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Economic Instruments and Economic Regulators: With applications to the case of India

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Abstract:

In India, given the constitutional provision for protection of property rights to clean environment, the government has enacted a number of laws for environmental management. The presence of these laws has made it mandatory for the economic regulators: government, market and communities to use various economic instruments to realize the environmental objectives. Government uses both the indirect second-best budgetary policy instruments and the direct policy instruments such as pollution taxes and permits to control environmental externalities. The market as a regulator provides incentives to consumers, producers, and stockholders to control pollution by influencing market prices, providing a platform for expression of demands by consumers for more environmentally friendly goods, and by incentivising firms to adopt technologies conducive to environment. Laws protecting private ownership of property serve also as protectors of environment by making people liable for the damages they cause to others' property, e.g., through insurance markets for environmental damages. Communities as regulators assume importance when the government and the market fail in the efficient management of environmental resources.

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I Introduction

Government, markets and communities are economic regulators, which use a variety of regulatory instruments for enhancing social welfare. Given the laws protecting property rights/freedom of the people in making consumption and production decisions in the economy, the market driven prices of goods and services guide the consumers in making consumption decisions that maximize their utility and the producers in making production decisions that maximize their profits. However, the market and its regulatory instruments of prices fail to realize and secure, on their own, the socially desired income distribution with the guaranteed minimum living standards to the poor and the other larger societal objectives like the sustainable management of environment. The government with its normal budgetary policies and specific legislations/acts uses policy instruments that are either substitutes for or complements to market prices for realizing the larger societal objectives. Further, given the laws protecting the property rights to clean environment and the presence of local common property resources, local communities often act as regulators when market and government fail to protect their property rights.

Government is by far a major regulator using prices, quantities, taxes, subsidies and public expenditures as instruments for achieving its objectives of social welfare maximization and environmental sustainability. Price instruments are used for regulating the supply and demand of essential services/commodities. These essential services, known also as public utility services, are supplied by institutions specially created as semi-autonomous bodies through special legislations enacted by the federal/central and provincial/state legislatures in India. Quantity instruments are used by the government to ensure that there are always supplies of some essential goods such as food and fuel to the poor households and essential inputs to agriculture and industry. The quantity restrictions on imports and exports of certain commodities are imposed by the government for achieving the trade policy objectives. Quantity instruments are also used to directly achieve the environmental objectives of reducing air and water pollution in the country.

Budgetary policy instruments of taxes and subsidies and public expenditures are used by the government to achieve efficiency, equity and environmental objectives. Traditional budgetary policies of government require some correction to deal with environmental externalities. Such corrections are achieved by extending the traditional budgetary policies of government to include

environmental taxes and subsidies and environmental public expenditures. The government of India was not originally empowered by the constitution to directly deal with environmental problems through its normal budgetary policy. However, over the years, specific laws have been enacted that have empowered the government to use direct environmental policy instruments such as pollution tax, market for tradable permits and command and control instruments. However, the use of these instruments has budgetary consequences, when studied in a general equilibrium framework. The revenue generated by the government from using direct environmental policy instruments can be used to finance public expenditures for development and environmental projects. A global carbon tax or a global market for tradeable carbon permits for controlling the global externality problem of greenhouse gases can also become an important source of revenue to national governments when the revenue generated by these instruments and collected by a relevant international organization is distributed among member countries on the basis of fairness or achievements in carbon reductions. International acceptability of these instruments depends on fair sharing of revenue generated by them by member countries.

2. Provision of Public Utility Services and Government

Public utilities are the regulatory institutions of the government that regulate the supply of essential services. The supply of these services, if left to free markets, has a tendency to lead to formation of natural monopolies, which are detrimental to consumer interests – they result in higher prices and lower supplies of these services. Public utilities are created therefore to safe guard the consumers with the intervention of government or a public authority. They are generally created under the special legislation by Parliament or state legislatures. In India, electricity boards, water supply undertakings, road transport authorities etc. are created by the special acts of state legislatures. Indian Railways are set up under a special act of Parliament.

Public utilities are autonomous institutions having freedom to decide the price policies for supplying essential services such as water for industrial and household uses, electricity for households, industrial and agricultural purposes, postal services, telecommunications, transport services, health services etc. As in the case of the general budgetary policies of the government, criteria employed for fixing the prices by these public utilities are based on promoting the efficiency and redistribution objectives of the government. The prices are normally fixed

independently by the utilities as autonomous bodies and sometimes with supplementary support of the budgetary policies of the general government.

One of the characteristics of public utilities is that they supply jointly a number of services with non-decreasing returns to scale. The cost structure of a utility is such that there are both joint costs for all the services it supplies and a cost attributable to each service. In view of this, a public utility has to consider different regulatory approaches for fixing prices for the services it supplies. The approaches normally used are[3] (i) full-cost pricing or first-best pricing with a balanced budget (ii) two-tier pricing with full cost pricing and over all subsidy, (iii) second-best pricing and (iv) pricing with cross subsidization and overall budgetary deficit. Full cost prices imply that the utility recovers the complete cost of supplying each service so that its budget is balanced. Full cost recovery by the utility ensures competitive supply and efficiency. Full-cost pricing while ensuring efficiency may result in very high prices for some services which are normally availed by poor and disadvantaged people. This in turn works against the redistributive or equity objective of the utility. A two-tier pricing approach involves the utility charging full-cost prices and the general government giving subsidies to services generally availed by the poor. Thus, this pricing scheme helps in achieve both the objectives of efficiency and equity. Second-best pricing involves pricing with budget-balancing and cross subsidization of utility services. This scheme achieves the equity objective while also recognizing that there are trade-offs in achieving the objectives of equity and efficiency. This approach may result in implicit cross subsidization with prices of some utility services fixed on cost-plus basis (above the cost of provisioning of the utility service), while others receiving subsidies. Finally, prices involving cross subsidies and over all budgetary deficit requires linking utility pricing with the general/aggregate expenditure policy of government. The government finances or compensates the budgetary deficits of utilities arising out of subsidies given to certain services to achieve equity objective. Public utilities in India use some of these approaches for charging prices for their services.

