EXERCISE 27

WHEN THIRD-DEGREE PRICE DISCRIMINATION HELPS (ALMOST) EVERYONE

Can be answered and the figure drawn either manually or on a spreadsheet like Excel.

After having co-opted the Prime Minister's son as Director, the firm "K.K.N. Bhd" was granted the monopoly to deserve the air route between two cities of that faraway kingdom. However this did not guarantee any positive profit because, even if such patronage was the best entry barrier K.K.N. Bhd could buy from the government against potential rivals, it also created high fixed costs since nowadays politicians don't come cheap[1].

K.K.N. Bhd has isolated two distinct markets with the following demand :

businessmen (frequent fliers, subscript B) : $Q_B = -1/2\ P_B + 150$

and foreign tourists (subscript F) : $Q_F = -5/2\ P_F + 300$

K.K.N. Bhd total costs are given by : $TC = ¼\ Q^2 + 10\ Q + 10\ 000$

Question 1.

Initially K.K.N. Bhd charged a single common profit-maximising price on both markets. Compute the common price and this maximum amount of profit.

From a figure where the average cost and average revenue curves are drawn what is K.K.N. Bhd situation ? Beware, with a common price, K.K.N. Bhd has the possibility to sell only to one market at a price too high for the other market , or to sell at a lower price to both markets, profits from both situations should be compared.

Question 2.

Realising that the two markets are different and well insulated, K.K.N. Bhd plans to charge different prices on each market. What would be the maximum profit attainable then ? Compare this solution to the earlier one for K.K.N. Bhd and for both groups of customers.

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[1] Americans, usually proud of their institutions, use to say "*Our Congress, is the best Congress money can buy*".

ANSWERS

Question 1.

If a common price is charged, the total demand must first be found by horizontally aggregating the two demand functions : $P_B = -2\ Q_B + 300$ and $P_F = -\ 2/5\ Q_F + 120$.

Since the intercepts of the two demand curves are different it is possible to serve only the business market if 120 < P < 300. The total demand curve will have a kink for P = 120 and Q = 90. For quantities greater than 90 or price lower than 120 the firm will sell on both markets.

Aggregated demand is found by adding the two market demands :

$$Q_B = -\frac{1}{2} P_B + 150$$

$$Q_F = -\frac{5}{2} P_F + 300$$

$$Q_T = Q_B + Q_F = -\frac{1}{2} P_B - \frac{5}{2} P_F + 450$$

and since $P_B = P_F = P_T$: $Q_T = -3\ P_T + 450$ or $P_T = Q_T/3 + 150$

The average revenue and marginal revenue functions are thus :

$$\left.\begin{array}{l} P \text{ or } AR = -\ 2\ Q + 300 \\ MR = -4\ Q + 300 \end{array}\right\} \quad \text{if } 120 < P < 300 \qquad \text{or if } Q < 90,$$

$$\left.\begin{array}{l} P \text{ or } AR = -1/3\ Q + 150 \\ MR = -2/3\ Q + 150 \end{array}\right\} \quad \text{if } P < 120 \qquad \text{or if } Q > 90,$$

For the cost side now, the total cost function $TC = 1/4\ Q^2 + 10\ Q + 10\ 000$ translates into the average cost function : $AC = 1/4\ Q + 10 + 10\ 000/Q$ and the marginal cost function : $MC = ½\ Q + 10$.

By plotting the average revenue and average cost curves on the same graph (figure 1) it becomes evident that for any level of Q, costs are higher than revenue per unit. Hence if a single price is charged on both markets K.K.N. Bhd will never be able to cover its costs. In this case, it would seem likely that the airline should avoid operating this new route.

If however it decides to offer the service, then it must chose a solution which will minimise its losses by applying the same rule as for maximising its profit.

- If it sells on both markets : $MC = MR_T$ or $-2/3\ Q + 150 = -½\ Q + 10$ or **Q’ = 120** and $P = -120/3 + 150$ or **P’ = 110**, **Q_F’ = 25** and **Q_B’ = 95**.
  Total losses in this case are equal to **π‘** = 120 [110 - (120/4 + 10 + 10,000/120)] = 120 (110 - 123.33) = **-1,600.**

- If it serves only the businessmen segment : MC = MR_B
  or -4 Q + 300 = ½ Q + 10 or **Q* = 64,4** and **P* = 171,20**
  Total losses in this amount to **π* =** 64.4 [171.20 - (64.4/4 + 10 + 10,000/64.4)]
  = 64.4 (171.20 - 181.38) = **-655,56** only.

