How Do We Characterize a Market?

- What is a market concentration measure?
  - Indicators based on market shares, which in turn are based on some important “size” variable like
    - Sales of specific products
    - In case of banks, deposits or credits.
  - Market concentration measures should ideally be computed for the same product and also for the same geographical area.
- Why market concentration measures?
  - Arises from their ability to capture structural features of a market.
  - Related to competitiveness in an economy and market power.

Different Weighing Schemes

- Weights of unity are attached to the shares of first k firms in the descending order. Weights corresponding to the rest of the (n-k) firms are zero. Choice of k is arbitrary.
  - Example: k-Firm concentration Ratio
- Industry's market shares are used as their own weights.
  - Example: Herfindahl-Hirschman Index

Herfindahl-Hirschman Index (HHI)

- $HHI = \Sigma s_i^2$
- Notes:
  - HHI stresses more importance to larger banks, assigning them more weights.
  - Sum of weights is equal to unity here.

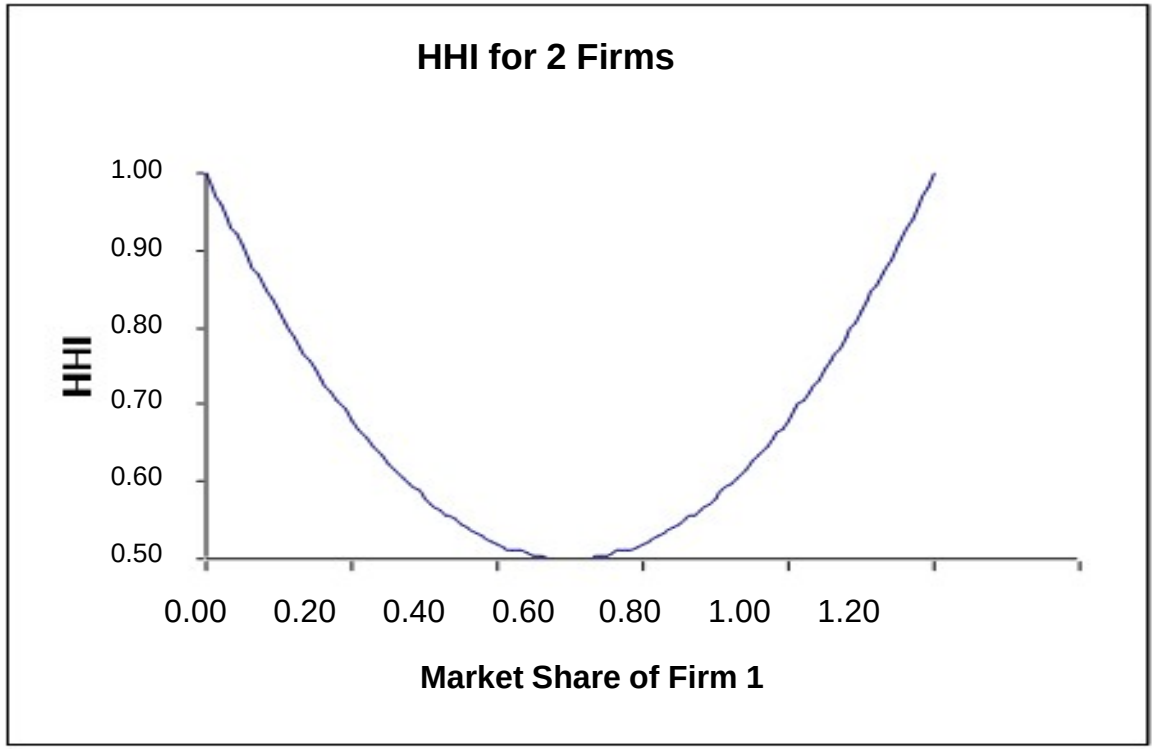
- What is the range of HHI?
- When is the lowest and highest value attained?

Calculating the HHI: an illustration

(A)	(B) = 1 - (A)	(C) = sq. (A)+ sq. (B)
Share of Firm 1	Share of Firm 2	HHI
1	0	1
0.1	0.9	0.82
0.2	0.8	0.68
0.3	0.7	0.58
0.4	0.6	0.52
0.5	0.5	0.5
0.6	0.4	0.52
0.7	0.3	0.58
0.8	0.2	0.68
0.9	0.1	0.82
1	0	1

