

# ECO411A-2020-21-I- Solutions to Assignment 1

University

Indian Institute of Technology Kanpur

Course

Financial Econometrics (ECO764)

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**Indian Institute of Technology Kanpur  
Department of Economic Sciences**

**ECO411A Industrial Economics  
(2020-21-I Semester)**  
**Instructor: Dr. P. Kulshreshtha**

## SOLUTIONS TO ASSIGNMENT # 1

### **Instructions:**

- There are **7 questions** in this assignment. **Maximum Marks = 70**
- Complete answers should be given.
- '*Quality of reasoning provided*' is very important.
- Make *all necessary mathematical derivations* to support your reasoning.
- Draw graphs, if necessary.
- Show all of your steps and work (including calculations) clearly.

1. In an imperfectly competitive industry, strategic behaviour by existing firms can be socially beneficial. Do you agree? Why? **(3 marks)**

Ans: Yes. Strategic behavior can lead the existing firms to:

- lower their prices, which is beneficial to the consumers of the commodity. Lowering of prices by existing firms also dissuades the inefficient (i.e. high cost) new firms from entering the market/industry. Thus, only efficient (i.e. low cost) new firms can enter the market/industry, which is beneficial to society.
- incur large Advertising/Sales Promotion expenditure. Advertising and Sales Promotion is socially beneficial because it leads to the consumers being better informed regarding

the commodity's features and uses.

- (c) incur large Research and Development (R & D) expenditure. R & D is socially beneficial because it leads to either – (i) product innovation (i.e. new and better products being produced), or (ii) process innovation (i.e. new and better technologies to produce the same product).
- 2. The SCP Paradigm postulates that markets tend to be perfectly competitive, both in the *short-run* and the *long-run*. Do you agree? Why? **(5 marks)**

Ans: No. The SCP Paradigm postulates that markets tend to be *imperfectly* competitive, both in the *short-run* and the *long-run*. This is because the existing firms in a market/industry tend to engage in *strategic behavior*, which raises the costs of entry for the new firms/entrants in the market/industry. By doing so, the existing firms can keep the new firms – both inefficient as well as the efficient ones – from entering the market/industry. Thus, the existing firms are able to exercise their *market/monopoly power* in the market/industry, hence causing losses in social welfare in a given

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society/economy. According to the SCP Paradigm theorists, governments need to intervene in markets/industries to curb the exercise of market/monopoly power by the existing firms, by introducing and using *anti-trust*, or *anti-monopoly* laws/policies.

The Chicago School Paradigm, in contrast, postulates that markets tend to be perfectly competitive, both in the short-run as well as the long-run, provided that governments don't intervene in the markets/industries. According to the Chicago School theorists, government intervention leads to entry barriers in the markets, which keep new, efficient firms from entering the markets/industries.

- 3. In an *imperfectly* competitive market, higher profitability of firms indicates better market performance. Do you agree? Why? **(4 marks)**

Ans: No. In a *perfectly* competitive market/industry, firms can make *supranormal profits only in the short run. In the long run, the supranormal profits are dissipated away*

*profits only in the short-run. In the long-run, the supranormal profits are dissipated away due to free entry by new firms in the market/industry. Hence, in the long-run, all firms in a perfectly competitive market/industry earn only *normal profits*, i.e. their economic profits are zero in the long run.*

However, in an *imperfectly* competitive market/industry, firms can use their market/monopoly power to earn *supranormal profits, both in the short-run as well as the long-run*. Thus, higher profitability of firms in an imperfectly competitive market/industry indicates that firms are able to exercise greater market/monopoly power in the market, which leads to greater losses in social welfare (i.e. dead-weight losses) as well. Hence, higher profitability of firms is associated with higher social inefficiency in a market industry, which indicates poor/worse market/industry performance.

4. As Chief Economist of Alpha Books Publishing Co. – a firm in a *perfectly competitive* market/industry – you have been asked to present the company’s economic profit/loss situation at the Annual General Meeting of stockholders. You know that Alpha Books has “typical” (i.e. U-shaped) cost curves. **(10 + 8 + 10 = 28 marks)**

- (a) Draw separate graphs to depict two alternative short-run scenarios: (i) Alpha Books making an economic profit, i.e. earning a *supranormal* rate of return, and (ii) Alpha Books making an economic loss, i.e. earning a *less than normal* rate of return, but continuing to produce. Clearly label the areas denoting the firm’s economic profit/loss in each graph.

Ans: See PDF file: Perfect\_Competition[1].

- (b) Suppose that according to your estimates, the firm’s short-run total cost function is given by:  $SRTC(q) = 3q^3 - 25q^2 + 54q + 250$ , where  $q$  is the firm’s output. Calculate the firm’s “shut-down” point (both price and output), and depict it graphically.

$$\text{Ans: } SRTC(q) = 3q^3 - 25q^2 + 54q + 250 \Rightarrow TVC(q) = 3q^3 - 25q^2 + 54q$$

$$\Rightarrow AVC(q) = [TVC(q)/q] = 3q^2 - 25q + 54$$

Thus,  $AVC$  is a ‘U-shaped’ curve.

$$\text{Also, } SRMC(q) = d[SRTC(q)]/dq = 9q^2 - 50q + 54$$

Thus,  $SRMC$  is also a ‘U-shaped’ curve.

