

HS 200:

~~Economic Instruments For Environmental Protection~~

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Economic Instruments For Environmental Protection:

- The problem of pollution can be attributed to the divergence between social marginal cost and private marginal cost.
- Opinions on the nature and extent of State intervention in the prevention of pollution and protection of the environment also vary.
- The available policy options range from command and control [CAC] instruments to market-based instruments [MBIs].

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- The actual mix of policy instruments chosen varies from country to country depending on its goals, stage of development, institutional capabilities and political preferences. We examine the effectiveness of these economic instruments for environmental protection, especially from a developing country [largely Indian] perspective.
 - Economic Instruments for environmental protection can be classified under: Direct & Indirect instruments.

Economic Instruments

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graph TD; A[Economic Instruments] --> B[Direct Economic Instruments]; A --> C[Indirect Economic Instruments];
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The diagram is a hierarchical flowchart. At the top is a light green rectangular box with a black border containing the text 'Economic Instruments'. A vertical line descends from the center of this box, which then splits into two horizontal lines. From the left end of the left horizontal line, a vertical arrow points down to a second light green rectangular box with a black border containing the text 'Direct Economic Instruments'. Similarly, from the right end of the right horizontal line, a vertical arrow points down to a third light green rectangular box with a black border containing the text 'Indirect Economic Instruments'. The background of the slide is light yellow, with a vertical olive green bar on the left and a horizontal grey bar on the right.

**Direct Economic
Instruments**

**Indirect Economic
Instruments**

Direct and Indirect Economic Instruments:

- The direct economic instruments are pollution taxes/charges, emission trading rights, deposit refund systems, performance bond and strict liability for pollution.
- The indirect economic instruments are taxes on outputs or inputs of polluting activities, fiscal incentives such as rebates on excise and custom duties, accelerated depreciation allowances, subsidies for adoption of cleaner technologies and effluent treatment plants, eco-certification of products and environmental audit.

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- Economic Instruments can, by altering the costs and benefits, provide signals to polluters to internalize the environmental costs in their decision making and make them behave in a socially acceptable manner.
- They provide incentives to polluters to search for least cost options of complying with the regulations.
- Command and control regulations have been widely used in many countries to regulate emissions.

Pollution Charges

- Pollution charges, is one of the most important instrument used by federal and local governments in order to regulate the optimal level of pollution.
- An ideal pollution charge system must consist of:
 - [a] a lump sum charge to cover firm-related cost;
 - [b] a charge scheme on the waste water discharge; and
 - [c] a per unit charge for each pollutant in the effluent in excess of the prescribed limit.

Economic Incentives for Environmental Protection:

- Incentive systems have been promoted by economists for decades as a cost-effective alternative to technological restrictions and other forms of inflexible command-and-control environmental regulations.
- The idea behind economic incentives is to raise the cost of environmental shirking while allowing the producer the flexibility to find the least-cost pollution control strategy himself.
- By increasing the cost of shirking, the producer has a private incentive to provide the socially optimal level of pollution control.

Economic Incentives:

- Economic incentives can be grouped into three broad categories:
 - Price rationing
 - Quantity rationing
 - Liability rules

Economic Incentives: cont..

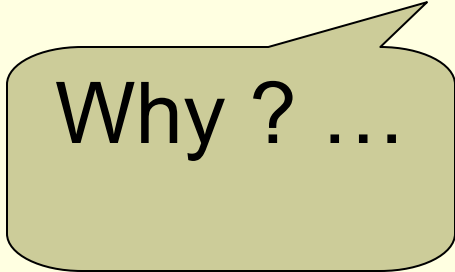
- Price rationing increases the costs of shirking by setting a charge, tax or subsidy on producer behaviour or products. Emission or effluent charges are the most commonly discussed form of price rationing.
- Quantity rationing as an economic incentive sets the acceptable level of pollution by allowing marketable permits that provide an incentive to producers with low pollution control costs to reduce pollution and sell their excess permits to producers with high control costs.
- Liability rules set up a socially acceptable benchmark of behaviour such that, if the producer violates this benchmark, he suffers some financial consequence. Noncompliance fees, deposit-refund schemes and performance bonds represent alternative liability rules.

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- Theoretically, an economic incentive is used to alter a producer's pollution control strategy.
- In principle, the regulator can attempt to change the producer's behaviour by imposing an emissions charge of $t = MB = MC$. Now the producer can either invest in pollution control or pay the charge t , for each unit of emissions.
- This charge provides the incentive for the producer to increase his level of control until his privately optimal level of control equals the social optimum, $MC = MB$. Such optimal taxes are known as *Pigovian taxes*.

