Approach to Pricing a Product

- **Unregulated**
  - Based on prevailing conditions in a given Market structure
  - May still be subject to market monitoring/oversight

- **Regulated**
  - Why regulated pricing? – market failure

- Regulatory approach
  - fixing price vs fixing rule
  - Cost based vs performance based
Understanding economics of pricing in regulated sector

• Cost concepts
• Perfect competition Vs Monopoly
• Market failure
• Natural Monopoly
• Need for price regulation
• Economic approach to determining regulated price

Typical Characteristics of Infrastructure / Power Sector

• Technical characteristics
• Economic characteristics
• Socio-economic and organizational characteristics
Technical characteristics

- Input into production/economic activity
- Technically indivisible (lumpiness of investment)
- Generally immobile asset
- Long life of asset
- Assets not widely traded
- Exclusion technically difficult (but possible)

Economic characteristics

- Reduction in transaction costs
- High sunk costs – road, airport, transmission line
- Network externalities – power network, telephone network
- Little rivalry in consumption – uncongested road/network (rivalry in consumption – congestion)
- Sub-additive cost function i.e. there are conditions for natural monopoly
Socio-economic and organizational characteristics

• Necessity of centralized planning and coordination (transmission, airport etc.)
• Traditionally publicly owned but increasing private-public cooperation/private ownership
• Sometimes considered citizen right (State should assure a minimum supply and subsidized prices)

Infrastructure/Electricity Provision & Need for Economic Regulation

• In historic times, Kings built bridges, canals etc.
• In modern times, ownership and operation of infrastructure is undertaken by the governments. While Policy/Regulation, Ownership and Operation was embedded with government, role of regulation was often ignored.

Need for Economic Regulation

• Inadequate and poor quality of services, and poor financial performance under public ownership.
• Private ownership and operation brings in a concern of private monopoly for government as well as consumers.
Economics of Regulation

• Perfect Competition - Pricing
• Monopoly - Pricing
• Consumer & Producer Surplus
• Market Failures
• Economic Regulation
• Pricing for Natural Monopoly

Concepts of Perfect Competition and Monopoly
Perfect Competition - Characteristics

- Large number of buyers and sellers, each acting independently
- No buyer or seller large to influence the market
- Homogeneous product
- No barriers to entry or exit
- No information asymmetry
- No artificial restraint on prices
- Profit maximizing firms
- Perfect mobility of factors of production

Cost Concepts

- P vs. Q
- TC, VC, AC, MC
- FC
Pricing – Perfect Competition Outcome for firm

\[ P^* = MC \]

P
Q

Consumer surplus: the difference between what buyers are willing to pay and what they have to pay
Producer surplus

Difference between what producers are willing to sell at versus what they actually get.

Total surplus

Sum of producer and consumer surpluses.
Perfect Competition - Social Welfare

- Production Efficiency - incentive to produce at lowest possible cost
- Incentive to lower cost
- Allocative Efficiency - right amount of good is produced since $P = MC$

Concepts of Monopoly
Monopoly

• Single producer (supplier) of products
• Price set by the Monopolist (who maximises profit)
• Faces no competition because of barriers to entry:
  • high entry costs (investment)
  • legal protection (license)
  • access to resources (transmission, mine, bandwidth)
  • patents, copyrights
  • natural monopoly

Monopoly behaviour

• Goal: maximize profits
• Rational choice: sell less quantity at a higher price (than perfect competition) to maximise profits
• Total surplus (consumer plus producer surplus) is lower than in competitive market case. Dead weight loss.
• X-inefficiency - firm doesn’t work hard to reduce cost and improve efficiency.
Monopoly: Price Setting

Monopolist sets quantity where profits are greatest, output at which MR=MC

Monopoly: How society looses

Monopolist captures part of consumer surplus.

Consumer surplus lower compared to competitive market case.

“deadweight loss”; social loss as compared to perfect competition
Market Failures

Sometimes markets can fail to operate in beneficial way. Market failures can be so severe as to merit regulation. There are three main classes of market failure:

• Market Power
• Externality
• Information asymmetry

Market Failures (contd.)