If the airline company chooses to operate this new route the best solution is to charge a high price and to serve only the businessmen, but even then K.K.N. will still incur a loss.

Question 2.

Instead of a single price, a third-degree price discrimination strategy could be considered and the profit maximising rule in this case becomes : $MR_B = MR_F = MR_T$.

MR_T will have a kink for MR_T = 120 or Q = 45.

- if Q < 45, MR_T = -4 Q + 300
- if Q > 45 we must aggregate horizontally the marginal revenue functions from both markets

$$\begin{array}{r} Q_B = 75 - 1/4\ MR_B \\ Q_F = 150 - 5/4\ MR_F \\ \hline Q_T = Q_B + Q_F = 225 - 6/4\ MR_T \end{array}$$

or $MR_T = 150 - 2/3\ Q_T$

To find the profit-maximizing level of Q, we equate MR_T = MC.

-150 - 2/3 Q = ½ Q + 10 which yields **Q* = 120** (> 45) and MR_T* = 120/2+10 = 70

Substituting this value into the respective MR_A and MR_B equations gives :

Q_B* = 75 – 70/4 = **57,5** and **Q_F*** = 150 - 5/4 (70) = **62,5**

Substituting these quantities into their respective demand curves :

P_B* = -2(57.5) + 300 = **185** and **P_F*** = -2/5(62.5) + 120 = **95**

This yields a profit of $\pi = (P_B^* \cdot Q_B^*) + (P_F^* \cdot Q_F^*) - TC(Q_B^* + Q_F^*)$

π = 185 * 57.5 + 95 * 62.5 – 120 (120/4 + 10 + 10,000/120)

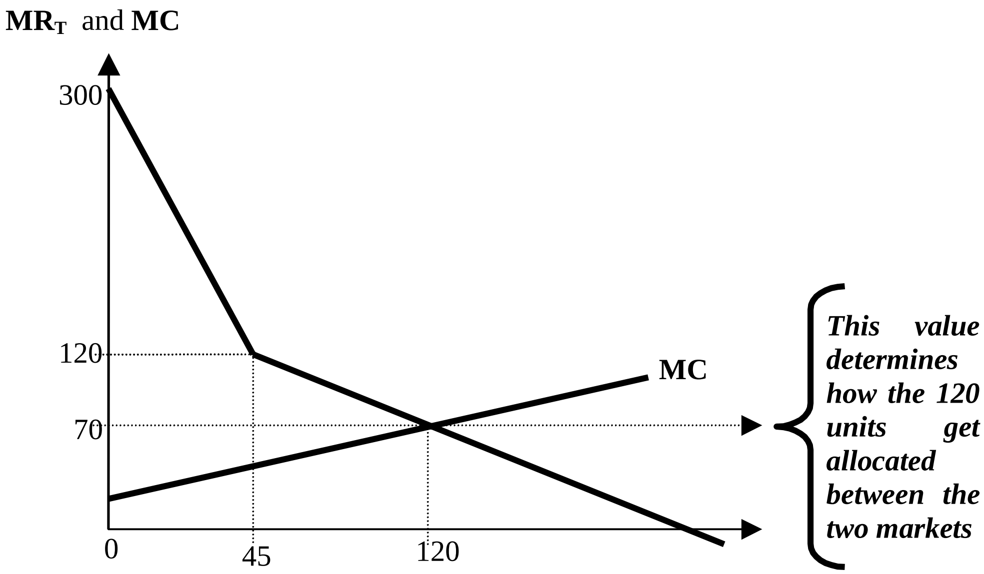
π* = 10,637.50 + 5,937.50 – 14,800 = **+ 1,775**

The average revenue is (57.5*185+62.5*95)/(57.5+62.5) = **138.125** shown by a star * on the graph.

In this situation almost everybody benefits from a third-degree price discrimination strategy.

The airline company is finally able to make a profit. It is also the only solution that makes it possible to serve the tourist segment. Price discrimination lowers the price of the tourist segment, in case it was serviced, but increases the price of the businessmen segment. Therefore, price discrimination benefits the tourist group at the expense of the business segment. Price discrimination also allows the firm to better spread its fixed production cost on more units.

FIGURE 2.


MR_T and MC
300
120
70
MC
0
45
120
This value determines how the 120 units get allocated between the two markets

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