The State Electricity Boards (SEBs), which are the public utilities supplying electricity in India, levy tariffs following the budgetary policy of cross subsidization with the budgetary support of state governments to finance budgetary deficits. A SEB follows the policy of discriminatory pricing charging different prices for different users. Industries are supplied at higher prices on the

[3] See Jha, Murty and Satya Paul (1990)

cost-plus basis while households are supplied at subsidized prices. There is also non-linear pricing with respect to units of consumption by the users, i.e., the price of the utility varies with the level of consumption by the users. In the case of electricity subsidy for ground water irrigation, the difference between the actual cost of generation and distribution and the tariff charged is a subsidy benefitting the farmers. However, the cost of this subsidy is entirely born by other users of electricity (industry and households) if SEB follows the policy of cross subsidization with balanced budget. If SEB has budgetary deficit due to power subsidy even after some cross subsidization and if it is funded from general state government budget, the general tax payer bears part of the burden of subsidy.

Municipal water supply undertakings also follow the policy of discriminatory prices. They charge higher prices for industry and subsidized prices for households with non-linear pricing with respect to units of consumption. The state governments subsidize the use of water for irrigation by farmers from two sources: canal and ground water. The cost of canal irrigation consists of costs of infrastructure and maintenance and the distribution cost. The irrigation fees charged by the government by covering only a small part of the maintenance cost and ignoring very high infrastructure cost results in a huge subsidy to the farmers. The subsidies for ground water irrigation, to the farmers, take the form of very low or zero power tariffs charged by SEBs for pumping water.

In the case of railway services in India, the Railway Board follows the approach of cross subsidization with deficit budget for fixing prices for its services: passenger and goods traffic. The railway budget forms the part of Union budget, with the latter absorbing the budgetary deficit of the former. The Indian Railways provides an overall 45 percent subsidy implying that it recovers only 55 percent of its cost from its users. This subsidy mainly takes the form of cross subsidization from the revenue it earns from goods traffic and a net budget deficit absorbed by the union budget.

The Indian postal department (IPD) follows the approach of cross-subsidization with budgetary deficit for fixing the prices for services it offers. That means that subsidies on some of its services are financed partly from cross-subsidization and partly from general government revenue. This approach is justified if the IPD as public utility along with its subsidizer, the Union government,

has the objectives of efficiency and equity. The estimates of distribution of demand by sector for postal services show that household sector consumes 70 per cent of unregistered mail services and 30 per cent of registered mail services. If the government has distributional preferences in favor of consumption of postal services by household sector in comparison to its own consumption and consumption by business sector, these preferences have to be reflected in the prices it charges for various services.

3. Environment and Budgetary Policies of Government

3.1 Environmental Taxes and Transfers[4]

In a world with no externality problems, the second fundamental theorem of welfare economics states that any Pareto optimum can be decentralised as a competitive equilibrium provided the government can implement a system of personalised lump-sum taxes/transfers. Thus, in particular, the Pareto optimum that maximises social welfare, which is based on equity considerations, can be decentralised with these instruments. In that sense, these instruments promote the equity objective of the government. Additionally, lump-sum taxes can also be used when the government has expenditure requirements, for example, for providing public goods. These are often called the first-best instruments of tax policies as use of these instruments does not involve distortions – dead-weight losses – for the economy. Noting that negative personalised lump-sum taxes are positive personalised lump-sum transfers, the Walras law implies that, at such a competitive equilibrium, the government budget is balanced, i.e., these lump-sum taxes and transfers are self-financing:

$$T = \sum_{h=1}^{H} r^h$$

where T is the government's a-priori revenue requirement, $r^h$is the personalised lump-sum tax levied on consumer h, and H is the number of consumers. If someone is receiving a transfer, i.e., if $r^h < 0$ for some h, then somebody else in the economy must have been taxed, i.e., $r^{h'} > 0$ for some consumer h'.

In a world with an externality where environmental tax (Pigouvian tax) is employed as an instrument of externality correction, the second welfare theorem counterpart would state that a

[4] See Sushama Murty (2019) for more details.

Pareto optimum can be achieved with an environmental tax provided the government can also implement a system of personalised lump-sum taxes/transfers. Analogous to the case where there are no externalities, personalised lump-sum taxes/transfers continue to be instruments that help attain the redistributive/equity and revenue-raising objectives of the government, while the Pigouvian tax is fixed at a level that reflects the social marginal damage caused by the externality. The Walras law implies that the government's budget will be balanced at such an equilibrium: the revenue from environmental taxation and personalised lump-sum taxation will be equal to the government's revenue requirements:

$$T = \sum_{h=1}^{H} r^h + \tau \sum_{h=1}^{H} x_E^h$$

where, assuming a public-good type consumption externality, τ is the environmental tax rate and x_E^h is the consumption by consumer h of the externality causing commodity. Once again, the personalised lump-sum taxes can be negative or positive. Thus, it does not follow that decentralisation of a Pareto optimum with externalities as a competitive equilibrium with environmental taxation implies that revenue from environmental taxation is always to be used for making positive transfers to all consumers, i.e., $r^h < 0$. Redistribution and revenue-raising objectives may prevail and imply that there could still be a social need for positive lump-sum taxation of some consumers, i.e., there could still be some consumer h' such that $r^{h'} > 0$.

