**MANAGERIAL ECONOMICS AND INDUSTRIAL ORGANIZATION**

**MAY 2024**

1. Suppose that Ericsson and Nokia compete in the market for 4G handsets. Each firm must decide between two possible price levels: $100 and $90. Production cost is $40 per handset. Firm demand is as follows: if both firms price at 100, then Nokia sells 500 and Ericsson 800; if both firms price at 90, then sales are 800 and 900, respectively; if Nokia prices at 100 and Ericsson at 90, then Nokia’s sales drop to 400, whereas Ericsson’s increase to 1100; finally, if Nokia prices at 90 and Ericsson at 100 then Nokia sells 900 and Ericsson 700.
2. Suppose firms choose prices simultaneously. Describe the game and solve it.
3. Suppose that Ericsson has a limited capacity of 800 units. Moreover, all of the demand unfulfilled by Ericsson is transferred to Nokia. How would the analysis change?

 The above matrix shows the profits for the different combinations. Low Price is the dominant strategy for both firms so the equilibrium in dominating strategies, which is also a Nash Equilibrium, is Low price, Low Price with profits equal to 45000 for Ericsson and 40000 for Nokia.

|  |  |  |
| --- | --- | --- |
|  **Nokia***Ericsson* | **High Price** | **Low Price** |
| *High Price* | 48000,30000 | 42000,45000 |
| *Low Price* | 55000,24000 | 45000,40000 |

 If Ericsson cannot sell more than 800, and if the units that are beyond Ericsson’s capacity are sold to Nokia (this happens only when Ericsson charges a low price), the matrix modifies as follows.

|  |  |  |
| --- | --- | --- |
|  **Nokia***Ericsson* | **High Price** | **Low Price** |
| *High Price* | 48000,30000 | 42000,45000 |
| *Low Price* | 40000,42000 | 40000,45000 |

 High price is the dominant strategy for Ericsson, now, while Low Price is still the dominant strategy for Nokia. The new equilibrium is High Price/Low Price.

1. The demand function has been estimated as follows: Qe = 2000 – 500 Pe + 0.4 Y + 200 Pg, where Q is measured in millions of gigawatts, P in euro per kilowatt hour, Y in millions of euro.
* Suppose that Pe increases by 1 euro, Pg increases by 1 euro and Y increases by 1 billion euro. How much the consumption of electricity will change?
* Suppose that Pe= 5€, Y= 20 billion euros, and Pg=2€. Compute the consumption of electricity and the elasticity of electricity to income.
* How much will be the own-price elasticity and the cross-price elasticity? Is g a complement or a substitute good for electricity?

 If Pe increases by 1 euro, Qe reduces by 500. If Y increases by 1 million €, Qe increases by 400. If Pg increases by 1 euro, Qe increases by 200. Therefore, the quantity of electricity will increase by 100.

 Substituting the values: Qe is equal to 7900. The income elasticity is εY=(dQ/dY)\*Y/Q=0.4\*20000/7900=1.013.

 The own-price elasticity and the cross-price elasticity are respectively

 εPe=(dQe/dPe)\*Pe/Q=-500\*5/7900=-0.316 and εPg=(dQ/dPg)\*Pg/Q=200\*2/7900=0.05. Electricity and gas are substitute goods but the degree of substitution is quite low.

1. Consider a restaurant selling bento boxes and bubble tea. Assuming that there are 80 consumers of type A and 20 of type B, whose willingness to pay are reported in the following table, find the optimal choice in the case of separate sale, pure bundling and mixed bundling. Costs are supposed to be equal to zero.

|  |  |  |
| --- | --- | --- |
|  | Bento boxes | Bubble Tea |
| A: Food lover | 120 | 30 |
| B: Tea Lover | 60 | 60 |

In the case of separate sales, it is better to sell the bento boxes at 120 and the bubble tea at 30. Total profits will be 120x80+30x100=12600.

In the case of pure bundling, it is indifferent to set a price of 150 or a price equal to 120 for the combination bento box/bubble tea. In both cases, profits will be equal to 12000 (150x800 or, alternatively, 120x100).