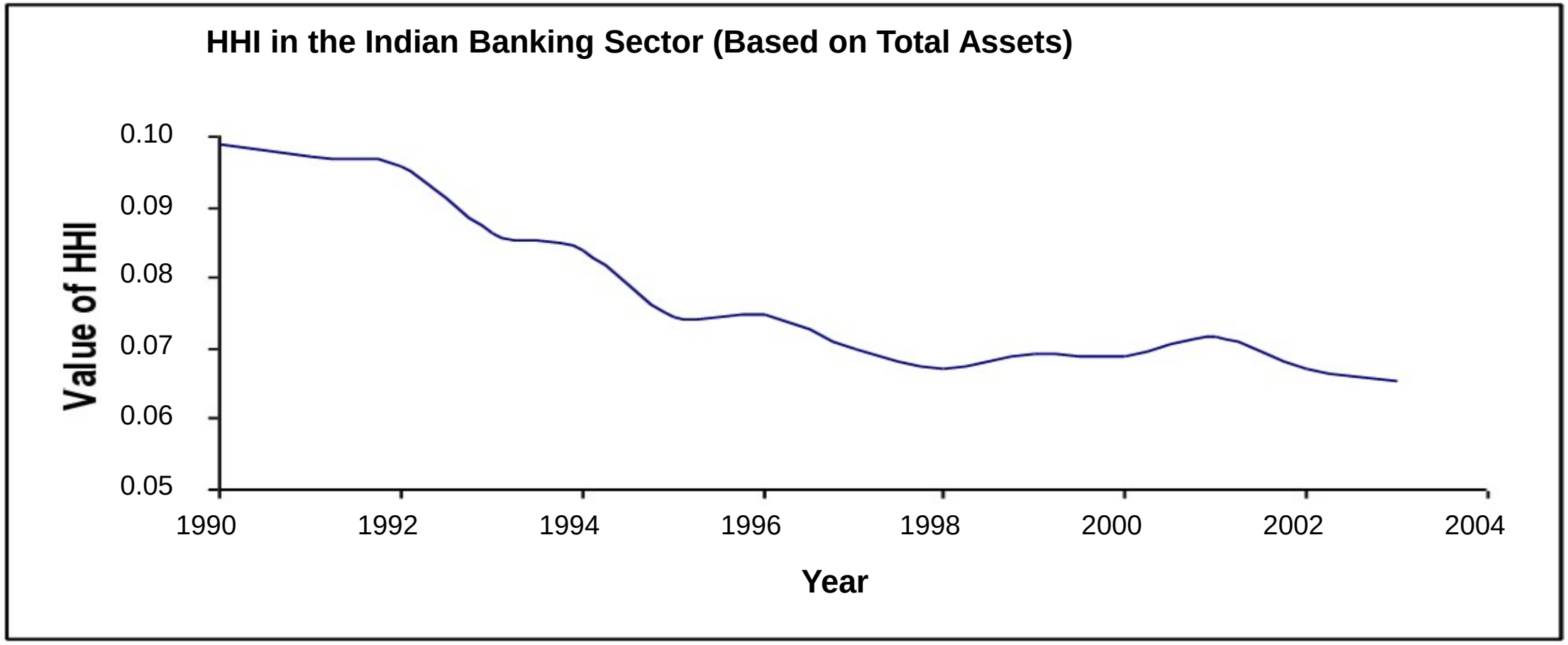
In a competitive market with n firms where n is fairly large, the share of each firm will be 1/n. Can you compute the HHI for such a firm?

HHI for Different Market Structures: An Illustration



- Pure Monopoly: HHI=1
- Oligopoly (A Few Illustrative Examples)
  - Two Firms (See the Graph)
  - Three Firms:
    - (1/3, 1/3, 1/3)=>1/3
    - (0.4,0.4,0.2) =>0.36
    - (0.6,0.3,0.1)=>0.46
- Perfect Competition: (1/n) where n is the number of firms so that HHI is near zero.

A Real Life Example: Indian Banking Sector



Use of HHI in Policy

- In the US, the HHI plays a significant role in the enforcement process of antitrust laws.

- General Standard for horizontal merger:
- Three ranges: (i) below 1000, (ii) 1000 to 1800, and, (iii) more than 1800.
- Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise.

Limitations of Concentration Measures

- **Though market concentration measures are strongly related to market power, they do not have exact one to one correspondence.**

- Market power of a firm may also strongly depend on
  - Entry and exit barriers (or, lack of it).
  - Availability of close substitutes

Economic and Accounting Profit

- In economics, the concept of cost and profit differs from pure accounting sense.
- Economists count the *opportunity cost* of the owner's capital as part of the firm's implicit cost.

Owner’s Opportunity Cost

- Opportunity cost => [What could be earned by lending the capital to someone else in a riskless loan (e.g., a government bond)] + [Risk premium, e.g., what could be earned in addition by lending the money to another firm whose risk of default is the same]

Example (From Lipsey and Chrystal, Slightly Modified)

Income		**Expenditure**	
Sales =	100	Wages =	20
		Materials =	30
		Others =	10
		Rent =	5
		Salaries (Regular Staff) =	6
		Interest on Loan =	9
		Depreciation =	5
(1) Total Revenue	**= 100**	**(2) Total Cost**	**= 85**

(a)	Profit in the Accounting Sense [(1)-(2)]	= 15
(b)	Risk-free Return on the firms Capital	= 10
(c)	Risk Premium	= 4
	Pure or Economic Profit [(a)-(b)-(c)]	**= 1**

Profits

- **What firms call profit is the return to the owner's capital.**
- **In economics, we deduct from this profit figure *the imputed opportunity cost* of the owners' capital to obtain pure or economic profits.**

Profits and Resource Allocation

- When resources are valued by the economic principle, their costs show how much these resources would earn if used elsewhere in the economy
- Profits and losses (in economic sense) play a crucial signalling role in the working of a market economy.
  - Positive Profit =>Resources can be profitably moved to that industry
  - Negative Profit => Resources can be profitably moved elsewhere
  - Zero Profit => No incentive for resources to move into or out of an industry

Basic Specification of Profit

- Let the total revenue of the producer be R, and let the total cost in production be C. If profit of the producer be denoted by Π, then,

  (1) $\Pi = R-C$

- Note that R, the total revenue could be considered as a function of output. (Why?)
- Similarly, note that C, the total cost, could be considered as a function of output (Why?)
- Equation (1) then can be written as:

  (2) $\Pi(q) = R(q)-C(q)$

- **A necessary condition of profit maximization is, therefore, that marginal revenue equals marginal cost.**

Benchmark Equation: $\Pi(q) = R(q)-C(q)$

- Question 1: How does the C(q) function behave?
- Question 2: What is the role of technology in this process? Can this model tell us (i) producer's choice of one technology over the other (say, a labor intensive technology vis-à-vis a capital intensive one), and (ii) what happens when technology improves?
- Now note that if p is the price of the commodity and q is the quantity, then $R(q)=pq$.
- Question 3: Is p given, or do the producer have some control over p?
  - Perfect control over p: The case of Monopoly
  - Some control over p: Oligopoly
  - No control over p: Perfect Competition

To develop a theory of supply, we need to determine the level of output that will maximize a firm's profit and relate it to the price.