Now, at the “shut-down” point of the firm, the following conditions hold:

(i)  $AVC(q)$  attains its “minimum value”. Therefore, F.O.C. holds,

$$\text{i.e. } d[AVC(q)]/dq = 6q - 25 = 0 \Rightarrow q = (25/6).$$

(ii) The  $SRMC$  curve intersects the  $AVC$  curve from below. i.e.  $SRMC(q) = AVC(q)$ ,

$$\text{or, } 9q^2 - 50q + 54 = 3q^2 - 25q + 54 \Rightarrow 6q^2 - 25q = 0 \Rightarrow q = 0, \text{ or } (25/6).$$

From (i) and (ii) above, we can conclude that at the “shut-down” point of the firm,

$q = (25/6)$ . Thus, the “shut-down” output of the firm = **(25/6), or 4.167 units/period**. Plugging the “shut-down” output in the  $AVC$  function, we obtain the “shut-down” price of the firm as follows:

$$P_{\text{SHUT-DOWN}} = 3(25/6)^2 - 25(25/6) + 54 = (625/12) - (625/6) + 54 = (23/12), \text{ or } \text{Rs. 1.9167 per unit.}$$

- (c) Now, answer part (a) above, assuming that Alpha Books is a *monopolist/monopoly* firm, with “typical” (i.e. U-shaped) cost curves.

Ans: See PDF file: Monopoly-Supranormal and Less than Normal Profit in SR

5. Suppose that a market/industry consists of a *monopolist/monopoly* firm, which faces a *linear, downward-sloping* market/industry demand curve for the commodity it sells, i.e.

$P(Q) = a - bQ$ , where  $Q$  is the market/industry quantity demanded of the commodity, and  $a$  and  $b$  are *positive* constants. **(8 + 7 = 15 marks)**

- (a) Show that the *marginal revenue* of the firm can be mathematically expressed as follows:

$$MR(Q) = dTR(Q)/dQ = P(Q)[1 - (1/|e_p|)]$$

where  $MR$  = the marginal revenue of the firm,  $|.|$  is the “modulus” function, and

$e_p$  = *price/own price elasticity of demand* for the commodity

$$= (\% \Delta Q / \% \Delta P)_{c.p.} = (dQ/dP)(P/Q) \text{ (c.p.: ceteris paribus)}$$

Ans: By definition,  $TR(Q) = P(Q)Q$  Also, by definition,  $MR(Q) = dTR(Q)/dQ$

Thus, we can write:

$$\begin{aligned} \text{MR}(Q) &= d\text{TR}(Q)/dQ = d[P(Q)Q]/dQ \\ &= P(Q) + QdP(Q)/dQ \end{aligned} \quad (1)$$

Assume  $P(Q) > 0$ . Then, multiplying and dividing the second term in equation (1) above by  $P(Q)$ , we obtain:

$$\begin{aligned} \text{MR}(Q) &= P(Q) + P(Q)\{Q/P(Q)\}dP(Q)/dQ \\ &= P(Q)[1 + \{Q/P(Q)\}dP(Q)/dQ] \end{aligned} \quad (2)$$

Now, note that:

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$$\{Q/P(Q)\}dP(Q)/dQ = 1/[(dQ/dP(Q))(P(Q)/Q)] = (1/e_p),$$

where  $e_p = (\% \Delta Q / \% \Delta P)|_{c.p.} = (dQ/dP)(P/Q)$ . Substituting back in equation (2) above, we get.

$$\text{MR}(Q) = P(Q)[1 + (1/e_p)] \quad (3)$$

Now, note that:  $e_p \leq 0 \Rightarrow |e_p| = -e_p$ , or  $e_p = -|e_p|$ . Substituting back in equation (3) above, we get.

$$\text{MR}(Q) = P(Q)[1 - (1/|e_p|)]$$

- (b) Suppose that the “first order condition” for *short-run* profit maximization of the monopoly firm holds. Show that *the firm will never operate in the “inelastic region” of the market/industry demand curve*.

Ans: We know that if the market/industry demand curve is a *straight line (i.e. linear)*, the market/industry demand for the commodity is: (i) *Elastic, above the mid-point* of the straight line market/industry demand curve, (ii) *Unit-Elastic, at the mid-point* of the straight line market/industry demand curve, and (iii) *Inelastic, below the mid-point* of the straight line market/industry demand curve.

