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**THE APPLICATION OF ECONOMIC INSTRUMENTS IN ENVIRONMENTAL POLICIES IN
BRAZIL, CHINA
AND SOUTH KOREA: A SYNTHESIS REPORT**

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by

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Preface and Acknowledgement

The context in which economic instruments have been introduced and are increasingly being used in the countries under review has been one of pressing and even growing environmental problems and severely limited resources to enforce environmental standards.

Several developing countries, especially those with rapidly growing and newly industrializing economies, have been gradually introducing economic instruments, mainly as financing mechanisms for monitoring and enforcing environmental regulations, but also, more generally, for sustainable development investments. Three large and suitably representative countries from among this group, Brazil, China and South Korea were selected as case studies on the use of economic instruments outside the OECD.

The paper synthesizes the findings of these three studies, supplementing them with information from other sources when necessary, to draw lessons learned and to make recommendations on promoting the wider use of economic instruments in environmental management in these and other similar countries.

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Introduction

Command and control regulations have been the instruments of choice for environmental management in market and planned economies alike. In recent years OECD countries, in response to the high and rising costs of attaining rigid end-of-the-pipe standards have begun experimenting with economic or market based instruments (MBI) as a mechanism for raising revenues to finance monitoring and enforcement, as well as incentive systems for inducing more environmentally sound behaviour. At present, in most OECD countries economic instruments are part and parcel of the regulators' policy tool kit along with command and control regulations and, while the revenue raising objective has dominated, the incentive objective is receiving increasing attention.

At the same time, several developing countries, especially those with rapidly growing and newly industrializing economies, have been gradually introducing economic instruments, mainly as financing mechanisms for monitoring and enforcing environmental regulations but also, more generally, for sustainable development investments. Three large and suitably representative countries from among this group, Brazil, China, and South Korea, were selected as case studies of the use of economic instruments outside the OECD. (Serôa da Motta and Reis, 1994; Florig and Spofford, 1994; and Shin 1994.) The purpose of this paper is to synthesize the findings of these three studies, supplementing them with information from other sources when necessary, to draw lessons learned and to make recommendations on promoting the wider use of economic instruments in environmental management in these and other similar countries.

Context

As in most OECD countries the dominant approach to environmental management in the countries under review has been one of command and control regulations in the form of setting ambient environmental quality standards as goals and effluent and emission standards as means for achieving them. Such standards are also supplemented by mandated production technology changes, pollution control technology specifications, and waste-treatment investment requirements. OECD countries have been able to achieve significant environmental improvements with command-and-control regulations, albeit at high cost, because they possess the financial resources, the enforcement capability and relatively efficient court systems. Nevertheless, the high cost of command and control regulations (both in terms of enforcement and compliance), the need to raise financial resources to achieve further improvements in environmental quality, and the potential for cost-savings through induced behavioural changes have motivated OECD countries to experiment with the use of economic instruments complementary to command and control regulations.

The motivation behind the growing interest in economic instruments in Brazil, China and South Korea, as in other developing countries, has been to some extent similar to that of OECD countries but with the added urgency of environmental crisis, severely limited financial resources, weak institutional structure, and lagging enforcement capability. At the same time, they must be content with rapidly advancing resource depletion and environmental degradation, due in part to rapid economic growth and structural change and partly to the relative ineffectiveness of command and control regulations under developing country conditions.

Thus, the context in which economic instruments have been introduced and are increasingly being used in the countries under review has been one of pressing and even growing environmental problems and severely limited resources to enforce environmental standards. Hence, the focus has been on using economic instruments as revenue raising mechanisms to finance the monitoring and enforcement of regulations, to undertake public environmental investments (e.g., waste treatment facilities) and to subsidize private environmental investments. While the motivations in OECD countries were similar and economic instruments have been used mainly as revenue-raising devices rather than as incentive systems for changing behaviour, it is fair to say that economic efficiency and even cost effectiveness have been even less of a concern and a motivating factor in developing countries.

In terms of priorities and focus of environmental policy, urban air and water pollution problems have been centre stage for the same reasons that development infrastructure in developing countries tends to concentrate in the major urban centers. While this focus can be justified in terms of high concentration of pollutants (due to urbanization and concentration of industry in urban areas), low assimilative capacity and high exposure of large populations and valuable property, the neglect of the national resource base and rural environmental problems (pesticide pollution, watershed destruction, soil erosion, deforestation etc.) is a serious distortion of priorities in countries which continue to be resource dependent. While this is partly a reflection of the urban focus of the case studies and certainly is an omission of less significance in highly industrialized South Korea, the green environmental issues are of paramount importance to China and Brazil. Appropriately, the Brazil case study addresses green issues such as deforestation, land use, water supply, and nature conservation as priority issues. Deforestation and forest land conversion have been focal priority issues in Brazil and did influence the choice of environmental policy instruments in this country.

Political and public acceptability has been another critical contextual factor in all three countries, while policy integration has not been a significant factor in the instrument selection, reflecting the lack of recognition of the inseparable relationship between environmental management and sustainable development in a developing country context (see section below).

Legislative structure and to a lesser degree administrative practicality have influenced the choice of instruments. For example, the limited role given to economic rationality and efficiency in the Brazilian constitution biased the selection of instruments in favour of command and control and against market based instruments (MBIs). The Brazilian constitutional treatment of environmental (and other) damages as unbailable crimes has retarded the growth of MBIs in general and of tradable permit systems, credits, and offsets in particular. Environmental taxes are further circumscribed by the constitutional principle that only one tax can be imposed on a given transaction (Serôa da Motta and Reis, 1994). Other examples of the significance of the legal structure for the selection of instruments include the challenged legality of the discharge permit system in China and the legal uncertainty of a carbon tax and a broader environmental tax in South Korea. Administrative practicality played a role in both the selection of instruments as evidenced by the Brazilian preference for differentiation of tax rates over the introduction of new taxes for environmental purposes in Brazil and in the implementation of economic instruments as evidenced

by the weak enforcement of the pollution levy system in China's 25 million township and village industrial enterprises.(TVIEs).

Distributional equity and the perceived impact on low-income groups significantly affected the levels of user charges (especially for water and electricity) and the enforcement of levies and charges on small-scale producers in all three countries. For example, China has allowed significant regional variation in the discharge fee system, issued temporary short-term permits to firms unable to meet regular permit conditions and allowed local officials to waive the levy fees for unprofitable operations so as not to threaten the viability of vital local enterprises. This involves significant tradeoffs and costs in terms of economic efficiency and environmental effectiveness. Similarly, too many exemptions were initially given in South Korea to manufacturing firms and government-owned facilities, vehicles, buses, education facilities, national hospitals, and social welfare facilities on account of public interest or social and equity considerations. The equity problem created by the exemption of charges on specified buildings and facilities were solved in the 1994 Amendment of the Environmental Quality Improvement Change System.