Short-Run Equilibrium

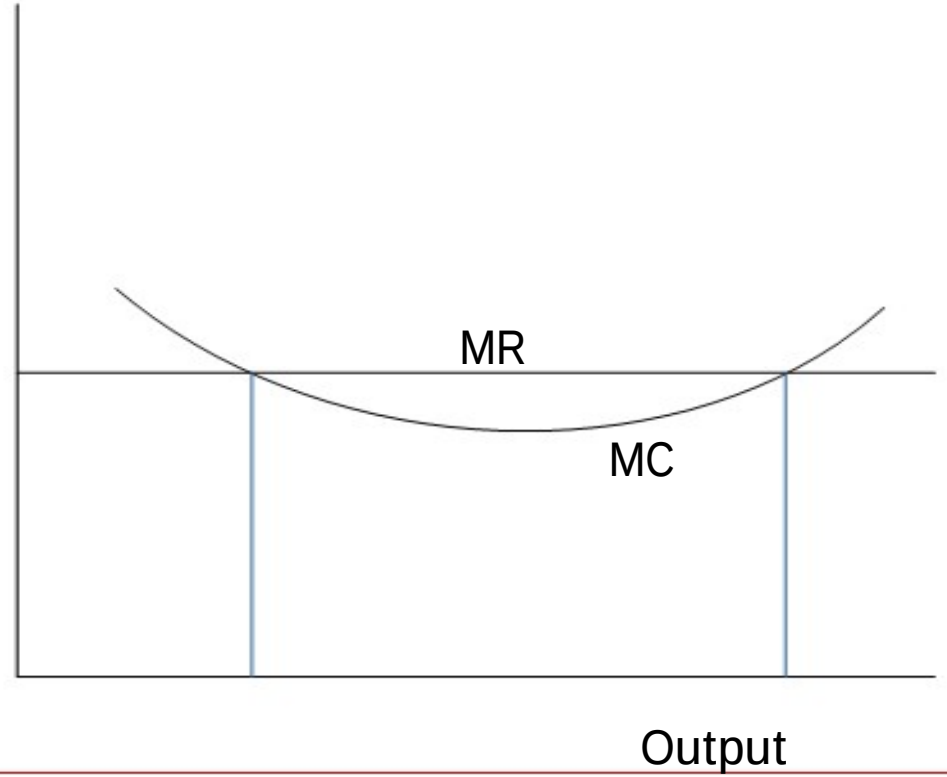
- We now combine information about the firm's costs and revenues to determine the level of output that will maximize its profits.
- In the short-run, the firm has one or more fixed inputs such as its plant and machinery.
- Only way the output can change in the short-run is by altering its variable inputs such as labor.

How Much Should the Firm Produce?

- Common Sense Suggestion: On a unit by unit basis, if any unit of production adds more to revenue than it does to the cost, producing and selling that unit will increase profit.

- Rule: Whenever it is profitable for the firm to produce some output, it should produce the output at which marginal revenue equals marginal cost.

Sufficiency



- **Equality of marginal revenue and marginal cost is necessary, but not sufficient condition.**

- Rule: An output where marginal cost equals marginal revenue may be either profit maximizing or profit minimizing. Profit maximization requires that marginal cost be less than marginal revenue at slightly lower outputs. In other words, firms operate on the rising portion of the marginal cost curve

Market Power

- Ability of a firm to raise price without losing all its sales
  - Any firm that faces downward sloping demand has market power
- Gives firm ability to raise price above average cost & earn economic profit (if demand & cost conditions permit)

Monopoly

- Single firm
- Produces & sells a good or service for which there are no good substitutes
- New firms are prevented from entering market because of a barrier to entry
- Monopolistic Competition?

Measurement of Market Power

- Degree of market power inversely related to price elasticity of demand
  - The less elastic the firm's demand, the greater its degree of market power
  - The fewer close substitutes for a firm's product, the smaller the elasticity of demand (in absolute value) & the greater the firm's market power
  - When demand is perfectly elastic (demand is horizontal), the firm has no market power

Measurement of Market Power

- Lerner index measures proportionate amount by which price exceeds marginal cost:

$$\text{Lerner index} = \frac{P - MC}{P}$$

  - Equals zero under perfect competition
  - Increases as market power increases
  - Also equals $-1/E$, which shows that the index (& market power), vary inversely with elasticity
  - The lower the elasticity of demand (absolute value), the greater the index & the degree of market power

Measurement of Market Power

- If consumers view two goods as substitutes, cross-price elasticity of demand (E_{XY}) is positive
  - The higher the positive cross-price elasticity, the greater the substitutability between two goods, & the smaller the degree of market power for the two firms

Measurement of Market Power

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Barriers to Entry

- Entry of new firms into a market erodes market power of existing firms by increasing the number of substitutes
- A firm can possess a high degree of market power only when strong barriers to entry exist
  - Conditions that make it difficult for new firms to enter a market in which economic profits are being earned