3.2 Second Best Revenue Policies of Government and Environmental Taxes

A second-best situation arises when the first-best instruments of taxation such as personalised lump-sum transfers/taxes cannot be implemented due to informational constraints. These instruments are not incentive compatible, in that, if government relies on people to indicate their true wealth status then, under many popular equity criteria employed by the government, there are incentives for people to under-report their wealth to escape personalised lump-sum taxation and to benefit from positive personalised lump-sum transfers. In such situations, the government will have to abandon these first-best instruments and take recourse to more incentive compatible tax instruments such as commodity taxes and personal income tax to meet both its revenue and redistribution objectives. This is because all consumers face the same commodity tax rates when they buy goods and a common personal income tax schedule. However, such tax systems are

distortionary as they further government's revenue and redistribution objectives at the cost of compromising on Pareto efficiency, i.e., they involve some deadweight/efficiency losses.

The Many Person Ramsey Rule (MPRR)[5] of taxation reveals that such a tax structure will balance the trade-offs between the objectives of equity and efficiency[6]. To promote equity criterion, intuitively it implies that such a tax structure will encourage (discourage) more the consumption of those commodities which are consumed by poor (rich). On the other hand, to promote the efficiency criteria, it implies encourage (discourage) the consumption of commodities with high (low) price elasticities of demand. Note that, often goods with inelastic demands are necessities that are disproportionately consumed by the poor who are the people whom the society values more. Hence, trade-offs between equity and Pareto efficiency are inherent in designing second-best optimal commodity taxes.

The common income tax schedule faced by all income earners could be highly non-linear (with the marginal tax rate varying with the level of income earned) to promote redistributive objectives of the government – for example, marginal tax rates could be high for people earning higher incomes because the government's social welfare weight/value given to an additional unit of consumption by such income earners is low. The design of the optimal personal income tax schedule also involves equity-efficiency trade-offs. Higher marginal tax rates have disincentive effects on labor supply and can shrink the size of the economy's GDP[7].

Moreover, Mirrlees 1971 and Diamond and Mirrlees 1971 show that second-best optimal tax policies are production efficient, i.e., they lead to production on the frontier of the economy's aggregate technology. An implication of this is that, second-best optimal commodity taxes should involve no taxation of transactions between firms in intermediate inputs. A direct real world policy implementation of this prescription takes the form of tax credits/rebates given to producers on all the taxes they pay on purchase of inputs.

In a second-best world with environmental externalities, commodity taxes serve the purpose of not only redistribution and revenue generation for the government but also of externality correction.

[5] See Atkinson and Stiglitz (1979)
[6] See Diamond and Mirrlees (1972a, 1972b)
[7] See Mirrlees (1971)

In the context of a consumption externality, Sandmo (1975) demonstrates that under a second-best optimal commodity tax structure, the optimal commodity tax rate for each commodity can be decomposed into (i) a MPRR component that addresses the trade-offs between equity and Pareto efficiency that are inherent to commodity taxes and (ii) an externality correction (i.e., environmental or Pigouvian tax) component which ensures that the environmental tax reflects the net marginal social damage due to the externality measured in units of government revenue, which reflects the social marginal disutility from the externality in units of govt revenue less the fiscal gains from the externality due to its complementarity\slash substitutability with other commodities. The latter could arise, for example, because smoking of cigarettes, while externality generating, could have adverse consequences for health of consumers leading to the incurring higher medical expenditures, which could be significantly taxed, hence increasing revenue for the government.

In a second-best world with production externalities – externalities generated by producers of goods, the second-best production efficiency result of Diamond and Mirrlees (1971) with respect to commodity taxation gets violated. Second-best optimal commodity taxation will require that firms generating production externalities should pay a Pigouvian tax on externality-causing intermediate inputs purchased from other firms equal to the net marginal damages that they inflict on the society when they use such goods as inputs. For example, a Pigouvian tax on purchase of coal as an input by a firm from a firm supplying coal. Thus, the tax rebate given to a firm on purchase of an externality causing input from other firms should be reduced by the amount attributed to the social cost of externality generation[8].

3.3 Integrating Carbon Taxes or Taxes for Climate Change Mitigation with Budgetary Policies of National Governments[9]

Greenhouse gas emissions create externalities which are domestic as well as international. The economic instruments of domestic taxes levied by national governments and an international carbon tax levied by an international agency on carbon intensive commodities are complementary policies for reducing these externalities. Domestic taxes on energy apart from facilitating energy conservation and pollution reduction are also sources of revenue to the government. Given the highly inelastic nature of energy demand, these taxes are regressive to a greater extent with adverse

[8] See Bovenberg and de Mooij (1994), Bovenberg and Goulder (1995),and Murty (2018).
[9] See Murty (1996) for more details

effects on income distribution. For example, the recent tax-induced hike in fuel oil prices in India, while providing the government with substantial revenue, have been a source of public concern due to their inflationary impact on prices that affects mainly the consumers in the lower and middle of the income distribution.