• Market Power – Ineffective competition; actual or potential; Monopoly, cartel, monopsony; (special case - Natural Monopoly)
• Externality - behaviour of one firm affects others for reasons other than prices (when firms or people impose costs or benefits on others outside the marketplace)
• Information asymmetry – consumers do not have enough information about the goods that they buy
Natural Monopoly

- Industry cost is minimised by having only firm in the industry.
- Average costs are declining.
- Natural monopolies are likely to exist when there is large fixed-cost component to cost. (fixed costs are large as compared to marginal cost).

Natural Monopoly (contd.)

- In case of natural monopoly – allocative and productive efficiency can not exist together.
- Productive efficiency requires that only one firm produces all output (cost minimised).
- Such firm will fix prices above cost to maximise profits – allocative efficiency is violated.
- For allocative efficiency – a number of firms need to compete to bring prices down to marginal cost ($P = MC$).
Externality

- Actions of agent A effect the welfare of B.
- Negative externality
e.g. environmental pollution, fishing

- Positive externality
e.g. beekeeper & farmer

Information Asymmetry

- Information may not only be imperfect but also asymmetric
- Eg. “Market for lemons”
Why Regulation?

• Regulation – restrictions on decision of economic agents (Firms, consumers)

• Rationale for Regulation
  • Market Power - Natural Monopoly
  • Externality
  • Information asymmetry

\[ \text{Market Failure} \]

Types of Regulation

• Antitrust Policy (licensing / certifications) - seeks to protect consumers from anticompetitive behavior through the judicial system (MRTP / Competition Act)

• Direct Regulation or Economic Regulation - controls pricing and/or output due to the belief that the industry is inherently Monopolistic (Power, Telecom etc.). Market power is the main focus of utility regulation.
Types of Regulation (contd.)

• **Social Regulation** - controls undesirable consequences of firm behavior to obtain various social goods such as clean air and water, safe products and workplaces. (Pollution Control Acts, Safety Regulations etc.);

• **Technical** - licensing requirements, drug regulations, quality certifications like BIS etc., safety in nuclear plants, water flow in hydro plants

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Economic Regulation - What can be regulated?

• Price
• Quantity
• Entry & Exit
• Quality
• Investment
• Access to Resources
Economic Regulation - What can be regulated? (Contd.)

• **Price** - power, telecom (partly)
• **Quantity** - spectrum#, banks branches
• **Entry & Exit** - telecom, power, banking, insurance
• **Quality** - telecom, power etc.
• **Investment** – capacity expansion during license raj
• **Access to Resources** – mining rights for power (coal), Iron & Steel etc

How to ease Monopolistic Pressure (including regulated natural monopolies)?

• Allow / facilitate entry of more market players
• ‘Control/influence’ prices / quantity supplied
• Create incentives so that Monopolists emulates a competitive behaviour.
Market Failures

Market failures lead to non-beneficial outcomes and can be often merit regulation. There are three main classes of market failure:

- **Asymmetric information**: consumers do not have enough information about the goods that they buy. All producers do not have information of best practices.
- **Externalities**: behaviour of one firm affects others for reasons other than prices
- **Market power**: ineffective competition - actual or potential. Manifested in extreme as natural monopoly
  - *Market power is the main focus of ‘utility regulation’*

Natural monopoly

Definition: Industry where production is more efficient by one firm than by many firms

- Average cost of production is falling over the relevant portion of market demand
- Producing at marginal cost results in losses, rendering competition undesirable
Economies of Scale

Average costs decrease as quantity increases up until \( q_1 \), and then increase with quantity.

Natural Monopoly: \( MC < AC \)

Average costs are decreasing, so marginal costs must be lower than average costs.

Pricing at marginal cost loses the firm money because average costs are not covered.
Natural Monopoly – Economic Definitions

• In an industry, where average cost of a single firm that can produce entire output to meet the market demand is lower than in case of presence of more than one firm. (subadditivity of the cost functions).