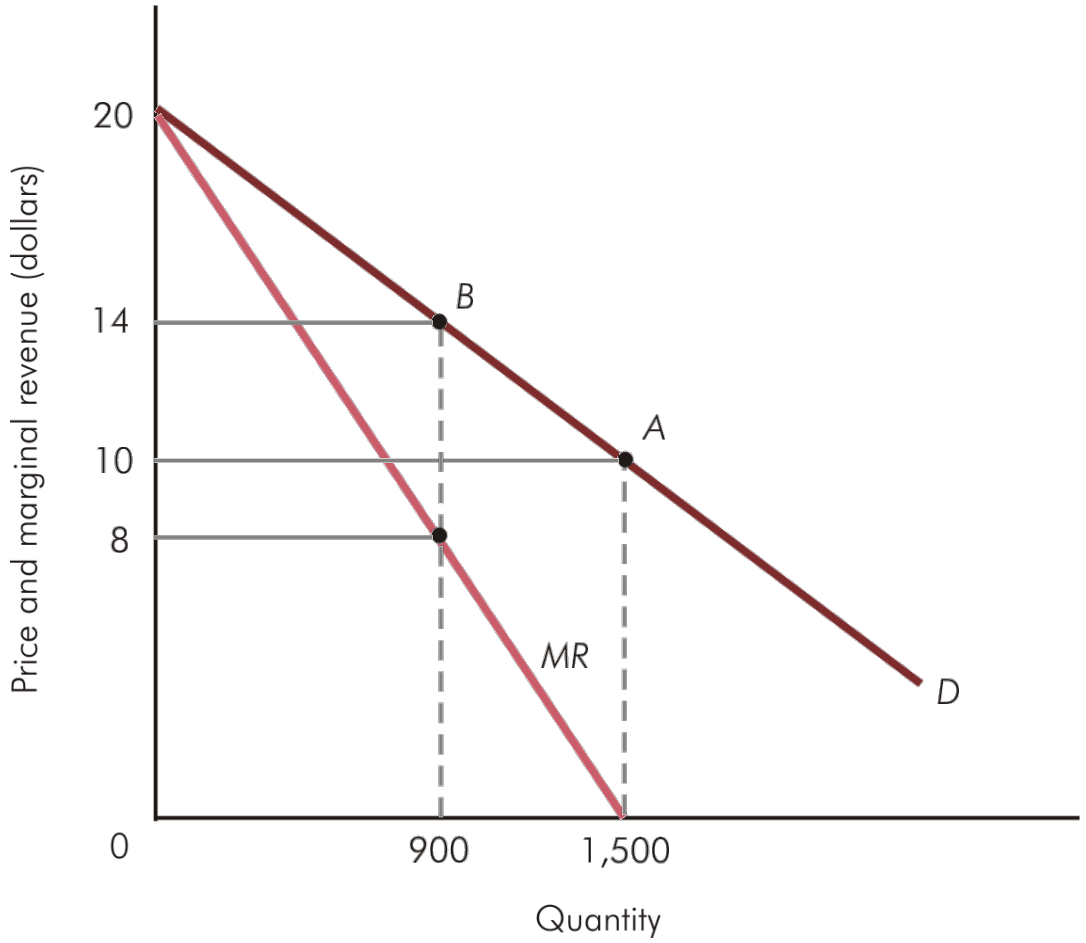
Barriers to entry

- Economies of scale
  - When long-run average cost declines over a wide range of output relative to demand for the product, there may not be room for another large producer to enter market
- Barriers created by government
  - Licenses, exclusive franchises
- Essential input barriers
  - One firm controls a crucial input in the production process

Demand & Marginal Revenue for a Monopolist

- Market demand curve is the firm's demand curve
- Monopolist must lower price to sell additional units of output
  - Marginal revenue is less than price for all but the first unit sold
- When ***MR*** is positive (negative), demand is elastic (inelastic)
- For linear demand, ***MR*** is also linear, has the same vertical intercept as demand, and is twice as steep

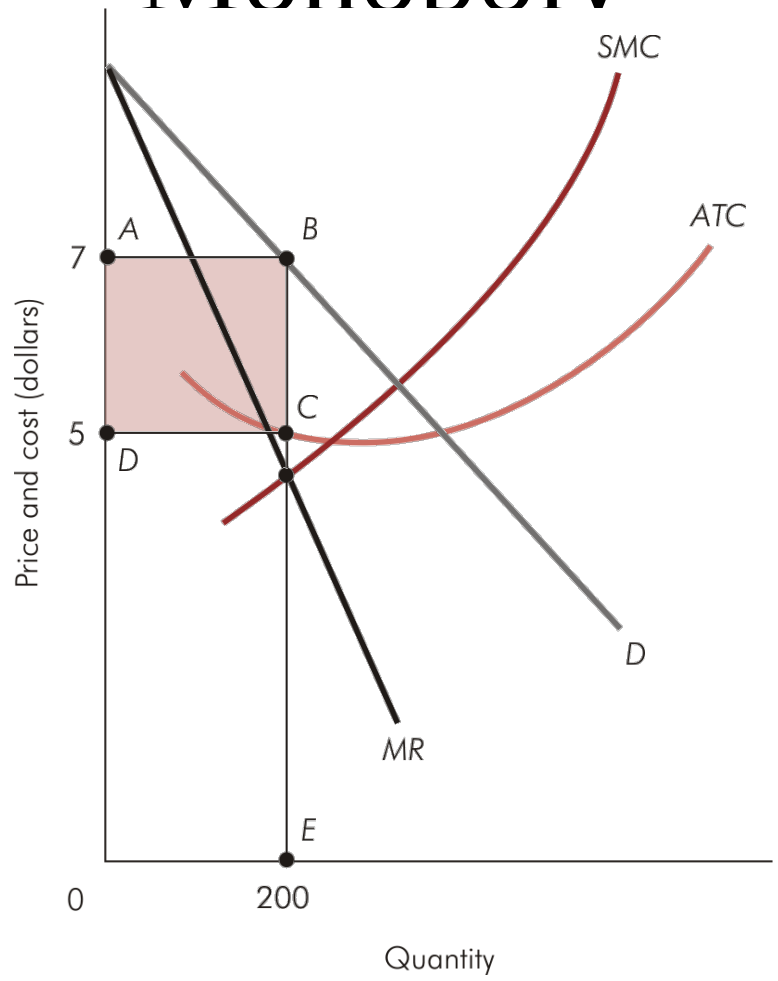
Demand & Marginal Revenue for a Monopolist



