvious reasons related to the present priorities and focus of environmental policies in Brazil. The emergence of environmental concern and policy awareness are fairly recent trends in Brazil. Given the lack of knowledge concerning the natural resource base of the country and its urban environmental problems, ecological zoning and environmental standards setting are necessary steps to lay the foundations of environmental policies, no matter the approach adopted. Further developments towards MBI will also require a more sophisticated institutional arrangement enhancing intra and intergovernmental linkages.

3. The use of economic instruments in environmental policy-making

The use of MBI in Brazilian environmental policies is still restricted to a few areas where they have played limited roles. The important pioneer experiences are forest preservation and water pollution. In both cases, however, MBI were used with revenue raising objectives with practically no concern for the incentive effects (Margulis, 1992; and Serôa da Motta, 1991).

The lack of incentive purposes imply that charges or taxes are not determined on the basis of net marginal abatement costs. Therefore, they do not stimulate efficiency in the use of natural resources. In addition, when dealing with both pollution and natural resources preservation, charges are usually set as complements to regulation without replacing individual emission standards and their administrative requirements. On both counts, the benefits of MBI are not exhausted.

Table 4 presents summary information on the most important economic instruments currently implemented or under discussion in Brazil. As can be seen, most of them are fairly recent and their objectives are to recover the costs of sewer services supply, to finance river basin authorities, to generate funds to subsidize programs of pollution control or to compen-

⁴ Interesting enough, according to a recent survey made by Boucinhas e Campos Consultores, a significant proportion of large corporations (9 out of 23 with annual sales higher than US\$200 million) in Brazil have already adopted environmental auditing as part of their management routine. And more so, the most important motivation is the attempt to anticipate environment legislation. (*Gazeta Mercantil*, 11-4-1994.)

sate municipalities and states for the administrative costs of environment management. A more detailed description of each of these instruments is made along this section.

Table 4
Charging natural resources uses in Brazil

Instruments	Current status	Estimated revenue in 1993 (US\$ million)	Expected revenue (US\$ million)	Purpose
Water charges in river basins for volume and pollution contents:				to finance water basins and rationing water resources
• nation-wide	• under discussion on the federal Congress	-	unknown	
• São Paulo state	• to be implemented in 1995	-	197	
Industrial sewage tariff based on pollution contents:				for cost-recovery of sewage treatment stations
• São Paulo state	• partially implemented since 1981	13	-	
• Rio de Janeiro state	• implemented since 1986 and ceased in 1994	3	-	
Pollution tax on air and water pollution in Rio de Janeiro	• under discussion in the state legislature	-	3	to finance the state EPA
Financial compensation due to natural resources exploitation:	• fully implemented since 1991			to compensate municipalities and states where production takes place and also the environmental regulation agencies
• hidroelectric generation		315	-	
• oil production		97	-	
• mineral (except oil)		41	-	
Fiscal compensation for preservation areas (water supply and ecosystems areas):				to compensate municipalities for land use restrictions
• São Paulo state	• implemented in 1994	-	19	
• Paraná state	• implemented since 1992	53	-	
• Rio de Janeiro state	• under discussion in the state legislature	-	55	
Deforestation taxes:				
• Federal Forest Re-position Fund paid by users without reforestation activities	• implemented since 1973	7	-	to finance public reforestation projects
• Forest tax in Minas Gerais paid by users of forest products	• partially implemented since 1968 and fully revised and implemented 1994	not available	-	to finance governmental activities on forest policy

Pollution and water resources management

The international experience shows that "water quality policy is one of the few environmental policy fields where economic instruments have played a relatively strong role" (OECD, 1992). Thus, user charges for waste water collection and treatment are well established in several OECD countries where they have been fairly successful in controlling oxygen-demanding substances.

The Brazilian experience is no exception. MBI have played a relatively strong role since the inception of water resource management systems. The most important examples are, first, the industrial sewerage tariffs introduced by several states to control water pollution; and second, the institutional format of river basin authority currently under discussion, where charges on water user are explicitly proposed as the basic policy tool. Though the legislation on river basins is not yet fully implemented or even approved, it is worth reviewing the current proposals.