• An industry that does not ‘naturally’ attract entrants and who can not survive even in the absence of predatory measures by the incumbent monopolist (sustainability of monopoly).

Economic characteristics of Natural Monopoly

• Production is more efficient by one firm than by many firms
  • average cost of production is falling over the relevant portion of market demand
• pricing at marginal cost results in losses, rendering competition undesirable

• public utility industries (gas, electric, water) characterised by
  • high fixed cost network infrastructure
  • returns to scale
Economic Conditions for Natural Monopoly

- Falling average and Marginal cost is a sufficient condition
- Presence of sub-additivity is a necessary condition
- Sustainability of monopoly

Natural Monopoly: Cost Characteristics

Average costs are decreasing, so marginal costs must be lower than average costs
Natural Monopoly: Sub-additivity

• If a single firm can produce a product or a group of products more cheaply than two or more firms, a natural monopoly is deemed to exist.

• Sub-additivity defines it more technically as,
  “If costs in an industry are sub-additive, a natural monopoly exists in an industry.”

If two firms produce outputs Q1 and Q2 respectively and their cost function is defined as \( c(.) \), sub-additivity would exist if

\[
c(q_1+q_2) < c(q_1) + c(q_2)
\]
Natural Monopoly: Sub-additivity

- Imp.: Note the difference between economies of scale and subadditivity. The later can exist even in the presence of this economies of scale. In the previous figure, we can note that average cost associated with a single firm AC1 lies below AC2 even though the former exhibits this economies of scale for quantities more than's Q*.
- In a single product case, economies of scale is a sufficient condition for subadditivity.
Pricing for Natural Monopoly

- MC Pricing
- AC Pricing
- Non-Linear Pricing
- Ramsey Pricing

Natural Monopoly: MC < AC

Average costs are decreasing, so marginal costs must be lower than average costs

Pricing at marginal cost leads to loss as average costs are not covered
Natural Monopoly: Revenue Gap

At \( P = MC \), efficient consumption, but revenue gap exists:

- Firm does not recover all costs
- Need for revenue reconciliation

Marginal Cost Pricing

- Outcome has allocative efficiency.
- Weak incentive to reduce costs.
- Firm does not covers costs and makes losses.
- Use tax revenues or direct subsidy to firm to cover revenue shortfall?
Issues with use of subsidy for bridging revenue gap

- Subsidy for bridging the revenues shortfall
  - Govt. need to raise taxes to fund the subsidy. Taxes are distortionary
  - Reduced incentive for cost reduction since the producer knows that revenue gap would be funded
- Costs may exceed consumer benefits
- Distributional issues

Average Cost Pricing
Average Cost Pricing

- Firm covers costs including opportunity cost of capital. (i.e. reasonable returns are covered in AC)
- Failure of allocative efficiency. Less quantity and higher price that in MC pricing case (but lower P and higher Q than profit maximisation by the monopoly)
- Weak incentive to reduce costs since costs are covered.
- Does not require subsidy or distortionary taxes to cover revenue shortfall.

Natural Monopoly: Non-Linear Pricing

- Also called Block Pricing
- Most basic form would be a two-part tariff
  \[ P = a + b \cdot Q \]
  - a – Fixed Charge covers revenue shortfall due to MC pricing. (to be recovered from all consumers)
  - b – Variable Charge, equal to marginal cost
- Revenue shortfall is covered.
- Firm earns economic profits, i.e. opportunity cost of capital.
- Little incentive to reduce costs.
Selected Readings (www.iitk.ac.in/ime/anoops)


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Selected Readings

(some accessible from www.iitk.ac.in/ime/anoops)

- Energy Journal, "The Impact of Electricity Sector Restructuring on Coal-fired Power Plants in India". (with Maureen L. Cropper, A. Limonov and Kabir Malik)

Selected Readings (Contd.)

Selected Readings (Contd.)

- “A Policy for Improving Efficiency of Agriculture Pump sets in India: Drivers, Barriers and Indicators”, Climate Strategies, UK, Working Paper 2009

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Energy Analytics Lab (EAL)
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For selected readings, find links through www.iitk.ac.in/ime/anoops