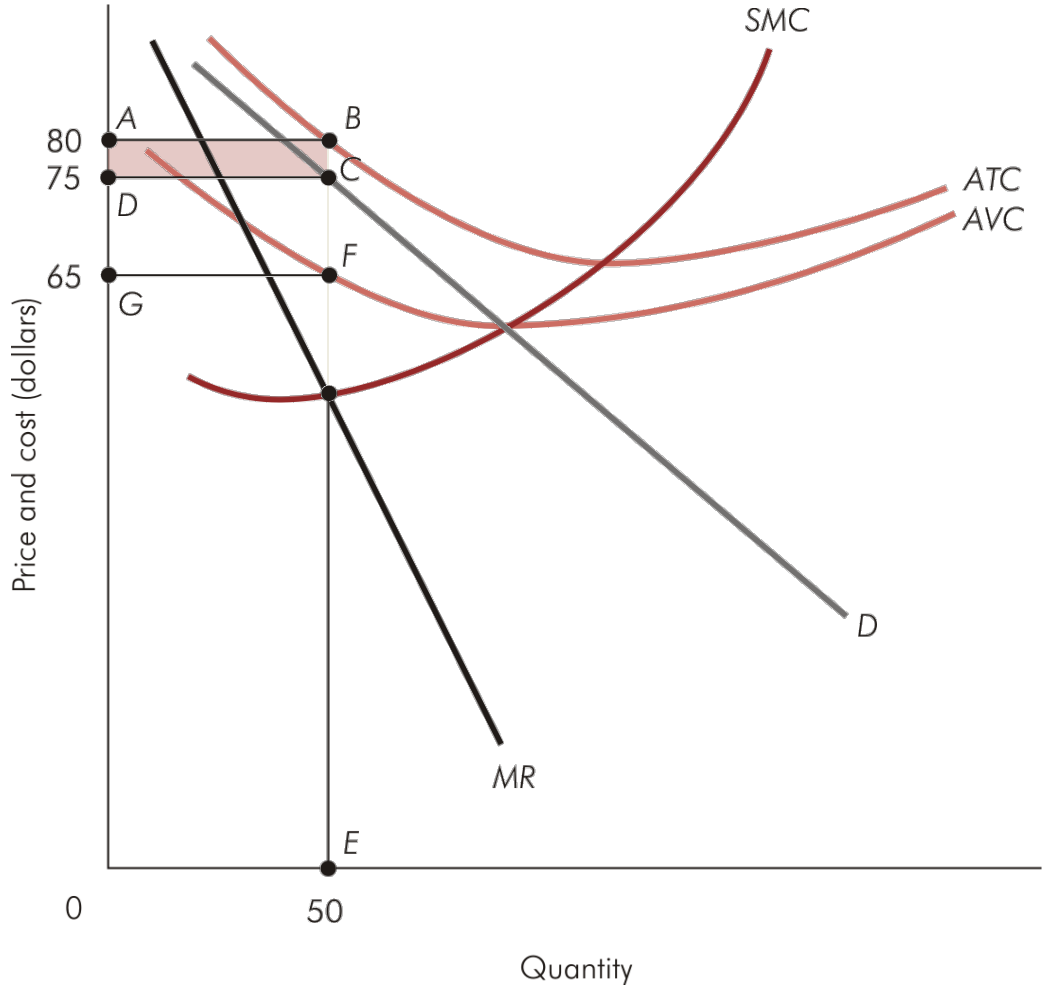
Short-Run Profit Maximization for Monopoly

- Monopolist will produce where ***MR = SMC*** as long as ***TR*** at least covers the firm's total avoidable cost (***TR ≥ TVC***)
  - Price for this output is given by the demand curve
- If ***TR < TVC*** (or, equivalently, ***P < AVC***) the firm shuts down & loses only fixed costs
- If ***P > ATC***, firm makes economic profit
- If ***ATC > P > AVC***, firm incurs a loss, but continues to produce in short run

Short-Run Profit Maximization for Monopoly



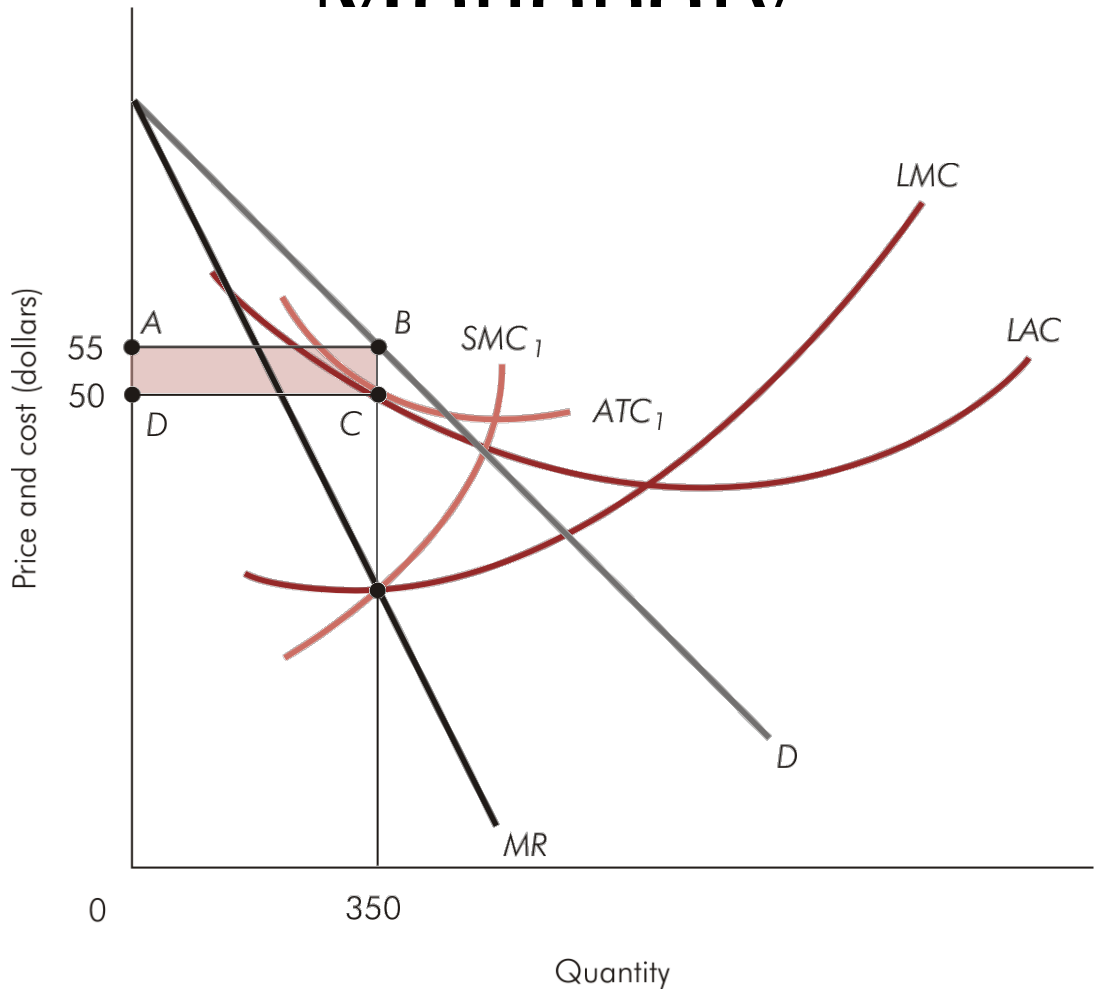
Short-Run Loss Minimization for Monopoly