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- Problem arises because incentives are typically set too low to induce producers to increase pollution control to the socially optimal level. More so because this tax is used to generate revenue for the govt. rather than to change behaviour.



Why ? ...

Problems:

- Because, lack of information required to implement successfully an incentive to achieve some social optimum.
- Asymmetric information in the form of moral hazard or adverse selection will play an important role in the design and success of the economic incentive scheme.

Asymmetric Information:

- Market failure can occur when one person in a transaction does not have full information about either the actions or the ‘type’ of the second person.
- ‘Type’ can imply the unknown quality of a good or the hidden characteristics of an agent such as inherent intelligence.
- Example: asymmetric information exists when an insuree knows more about his level of precautionary behaviour than the insurer, or a seller knows more about the quality of a product than a buyer.

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- Without complete information, markets will be incomplete and can fail to allocate resources efficiently.
- Two types of asymmetric information problems are referred to as *moral hazard* and *adverse selection*.
- The *moral hazard* or incentive problem arises when the actions of one person are unobservable to a second person.

- The *adverse selection* problem exists when one person cannot identify the type or character of the second person.
- Moral hazard creates two related problems for environmental assets.
- First, when the regulators cannot monitor actions, an individual has an incentive to shirk on pollution abatement since he bears all the costs of such abatement and receives only a share of the benefits.

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- Environmental shirking is likely to occur when an individual pays the costs of abatement but only receives a share of the total benefits to society.
- Ignoring transferable externalities, the individual has an economic incentive to reduce his or her effort to control pollution below the standard set by regulators, resulting in too few resources devoted to abatement, and too much pollution relative to the social optimum.

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- Second, when the private market cannot monitor actions, an insurer will withdraw from the pollution liability market because the provision of insurance will also affect the individual's incentives to take precautions.
- Given that accidental spills or storage of pollution can create potential financial liabilities [for example, clean-up costs or medical expenses], a firm would like to pay to pass these risks on to a less risk-averse agent such as an insurer.
- But, since there is a trade-off between risk bearing and incentives, the market for pollution liability insurance will be incomplete as insurers attempt to reduce the information rents of the better-informed individual.

- The market will produce an inefficient allocation of risk. One can use the analytical framework of Arnott and Stiglitz (1988) to illustrate the inefficient risk-bearing problem associated with moral hazard.
- Note: Competitive equilibrium with moral hazard implies the quantity rationing of insurance. Assuming the case where the insurer can observe all insurance purchases by the individual and can therefore restrict the quantity of insurance sold, the equilibrium is characterized by an exclusive contract where the insuree buys all his insurance from one insurer. Though this is an optimal contract [marginal benefits = marginal costs], the contract is not feasible.

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- Adverse selection may well be a problem for the development of eco-products that are produced with practices that are less harmful to the environment.
- Sustainable production of products from tropical forests, for example, is a commonly promoted alternative to clear cutting activities.
- The problem with eco-products is that, while they may be of perceived higher quality to some consumers given the production process, these products may also be more expensive as the result of the lack of scale economies and the fact that the environment is not subsidizing its production.

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- If the buyer cannot distinguish the eco-products from the same product produced from standard practices, he will have no incentive to pay the extra premium.
- If the high quality, high price producers do not think that consumers will pay the premium then they will withdraw from the market.
- This process will continue until the market for eco-products collapses.
- Unless there can be some acceptable warranty to verify production practices, the market for eco-products will be inefficient owing to the problem of adverse selection.

Price rationing: charges and subsidies

- Emission charges are fees levied on the discharge of pollutants into air or water, or onto the soil, or on the generation of noise.
- These charges are designed to reduce the quantity or improve the quality of pollution by making polluters pay at least part of the costs of the harm they do to the environment.
- Following Pigou, economists often favour emission charges over other options because, in principle, by charging for every unit of pollution released into the environment they induce firms to lower their emissions to the point where the incremental cost of pollution control equals the emission charges they must otherwise pay.

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- Because pollution control costs typically differ among producers, those with lower control costs will tend to reduce their emission levels further than will higher cost polluters.
- Emission charges give producers an incentive to develop and adopt newer and better pollution control technologies as a means of bringing down the charges they must pay.
- To that extent, aggregate costs of pollution control should be minimized.

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- Emission charge is a limited tool for many sources of pollution owing to the information requirements needed to set an optimal charge to change behaviour.
- Emission charges are likely to be inefficient because of moral hazard: the inability to monitor perfectly producer efforts to control pollution.
- In an attempt to reduce the moral hazard problem, Sergeron (1988) suggested that regulators could design a charge system based on the overall ambient concentration of a pollutant in a region.