In the case of greenhouse gas emissions, a global externality problem, the polluting countries are also affected by pollution. Collective decisions of countries are needed for setting the targets for global and country-specific carbon emissions and the instruments used to realize them. The success of these collective decisions depends upon the resolution of the problems related to distributional effects, fairness, carbon leakage etc by the national governments. In order for the national governments to be a party for an international agreement in this context, we feel that a uniform international carbon tax could be more acceptable to nations when there are inbuilt mechanisms in place for nations to compensate the affected stake holders. In this situation, nations could convince domestic stakeholders (consumers and producers of carbon intensive commodities) for becoming a party for the agreement. A uniform international carbon tax facilitates cost minimization to obtain targeted reductions in CO_2 emissions by member countries with producers incurring higher cost of production and consumers facing higher prices of carbon intensive commodities. An international agreement for having such a tax combined with an inbuilt mechanism to compensate the affected stake holders in the member countries implies that a carbon tax across the countries will naturally get integrated into budgetary policies of national governments.

The targets set for the member countries in a collective agreement to reduce greenhouse gases may require them to obtain much larger emission reductions than those needed to deal with the problem of local negative externalities of fossil-fuel based emissions (fossil-fuel based SO_2 emissions generate local externalities, while the CO_2 generated by the same fossil fuels have global consequences). The carbon tax to achieve the collectively agreed global targets is under the control of a global authority while the taxes to control local externality are decided by governments of individual countries. As an example, in the case of CO_2 emissions, there could be a fiscal system in which there are national pollution taxes and an international CO_2 tax. An institutional setup to design and implement international carbon tax has to have an international agency (IA) and member countries. Literature suggests that countries could agree to have international carbon tax

provided that the revenue collected by this tax is distributed among them in an acceptable way. The criterion for distribution could be either fairness and equity or performance in terms of reduction in CO_2 emissions. Literature shows that member countries agree to have a uniform international carbon tax if there are lump sum transfers from revenue collected by IA on the basis of any criteria mentioned above. A successful international cooperation to contain the global externality problem of greenhouse gases could be dealt within the framework of Many Country Ramsey Rule (MCRR) (Murty.1996). The MCRR suggests that a tax on carbon intensive commodity could be decomposed in to three parts: revenue tax, local externality tax and global externality tax or international carbon tax.

3.4. Environment and Public Expenditure Policies

Government of India makes direct environmental expenditures/investments as part of its budgetary policy to achieve the environmental objectives. These expenditures are made by both central and state governments and local self-governments in India. They are meant for dealing with water and air pollution abatement, ground water conservation, forest conservation, conservation of coastal and inland ecosystems, non-conventional energy sources, disaster management and climate change related issues. These expenditures are financed partly out of revenue directly generated by the relevant governments (centre, state or local) and partly out of revenue earned through inter-governmental resource transfers in the form of revenue sharing by centre and states and states and local governments. These transfers are facilitated by the centre and state finance commissions (FCs) constituted as per the Indian constitution.

In the case of forest conservation in India, the long term national target is to increase forest cover to 33 percent of the country's geographical area. This target was first set by the National Forest Policy, 1952 and reiterated in subsequent policies of the government, including the National Forest Policy, 1988 (Government of India, 1952; Ministry of Environment and Forests, 1988). The new draft National Forest Policy 2018 also aims to maintain at least one-third of India's total land area under forest and tree cover. Furthermore, India has committed to creating an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030 in its Nationally Determined Contribution (NDC) to the Paris Agreement.

As some examples of public expenditures in India, consider the cases of forest conservation, water resources and renewable energy in India. There are now two sources for funding forest conservation by states in India: statutory transfers through FCs and the compensatory afforestation fund created by the Union Government. The transfers to states through FCs generally take two forms. One is an earmarked grant specifically for forests and the other is inclusion of forest cover in the formula determining share of states in the total tax revenues of the Union Government. The compensatory afforestation was created by the Union Government through the enactment of Forest (Conservation) Act, 1980 restricting use of forest land for non-forest purposes by states. It is now mandatory for states to get approval from the Union government for using forest land for other purposes. In view of Supreme Court judgment in 2002, there is a need for making payments when the forests are cut down for industrial and other purposes based on the estimated value (net present value) of forest land lost. These payments form part of Compensatory Afforestation Fund which will be eventually distributed among states depending upon their needs for the forest conservation.

In the case of water resources, public expenditures both by union and state governments are incurred on river cleaning projects, supply of water to households, industrial and agricultural uses and conservation of coastal and inland ecosystems. All the three governments in the Indian federation: centre, states and local self-governments participate in the case of river cleaning programs. For instance in the case of the project for cleaning river Ganges in India, the stakeholders are the central government, the state governments and the local governments, households and industries belonging to Gangetic basin. Centre and concerned state governments are sharing the investments made on sewage treatment (STPS) and on riverfront development along the river. As per the environmental regulation in India, it is mandatory for the industries to invest in reducing industrial water pollution and for local self-governments (municipalities) to invest in reducing household borne pollution in the Gangetic basin. In the case of supply of fresh water, centre and states share investment expenditures on major dams constructed on the rivers with state governments investing in watershed management and minor irrigation schemes on their own. The local self-governments or municipalities and panchayats incur invest expenditures for supplying water to households and industries. The central and state governments in India share expenditures on investments made for the conservation of coastal and inland wetlands.