Long-Run Profit Maximization for Monopoly

- Monopolist maximizes profit by choosing to produce output where $\boldsymbol{MR = LMC}$, as long as $\boldsymbol{P \geq LAC}$
- Will exit industry if $\boldsymbol{P < LAC}$
- Monopolist will adjust plant size to the optimal level
  - Optimal plant is where the short-run average cost curve is tangent to the long-run average cost at the profit-maximizing output level

Long-Run Profit Maximization for Monopoly



Case Discussion on

Managing Natural Monopolies: Interplay of the Regulator and Telecom Companies in India

Natural Monopolies

- Infrastructure and utilities sector exhibit the characteristics of a natural monopoly
- Natural monopolies have increasing returns to scale in production function
- In natural monopolies, fixed cost of production is very high which results in falling long run average cost for large range of output (Sharkey, 1983)
- A large proportion of fixed cost of investment can also be sunk cost which deter entry and exit of other firms
- The demand curve for natural monopolies lies in the falling region of marginal and average cost curves (see the next slide)

Natural Monopolies

- During the initial phases of operations, marginal and average cost for providing per unit of infrastructure remains quite low
- Resultantly, the sector enjoys decreasing average cost per unit of production, which means ‘economies of scale’ are usually very significant (Armstrong, 1997)
- ‘Network effects’ are also prominent for natural monopolies
- ‘Network effect’ is a phenomenon where additional users of the service add value of the good/ service for the existing users/ customers i.e. *marginal utility is an increasing function of the number of users*

Network Effects

Natural Monopolies

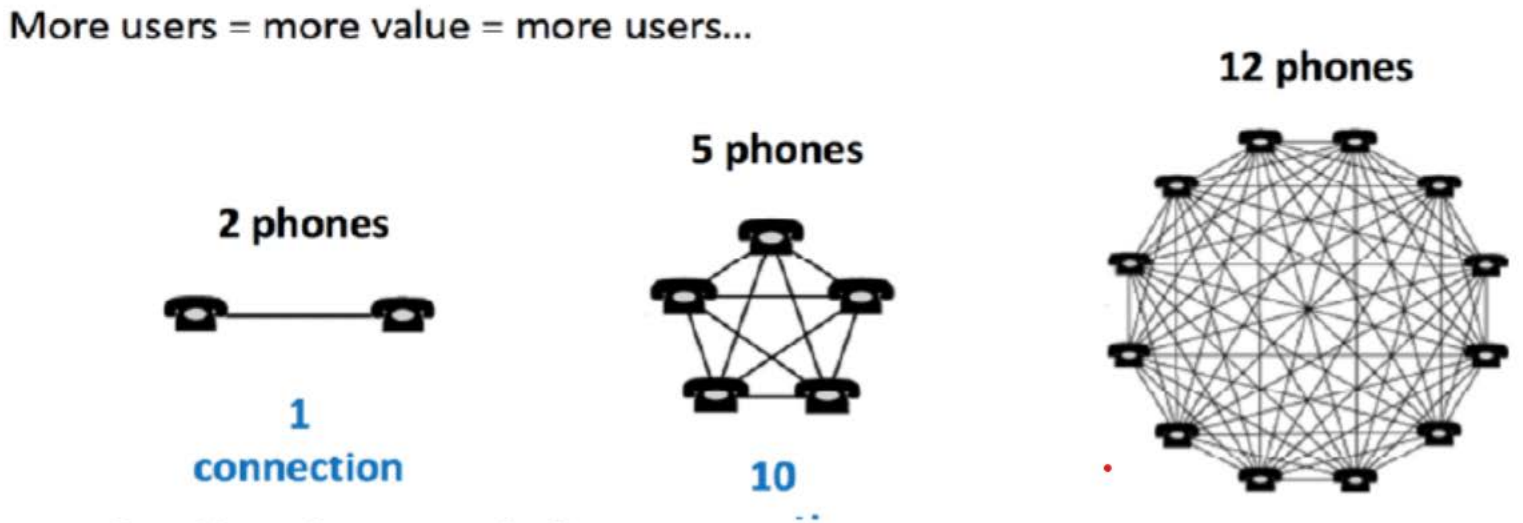


Figure 2: Value addition due to network effects

Source: https://inform.tmforum.org/features-and-analysis/2017/05/platforms-design-deploy-diversify-repeat/

Network Effects

Natural Monopolies

- With more use, lower interconnectivity cost, network coverage, ease of use and reluctance to shift to other service providers
- Service providers can tweak origination charges, interconnection charges and termination charges to differentiate their products on price points
- Switching cost can be increased by keeping termination charges high which means that the customers have to pay higher if they are calling a person who has subscribed to a service provider other than theirs
- This strategy is followed by service providers of European countries

Trai Induced Competition

Natural Monopolies

- Imperative for the regulator to maintain competition in the sector
- In India, termination and interconnection charges are regulated by TRAI
- In view of the current situation, when many private sector service providers like Bharti Airtel, Idea, Vodafone, Tata teleservices Ltd., Reliance Jio and the only public sector service provider i.e. BSNL are under tremendous pressure to pay huge AGR dues and spectrum usage charges, it is likely that the sector will further consolidate
- With merger of Idea and Vodafone in 2017 and Bharti Airtel and Tata teleservices in 2019, the sector is left with a handful of major players

Trai Induced Competition

Natural Monopolies

- If TRAI advises the Government to provide relief to the service providers, this will keep the sector afloat and prevent monopolization
- BSNL should also be revamped to increase the reach of telecom services in rural areas and increase teledensity

First mover advantage – does it exist?