Finally, concerns about the possible loss of international competitiveness have circumscribed the use of MBIs, the choice of specific instruments and the rates at which they have been set. For example, Brazil has subsidized energy (especially electricity) and natural resource inputs (such as iron and wood) for its export industries such as aluminum, steel etc. (Serôa da Motta and Reis, 1994). China kept coal and transport prices low. South Korean ministries in charge of economic development have opposed the raising of deposit and charge rates because they fear loss of competitiveness, although more recently their attitudes toward economic instruments began to change as a result of the trade and environment debate.

Barriers to the Use of Economic Instruments

Several factors favour the use of economic instruments over command and control methods in general, particularly in developing countries. Among them are their revenue generating capacity, their cost-saving potential, their flexibility and efficiency-promoting incentive structure. There are additional reasons favouring MBIs of particular relevance to large countries and rapidly growing and structurally changing economies. The vastness of large countries such as China and Brazil implies enormous regional diversity in natural resource endowment, in assimilative capacity, in geo-climatic conditions and in level of industrialization and development. The severity of environmental problems, the levels of exposure, and hence, the consequent damage also varies enormously across regions as does enforcement capability. Flexible economic instruments can much more readily and efficiently accommodate heterogeneity and diversity than uniform environmental standards and mandated technology. Indeed the greater the variability in conditions the greater the variability in costs and benefits of environmental management. And hence, the greater cost savings (gains) from allowing trading, offsets, credits and other forms of exchange between pollution sources as long as care is taken to avoid pollution hot spots through appropriate selection of airsheds and watersheds within which trades and other exchanges would be allowed.

The rapid growth and structural change feature of newly industrializing countries such as

Brazil, South Korea and China creates greater significant temporal variation which can also be accommodated and exploited by the flexibility of economic instruments. Because of the rapid turnover of the capital stock, MBIs even at low levels combined with preannounced escalation schedules can have significant impacts on pollution control today and on the design of investment projects that could determine pollution control in the future.

Finally, increased use of economic instruments is consistent with on-going market reforms in transitional economies such as China, and can be integrated into the price reform, enterprise restructuring and institutional changes under way, especially concerning enterprise autonomy and property rights. Indeed, we observe a growing reliance on economic instruments both as a source of revenue and as an incentive system in China paralleling the market reforms initiated in 1978 and accelerating in recent years as these reforms gathered momentum in the late 1980s and early 1990s.

Despite these favourable factors, the introduction of economic instruments faces serious barriers in all three countries. Some are common to all three, others are specific to each country. The common barriers are (a) rapid urbanization and urban concentration of industry, (b) concerns over competitiveness, (c) distributional concerns, (d) environmental crises, (e) sectoral policies, (f) limited understanding of the incentive effects and potential cost-saving benefits of economic instruments, and (g) unclear or undeveloped legal structures.

The concentration of industry in large urban population centres and the growing environmental crisis, especially in terms of air and water pollution, favours the use of command and control instruments which are perceived to have quick and predictable effects; in a crisis, climate MBIs are considered to be too little too late. Sectoral or trade policies which subsidize energy, new materials or agricultural inputs to attain sectoral or national objectives such as food self-sufficiency, input substitution, or export promotion, stand in the way of the introduction of economic instruments that aim to internalize environmental costs. Distortionary subsidies may be thought of as negative MBIs; without their removal, the introduction of MBIs would be meaningless and wasteful even if feasible. For example, carbon taxes and emission charges are unlikely in Brazil as long as the objective of self-sufficiency calls for fuel subsidies. Similarly, export promotion in all countries raised concerns about the impacts of pollution taxes and charges on industrial competitiveness thereby limiting the use of these instruments. When MBIs were used, the rates were kept at very low levels, often at a small fraction of the marginal cost of pollution control. For example, the operating costs of wastewater treatment facilities in one Chinese city were estimated to be eight times the fee imposed for not operating the equipment. In South Korea, the waste disposal-refund system provides for a deposit that is only 10-20% of the necessary waste collection and treatment costs; yet, efforts to raise the deposit fee are strongly resisted, not only by industry but also by consumers and the government itself (especially the ministries of industry, commerce, and resources). Recently, there was a decision among relevant ministries and organizations to raise the deposit fee to at least 80% of the necessary waste collection and treatment costs (Shun Yong Lee, personal comm.).

Inequality and poverty, particularly severe in Brazil and China (less so in South Korea), are

potent barriers against MBIs because of the (often wrongly) perceived impact of higher taxes and user charges such as water fees and electricity tariffs on the poor. For example, in Brazil on account of poverty and inequality, water and electricity are underpriced while fuels, pesticides, and fertilizers are subsidized. In effect, the major beneficiaries of underpricing and subsidization are not the poor but the wealthy. Yet, since these subsidies have been introduced ostensibly to help the poor, their removal is considered regressive, and as long as the subsidies persist, the introduction of MBIs in the form of environmental taxes and charges is not being seriously considered.

Country-specific barriers in Brazil include inflation, fiscal crisis, tax saturation, and pervasive erosion as well as regional development policies, land ownership concentration, and heavy reliance on road transport. The effect of the barriers on MBIs are described in Table 1. Two examples here will suffice. Tax saturation and widespread tax evasion argue against new taxes and new brackets while heavy reliance on road transport perpetuates energy subsidies and constrains the application of fuel taxes and user charges for road infrastructure needed to control pollution and congestion, as well as to recover costs and maintain and expand the road network (Serôa da Motta and Reis, 1994).

In China, the main country-specific set of barriers relates to the legacy of the centrally planned economy, the large share of the public sector, and of state enterprises in the economy (with a soft budget constraint), the lack of clarity of property rights, and the limited enterprise autonomy. Specifically, the authorization of enterprises to include the pollution levy fees in their production costs (rather than taking them out of profits) effectively destroys the incentive effect of the levy system (Florig and Spofford, 1994).