Industrial sewerage tariffs

Industrial sewerage tariff based on pollutant contents was introduced for the first time, in 1983, by Sabesp — the water and sanitation company of São Paulo. In 1993, total revenue collected with sewerage tariff in São Paulo was approximately US\$13 million.

Up to 1990, for large industrial firms, the tariff was a negotiated service charge for the water treatment provided by Sabesp. In 1991, only 95 firms remained under this contractual arrangements. The average revenue per firm at pollutant content tariff was US\$11,600 whereas in volume tariff this figure is US\$570. The share of this sample of firms in total revenue was, approximately, 10 percent.

The figures above show the financing advantages of effluent charges over common tariffs. Sabesp acknowledges that the system expansion was halted mainly due to the lack of investment in treatment stations which justify the service charge. Without treatment Sabesp cannot offer services where pollution is the key parameter for charges (only for collection, volume is the parameter for charges). Another problem was that firms' obligation to subscribe to the system were not clearly specified by laws, thus allowing litigations.

Though cost-recovery tariffs do not assure desirable abatement behavior, the São Paulo experience showed some gains in this way. Though only a few cases were analyzed, Migliano & Harrington (1984) estimates show that pollution coefficients per unit of output have dropped significantly. An unexpected consequence was the revenue reduction undermining the intended cross-subsidy from industrial to domestic water treatment. Thus, even in the case of cost-recovery tariffs, it is necessary to evaluate the abatement cost curves in order to estimate the pollution responsiveness to tariffs which will ultimately determine the resulting tariff revenue.

The new legislation, introduced in 1990, extends the system to 1,200 firms in the Tietê Basin and avoids some of the legal loopholes. The charge is a component of the water tariff based upon volume of discharge and the average effluent by sector. Part of tariff revenues is now diverted to Cetesb — the state EPA — to compensate her for the monitoring costs.

In the new system, firms are compelled to connect their discharges into Sabesp systems. This provision will certainly reduce the effectiveness of the tariff as an incentive to pollution control since more efficient abatement technologies within the plants will not be allowed. Moreover, firms are reluctant to accept the restrictions and litigations are likely to happen.

In 1986, industrial sewerage tariffs were also introduced in the state of Rio de Janeiro. The tariff was applied to 400 firms and revenue collection was almost US\$3 million, in 1993, which represents approximately 1 percent of total receipts of the state sanitation company. In this case, the additional related to pollution contents in effluents was also charged above certain limits on BOD and suspended solids, and 35 percent of the resultant revenue is dedicated to the budget of Feema — the state's EPA. In 1994, however, the charges ceased to be collected for political reasons.

Finally, pollution charges similar to São Paulo are being proposed in the states of Paraná and Minas Gerais.

River basin authorities

The proposition of a river basin approach in Brazil started in 1978 with the creation of the Special Committee of Joint Studies on River Basins (CEEIBH — Comitê Especial de Estudo Integrado das Bacias Hidrográficas), and later on of the Brazilian Association of Water Resources (ABRH — Associação Brasileira de Recursos Hídricos) comprising all agencies related to water services in Brazil. Other developments, since then, were the organization of executive commissions of several river basins.

In 1989, legislation on the National System of Water Resource Management (Singreh — Sistema Nacional de Gerenciamento dos Recursos Hídricos) was for the first time proposed to Congress where its approval is still under discussion. Recently, in June 1993, the proposal was drastically reformulated and resubmitted to the Congress (Project Law n° 2.449-A/91).

The current version of the proposal is based upon the French model of water management. Thus, Singreh will be hierarchically organized in one national council composed by an intersectoral committee and three hydrographic region committees. To the latter are subordinated an indeterminate number of river basin committees which are the basic units of water resource management, and as such are autonomous to create their own financial agencies.