There have been direct public sector investments in different sources of renewable energy as parts of the budgetary policy of government apart from significant investments in the same by the private sector and joint public and private sector partnerships in India. As of the year 2019, India was ranked fifth both in wind and solar power generation and ranked fourth in the world in terms of the total installed capacity for renewable energy generation. The Government of India has set the target of achieving an installed capacity of 523 GW for renewable energy including 73 GW for hydro power by 2030. The Central Electricity Authority (CEA) estimates that the share of renewable energy generation would increase from 18 to 44 per cent, while that of thermal is expected to reduce from 78 to 52 per cent by the year 2030 in India. The central government budget of 2021-22 has allotted Rs 5753 crores to the Ministry of New and Renewable Energy and Rs. 300 crores for the New Green Energy Corridor scheme. In addition, the budget of 2020-21 also provides for a capital infusion of Rs. 1,000 crores to Solar Energy Corporation of India (SECI) and Rs. 1,500 crores to Indian Renewable Energy Development Agency.

4. Government and Direct Environmental Policy Instruments

Here we consider policies that directly tax pollution/emissions to control environmental externalities as opposed to taxing goods whose consumption or production as outputs or use as inputs directly or indirectly causes emissions.

In this case, the government uses both market-based/economic instruments, which can involve both prices and quantities, and the non-market based instruments such as command and control for dealing with pollution. The choice between these instruments depends both on their efficacy in achieving the target level of emissions as well as on the relative size of welfare losses they produce (Baumol and Oates, 1988). Government can use either of these two types of instruments or a combination of both. Command and control instruments take the form of fines and penalties on polluters for not attempting to reduce pollution. These instruments do not ensure efficiency in pollution reduction, given that the polluters are not incentivized to use cost minimizing abatement technologies. Economic instruments are of three types: price based instruments, quantity based instruments and hybrid instruments. These instruments help in achieving market/allocative efficiency while reducing pollution. The price based instruments are pollution taxes and subsidies and the quantity based instruments are tradable pollution permits.

Using economic instruments requires a lot of information on firm-level emissions, technology etc. and individuals' valuation of pollution which are not easy to obtain. Similarly, the estimation of damages to the affected people involves practical problems for the design of the socially optimal pollution tax, and the un availability information about the socially optimal level of pollution poses problems for fixing the emission cap for the market for tradable permits. A hybrid method that uses both command and control and economic instruments includes the Pollution Control Boards fixing standards and using either pollution tax or marketable permits to induce the polluter industry to meet those standards. The difficult problem of estimating the damages to all the affected people from pollution can be avoided once the environmental standards are given a priori. The marginal abatement cost schedules can be estimated given the firm-level data on pollution loads, costs of abatement, and production levels. Given knowledge of these schedules, a rate of tax can be fixed such that the firms will automatically have an incentive to reduce pollution for meeting the standards.

In India direct market-based economic instruments are not used so far and only command and control instruments have been used by the government to deal with industrial pollution. In particular, to the best of our knowledge, there is no evidence of use of emission taxes. However, there are couple of instances of using cap and trade-type schemes in India: the renewable energy certificates scheme and the Bureau of Energy Efficiency's (BEE) Perform, Achieve, Trade (PAT) scheme. Also, the Gujarat Pollution Control Board (GPCB) launched recently a conventional cap-and-trade regulation for particulate pollution in Surat[10].

In a market economy without informational uncertainties either pollution taxes or pollution permits as explained above can be used to ensure efficiency in emission reduction. However, in a situation of incomplete information there is a case for making a choice between these two instruments. It is shown in the literature that if there is uncertainty about the measurement of benefits and costs of pollution abatement, there will be efficiency losses associated with both tax and permit instruments (Weitzman, 1974). Efficiency losses are less with pollution tax if marginal cost of abatement schedule is relatively steeper than the marginal benefit from abatement schedule or in a situation

[10] See Sukanya Das, Murty and Kavita Sardana (2021) for details.

of relatively flatter marginal benefit curve. In contrast, with marketable permits, efficiency losses are less if marginal benefits curve is relatively steeper than marginal cost curve or in a situation of relatively flatter marginal cost curve. Hence, in the case of incomplete information about benefits and costs of pollution abatement, these are scenarios where the regulator has to choose between a carbon tax and carbon permits for climate change mitigation (Stern, 2006). In the case of climate change mitigation, the regulator may find that the marginal abatement cost curve of carbon emissions is relatively steeper than marginal benefit curve of carbon reduction in the short run. However, in the long run he may observe the opposite.

In the short run, the expected marginal costs of abatement are steeply increasing or marginal abatement cost curve become relatively steeper since firms find it progressively more difficult to reduce emissions as they cannot adjust capital stock and technology. In view of this the emissions reductions of greenhouse gases in response to a policy instrument are small in comparison to already accumulated stock if they are measured over a short period, say a year. The expected marginal benefits in this case are gently decreasing or marginal benefits curve become relatively flat as the emissions reduce. In the long run, marginal benefit curve may become more steeper (climate change damage response functions becoming non-linear with rising stocks of greenhouse gases) and while marginal cost of abatement curves becoming flatter (with firms using new technologies of abatement).