In South Korea, there is a strong bias in favour of manufacturing and of government-owned facilities that creates a perverse incentive structure when different MBIs are combined. For example, while the distribution and service sectors pay environmental quality improvement charges based on their total fuel and water consumption, the more-heavily polluting manufacturing sector pays emission and effluent charges for only emissions and effluents that are above the standard (This is equivalent to giving the manufacturing sector free polluting rights up to the standard which is denied to cleaner sectors, an obvious perverse incentive.) Similarly, coal is subsidized and diesel fuel is only lightly taxed while less polluting gasoline is heavily taxed; another reflection of the industrial bias in South Korean fiscal and environmental policies. The environmental quality improvement charge system was revised at the end of 1994 to lessen the inequality and inefficiency that was introduced during the negotiations which led to its adoption. The non-compliance charge system is an interim option to increase the effectiveness of the command and control system. The Amendment draft to shift the non-compliance charge to pure charge system was submitted to the National Assembly in late 1994.

Environmental Management and Sustainable Development

It is fair to say that the relationship between environmental management and sustainable development played a minimal role in the design of economic instruments in the three countries under review. The role of economic instruments in sustainable development lies in (a) their

function as vehicles for internalizing environmental costs and full-cost pricing and (b) their capacity to save as well as generate financial resources that can be invested in human, man-made, and natural capital to replace the depleted natural resources and degraded environmental assets. These are precisely the two functions of instruments that have been largely ignored in all three countries. There has been little effort to value natural resource depletion and environmental damage and to internalize depletion and environmental costs via economic instruments. Any incentive effect of MBIs, even at a suboptimal level, was often neutralized by exemptions, subsidies, rebates, and mandatory regulations that limited the flexibility of response and inducement for technological innovation.

Not only did the revenue-revising objective dominate the use of MBIs, but the use of the revenues so collected was rarely directed towards investments that enhance sustainability, such as reforestation of watersheds, investments in human capital, soil conservation, etc. The main use of revenues has been the subsidization of water treatment facilities, end-of-the-pipe technologies, as well as public sector consumption (e.g. recurrent expenditures of environmental agencies). The use of revenues from environmental taxes, charges, and fines for strengthening, monitoring, and enforcement capability and for building new environmental institutions is a necessary ingredient of effective environmental management, but it was never cast as an investment in environmental (or social overhead) capital in the context of sustainable development. The consequence is that such investments have gone generally underfunded because of lack of appreciation by the ministries charged with economic development. Moreover, royalties from the depletion of natural resources were kept significantly below the depletion of user costs and the revenues were not always invested in order to maintain the economy's productive capacity.

Since the Rio Conference and the formulation of Agenda 21 there has been some effort to formulate instruments in the context of sustainable development. For example, in 1994 China formulated its own national Agenda 21, in an effort to integrate long-term economic and environmental strategies while at the same time it initiated a two-year study of its pollution levy system to improve its efficiency and effectiveness. The goal is to develop a levy system (based on the marginal cost of pollution control) that is effective in reducing emissions and effluents, cost-efficient, flexible, adapted to local conditions (both economic and environmental), and administratively practicable, that permits continued rapid economic growth with environmental protection and resource conservation.

Table 1

Barriers to the introduction of market-based instruments (MBI) in Brazil

Barriers to MBI	Effect on MBI Use
Poverty & Inequality	underpricing of water & electricity; fuels, pesticides, fertilizer subsidies; preferential credit rates, etc.
Land Ownership Concentration	pressure on the agricultural frontier (effectively open access); undervaluation of forests & public lands; equity concerns dominate environmental concerns
Urbanization & Industry Concentration	instrument choice bias in favor of CCI because of perceived need for prompt, tough action; perception that CCI easier to enforce when in effect this leads to regulators' capture
Environmental Crisis	CCI favored to deal with urgent and critical situation (MBI) perceived to be "too little too late"; uncertainty of effects
Heavy Reliance on Road Transport	energy self-sufficiency policy; subsidies for oil, hydro, nuclear alcohol development investments; fuel subsidies; free of charge use of road infrastructure
Import Substitution Policy	self-sufficiency in energy, steel, pulp and paper: subsidies for electricity, iron ore, wood, chemicals, etc.
Export Promotion Policy	subsidies for energy (e.g. for electricity to produce aluminum) and for natural resource inputs (wood, iron ore, etc.)
Regional Development Policies	fiscal and credit incentives for agriculture, mining, industry and settlement in Amazon region; land-clearing and ranching subsidies; soft loans, etc.
Inflation	variability and uncertainty of effects of new taxes and charges on prices and on revenues and environmental budgets; revenue erosion from lack of indemnation and collection lags; uncertain allocative effects
Fiscal Crisis	reduction of subsidies, especially for Amazon settlement; reduction in sanitation investments and other environmental expenditures
Tax Saturation (over 50 different taxes) and Tax Evasion	resistance to new taxes; preference for fewer taxes and brackets; creation of new taxes with environmental objectives unlikely due to need for complex and discriminatory enforcement; trend towards tax simplification, less differentiation
Constitutional Constraints	limited constitutional support for economic rationalization and efficiency; damages are unliable crimes; only one tax per transaction is allowed
FUTURE PROSPECTS	
Deregulation	increased need for use of MBIs
Privatization	private enterprises likely to be more responsive to MBIs than state enterprises; the soft budget constraints of state enterprises has been a major barrier to the use of MBIs
Trade Liberalization	reduced subsidization for inputs; pricing at world price levels; even low levels of MBI may have allocative effects
Competition Policy	MBIs are more effective as allocative instruments under competitive market structure

Source: Constructed from information in Seroa da Motta and Reis (1994) and other sources.

Institutional Arrangements, Monitoring Needs, and Human Resource Requirements

The legal and institutional requirements of economic instruments are different than those of command and control regulations, but they are just as essential. Property rights, and enforcement of contracts are essential for the efficient operation of markets, on which the effectiveness of market-based instruments, depends. Where property rights cannot be defined in physical space, they can be defined in legal space (e.g., permits, licenses, quotas) which assigns right of use. This requirement is particularly lacking in the open access forests and lands of the Amazon region of Brazil and the clouded property rights over natural resources (including land) in the transitional economy of China. Economic instruments require enabling legislation, legitimization, or legal framework, not detailed regulation. Characteristically, the legitimacy of the discharge permit system in China is being challenged because the 1989 Environmental Protection Law makes no mention of a permit system nor does it provide a framework within which such a system could be introduced (Florig and Spofford, 1994). Similarly, the introduction of new taxes with environmental purpose is constrained in Brazil by the constitutional prohibition of more than one tax per transaction; similarly, tradable pollution permits are apparently preceded by the "unbaibility" of environmental damages (Serôa da Motta and Reis, 1994).