Concerning policy instruments, the proposal emphasizes the need to apply the Polluter Pay Principle at all levels of the system. Thus, charges on water quality and quantity are proposed for the users of a river basin, as well as for water discharges of tributary river basins. In addition, the proposal determines that the costs of investment on infrastructure are charged in proportion to net benefits. Finally, the financial feasibility of the system is assured by the royalties paid by the hydroelectric companies which are equivalent to 6 percent of their operational revenues (Law n° 8.001, 13-4-1990).

As it stands now, the proposal seems to be excessively ambitious in the sense that it tends to neglect the incentive and moral hazard problems brought by the public good character of water basin investment projects, as well as by the transboundary pollution problems caused by tributary rivers.

The river basin approach to water resources management together with MBI were also introduced into several state constitutions. Once again, the implementation is much more advanced in São Paulo than at the federal level or in any other state. The main reason is the critical level of water availability and quality in São Paulo, which led to the early experiences with municipal consortia to manage common water resources. Furthermore, in the recent loans to environmental and sanitation programs obtained at the IBRD and IDB, the state of São Paulo had to comply with conditionalities in this way.

São Paulo state Law nº 7.663, with implementation due in 1995, is the most comprehensive legislation in Brazil with respect to the use of user charges for water resources management. Charges are introduced in two ways: first, as payment for the physical consumption of water, which will vary according to availability and final use; and second, as payment for the quality of effluents discharged, which will vary with the assimilation capacity of the watershed. Thus, the polluter or user pays principle is applied both through quantity and quality parameters in charges.

Total revenue with water charges are expected to reach US\$200 million (Fundap, 1991). The revenues from these charges will be part of Fehidro (State Fund of Water Resources), which will also raise financial resources from loans and governmental credits. Resources from Fehidro will be applied according to the state plan of water resources on sanitation and other water protection investments. At least 50 percent of the revenue collected in a basin ought to be invested in the same basin.

As a market-oriented policy, the effectiveness of Law nº 7.663 is likely to be constrained by political and institutional conflicts, the regulatory framework, and by government revenue objectives. Thus, the strong role of the state in defining institutional arrangements and priorities may face political reactions from municipalities which have already consorted to manage their water basins. This is certainly the case of the Piracicaba Consortium, which covers a highly developed region where important water sources are located.

Concerning to regulatory constraints, in addition to charges, the Law requires compliance to norms and standards. It is not clear, however, whether charges will be levied on emissions exceeding standards or only emissions below the standard levels can be levied. In the former case, polluters may claim pollution rights, whereas the latter case may come about as the pay-twice dilemma. Whatever the regulation finally imposed, the requirement will be a restriction on the effectiveness of the proposed economic incentive.

The imposition of emission standards does not allow that polluters fully perceive the price signal of charges since compliances are compulsory at plant level. A possibility to avoid this setback is the definition of pollution allowances, i.e., emissions not subject to charges, and compliance to water quality standards to be achieved in the basin as a result of the charge level.

Finally, revenue raising objectives are likely to constrain the effectiveness of charges. Funding objectives have high priority in Law nº 7.663 since Fehidro will be the main source of investments on water resources in the state. Thus, given the state budget problems, it can be expected that charge levels may reflect revenue raising purposes rather than incentive mechanisms. Therefore, policy makers will not account the economic agent's behavior and, consequently, will not grasp all advantages of market-based instruments.

The pollution control tax

The pollution control tax currently under discussion in the state legislature of Rio de Janeiro (Project Law nº 683/91) is, perhaps, the best illustration of a charge with revenue generation objective. The Law is specifically aimed to generate revenue to cover the costs incurred by Feema (the state EPA) in the monitoring and enforcement of both water and air pollution control. As in the case of the industrial sewerage tariff previously mentioned, this Project Law faces a strong local political opposition, since environmental control in the state is regarded as a serious threat to the fragile economy of Rio de Janeiro.

According to the Project Law, the pollution control tax will be imposed on water effluents from domestic, commercial, industrial and agricultural sources, as well as on residual gases from industrial plants. Tax revenue will be collected by Feema and will be earmarked to this agency.