Natural Monopolies

- In oligopoly markets with close substitutes, there is a first mover advantage to earn profits
- This happens specifically in quantity games of Stackelberg's Cournot model, because the total market demand is known and the first mover can choose the quantity it wants to sell and other firms respond accordingly
- If the first mover wants to increase the quantity to be sold, then other firms must decrease the quantity for an optimal solution
- Entry cost is generally very high in oligopoly markets

First mover advantage – does it exist?

Natural Monopolies

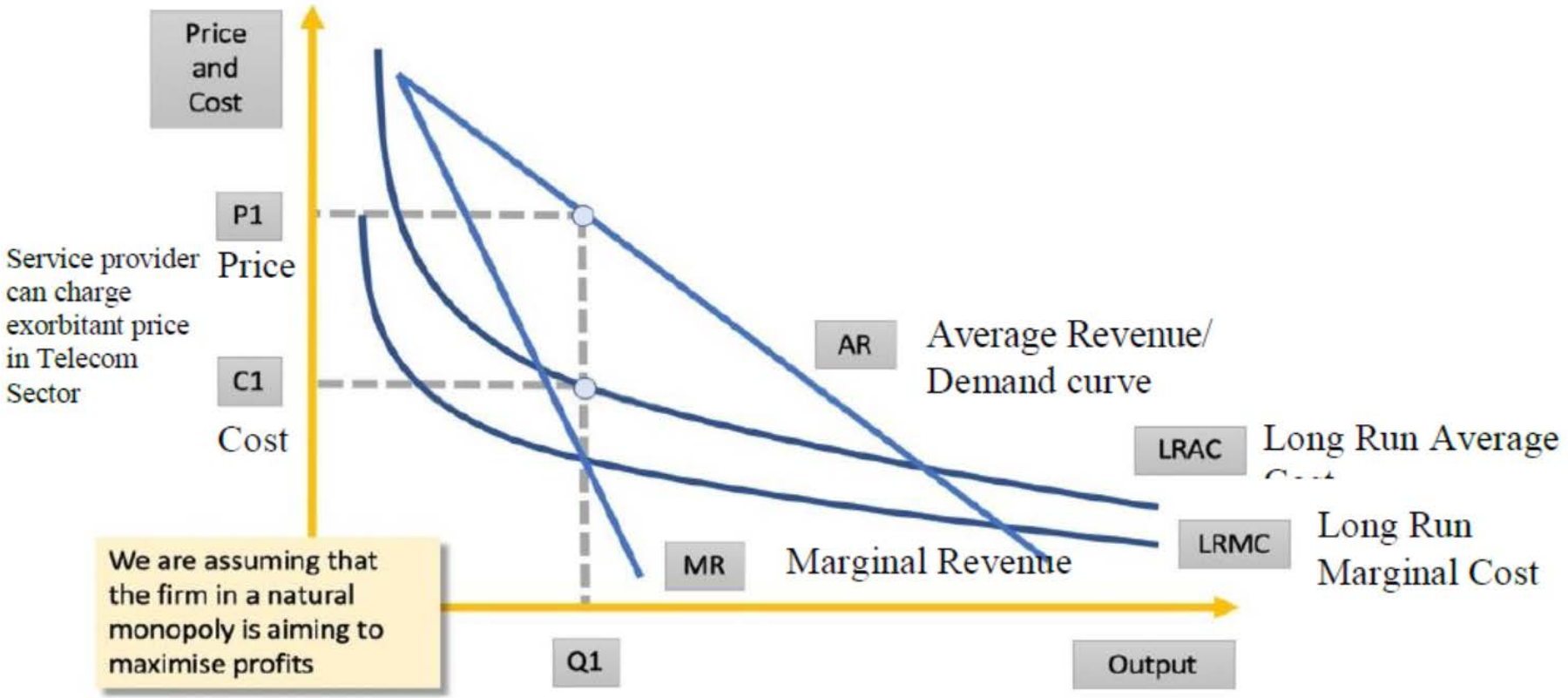
- Cost of building infrastructure, acquiring licenses, purchasing spectrum and entry fees was very high
- High cost of entry inhibited competition in the market
- Bharti Airtel was one of the first service providers to enter the wireless segment and captured the highest market share
- It gauged on ‘network effect’ to capture market share
- First mover advantage is more prominent in telecommunications sector due to ‘network effect’
- Market share of Bharti Airtel has continuously increased since inception - captured 25.7 per cent of the market share in 2017-18 with highest number of subscribers amounting to 304.19 million

First mover advantage – does it exist?

Natural Monopolies

- With time, the telecom sector underwent a large number of merger and acquisitions specially after 2010, wherein, Bharti Airtel acquired Spice, Telenor and Tata Teleservices in 2010, 2017 and 2019 respectively
- JIO entered the market quite late, hence, reaping the benefits of ‘network effects’ was not an option
- It could only capture the market by introducing dirt cheap prices and differentiated products
- JIO differentiated its product by focusing on data based services. JIO’s subscriber base reached 186.56 million in 2017-18 as it became 4th largest service provider in second year of its operation