Environmental charges need to be legislated, unless they qualify as taxes or user charges permissible by executive decision within existing legal framework. Indeed, Brazil has been exploiting the existing legal framework for taxes to introduce environment-related tax differentiation. Similarly, performance bonds and transferable development rights need to be legislated and environmental funds need to be legally constituted. However, once economic instruments are in place they should be more-or-less self-enforced; otherwise, they have not been properly designed. The economic instruments approach to environmental management and sustainable development requires regulations to set the rules of the game not to specify and arbitrate every move.

In most real world situations, a command and control structure already exists and economic instruments should not seek to replace it overnight, but to support it, make it more flexible and cost effective by making allowances for differences in compliance cost through credit, offsets, trades, and other mutually beneficial exchanges. Indeed, all countries under review sought to supplement rather than supplant CCI by MBI; yet, many opportunities for cost-saving offsets and trades still lie unexploited, although China is beginning to experiment and Brazil has embryonic offset systems in place, such as the deforestation charge in lieu of reforestation mandates (Serôa da Motta and Reis, 1994).

Economic instruments as a group tend to have lower institutional and human resource requirements than command and control regulations, because they operate through incentives rather than through coercion. First, it is far easier to implement an instrument that makes compliance in the best interest of the economic agent than an instrument which forces compliance through the (often not exercised) threat of prosecution, closure, and imprisonment. Second, economic instruments make maximum use of the superior and privileged information that the polluters and resource users have on their own pollution control and resource conservation cost without attempting to find out what that information is. This contrasts with the considerable

informational demands of command and control regulations which include intimate knowledge by the regulators of the production and pollution control technologies of a multitude of production processes.

Yet, the informational requirements of economic instruments are not insignificant, especially when one attempts to introduce them at the optimal level (i.e., at the point where the marginal control cost equals the marginal damage cost). This presumes knowledge of pollution control (or conservation), cost function, and of the environmental damage functions, none of which are readily available. These informational requirements are considerably reduced if we only seek to attain cost-effectiveness (i.e., the environmental objective is set through some other means such as the political process or at scientifically-established ecological thresholds), and if the economic instrument only attempts to achieve this objective at minimum cost. Then experimentation with pilot projects or trial and error would help reveal the needed information for determining the optimal level of the instrument. Since gradual introduction is often preferable, the instrument can first be introduced at a very low level and progressively escalated, gaining information in the process until the optimal level is approximated. Indeed, the very low levels at which MBIs have been introduced in all three countries can be justified on political acceptability and experimental grounds. What is missing is a preannounced schedule for gradual escalation towards their optimal levels.

The informational requirements can be reduced further by taking into account the special conditions of the country, the industry, the environmental media, and the specific pollutant or resource whose control is sought. When the instrument is tailor-made to fit these conditions, the informational and enforcement costs are minimized. An ill-designed economic instrument or one which is alien to the culture of the country and the structure of the industry could have higher informational and enforcement requirements than well-designed command and control regulations. For example, effluent charges applied to scattered, small-scale industries, such as TVIEs in China, have enormous information requirements and little chance of successful implementation. Indeed, the local Environmental Protection Bureaux wisely concentrate on collecting levies from the larger state-owned companies which are both fewer in number (a few thousand) and worse polluters than the 25 million scattered TVIEs. Under these circumstances, product taxes and deposit-refund systems, though indirect instruments, are overall more efficient. In contrast, effluent charges are very appropriate for the industrial conglomerates of South Korea and large state enterprises of China (except for the fact that the latter is not cost accountable).

While every effort should be made to choose instruments, designs, and modes of introduction that minimize the informational and management/ enforcement requirements, there is an irreducible minimum level that must be met if environmental policy is to produce results on the ground. Informational and management requirements are translated into institutional and human resource requirements - two resources in high demand and limited supply in developing countries. To minimize institutional demands, maximum use must be made of existing administrative structures (e.g., existing tax collection, bureaucracy, industry licensing procedures, vehicle registration system, the town and country planning department, the government tourist agency, line ministries or departments such as forestry, mining, industry, and agriculture). For example, product taxes can be integrated into existing sales, excise tariffs, or Value Added Tax

systems and collected by the relevant collection agencies (e.g. Brazil). Betterment charges can be integrated into the property taxes and collected by the existing property tax department. Wastewater treatment charges or watershed protection charges can be incorporated into the monthly water bill and collected concurrently (e.g. water charges for both volume and quality in river basins in Brazil). Land-use taxes can be implemented through the land registration department to maximize use of the private land market institutions (e.g., real estate firms, land surveyors, property value assessors, etc.). South Korea introduced the per-bag pricing system for household and commercial solid-waste collection and treatment nationwide. The price of an official garbage bag includes the production cost of the bag as well as the cost of collection and treatment of the waste contained in the bag.

Using existing institutions would significantly reduce the need for new institutions and additional human resources though it will not eliminate it entirely. For example, water rights, tradable catch quotas, or emission permits would require a special registry which is regularly updated. Issuance of secure land titles require cadastral surveys and a process for the resolution of conflicting claims, while land use taxes call for land use registry. Performance bonds require a financial institution that will manage and reinvest the funds, pay interest, assess performance, and dispose the bond accordingly. Effluent charges require a monitoring and collection system which has relatively high institutional and human resource requirements, because it calls for specialized knowledge and measurement capabilities. While existing institutions can be restructured or upgraded to handle many of these tasks, additional specialized organizational and human resources need to be added.

Among the new skills required are specialists in environmental impact assessment and valuation (damage or betterment assessment), environmental auditors and inspectors, environmental engineers and economists, financial analysts, environmental tax experts, etc. While some of these skills may not be available in developing countries, related skills exist and can be easily retro-fitted for the use of economic instruments in environmental management. In Brazil, the introduction of EIA requirements has facilitated the introduction of MBIs by helping create the technological capability, environmental consultancy and audit skills and information necessary for valuation of environmental impacts and eventual internalization through MBIs. External training and technical assistance might be needed for some time in certain countries but local expertise would not take long to respond if effective demand exists because related skills are often available. In China there are already over 4,000 companies specializing in pollution control, monitoring, and recycling and special industrial parks for environmental protection industries are being created, generating new skills, knowledge, and information essential for the design and implementation of economic instruments.