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- This is a scheme that combines penalties and rewards for exceeding or beating a specific level of total ambient concentration.
 - The ambient scheme has two parts:
 - A per unit charge or subsidy based on the deviation from some ambient standard and
 - A lump sum penalty for not achieving the standard.

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- The liability of each polluter depends on the aggregate emissions from the entire group of polluters, not just his own level of emissions, since these emissions are unobservable to the regulator. This creates a bubble of total ambient concentration that the entire group of producers must satisfy.
- If the total ambient concentration of a pollutant is found to exceed the standard, each polluter pays the full incremental social costs of the excessive ambient concentrations.
- The system is not budget balancing – more money is collected in charges from the polluters than society suffered in damages.

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- The major advantage of the ambient charge system is that it does not require continual monitoring of emissions.
 - There are several ways the regulator can set the ambient charge to achieve the desired level of production.

- The regulator could:
 1. Set the fixed penalty equal to zero and set the tax equal to the ratio of expected marginal benefits over the marginal contribution to ambient concentrations of increased production;
 2. Set the tax equal to zero and set the fixed penalty equal to the ratio of expected marginal benefits over the marginal likelihood of exceeding the cut-off standard;
 3. The tax could be set at an arbitrary level and fixed penalty could be set equal to the ratio of the sum of expected marginal benefits and the tax-weight marginal contribution to ambient concentrations over the marginal likelihood of exceeding the cut-off standard.

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- All three forms of the ambient charge give the producer an incentive to select the level of output that the regulator wants.
- Since each producer pays the full marginal damage of the total level of ambient pollution, there is no incentive to free-ride on the other producer's actions.

Major limitation:

- The ambient charge would require collecting site-specific data on the complex fate and transport systems associated with pollutant leaching, run-off and volatilization, and the polluter's and regulator's prior beliefs about this transport system. Without this, the ambient charge will be mis-specified and will not achieve its desired goal of achieving a socially optimal level of pollution.

Product charges:

- Fees or taxes levied on outputs or inputs that are potentially hazardous to humans or the environment when used in production, or when they or the containers that carry them become waste matter.
- **They encourage:**
 - To substitute more environmentally safe products or inputs;
 - To promote a life-cycle approach to pollutant control.

Product charges have many variations and are applied extensively:

- The Netherlands uses a product charge with its general fuel charge in the form of a surtax on oil excise duties.
- Norway and Sweden apply product charges to batteries, fertilizers and pesticides.
- Italy levies a tax on plastic bags, which is paid by manufacturers and importers.

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- OECD (1994) says that there is little evidence of product charges leading to significantly reduced use of target inputs or final products.
- However, they appear to help regulators finance policies and programmes to deal with the environmental problems of the target products.

Subsidies:

- Subsidies are forms of financial assistance offered to a producer by regulators.
- They are incentives to encourage pollution control or to mitigate the economic impact of regulations by helping firms meet compliance costs.
- They take the form of grants, loans and tax allowances.

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- France provides loans to industry to control water pollution.
- Italy provides subsidies for solid waste recycling and recuperation, favouring industries which commit themselves to altering manufacturing processes.
- The Netherlands provides incentive to industries to promote compliance with regulation and promote technology research and the introduction of pollution control equipment.

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- The German system assists small producers which could experience cash flow problems because of sudden additional capital requirements for pollution control.
- Sweden used it to reduce pesticide loadings by providing funds to test the efficacy of pesticide spraying equipment, to provide pest forecasts and warning services, to supply financial assistance and technical advice on organic farming, to increase training of applicators and to increase the level of research and technical training on low-dose sulphonylureas herbicides.
- The U.S. subsidized the construction of municipal water treatment plans and helped the farmers pay the costs of soil conservation and preventing erosion-induced losses of soil productivity.

Major Limitation of Subsidy scheme:

- There is a potential financing problem with the subsidy scheme, given the regulator's inability to determine a producer's type.

Liability Rules:

- Liability rules are set in such a way that there is an incentive for a producer to follow some prescribed mandate, technological restriction or acceptable behaviour.
- How? They can be set so that the producer pays a bond in advance and is reimbursed if there is no harm committed or pays a ***non-compliance fee*** after the harm has occurred.
- Liability rules attempt to reduce the level of shirking on environmental pollution control by raising the costs of misbehaviour.
- Difficulty arises with moral hazard: Identifying the exact culprit.

Non-compliance fees:

- The random penalty mechanism.
- It is better than emission or ambient charges for two reasons:
 1. The information required to implement the mechanism is less than that required for the charges or subsidies, and
 2. The mechanism is budget balancing, and does not require additional revenues beyond the welfare gains generated by abatement.