Uncertainty about costs and benefits of climate change mitigation suggest that (Stern, 2006):
(i) Policy instruments should distinguish between the short term and long term, ensuring that short-term policy outcomes are consistent with achieving long-term goals (ii) The policy-maker should have a clear long-term goal for stabilizing concentrations of greenhouse gases in the atmosphere. This reflects, first, the likelihood that marginal damages (relative to incomes) will accelerate as cumulative emissions rise and, second, that the marginal costs of abatement (relative to incomes) are likely to be relatively flat in the long term once new technologies are available, (iii) In the short term, the policy-maker will want to choose a flexible approach to achieving this long-term goal. The policy is to keep the short-term policy framework on track to deliver the long term stabilization goal, (iv) Having established the long-term stabilization goal, the price of carbon is likely to rise over time, because the damage caused by further emissions at the margin-the social cost of carbon-

is likely to increase as concentrations rise towards this agreed long term quantity constraint and (v) Short-term tax or permit trading policies will then need to be consistent with delivering this long-term quantitative goal.

5. Integrating Environmental Policy with Budgetary Policies in India

The revenue policies of Indian government have undergone major reforms during last two decades. These reforms in India have to take cognisance of its implications to centre-state financial relations and environmental management. During pre-tax reform period the revenue instruments of central government were excises, customs, income tax and taxes on capital gains. The revenue instruments of states were sales tax, excise duty on alcohol, taxes on profession and trades, land and buildings, tax on goods entering states, tax on vehicles and tax on entertainment and agricultural income tax and stamp duty. Highly differentiated tax rates were levied as specific and ad valorem duties on goods and services by both centre and states. The first major reform of commodity taxes has taken place during the year 2005 to introduce value added tax (VAT) in India. Introduction of VAT in India has resulted in making tax base relatively more comprehensive and replacement of specific taxes by ad valorem duties, reducing the multiplicity of tax rates, and giving credit to taxes on inter-regional trade[11]. As a part of reforms, two options were considered for VAT in India: a national VAT with inter-governmental sharing arrangements and joint national and state VAT with federal tax imposed at uniform rate across the nation and a state VAT with variable rates across the states. Before the current goods and service tax (GST) was introduced in the year 2017 as a major tax reform in India, there were central VAT (MOD VAT or modified value added tax) and state VAT on goods and services in India. Many states have replaced several types of commodity taxes by VAT in India.

It is important to know how the environmental policy objectives of government could be realized using a VAT regime in India. Using commodity tax regime in India for achieving environmental objectives requires significantly differential rates of taxes. Environmental pollution taxes have to be commodity specific because commodities differ with respect to pollution intensities in production and consumption. Take for example, a tax on electricity. In the case of a uniform VAT, a 10 percent tax levied on electricity does not distinguish between hydro and coal fired thermal

[11] See Burgess and Stern, 1992 and Murty, 1995 for more discussion on VAT in India.

power. However from the point of view of environmental protection, different rates of taxes have to be levied on thermal power and hydro power with probably a subsidy for hydropower. VAT on goods and services is levied to achieve the objectives of budgetary policies: revenue efficiency, equity, environmental objectives etc. Since VAT is levied mostly as an ad valorem tax, any increase in the rate of tax to realize environmental objectives could result in consumer and producer surplus losses that have to be weighed against gains in environmental benefits.

Income taxes could be used to raise revenues for environmental expenditures of government. There are empirical evidences to show that people would like to make direct payments for environmental improvements (improving urban air quality, water quality, river cleaning, forest conservation, soil conservation etc.). A plethora of environmental valuation studies were done across the globe providing evidence for this. These studies use voluntary direct contributions by people, pure environmental taxes or budgetary policy instruments like income taxes or commodity taxes as vehicles for these payments. Take for example river cleaning in India. A study done to find out household valuation of cleaning the river Ganger shows that, on an average, the urban household in India as a non-user[12] is willing to pay Rs. 1506 per year at 2018 prices to maintain the bathing river quality[13]. These payments could be appropriated by the government to finance river cleaning in India as part of income tax paid by urban households (for example surcharge on income for river cleaning) or through a mechanism to receive direct payments by government. The income tax alternative introduces market imperfections distorting work-leisure choices of people while a direct payment is a pure environmental instrument and hence is not expected to cause market inefficiencies.

It is important to discuss the efficacy of using GST,[14] for achieving the environmental objectives of government viz-a-vis employing the pre-reform commodity taxes in India. Given that the central and state GST rates are less differentiated, they are not flexible enough to address the environmental problems. Pure environmental policy instruments discussed in Section 4 help achieve the environmental objectives by providing incentives to firms and households to reduce

[12] People express non-user benefits to an environmental resource due to bequest, altruistic and spiritual motives they may have. In the case of river Ganges people may be religious motive also.
[13] See Markandya and Murty (2000) for details.
[14] GST is a destination based tax avoiding the cascading effects and other problems of associated with VAT..

pollution at various stages of the production cycle. In the production cycle, environmental problems arise while making input choices, choices regarding the production processes to use, choices regarding product quality etc. GST is levied as VAT on the value of product at the final stage of product cycle. Therefore, in its current form, the burden of any increase in this tax to achieve environmental objectives will not be immediately passed on to the intermediate stages of the product cycle so that incentives are built to adopt required abatement methods by producers and consumers. To correct for this, the public economics literature reviewed in Section 3.2 suggests that, the tax credit/rebates given to producers on purchases of intermediate inputs such as coal under the GST have to be reduced by the amounts that reflect the social damages due to the externalities generated by the use of these inputs by producers. It is possible under this correction that producers using such inputs actually end up paying positive Pigouvian taxes on the use of such inputs, i.e., the input tax rebates/ credits are negative.