Lessons Learned

While command and control instruments (CCI) continue to dominate environmental management in the newly industrializing economies of Brazil, China and South Korea, as they do in most of the developed and developing world, important lessons have been learned from the rather recent, tentative and even timid use of economic instruments in these countries. All three countries have used economic instruments in the same way that a drunkard uses a lamp post: more

for support than illumination! It was never the case that economic instruments were thought of as replacements or substitutes for CCI whether effluent and emission standards or zoning and licensing. Nor was the cost-saving, incentive creation, and information generation potential of economic instruments appreciated and exploited, except incidentally. MBIs were used strictly as "cash cows" for the support of environmental institutions and of the regulatory system in place. The implication being that a dollar saved is not a dollar earned; even worse, several dollars of averted pollution or avoided damage is not worth a dollar of revenue raised and expended on clean up or on compensation for damages, since the incentive potential of MBIs was repeatedly sacrificed in all countries in the interest of revenue generation. The behavioural response of economic agents to taxes, charges, and other instruments was not considered even in the interest of the revenue raising objective, an indication that policy makers assume near-zero response or a fixed coefficient model.

Despite all these shortcomings in the use and application of economic instruments, which are not unique to the countries under review or even to developing countries as a whole, important lessons emerged which would be of value in further application of MBIs in these and other countries. Below we list selected lessons from this experience along with the implied policy implications (recommendations), in no particular order.

(1) MBIs as Revenue Sources:

MBIs are not a reliable and stable source of revenue unless (a) the economic agents' (polluters', users') behavioural responses to economic instruments (taxes or charges) are modeled in order to set the tax rates accordingly (rather than on an ad hoc basis and to predict the likely revenues; (b) environmental charges are indexed to protect the real value against erosion by inflation; (c) exemptions are kept to a minimum (little or no discretion is allowed for further exemptions or reductions); (d) collection is better enforced by addressing past deficiencies that led to erratic collection, evasion, and bribing in many cases; (e) application of charges to both below and above standards; (f) charges apply not only to toxicity but also to the total volume of pollutants discharged to limit evasion through dilution; (g) fiscal neutrality is not an issue; (h) cost sharing of environmental costs with polluters is resisted; and (i) the cost of administering and collecting MBIs is kept to a minimum by using existing administrative structures.

(2) Use of the Revenues from MBIs

Since the incentive function of MBIs is either ignored or effectively sacrificed to the revenue generation function, the effects of MBIs on environmental protection, social welfare and sustainability depends critically on the allocation and use of the revenues generated. If they are expended largely on consumption, inefficient bureaucracies, low-cost loans for inefficient and unprofitable firms, and subsidies for environmentally harmful activities, the effects on environment, welfare, and sustainability would be unambiguously negative. If, on the other hand, the MBI-generated revenues are invested in strengthening, monitoring, and enforcement capability and in replacing depleted natural and environmental capital through investments in natural, human, and man-made capital, environmental protection, intertemporal welfare, and sustainability would all be enhanced. While environmental agencies and NGOs are often sceptical if not outright

critical of the capacity of national treasuries and finance ministries to allocate environmental (and other) revenues to advance environmental protection and sustainability, earmarking of these revenues, allocating them through specially created environmental funds is no guarantee. However, the more decentralized the collection and allocation of revenues the more likely that they be used to restore degraded environments than to support bloated bureaucracies. For example in Brazil, royalty revenues are distributed 45% to the state, 45% to the municipalities where production takes place and the remaining 10% to government agencies concerned with the specific activities (e.g. forests in the case of forestry royalties). While this is no guarantee that the royalties would be invested rather than consumed, decentralization of both taxation and expenditure is likely to both save tax revenues and advance sustainable development as local solutions are applied to local problems by elected officials accountable to immediately affected constituents.

(3) Distributional Implications

Different instruments have different distributional implications. Environmental taxes tend to be regressive compared to regulatory standards. The pollution control costs fall more heavily on low-income groups, especially with product taxes or pollution charges that affect the prices of commodities (such as food, clothes, or shelter) on which the poor spend a higher proportion of their income. The benefits of environmental improvements such as improved water supply, sanitation, and reduction of indoor pollution of suspended particle matter (SPM) and of lead emissions, tend to be progressive (pro-poor) because the poor are more exposed to these pollutants due to their living and working conditions and the lack of means for preventive or mitigating expenditures. On the other hand, when these benefits are valued in monetary terms, their distribution may in fact be regressive because the poor have a much lower willingness to pay for environmental improvements due to their low income. Thus, ultimately the distributional impact of economic instruments depends on (a) how the property rights or pollution permits are allocated and (b) how the revenues from environmental taxes and charges are spent. For instance, the poor could be issued secure property rights over open access resources (e.g., land rights, water rights, etc.). The regressivity of environmental taxes can be dealt with through differential taxation (lower taxes on necessities). The distributional impacts of different instruments vary by location and time horizon; they are higher in targeted areas (e.g., industrial towns, coal producing areas, etc.) and during the transitional period than in other areas and subsequent periods, respectively. Retraining, compensation for impacts, gradual implementation, grandfathering of old (or small) producers, and revenue neutrality (commensurate reduction of other taxes) are some ways in which the distributional impact of economic instruments can be mitigated or compensated for.

(4) Fiscal Reform and Fiscal Neutrality

Many developing countries are undergoing partial or comprehensive fiscal reform which offers a unique opportunity for the greening of the central (and state) budget and for the introduction of economic instruments such as environmental taxes. The lessons learned from the three case studies, but especially from Brazil, are that the matter is not as simple as initially thought. While environmental objectives call for new taxes, new brackets, tax differentiation, and

generally a complex tax structure, the demand from fiscal authorities and the taxpayers is for fewer taxes, fewer brackets, and a broader tax base with fewer tax exemptions. With 50 different taxes, the Brazilian fiscal system has reached tax saturation while the multiple brackets, tax shelters, and exemptions have resulted in widespread tax evasion and tax avoidance. Fiscal reformers striving for tax simplification and for broadening of the tax base are not sympathetic to either new taxes with environmental purpose or to the detailed tax differentiation called for by Peguvian purity. At the same time, fiscal authorities are not eager to see the tax potential of the economy eroded by extra-budgetary taxes (or charges) over which they have little control. Furthermore, environmental taxes may be subject to litigation for amounting to double taxation as indeed happened in the Brazilian state of Minas Gerais with the forestry tax which was attacked as double taxation on top of the state value added tax.

Despite these difficulties, fiscal reform offers a unique opportunity for greening the budget (both revenues and expenditures) by first focusing on the removal of environmentally harmful tax exemptions, tax shelters and subsidies as indeed was done in Brazil with the removal of the agropastoral tax shelters and other subsidies for forest conversion. A second lesson from Brazil is that instead of trying to introduce new taxes with environmental purpose, efforts should focus on "smuggling" environmental considerations into the tax structure by proposing amendments to allow a broad differentiation of tax rates according to environmental criteria. For example, to avoid the double taxation problem, the Brazilian state of Minas Gerais has translated the original 3% tax on the value of forest products into differential tax rates for the state value added tax (ICMs), defined as a percentage of an "indexed currency" varying according to each type of forestry product. For example, charcoal and firewood from native forests are taxed at 2-3 times the tax on other products. A 50% tax reduction was given to sustainable forestry, thereby turning a value added tax into a deforestation tax (Serôa da Motta and Reis, 1994).