In the case of mixed bundling the bundle can be sold at 150 and the bubble tea at 60 (due to the incentive compatibility constraint, it is not profitable to sell separately the bento box: the price will be set at 120 so nobody will buy it). Profits will be equal to 150x80+60x20=13200.

1. Market demand for ethanol is given by Q = 1500−2 p. There are two producers that face quantity competition, and their marginal costs are constant and given by c1 = 340, c2 = 420
2. Determine equilibrium price, output and profits.
3. Firm 2 is currently considering two possible strategies: (a) a public opinion campaign that

 would cost 1150 and shift the demand curve to Q = 1520−2 p; (b) a capital investment of 4900 that would reduce marginal cost c2 to 400. (b) Are investments worthwhile if taken together? Justify your answer.

 It is an asymmetric Cournot duopoly. From the direct demand function we obtain the inverse demand function: p = 750 – ½ q1 – ½ q2. Equating marginal revenue with marginal cost we get the two best response functions:

 750-q1-1/2q2=340 🡪 q1=410 – ½ q2

 750-q2-1/2q1=420 🡪 q2= 330 – ½ q1.

 By solving for the system of two equations in two unknown variables we get q1= 326.67, q2=166,67 p=503, and profits equal to π1=53247 and π2=13.833.

 After the two investments, the direct demand function is Q = 1520−2 p and the new marginal cost of firm 2 is 400. The inverse demand function: p = 760 – ½ q1 – ½ q2. Equating marginal revenue with marginal cost we get the two best response functions:

 760-q1-1/2q2=340 🡪 q1=420 – ½ q2

 760-q2-1/2q1=400 🡪 q2= 360 – ½ q1.

 By solving for the system of two equations in two unknown variables we get q1= 320, q2=200 p=500. Profit of firm 2 increases to π2=20000, i.e. by 6167. The investment costs 4900+1150=6050, so it is worth it.

1. There are three firms that manufacture three products with the following inverse demand functions: P1=100-10y1-5 y2-5y3; P2=100-10y2-5 y1-5y3 ; P3=100-10y3-5 y1-5y2

Assuming for simplicity that marginal costs are equal to zero, find the Cournot equilibrium (quantities, prices, profits). Imagine now a merger between firm 1 and firm 2. Find the new duopoly equilibrium and compare the results before and after the merger.

By equating marginal revenue with marginal cost: 100-20y1-5 y2-5y3=0; 100-20y2-5 y1-5y3 =0; 100-20y3-5 y1-5y2 =0. By solving the system one gets y1= y2=y3= 10/3; prices are equal to 100/3 and profits are 111.11 for each firm. In the case of a merger, the firm 1+2 maximizes the joint profits; π1+ π 2 = (100-10y1-5 y2-5y3)y1+(100-10y2-5 y1-5y3)y2.

The first order conditions are 100-20y1-5y2-5y3-5y2=0 and 100-20y2-5y1-5y3-5y1=0. By imposing y1=y2 one gets y1=y2=3.33-1/6 y3. The reaction function of firm 3 is always y3=5-¼y1- ¼ y2. By imposing again y1=y2 one gets y1=y2=2.727 and y3=3.636. Prices are p1=p2=40.9 and p3=36.37 and profits are π1+ π 2 =223 and π3 =132.24. Profits after the merger are substantially unchanged, so the merger paradox does not appear anymore. This is because goods are differentiated. Firm 3, however, clearly gains from the merger.

1. In which of the following three situations collusion is more likely? Motivate your answer, considering that each underlined word in italics is a factor that potentially impacts the chances to form a cartel.
* *2* firms (one *large* and one small), that compete in *3* regional markets using *price* as strategic variable
* *3* firms of *equal* size, that compete in *one* market with *homogeneous* products, whose demand is supposed to *grow* in the future, and use *quantity* as strategic variable
* *3* firms of *equal* size, that compete in *two* markets (mobile and fixed-line telephone services), one with *good* prospects for growth that attract *entry* of rivals and the other *declining* in size.