According to the “first order condition” for *short-run* profit maximization of the

monopoly firm,  $MR(Q) = MC(Q)$ . Note that, by definition,  $MC \geq 0$ , since it is the cost of producing an additional unit of output. Therefore, for the monopolist:

$$MR(Q) = MC(Q) \geq 0$$

$$\Rightarrow MR(Q) \geq 0$$

$$\Rightarrow MR(Q) = P(Q)[1 - (1/|e_p|)] \geq 0 \quad (\text{from part (a) above})$$

Since  $P(Q) \geq 0$ , this implies that:

$$[1 - (1/|e_p|)] \geq 0 \Leftrightarrow |e_p| \geq 1$$

Thus, in the short-run monopoly market/industry equilibrium, the market/industry demand must be either elastic ( $|e_p| > 1$ ), or unit-elastic ( $|e_p| = 1$ ).

Therefore, the demand for the monopolist **cannot be inelastic** at the monopoly market/industry equilibrium.

6. Give an example of a monopoly firm, for which the Lerner Index  $\mathcal{L} \approx 1$  ( $\approx$  means ‘approximately equal to’ or ‘arbitrarily close to’). Show that in this case, the firm has *unlimited/infinite* market/monopoly power. **(7 marks)**

Ans: Consider a monopolist/monopoly firm, which faces a PERFECTLY INELASTIC MARKET DEMAND. For such a firm, the output it produces and sells equals the market quantity demanded, which is fixed, say  $Q^* > 0$  (since the market demand is perfectly inelastic, or the market demand curve is ‘vertical’). Therefore, the economic profit of the firm is given by:

$$\Pi(Q^*) = TR(Q^*) - TC(Q^*) = PQ^* - TC(Q^*)$$

Since  $Q^*$  is fixed,  $TC(Q^*)$  is fixed as well. Also, note that the market price  $P$  is independent of the market quantity demanded, i.e.  $Q^*$ .

indefinitely. A profit-maximizing firm will raise the price to infinity, as it strives to achieve the highest possible economic profit. Therefore, for such a firm:

$$\mathcal{L} = [P - MC(Q^*)]/P = 1 - [MC(Q^*)/P] \approx 1$$

since  $P \uparrow \infty$  and  $MC(Q^*) \geq 0$  is finite, as  $Q^*$  is finite.

As the firm raises the price to infinity, it clearly raises the price infinitely above its marginal cost, and hence, it has *infinite/unlimited* market/monopoly power.

### 7. Pepall, Chapter 2, p. 39, Practice Problem 2.5

(2 + 4 + 2 = 8 marks)

Ans:

- a. In order to reach the efficient allocation, the government should charge a *price that equals the marginal cost of production*. This is because *in the absence of externalities and public goods, the perfectly competitive market price, where price equals marginal cost of production, provides the socially efficient allocation of a commodity*. Thus, the price that the consumers are willing to pay ( $P$ ) must equal the marginal cost of production ( $MC$ ) at the socially efficient level of output of water ( $Q_C$ ). Thus,  $P = MC(Q_C)$ , where  $P$  is given by the demand equation:  $Q = 50 - 2P$ , or  $P = 25 - (Q/2)$ , and  $MC(Q) = dTC(Q)/dQ = 10$ , where  $TC(Q) = 100 + 10Q$ . Hence, for the efficient allocation of water,

$$P = MC(Q_C) = 10, \text{ or } 25 - (Q_C/2) = 10 \Rightarrow Q_C = 30 \text{ units per period.}$$

Also,  $P = P_C = \text{Rs. 10 per unit.}$

b. Profit from the sale of water =  $\Pi(Q) = TR(Q) - TC(Q)$   
 $= PQ - TC(Q) = [25 - (Q/2)]Q - [100 + 10Q]$

The necessary condition for profit maximization is:

$$d\Pi(Q)/dQ = 25 - Q - 10 = 0 \Rightarrow Q = Q_M = 15 \text{ units per period.}$$

(Check the S.O.C.:  $d^2\Pi(Q)/dQ^2 = -1 < 0$ , which is *sufficient* for profit maximum.)

Also,  $P = P_M = 25 - (Q_M/2) = 25 - (15/2) = \text{Rs. 17.5 per unit.}$

- c. Refer to **Figure 2.6** on p. 38 of Pepall's textbook. According to the above figure, the value of the efficiency loss from charging the price in part b. above ( $P_M = \text{Rs. 17.5 per unit}$ ) rather than the price determined in part a. above ( $P_C = \text{Rs. 10 per unit}$ ) is given by the area of the right-angled triangle:

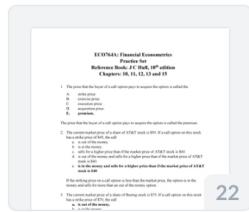
$$\Delta xyz = (1/2)(P_M - P_C)(Q_C - Q_M) = (1/2)(7.5)(15) = (7.5)^2 = \text{Rs. 56.25}$$

(Note that in this case, the **Competitive supply curve** is a horizontal straight line at  $P = P_C = 10$ .)

## Recommended for you



Practice set 1  
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J.C. Hull Ch.1,2,3,5  
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