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- Herriges et al (1994) demonstrate that the random penalty schemes will work only if all the producers are risk-averse. The reason is that the balance budget requirement creates an inter-dependence among the producers – one producer's loss is another producer's gain.
- Govindasamy et al (1994) identify an alternative incentive scheme that attempts to bridge the information requirements of the ambient charge and the potential political unattractiveness of the random penalty scheme – the environmental rank-order tournament.
- The tournament would use readily available information on inputs use or pollution control effort to construct an ordinal ranking of the set of producers.

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- The advantage is that the ordinal ranking of producers by some proxy of actual pollution control provides information that is typically less costly to obtain than the cardinal rankings required by ambient charges, and it attempts to rank producers by actions.
- The disadvantage is that, if the information used to construct the ordinal ranking is biased as a result of a heterogeneous fate-and-transport system, for instance, the tournament may send incorrect signals to the polluters and the wrong producers will be punished or rewarded.

Deposit refund systems:

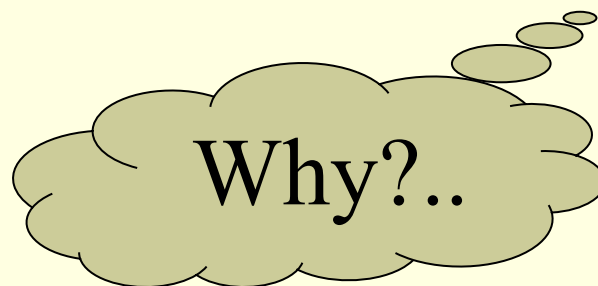
- Under a deposit refund systems purchasers of potentially polluting products pay a surcharge, which is refunded to them when they return the product or its container to an approved center for recycling or proper disposal. This rewards good environmental behaviour.
- Many countries in the world, including India, have been following this especially for particular kinds of beverage containers.
- Well functioning deposit refund systems may also stimulate the emergence of markets in safe waste disposal.
- They provide economic benefits for good environmental behaviour and impose costs for bad behaviour.

Performance bonds:

- A performance bond is a direct mechanism argued to induce socially desirable incentives in a producer.
- The bond increases the costs of shirking, thereby reducing the incentive for malfeasance.
- The value of the bond is determined by the potential environmental impact of the producer's actions. If a producer shows that the cost of environmental damages of an activity is less than the cost of their posted bond, the value of the bond can be reduced.

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- Incentive to invest resources in R & D to discover the true value of environmental damage or increase the use of inputs that are more benign to the environment.
- Bonds are rarely used in environment policy.



- Shogren et al (1993) identify three key limitations to environmental bonds:
 1. Moral Hazard
 2. Liquidity constraints and
 3. Legal restrictions on contracting.

When should a producer post an environmental bond?

- Shogren et al (1993) identify seven conditions under which bonds may work for environmental problems:
 1. Well-understood costs of environmental damages
 2. Observable producer actions [no moral hazard]
 3. Few agents to administer
 4. Fixed time horizons for remittance issues
 5. Well-defined outcomes and their likelihood of occurrence
 6. No irreversible effects and
 7. A relatively small bond value.

Quantity rationing:

- Crocker (1966) and Dales (1968) introduced the idea of quantity rationing through marketable permits.
- Marketable permits specify a predetermined total level of emissions or emission concentrations within a specified region.
- Permits equal to the permissible total emissions are distributed among producers in the region.

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- The permits can be traded among plants of a single producer as well as among producers. The scarcity value creates an incentive to trade to permits.
- The main feature is the shift to producers from regulators as regards the design and location of pollution control strategies.
- To make it work, the regulators must have sufficient knowledge to design the market.

This includes knowing:

- (i) how to establish the time frame of permits;
- (ii) the kinds of information required to allocate permits efficiently and fairly;
- (iii) how monitoring data will be obtained and tested;
and
- (iv) what the inspection schedule should be.

One can construct alternative scenarios where either the charge or permit scheme is preferred, depending on the relative slopes of the marginal benefits and cost curves.

Evaluative criteria:

- Judgments about the usefulness and practicality of the economic incentives that we have learnt so far can be based on the extent to which they meet four criteria:
 1. Effectiveness
 2. Efficiency
 3. Equity
 4. Flexibility

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- Regardless of theoretical appeal, an incentive scheme will fail if it is ineffective in reducing pollution damage, unacceptably inefficient in accomplishing these goals, violates social norms of equity or lacks the flexibility to charge with shifting economic, technological and environmental conditions.

Practical conditions for use of economic incentives:

1. Information base and administrative capacity
2. Legal structure
3. Competitive markets
4. Political feasibility

In sum, *the effectiveness of nearly all the proposed instruments/ incentives schemes depends on acquiring information on behavioural types or adjusting the optimal incentive to reduce potential information rents gathered by those being regulated.*

Thank You

For your attention