A numeraire denominated as pollution unit (UP) measures the tax base in each source of pollution. For each pollutant is assigned a number of UPs and the resultant sum up of these units multiplied by its monetary value represents the total annual tax payment incurred by the polluter to be collected in 10 monthly installments. Those with less than 50 UPs are exempted from taxation. The law also allows reductions in the tax burden during the implementation of abatement investments. The UP value is fixed in indexed currency and together with coefficient of UP per pollutant it can be changed every five years to allow for the technological and environmental innovations affecting the activities of pollution control.

There is no explicit criteria determining the UP per pollutant and its monetary value. However, the underlying criteria is to generate adequate funds to Feema and, therefore, the proposed UP values will be determined in accordance to budgetary needs of this agency, which is around US\$3 million per year. There is no mention in the project to use the tax as an incentive instrument to change polluter's behavior. As long as the revenue meets Feema needs, the tax will be satisfactory.

Preservation of natural resources

Although tropical deforestation and the destruction of major ecosystems are major environmental concerns in Brazil, the concept of valuation of natural resources through market mechanisms is rarely applied in Brazilian environmental policies. Policies to stimulate sustainable use of forest resources are mainly based upon CCI, where the most important examples are zoning, in particular conservation unities, and the regulations on the industrial use of forestry raw material.

Usually designed as complements to the CCI there were a few timid attempts to introduce economic instruments dealing with incentives/compensations to the preservation/depletion of natural resources. In this way, two different kinds of instruments could be distinguished.

The first kind is the application of deforestation tax to the unsustainable uses of forestry made by the private sector. In this way, two experiences deserve attention. The first one, so far considered unsuccessful, is the Federal Forestry Reposition Fund collected by Ibama — the federal environment agency. The other experience, carried by the state of Minas Gerais, is a charge on forestry products collected in order to finance the activities of IEF — the State Institute for Forestry — but which has been partially successful as an incentive to reforestation.

The second kind of instruments refers to incentives/compensations to the conservation/depletion of natural resources by local governments, either at state or municipal level. The Brazilian experience shows, at least, two examples in this category. Thus, since 1989, the payment of financial compensation or royalties for the use of natural resources — which includes water for hydroelectric generation, oil and other minerals as well — was established by Federal Law. Other important initiatives taking place in the states of Paraná, São Paulo, and Rio de Janeiro, in the last two years, were the establishment of fiscal incentives to municipalities where land use is restricted by preservation unities.

The environmental implications of these two policies are radically different. In the case of royalties, payments are just a compensation to enhance municipal and state government budgets with no attempt whatsoever to induce changes in the patterns of natural resource use. In contrast, fiscal compensations are expected to bring incentives that will induce municipalities to carry on environmental sound activities, thus preserving this additional source of income.

The forestry reposition fund

Since 1973, Brazilian Institute of Forestry (a department of Ibama today) relaxed regulations, allowing that consumers which used less than 12.000m³ of forest raw material per year had the option to pay a deforestation charge instead of investing in reforestation. The value of the charge is approximately US\$4 per m³ of wood for all regions and/or species. Though indexed to inflation, charges did not take account of the real increase in costs of reforestation. In 1993, revenue generated were US\$7 million.

The rationale for the introduction of charges were the prohibitively high costs of monitoring small reforestation projects. Furthermore, economies of scale in forestation made small scale plantation unprofitable, and therefore, deforestation charges amassed in government funds could be a more efficient and more equitable way to make forest reposition.

The charge was conceived as a compromise solution between minimizing enforcement costs and an economic incentive to curb deforestation. The latter purpose, however, was never satisfactorily achieved. The main reasons are the enormous possibilities of fiscal loopholes and evasion brought by the discrimination between original/planted forests, and between small/large industrial consumers of forestry raw materials. On top of that, charges rates are too small to induce change in the behavior of forestry activities. Thus, one can hardly find evidence of investment in reforestation.

Finally, funds raised from this contribution have been mostly used to alleviate Ibama's budgetary problems rather than in reforestation activities. In this way, Ibama's incentives have been distorted towards bureaucratic cadastering of forestry activities, instead of environmental control. Recently, however, the government allowed to divert part of these funds to states and NGOs willing to invest in forestry activities.