A third way in which the budget can be "greened" with the consent (even endorsement) of the fiscal authorities is by removing utilities such as water, electricity, waste treatment, and sanitation from the budget by raising the user charges to achieve cost-recovery and even better, to implement marginal cost pricing, thereby generating surpluses given of the rising long-run marginal supply price for water and electricity.

Another concept that can make the greening of national, state, and local budgets more acceptable to industry and the public is fiscal neutrality, i.e., a commensurate reduction of taxes on value (conventional taxes) to offset the added tax burden introduced by the taxes on vice (environmental taxes). Alternatively, tax neutrality can be achieved through cross-subsidization of "goods" by "bads," e.g. a deforestation tax finances a reforestation subsidy or a tax allowance is offset by a tax penalty.

(5) Innovative Instruments

The three country experiences demonstrate the capacity of developing countries to design and implement their own innovative instruments to address environmental and resource problems under local conditions. Some of these instruments with further refinement and adaptation, can be used in other countries to address similar problems. We identified at least three such innovative

instruments in Brazil: (1) royalties for water use charged to hydroelectric companies by river basin authorities with the revenue going to maintain the resource base as well as to finance the cost of the basin authority; (b) fiscal compensation paid to municipalities under restrictions on their land use for the purpose of protecting water supply and the integrity of the ecosystem; the fiscal compensation which is based on the size of the area, the degree of restriction, the extent of compliance with regulations and a water quality indicator, is a form of transferable development rights, whereby the general tax payer purchases the development rights of the conservation areas, but does not exercise them (which is analogous to a transferable conservation service instrument); (c) deforestation tax for "unsustainable" forest uses instead of complying with the reforestation requirement (four trees per cubic metre of wood extracted). This is a compromise between minimizing enforcement costs (in the case of small operators) and creating an incentive to reduce deforestation. This embryonic system of credits, offsets, and (indirect) trades has both efficiency and equity benefits which were explicitly recognized and, in fact, motivated the instrument:

- (a) it avoids the prohibitively high costs of monitoring small reforestation projects;
- (b) it takes advantage of economies of scale in reforestation by using the collected funds for large-scale reforestation projects;
- (c) it gives small-scale forest users a lower cost alternative to direct reforestation. As this system currently stands, it suffers from loopholes and low reforestation rates. The system can be refined and strengthened, by increasing the charge, and by allowing trading of reforestation obligations between small and large-scale forest users.

South Korea also uses a number of innovative instruments of wider applicability:

- (a) the environmental quality improvement system which is levied on the owners of buildings and vehicles that emit considerable amounts of pollutants. The charge is based on the quality of fuel and water used by buildings (collected twice a year) and on the exhaust gas emitted by diesel-fueled vehicles. The charge is based respectively on the cost of pollution abatement/treatment and the price of catalytic converters and varies by region. While this system, as currently applied, has some perverse effects because of the exemption of the manufacturing sector, it can be refined and extended to cover noise, odour, and visual pollution in all sectors; however, as indicated above, polluting sources in manufacturing sectors are to be levied under the new pure charge system which replaces the interim option of the current non-compliance charge system.
- (b) South Korea uses an extensive waste disposal deposit-refund system that covers food, beverages, liquor bottles and containers, batteries, tyres, lubricating oil, electric home appliances and any other item that generates toxic waste, bulky or heavy commodities that require treatment, non-degradable materials, and household harmful commodities that should not be mixed with the general waste stream (Shin, 1994). The manufacturer is required to deposit a certain amount for each unit sold, refundable upon collection and treatment. While the system can be improved by more careful selection of the items included, by increasing the deposit fee and by not restricting reimbursement to the original depositor, its potential for developing countries is enormous and largely unexploited. A great advantage of deposit refund systems for

developing countries is the inducement of a labour-intensive activity (waste collection) in an environment of low-cost, abundant and underemployed labour with significant economic, environmental and distributional benefits.

- (c) South Korea also uses an innovative instrument for financing local road construction from property value appreciation known as the land redevelopment scheme (not discussed in the case study). Landowners in the affected area relinquish control of their properties to the road construction authority, which builds the road through the most advantageous route and then returns to the landowners a smaller – but more valuable – piece of land than they surrendered. The authority retains a certain percentage of the land, which it sells to finance the construction of the road. In this manner, road construction is self-financed and both the affected landowners and the general public benefit (the former through a higher value property and the latter through lower taxes).

China's experience has rich lessons to offer both transitional and developing economies. One of its innovative approaches is the comprehensive levy system, backed by non-compliance fines, now under comprehensive review and eventual rehaul. Another innovation is the environmental responsibility system which is a set of contracts for environmental improvement between local environmental protection bureaus, city mayors and enterprise managers accompanied by performance ratings and awards for meeting or exceeding contractual obligations. A similar system of annual environmental improvement rating and public awards for the "greatest improvements" exists at the national level for major cities. Aside from the incentive effect such schemes are reported to have had a significant role in raising environmental awareness both within enterprises and city governments and among the general public. It is also notable that China has begun trial experimentation with both a sulphur tax and emissions trading, probably in conjunction with the discharge permit system, itself an innovation that accommodates regional heterogeneity as well as provides incentive to invest in pollution prevention and control (Florig and Spofford, 1994).

(6) Valuation of Natural Resources and Environmental Damage

In all three countries, the rates of environmental taxes, charges, refundable deposits, and other MBI instruments used were determined by budgetary needs, cost recovery targets, and projected expenditures rather than by any attempt to obtain measures of incremental abatement costs and incremental benefits (damages averted). This is understandable since the objective has been exclusively one of revenue generation. However, as MBIs are now beginning to be used as incentive mechanisms, it is important that marginal damage costs and marginal pollution control costs are estimated and used to determine the optimal tax or charge rates even if these will only serve as long-term targets. At a minimum, if ambient standards are to be set exogenously by the political process or on purely ecological or non-economic grounds, estimation of marginal pollution control costs by alternative instruments and technologies is critical to achieving the target at the lowest possible cost (cost effectiveness).

Similarly, in the case of natural resource depletion, the setting of royalty rates, conversion fees, and other resource taxes requires estimation of marginal depletion or user costs (e.g.

stumpage values, or mineral rents). The experience of Brazil as well as that of China (from other sources) demonstrates that without such valuation, royalties are set far too low and the proceeds are rarely used to maintain or replace the productive resource base.