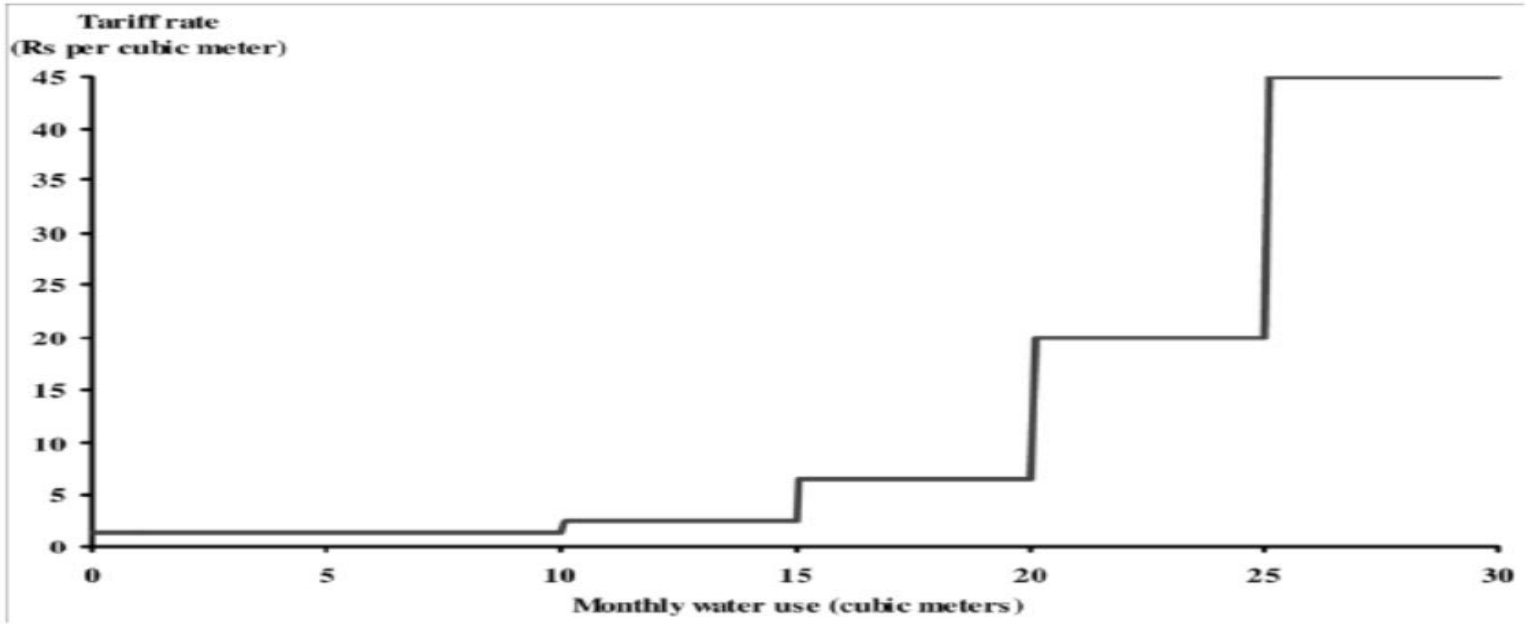
Profit maximisation for a natural monopoly



Tariff

Profit maximisation for a natural monopoly

Figure 3: Representation of Increasing block tariff

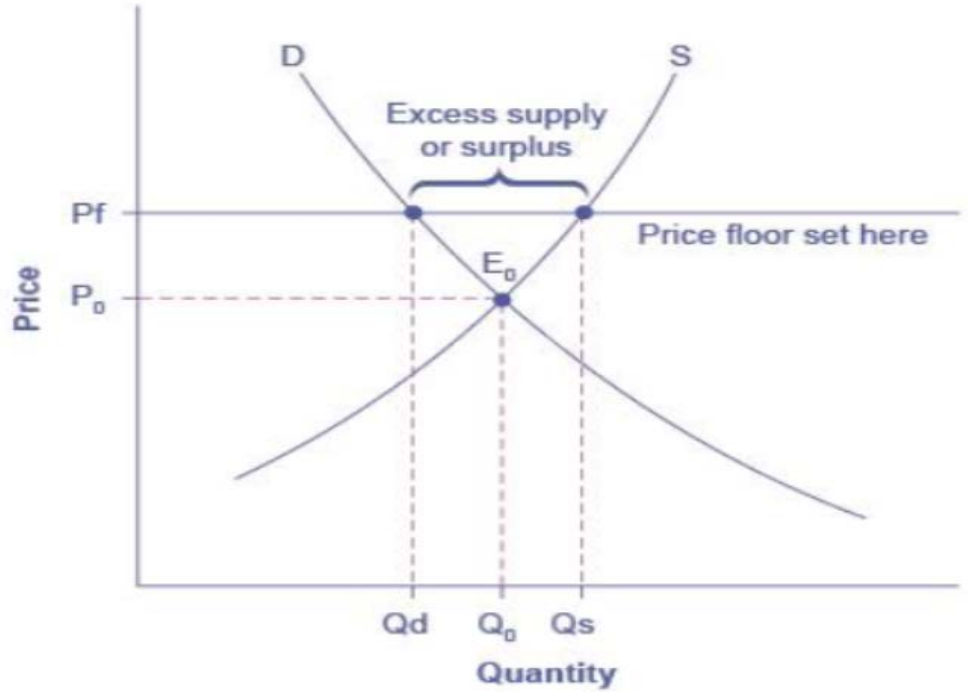


Source: Author

Setting a PRICE floor

Profit maximisation for a natural monopoly

Figure 6: representation of Price floor



Source: Author

Natural Monopolies

- Although price floor is beneficial for the producers, but it hampers competition and not beneficial for the consumers
- As we can observe from the figure in the previous slide, with a price floor i.e. Pf, there is an increase in producer surplus and decrease in consumer surplus
- There is a net loss in welfare when price floor is introduced. The social cost of price floor is represented by the triangle ‘abEo’
- This is also known as ‘deadweight loss’
- Hence, introducing a ‘floor price’ can hamper the interest of the consumers, but, in the present scenario, this seems a viable solution to keep the private service providers afloat.

Natural Monopolies

- This will also lead to increase in average revenue per user for the service providers.
- The service providers can use different pricing mechanism mentioned above and bundle some services to come up with innovative data and call plans

Thanks and wish you all the best