Forestry tax in Minas Gerais

Since 1968, the state of Minas Gerais has applied forestry tax in order to finance the monitoring and police activities of IEF — the State Forest Institute. Taxation is exercised on all kinds of forestry products — from logs and firewood to roots and seeds — consumed or transformed in economic activities. Deforestation, even when legally undertaken, is also subject to taxes. Tax rate was originally set at 3 percent of the value of forestry products and is collected by the State Treasury Department.

For 10 years, the forestry tax was subject to litigations based upon the argument that together with the ICMS they characterized double taxation. As a result, tax rates were defined as percentages of an indexed currency varying according to each type of forestry product. Furthermore, reductions up to 50 percent of tax due are granted if forestation activity is sufficient to generate forestry production equivalent to consumption levels. These changes made forestry tax more acceptable and more flexible since, by merely changing percentual,

it is possible to penalize certain activities. Note also that they practically turned the tax into a deforestation tax.

In December 1993, charcoal and firewood from native forest, important sources of deforestation in the state, were heavily charged — respectively, four and five times as many as in the last list whereas other items' values have only doubled. It is expected that reforestation activities will be significantly stimulated in the current plans for raw material supply.

Finally, it should be mentioned this tax was primarily conceived as a cost-recovery instrument. Its use as an economic incentive is a matter of political will currently prevailing in the state and the determination of tax levels is still made in *ad hoc* basis without detailed modeling about economic agents reactions.

Royalties on natural resources

According to Federal Law nº 8.001/90, which redefined the level of compensations to be paid, as well as the distribution of revenue among beneficiaries, the financial compensations for the use of natural resources are defined as follows:

(a) hydroelectric generation and oil production — compensation equivalent respectively to 6 and 5 percent of the electricity and oil production value;

(b) other minerals — compensation equivalent to 3 percent for aluminum, manganese, *salm-gema* and potassium; 2 percent for iron, fertilizers, coal, and other mineral substances; 0.2 percent for stones; and 1 percent for gold over the net receipt resultant from their production.

As shown in table 4, these compensations are significant. In 1993, they reached US\$315 million for hydroelectricity, US\$97 million for oil, and US\$41 million for minerals.

The distribution of royalty revenues is 45 percent for states, 45 percent for municipalities where production takes place; the remaining 10 percent are allocated to the governmental agencies concerned with the specific activities. Thus, in the case of hydroelectricity, approximately 2 percent of the revenue will be used to finance the Singreh — National Water Resources Management System.

Theoretically, at least, revenues from royalties should be invested to create capital stock equivalent to the depleted natural resources giving rise to the royalties. There is no doubt that royalty proceeds improved state and municipalities budgets and, consequently, increased the supply of public goods. In this way, however, two points should be kept in mind. First, there is no restriction or norm on the use of royalty revenues, and therefore, no guarantee that investments rather than current consumption will be financed. Second, royalty rates were not based upon economic criteria which take account of user cost or depletion rate. There is always the danger that royalty rates will be kept constant no matter what happens to the depletion or degradation patterns in the future.

Fiscal compensation for preservation

Fiscal compensation to municipalities where protection unities and/or water supply sources are located are now implemented by three states in Brazil — Paraná, São Paulo, and Rio de Janeiro.

In Paraná, since 1992, 4 percent of the revenue collected with the ICMS — a state value added tax on goods and services — are diverted to municipalities with restrictions in their land use due to the need to protect ecosystems or water supply sources. In 1993, 112 municipalities were entitled to this compensation, which amounted to US\$53 million.

The distribution of the compensation allowance is made according to water quality indicators, as well as to the importance of protection areas in terms of their size and degree of restriction they are subject to. In addition, the state EPA evaluates the compliance of these municipalities with the required environmental quality in these areas to determine the final amount to be paid. The implementation is still incipient, but it has already stimulated several municipalities to consider activities more appropriated to their natural endowment as, for instance, ecotourism.