(7) Using Mixed Regulatory and Economic Instruments

The experience of the three countries as well as that of OECD and other countries clearly suggests that the best prospects for economic instruments are as complements rather than substitutes to the existing command and control regulatory structure (see Tables 2 and 3). The contribution of the economic instruments or supportive mechanisms is then to:

- (a) provide flexibility of response to rigid regulations;
- (b) save costs to both industry and the regulators;
- (c) make easier the attainment of standards by bridging or at least narrowing the gap between private and social costs;
- (d) provide motivation for going beyond the standards as well as for investing in the development of more efficient technologies; and
- (e) raise revenues for financing monitoring and enforcement, and for investing in sustainable development.

Table 2. Comparative use of regulatory instruments in Brazil, China and Korea.

Type of Policy Instrument	Brazil	China	Korea
REGULATORY INSTRUMENTS	<p>Licensing for forest clearing</p> <p>Forest replacement regulations for logging, lumbering & industrial use of charcoal and firewood</p> <ul style="list-style-type: none"> - mgmt plans for self-sufficiency in forest raw materials with targets & deadlines - fines for small consumers (costs of planting 4 trees per m³ of log or 6m² of charcoal (mixed CCI & MBI)) <p>Economic-ecological zoning regulates use of private & public</p> <ul style="list-style-type: none"> - e.g. river springs, vegetation on steep hills are "ecological reserves" - 20% of private property in Amazon region registered as areas of permanent forest cover preservation - conservation unities (in which economic activities are strictly regulated) - Indian areas <p>Environmental impact assessment requirement for licensing new investment projects (by state environmental agencies)</p> <p>Air & water pollution standards</p>	<p>Ambient air & water quality standards</p> <p>Effluent & emissions standards for industries & vehicles</p> <p>Mandated minimum environmental investments (7% of new project funds)</p> <p>Three simultaneous policies (design, construction, operation)</p> <p>Mandatory charges in production technology</p> <p>Discharge license systems</p> <p>Compliance schedules</p> <p>Mandatory waste treatment facilities</p> <p>Environmental impact assessment</p> <p>Compulsory transfer of funds from bank accounts to pay levies (mixed)</p>	<p>Ambient air & water quality standards</p> <p>Effluent & emissions standards</p> <p>Compulsory promotion of resource conservation & reuse for specific industries & products</p> <p>Mandatory treatment of garbage (above 300 kg/day); Others: responsibility of local government</p> <p>All wastes from industrial agents should be treated by themselves or the registered contractors</p> <p>Mandatory building of landfill sites by toxic waste generators</p> <p>Mandatory collection & treatment system for designated items by manufacturers/sellers</p> <p>EIA requirement for public and private development projects with potential environmental damage</p> <p>Discharge license system</p>

Table 3. Comparative use of Economic Instruments in Brazil, China and Korea

Type of Policy Instrument	Brazil	China	Korea
ECONOMIC INSTRUMENTS	<p>Water charges in river basins for volume and pollution content (nationwide & Sao Paulo state)</p> <p>Industrial sewage tariff based on pollution content (Sao Paulo & Rio de Janeiro states)</p> <p>Air & water pollution tax (in Rio de Janeiro)</p> <p>Royalties on natural resource exploitation:</p> <ul style="list-style-type: none"> - hydroelectricity - oil production - mining <p>Fiscal compensation (transfers) for preservation areas (Sao Paulo, Parana & Rio de Janeiro states)</p> <p>Deforestation taxes</p> <ul style="list-style-type: none"> - federal reposition fund by users without reforestation activities - forest tax paid by users of forest products (Minas Gerais state) 	<p>Pollution levy system</p> <ul style="list-style-type: none"> -emissions (air) -effluents (water) <p>Non-compliance penalties ("four small pieces")</p> <p>Compensatory & punitive fines</p> <p>Discharge permit system</p> <p>Responsibility system (mixed CCI & MBI)</p> <p>Environmental compensation fee</p> <p>Sulfur tax</p> <p>Emissions trading</p> <p>Grants for pollution control to firms that paid pollution fees</p> <p>Competitive grant & loan system for environmental investments</p> <p>Low-interest loans for energy-saving investments</p> <p>Subsidies for energy-saving products</p> <p>Tax breaks & other incentives for recycling</p>	<p>Non-compliance charge system now being changed into effluent charge system</p> <p>Environmental quality improvement charge system</p> <p>Plastic waste charge system</p> <p>Glass bottle deposit system</p> <p>Waste disposal deposit-refund system</p> <p>Waste disposal charge system</p> <p>Environment mark system or eco-labelling (mixed CCI & MBI)</p> <p>Environmental pollution control fund and waste management fund with waste disposal charges and deposits</p> <p>Environmental Improvement Special Account</p> <p>Energy taxes (differential rates; non-Pigouvian)</p> <p>Environmental bonds</p> <p>Low-interest loans for pollution abatement facilities</p> <p>Grants to environmental R&D</p>

The complements between the two groups of instruments are evident from the experience of these and other countries and are widely understood and recognized. CCIs, at a minimum, need flexibility and financial resources and MBIs need ambient standards and allocation rules as well as enforcement. What are less known but well demonstrated by the experience of the three countries are the inherent conflicts between the two types of instruments that need to be carefully managed:

- (a) strict enforcement of standards reduces the incentive for firms to seek cost minimization solutions (such as compliance through offsets or trades) or to over-comply and sell credits;
- (b) requirements that all firms acquire certain technology or connect to a central treatment facility reduce the effectiveness of economic instruments as incentives to control pollution at minimum cost;
- (c) charges or levies that apply only to effluents or emissions above standards are equivalent to non-compliance fines that leave little incentive for doing better than the standard by taking advantage of low-cost pollution-reduction opportunities;
- (d) when MBIs are introduced as complements to CCIs, the administrative requirements of CCIs remain unchanged while the potential of MBIs is not fully exploited especially when their rate is far below the optimum and compliance to the standard or mandatory technology is compulsory at the plant level; and
- (e) a combination of CCIs and MBIs in one sector and only MBIs in another may become a source of perverse incentives. For example, the more heavily-polluting manufacturing facilities in Korea are treated more favorably by the combination of the effluent/emission standards and effluent/emission charges for discharges above standards compared to the less-polluting distribution and service sectors which are subject to the environmental quality improvement charge based on the total quantity of fuel and water they use¹.

