Economic Foundations to Power Sector Regulation

Anoop Singh
Centre for Energy Regulation (CER) & Energy Analytics Lab (EAL)
Dept. of Industrial and Management Engg.
IIT Kanpur
Typical Characteristics of Infrastructure / Power Sector

• Technical characteristics

• Economic characteristics

• Socio-economic and organizational characteristics
Technical characteristics

• Input into production
• Technical indivisibility (lumpiness of investment)
• Immobile
• Long life
• Assets not widely traded
• Exclusion could be technically difficult
Economic characteristics

• Reduction of transaction costs

• Sub-additive cost function i.e. there are conditions for natural monopoly

• High sunk costs

• Network externalities

• Little rivalry in consumption
Socio-economic and organizational characteristics

• Necessity of centralized planning and coordination

• Traditionally publicly owned but increasing private-public cooperation

• Sometimes considered citizen right (State should assure a minimum supply)
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 is so large to influence the market
• Homogeneous product
• No barriers to entry or exit
• No artificial restraint on prices
• Perfect information
• Profit maximizing firms
• Perfect mobility of factors of production
Cost Concepts

P

35

4

Q

TC
VC
MC
AC
FC

Anoop Singh, IIT Kanpur
Pricing – Perfect Competition Outcome for firm

\[ P^* = MC \]
Why companies care about costs

Increasing efficiency drives down the supply curve for an individual supplier.

Competitive markets give good incentives for efficiency and innovation.

Producer is able to sell more; total revenue increases, so does total profit.
As companies compete with each other, costs are driven down.

Consumer benefits:

Prices are cut to $p_2$ and demand rises to $q_2$ as a result of competition.
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

$q_1$
Perfect Competition - Social Welfare

- **Efficiency in Production** - incentive to produce at lowest possible cost
- **Efficiency in Allocation** - right amount of good is produced since MC to produce equals marginal willingness to pay equals price
Concepts of Monopoly
Monopoly

• Single producer (supplier) of products
• Price set by the Monopolist
• Faces no competition because of barriers to entry:
  • high entry costs (investment)
  • legal protection
  • 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 cut costs.
Monopoly: Price Setting

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

Where:
- \( P \) is the price
- \( q_m \) is the monopsony output
- \( q_e \) is the equilibrium output
- \( p_m \) is the monopsony price
- \( p_e \) is the equilibrium price
- \( MC \) is the marginal cost
- \( AC \) is the average cost
- \( MR \) is the marginal revenue
- \( D \) is the demand curve
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
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 (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 cannot 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
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.
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.
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)


• “Analysing Efficiency of Electric Distribution Utilities in India: a Data Envelopment Analysis” (with Dilip Kumar Pandey), IAEE International Conference, Stockholm 19-23 June, 2011.


Selected Readings (Contd.)


• “Analysing Efficiency of Electric Distribution Utilities in India: a Data Envelopment Analysis” (with Dilip Kumar Pandey), IAEE International Conference, Stockholm 19-23 June, 2011.


Selected Readings (Contd.)

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

• “Climate Co-benefit Policies for the Indian Energy Sector: Domestic Drivers and North-South Cooperation”, *Climate Policy* 9 (5) 529-543 2009


• “Rural Electrification in India: Economic and Institutional aspects of Renewables”, with James Cust and Karsten Neuhoff, EPRG WP 0730, University of Cambridge, UK., 2007
Thank You

www.iitk.ac.in/ime/anoops
anoops@iitk.ac.in
A healthy ‘CEREAL’ for the Power Sector