Environmental problems are commodity specific. Commodities differ very significantly in terms of environmental intensity or pollution intensity. A uniform pollution tax on emissions could help reduce pollution by all industries to the desired level as discussed in Section 4. However, in its current form, a proportionate increase in the rate of GST to reduce pollution will affect both polluting and non-polluting industries equally without resulting in desired reduction of emissions. A more differentiated GST relating to pollution intensities of commodities is required to achieve emission reductions which may not be administratively feasible in GST regime. To achieve environmental objectives, a practical approach could be to group commodities into high, medium, low and no pollution intensity groups and levy four different excises/subsidies in addition to existing GST rates on goods based on their pollution intensities. The tax changes attempted could be revenue neutral such that excise taxes on polluting commodities could be accompanied by excise subsidies (which reduce the effective tax rate on the good) on non-polluting commodities.

Constitutional provisions and legislations for environmental management present in India empower the center and states to use central and state GSTs as environmental regulatory instruments. This could result in interstate tax competition in which each state, given the taxes of other states, has an incentive to lower environmental taxes for attracting investments and business.

There is a need therefore for tax coordination among states to avoid inefficiencies in environmental management from the tax competition. Inter-jurisdictional competition is a well-known problem encountered in a federal structure of taxation.

Apart from domestic taxes countries could be tempted to use trade taxes to achieve environmental objectives. Export taxes on pollution intensive commodities and import taxes on imports that cause domestic pollution could result in reduction of environmental pollution. But trade instruments while improving domestic environmental quality could cause trade distortion resulting in welfare loses to the country. Therefore, it is welfare improving to use pure environmental policy instruments if feasible to achieve environmental objectives and avoid using domestic and trade taxes for this purpose.

6. Market, Community and Environment

6.1. Market and Laws Protecting Property Rights

If the government is benevolent and there are supporting legal and other institutions for enforcement in place, then empowering the government constitutionally with environmental regulation will help in achieving environmental goals. But the government may not be benevolent and the required environmental laws may be absent in many countries. The market mechanism can also complement government regulation in controlling environmental externalities. A competitive market ensures efficient supply of goods and services in the economy. The efficient functioning of the market requires the presence of laws enacted by the government to protect the property rights of producers and consumers. Market provides incentives to consumers, producers, and stockholders to control pollution. The consumers regulate the market for pollution intensive commodities by expressing preference for green products. The investors also have incentives to invest in industries using cleaner technologies. The polluting industries may suffer losses because of reduced demand for its products, increased cost due to higher penalties imposed by the government for non-compliance with pollution standards, and settlement of compensation to the victims. This will contribute to downward valuation of industry's stocks in the market. Some studies have shown that stock markets in both developed and developing countries react to environmental performance of companies.

Laws protecting private ownership of property can be considered as protectors of environment since they may allow safe transfer of ownership and make people liable to the damages caused to others' property. An effective liability system forces the polluting industries to insure their property with private insurance companies and avoid facing the courts. Presence of insurance markets for cleaner production will provide incentives to the producers to protect themselves from the liability of environmental damages. Private management of environmental quality is ensured to some extent through corporate social responsibility of companies whereby such companies incorporate environmental concerns in their planning and action. This is traditionally seen as a philanthropic activity of companies. In India, the introduction of Section 135 in the Companies Act 2013, statutorily mandates specified companies to practice corporate social responsibility. This Act requires companies with a net worth of ₹500 crore or more to spend 2 per cent of their net profits in a financial year on activities pertaining to corporate social responsibility including sustainable environmental management.

6.2. Property Rights and Community Action

Literature shows many types of externalities can be optimally controlled by creating specific property rights among concerned agents (Coase,1960). Property rights mean either rights to clean water and air to people or rights to pollute to the producers and consumers. Given the initial property rights to any resource either to the generator of the externality (polluter) or to the affected party (Public), and if the cost of bargaining is zero, it is shown that the bargaining between the two parties results in the optimal control of externality. There are several practical problems for the Coasean bargaining to work in practice for controlling the environmental externalities[15]. First of all, in reality, the transaction costs or costs of bargaining are positive. Secondly, one of the key assumptions in the Coasean solution is that all the externalities are captured in the value of property rights. There could be a problem in the context of defining the property rights of the future generations for an environmental resource and capitalization of future benefits from this resource. One approach for respecting the rights of the future generation is to consider the government as its representative. The government can compete in the market for environmental property rights of the future generation and pay for it by issuing a debt which has to be serviced by the future

[15] See Nalebuff (1997) for detailed discussion of some of these issues.

generation. Another approach is based on the assumption that the present generation has a bequest motive to the future and wants to bequeath to the future the preserved resources.

In the Coasean bargaining solution, government has a minimal role to play. Its role is only to create property rights and protect them and then the free-market bargaining between the agents will optimally control the externality. Recent institutional alternatives considered in the literature for the control of environmental externalities contain some elements of market mechanism with the government playing only a limited role. Given the doubtful quality of government and transaction costs of government instruments, it is imperative to look for new institutions to define and implement property rights for the environmental externalities. Becker (1983) has shown that political influence exerted by pressure groups in the free market can have impact similar to that exerted by the benevolent government to deal with market failure. For example, there are several agents involved in the political economy of industrial pollution abatement: the affected people, elected representatives, bureaucracy and industry. Incentives exist for forming sub-coalitions of affected people and elected representatives and coalitions of industry and bureaucracy. Existence of such incentives is a fertile ground for the emergence of politically active pressure groups. Following Becker's argument, the competition among these pressure groups may result in the optimal control of externalities.