In São Paulo, legislation similar to the state of Paraná was approved in 1993. Compensations are equivalent 0.2 percent of the ICMS revenue, and are paid for both areas of ecosystem protection and of hydroelectricity generation. In 1993, compensation revenues amounted to US\$19 million. Given the small magnitudes involved, significant impacts are not expected. However, proposals for increased incentives are under discussion in the state legislature.

In Rio de Janeiro, a similar legislation was submitted to the State Legislature, in 1993. The proposed percentual rate is 2.25 percent of the ICMS revenue. In 1993, that would amount to US\$55 million. The distribution criteria are designed to foster the preservation of ecosystems and water supply sources, as well as the implementation of municipal environmental planning.

4. Lessons and prospects

Despite significant progress in recent years, Brazil is still lagging in terms of both environmental management and the use of MBI. Some topical comments were already made throughout the paper. In this section, the discussion is restricted to what is considered to be the broader issues surrounding environmental policies and the use of MBI.

The first and most important point to emphasize is the need of convergence, that is, to make environmental policies through MBI. Given the vastness of the country, the diversity of her natural resources, the severity of her environmental problems, and the scarcity of her enforcement capability, MBI will surely have to play a crucial role in the implementation of successful environmental policies.

On the objectives of environmental policies

Up to the present, the use of MBI in environmental policies in Brazil was made with the sole objective of raising revenues. This limited role — acknowledged even in the industrialized countries — should not be taken as a problem, in particular if revenues are used to finance public investments and government programs related to environmental management.

Indeed, it can be seen as a necessary step for the development of adequate enforcement capability.

Table 4 show estimates of revenue from all kinds of environmental charges to be approximately US\$400 million in 1993. At least US\$300 million more are expected to be collected in the coming years. Thus, the total amount of annual environmental charges will represent approximately 0.2 percent of GDP. Comparison with figures of table 2 shows that this is an important source of finance, representing almost 2/3 of the value of government outlays with sanitation and environment protection. The genuine problem, therefore, is how to guarantee the earmarking of these revenues to EPAs and how to make in such a way that resources are not eroded by inflation.

Gradually, however, environmental policies will have to be concerned with the use of MBI as incentive mechanism. In the Brazilian case only timid attempts have been made in this way and the results were far from successful. The forestry tax in Minas Gerais is, perhaps, the only single exception. The reasons are, on the one had, the lack of adequate technical, legal, and administrative capability in the design of MBI. On the other hand, the strong resistance demonstrated by economic agents.

The recommendations derived are threefold: to reinforce the objective of revenue generation for the creation of adequate enforcement capacity; to penetrate environmental objectives in sectorial policies; and, for the time being, the need to conciliate the use of CCI and MBI, specially when dealing with forest resources.

On the use of sectorial policies

The recognition of the relative limitations of environmental policy instruments *stricto sensu* implies the need to use broader policy instruments to pursue environmental objectives. Chiefly among these are transportation and energy policies where a greater reliance on market-based policies can bring a significant contribution to environmental objectives.

In energy policies, a market-based approach would certainly give up the objective of self-sufficiency through the elimination of cross-subsides in public tariffs. For natural resource policies, that would bring an improvement in the intertemporal allocation of exhaustible resources exploitation — in particular, deep offshore oil production — most especially by the possibilities of using more efficient and less polluting technologies in the future.

In transportation policies, the use of MBI will imply, firstly, imposing charges for the use of transportation infrastructure, most especially in metropolitan areas where traffic zones, tolls, and parking charges can make a significant contribution to management of environmental problems of traffic congestion and air pollution. In addition, further liberalization of fuel prices would certainly bring a more efficient spatial allocation of economic activity, and in particular would restrain the expansion of agricultural frontier and of tropical deforestation.

The prospects of market-based reforms in energy and transportation policies are difficult to evaluate. Broad political options will be made in the presidential elections to be held in October 1994. However, the bureaucracy of the energy and transportation sectors are powerful interest groups against liberal reforms. To a large extent, therefore, the final outcome will depend on political choices and the fate of privatization after elections.