Recommendations

While recommendations have been made throughout the synthesis report and especially in the previous section, we present here an integrated set of recommendations based on the findings of and lessons from the three case studies and other literature. The general recommendation is that economic instruments have a considerable untapped potential in the three countries and the developing world more generally, and their use and application should be advocated and actively promoted in the interest of sustainable development. However, many guidelines need to be observed for their introduction to be successful. These guidelines constitute part of our specific recommendations.

1. Choosing the Right Instrument(s)

Choosing the right instrument or combination of instruments for a particular problem and circumstance makes the difference between efficient (and effective) intervention that mitigates market failures and a costly distortion that worsens the allocation of resources and reduces economic welfare. Factors to consider in choosing the right instrument include:

- (a) the scale of industry to which it will be applied to;

¹ Shun Yong Lee, pers. comm., explained that the biases do not arise from the combination of charges and standards but from the inherent problem of Korea's regulatory standards which are prescribed on the basis of "instantaneous concentrations."

- (b) the degree of competition;
- (c) the relative shares of public and private sectors;
- (d) ownership and control of economic assets and natural resources (property rights); and
- (e) the composition of industrial pollution (biodegradable vs. toxic), and
- (f) the instrument's enforcement needs relative to the country's (or agency's) monitoring and enforcement capabilities.

These criteria for choice of instruments were discussed in detail in Panayotou (1995a). Here, a few examples would suffice. In a country in the earlier stage of development with an economy dominated by agriculture, small scale industry, and large informal, sector regulations such as effluent standards and MBIs, such as effluent charges, are too costly to monitor and enforce relative to the potential benefits (averted damages) which are likely to be small. As China discovered, collecting levies from millions of township and village enterprises is too costly and laborious with minimal benefits. Under these circumstances, the right intervention would be indirect instruments such as product charges and differential taxes imposed at easily monitored points (e.g. imports, exports, raw material production, etc.)

In contrast, emission standards, effluent charges, mandatory installation of pollution control technologies, and environmental performance bonds can be very effectively applied to the relatively small number of state enterprises in China and industrial conglomerates in Korea. However, because of soft budget constraint and limited competition however, state enterprises in China and monopolistic oligopolistic industries in Brazil may not respond to economic incentives the way competitive firms do. State enterprises are able to shift the cost of such instruments to the state budget while monopolistic firms are at least temporarily able to shift the burden onto the consumer.

2. Setting the Instrument at the Right Level

Thus far MBIs have been used as revenue raising mechanisms and therefore, their rate was determined by financial needs and projected expenditure as well as by a sense of what the market would bear. In the future, as MBIs are increasingly used as incentive instruments for changing behavior, it is important to determine their rate based on estimation of marginal benefits (averted damages) and marginal abatement costs, using market and non-market valuation methods. Similarly, with the use of natural resource royalties, as the focus shifts from financing consumption and end-of-the-pipe development (maintaining the capital stock), the level of royalties must be determined by estimating user costs and Hotelling rents.

The determination of optimal taxes or optimal charges is important even when they are used only as long term targets. For political and economic reasons, taxes and charges may be set at a fraction of their optimal level and gradually escalated over time on a preannounced schedule to reduce uncertainty and to shape expectations in the right direction.

Another approach, in the absence of the necessary information to estimate optimal taxes or charges, is to determine the optimal level gradually, by trial and error, beginning at an acceptable low level and introducing annual increases at a predictable or pre-announced rate. Much can be learned from the changing response of industry. In this regard it is important to maintain the real value of MBIs through indexing to the general price level (or the wholesale price index of the industry concerned).

3. Entry Points for Economic Instruments

A window of opportunity is necessary for the successful introduction of economic instruments. Candidates include fiscal policy reform, privatization, trade liberalization, structural adjustment, transition to market economy, and decentralization of government. Other opportunities are provided by the preparation of a National Conservation Strategy or an Environmental Action Plan. China, for example, has taken advantage of this formulation of a National Agenda 21 to review and reform its pollution levy system and to consider other economic instruments such as sulphur taxes and tradable permits.

4. Use of Revenues from Economic Instruments

There is a need to ensure that revenues from economic instruments, such as charges and royalties, are not simply consumed (or even worse used to finance distortionary subsidies or environmentally harmful activities). One possibility is to introduce restrictions on the use of these revenues (not just earmarking) but a requirement that an amount at least equal to the rents from a depleted resource or the losses from environmental damages should be invested in maintaining the country's productive capacity and quality of life (including natural and environmental capital). It is only then that the relationship between environmental management and sustainable development will be firmly established and economic instruments along with environmental regulations will become vehicles of sustainable development.

5. Additional Guidelines and Recommendations

In addition to the above policy implications of the three case studies, the following additional recommendations stem from the international experience with economic instruments (see Panayotou, 1995a).

- (a) Introduce more flexibility into existing regulatory and economic instruments (offsets, tradable permits, etc.)
- (b) Implement economic instruments at the right pace, which is usually gradual and preannounced;
- (c) Explore the prospects for greening the national (and state) budgets;
- (d) Experiment with innovative instruments on a pilot basis.

Conclusions

The diverse experience with economic instruments of the industrializing economies of Brazil, China and South Korea, while still evolving, leads to a number of conclusions. First, economic instruments can be introduced successfully at any level of development as long as the level of development itself is properly factored in the designing of the instruments. Second, there is no standardized set of economic instruments that is applicable to all countries at all times; what works in one country or at one stage of development might not work in another country or at a different stage of development. Third, it is both desirable and possible—in fact necessary—that each country design its own version of a particular instrument (or indeed a new economic instrument altogether) to fit the local circumstances, while not ignoring lessons learned from the experience of other countries. Fourth, a trial and error approach is an inevitable outcome of the inadequate information on marginal abatement cost and the parameters of the industry response function. To avoid creating policy uncertainty during the introduction and fine-tuning period, it is advisable to experiment on a pilot basis; this approach is used extensively in China. Fifth, economic instruments are more acceptable as tools of environmental management when their primary incentive function is divorced from their secondary function or by product of revenue

generation through offsetting reductions of other taxes or charges.

While most countries, both developing and developed, have used economic instruments as a source of government revenues or to finance specific environmental investments, it is increasingly realized that the greatest promise of economic instruments is in their capacity to realign the incentive structure faced by economic agents to the social objectives, and to accomplish this at as low a cost as possible. In this regard, Brazil, China and South Korea have made considerable progress, albeit at a different pace, by introducing more flexibility in their regulatory structure and by experimenting with a variety of economic instruments. While much more remains to be done in these countries, their experience (both positive and negative) holds valuable lessons for other countries contemplating more extensive applications of economic instruments in their environmental policies.

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