6.3. Property Rights and Community Action: Some Examples from India

In India there are now a number of cases in which the organized groups of local people affected by pollution in areas surrounding various industrial estates resorted to legal action against polluting industries by filing public litigation cases in the courts. In one such public litigation case[16] on water pollution abatement by an industrial estate in Hyderabad, India, the Supreme court of India, on the advice of an expert group constituted by it, ordered that the affected people be appropriately compensated by the Industrial estate and that the industry and government should take remedial measures to prevent further pollution. The political organization of affected people in this case had also enlisted the support of local elected political representatives (members of local State Assembly and Union Parliament). The court's order requiring the industries in the industrial estate to comply with water pollution standards created a problem for the small scale industries given the

[16] See Murty, (2010a)

scale economies in pollution abatement. To deal with this problem, the industries formed a group to set up a common effluent treatment plant (CETP). The local government has provided an incentive to the industries by sharing a part of capital cost of CETP.

There are several other studies that show that local communities can influence the pollution abatement decisions of industries even in the absence of regulation by the government or in a free market situation. In case of big factories located in different regions of India it is found that the extent of compliance of factories to the environmental standards is related to the characteristics of local communities like the education, political activity etc., apart from the factory specific characteristics[17]. Even with government regulation, we see a trend of involvement of local communities and environmental groups in all activities of environmental management including design, monitoring, and implementation of environmental laws. This is viewed as the privatization of environmental management with laws permitting local environmental groups and industries to compete with government regulation.

A good example of community as a regulator is the management of common property in the village economies. A common property regime is defined as a situation in which individuals have mutual duties and rights. Individuals' right to limit the group size and the right to prescribe how the resource will be used by each member in the group will together constitute the common property. There is now a successful management of neighborhood forests (common lands) in the village economies by a regime known as Joint Forest Management (JFM) in India. In JFM, there is an agreement between village community and government for a mutually beneficial sharing of management of local forest. The agreement can be either involve the government conceding the property right to local forest land to the village community or the government keeping the property right and sharing the benefits with local community. In the case of village community possessing property rights to village commons or forest lands, the collective action for the management of commons is possible only if there is a complementarity between individual benefits and the benefits to rest of the community[18]. For example, since the conserved forest land increases the

[17] See Murty, James and Smita Misra (1999), Pargal and Wheeler (1996) and World Bank (1999).
[18] See Chopra, Kadekudi and Murty (1999) and Murty (1994).

supply of water for irrigation and fodder for cattle, the households owning these private assets have incentives to voluntarily contribute towards the preservation of common lands.

7. A Way Forward

Government, market (consumers and producers) and communities are regulators in the economy, who use various economic instruments for welfare maximization. Government uses prices, quantities, taxes, subsidies, transfers and public expenditures. Given the laws protecting property rights and their preferences and technologies consumers and producers make consumption and production decisions guided by market prices. Communities, through collective action, influence production and consumption decisions to achieve greater social objectives.

The property rights to clean environment granted by the Indian constitution and various laws enacted by the government to ensure sustainable use of natural resources provide incentives to the economic regulators to use some of the economic instruments mentioned above for the efficient management of resources. Historically, in the original constitutions of many countries, there have been no provisions empowering national governments to use regulatory instruments for environmental management. Subsequently, many countries have amended their constitutions to address this problem. The Indian Parliament too made the landmark constitutional amendments: 48, 73 and 74 to empower central and state governments and participatory institutions to use environmental regulatory instruments.

Traditional budgetary policy instruments could be used to achieve environmental objectives. Higher rates of commodity taxes on pollution intensive commodities could regulate the use of environmental resources. Given peoples' preferences for environmental improvements such as river cleaning, conservation of forests and wildlife, etc., income taxes could be used to raise revenue for meeting environmental expenditures. However, commodity and income taxes are only second-best instruments of government policy. In a world with environmental externalities they can be employed to serve the purposes of promoting equity through redistribution, raising revenue for the government, and for correcting environmental externalities. These taxes while improving environmental quality as environmental regulatory instruments, promoting equity, and raising revenue for the governments, result also in distortions in the form of dead-weight/efficiency losses.

Tax reforms undertaken in India in recent times are leading to significant changes in structure of taxes especially commodity taxes. Commodity tax reforms such as adoption of VAT and the more comprehensive GST, which usually involve limited differentiation of tax rates among commodities, tend to make commodity taxes less flexible as instruments for dealing with environmental problems. They need to be supplemented by additional excise taxes on commodities known for generating environmental externalities. In particular, correction of production externalities requires a GST structure that taxes producers for use of externality-generating intermediate inputs.

Environmental policy instruments that are targeted to directly tackle the environmental externality problem include pollution taxes, subsidies that promote use of environmentally friendly technologies, marketable pollution permits, enforcement of property rights, and community action. These instruments, which complement the traditional budgetary policy instruments of government, provide incentives to producers and consumers to take decisions for environmental improvements. While pollution taxes are associated with double dividends in the literature in the form of reducing pollution and earning revenue to the government, enforcement of property rights and community action could result in increased environmental expenditures by government and the industry.

The use of international carbon taxes and carbon permits for climate change mitigation under international agreements have to be integrated with the budgetary policies of national governments for their acceptability by all the concerned stakeholders. The literature shows that there could be a greater acceptability of these instruments if the revenue collected through a carbon tax by an international regulator is distributed among member countries based on either fairness and equity or performance in terms of reduction in CO_2 emissions.

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