On fiscal reform

Fiscal taxation in another crucial policy area where the penetration of environmental concerns is still lacking. The present mood of fiscal reform proposals is to simplify the tax structure and to enlarge the tax base. As a consequence, new taxes for environmental purposes are unlikely given their complexity and their (apparently) discriminatory character.

In more subtle ways, however, environmental considerations are being smuggled into the tax structure. Thus, some of the proposals submitted to the Constitutional Reform make amendments to allow for differentiation of tax rates according to environmental criteria. This would allow environmental policies to use the tax system anchored on sound constitutional principles, therefore avoiding the costs of litigations.

The Constitutional Reform is now in a political stale-mate, but even if these amendments are ever accepted, they will certainly require detailed, complex, and controversial regulations.⁵ Thus, practical consequences in the short run will be limited, though legal implications in the long run will surely be of utmost importance.

Land taxation is another important area for environmental policies. Fiscal legislation makes agropastoral activities in Brazil a tax shelter. In 1993, US\$35 million, which represents less than 0.01 percent of GDP, were collected with the ITR — the rural land tax. The consequence of light taxation is, since after tax rates of return are equalized, to inflate land prices inducing the expansion of the agricultural frontier beyond the efficient margin from a social and an environmental perspective. Land speculation as a result of inflation tends to aggravate this effect.

The reformation of ITR recently submitted to the Congress (*Medida Provisória*, 29-12-1993), despite explicit environmental concerns — for instance, tax exemption for preservation and natural forests and tax differentiation according to major ecosystems — seems to be unsatisfactory with respect to the rates of taxation which are kept practically equal to the existing legislation. The fate of the proposal is not clear, but prospects are not bright.

On property rights in forestry activities

Forestry activities in the Amazon Region are based upon deforestation of pristine forests, never leading to forest management or reforestation activities. Land is privately owned and properties rights are usually ascertained in litigious claims and based upon the extension of cleared lands.

The economic synergy between pasture and cropping, charcoal production and saw-mill activities — wood extraction from the opening of areas and residuals from saw-mills to charcoal ovens — generates private economic value to deforested lands significantly higher than those derived from the preservation or from the sustainable exploitation of the forest.

The large availability of unclaimed areas — 75 percent according to the Agricultural Census of 1985 and more than 25 percent according to more recent surveys of Incra (Agrarian Reform Institute) — and the possibility of their private incorporation reduce the percep-

⁵ The major issues revolve around the fiscal neutrality question which unfolds in three basic options: (a) should tax allowances be offered to environmental sound activities and, consequently, reduce fiscal revenue; (b) should tax be increased as a sanction to those not committed to environmental standards, therefore resulting in a higher fiscal revenue; or (c) should the tax system combine allowances and increases keeping the fiscal burden constant.

tion of the potential future costs resulting from sub-optimal deforestation levels. This is aggravated and stimulated by fragility of environmental agencies to enforce regulations.

Therefore, private property rights in land have not succeeded to determine a sustainable path of forestry in the Amazon Region. The system lacks market incentives and an appropriate legal framework to alter the behavior of agents in the required direction. Furthermore, the attempts to create productive forest in government lands with the Program of National Forests (Flonas) were not at all satisfactory.

A promising policy alternative is a system of public concessions, similar to those applied in countries like Canada and Sweden, where long term leasing contracts of large tracts of forests are made to private corporation with clauses specifying accepted conditions on the use of land and natural resources. A similar proposal was made by Pandolfo (1985). Her suggestion was to create 50 million hectares of productive forests, thus assuring that 20 percent of the forests in the region were put to sustainable use. An extreme version would extend the area allocated to Flonas to the unclaimed areas of the Amazon Region.

Before concluding, it is important to remind that equity issues will certainly be a crucial constraint for the implementation of MBI in Brazil. The design of environmental charges and taxes will necessarily have to face a trade-off between efficiency and equity. It is always possible to stick to efficiency criteria and to propose compensation measures to alleviate poverty and reduce inequality. However, apart from the intrinsic difficulties in the implementation of compensation schemes, inefficiencies are likely to emerge elsewhere in the system.

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