**MANAGERIAL ECONOMICS AND INDUSTRIAL ORGANIZATION**

**July 2023**

1) Consider the following two simultaneous games, concerning the adoption of a new technology:

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| --- | --- | --- |
|  Firm 2Firm 1 | Technology A | Technology B |
| Technology A | (2,2) | (4,4) |
| Technology B | (4,4) | (2,2) |

|  |  |  |
| --- | --- | --- |
|  Firm 2Firm 1 | Technology A | Technology B |
| Technology A | (8,5) | (3,3) |
| Technology B | (3,3) | (4,10) |

1. Tell if in the two games firm 1 prefers to have the same standard or two different standards (A and B) in the market
2. Tell if in the two games firm 2 prefers to have the same standard or two different standards (A and B) in the market
3. Find the Nash equilibria in the two games.
4. In the case in which firm 1 moves as first in a sequential game, what will be the standard that will emerge in the market?

By looking at the payoffs, in the first case both firms would prefer to have two different technologies not compatible the one with the other, while in the second case they would prefer to have a unique standard (technology A for firm 1 and technology B for firm 2, respectively). There are two Nash equilibria in both games: (A,B) and (B,A) in the first game and (A,A) and (B,B) in the second one.

If the game becomes sequential with firm 1 being the first mover, in the first game we have two subgame perfect equilibria: (A,B) and (B,A). It is indifferent choosing A or B for firm A, because firm 2 will answer by selecting the other technology. Therefore, there is not a first mover advantage. In the second game, instead, there is a first mover advantage and the subgame perfect equilibrium is (A,A).

2) Given the information provided in the following table (production and distribution costs in euro), tell if there are specific scale economies in the production and in the distribution stages. Are there economies/diseconomies of vertical integration for the different size levels?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Production Distribution | 0 | 100 kw | 200 kw | 300kw |
| 0 | - | 200 | 400 | 600 |
| 100 kw | 200 | 500 | - | - |
| 200 kw | 420 | - | 820 | - |
| 300 kw | 550 | - | - | 1000 |

Looking at the second column, we can see that if the quantity increases from 100kw to 200kw costs more than double, where if it increases from 100kw to 300kw costs increase less than 300%. Therefore, there are specific scale diseconomies from 100kw to 200kw and specific scale economies from 200kw and 300kw.

Looking at the second row, we notice that if quantity increases from 100kw to 200kw, costs are doubling, and are multiplied by 3 if quantity increases to 300kw. Therefore, there are constant returns to scale in production.

Looking at the numbers in the diagonal, it emerges that costs are 500 for a firm that distributes and produces 100kw, while the costs of two separate firms specialized in production and in distribution only are equal to 200+200=400. If the quantity is 200kw, instead, it is indifferent having separate or joint production, while for a quantity equal to 300kw the joint production is less costly (1000 versus 600+550=1150). Therefore, there are vertical diseconomies for small firms, there are neither vertical economies nor diseconomies if quantity is 200kw, and there are vertical integration economies if the firm produces and distributes 300kw.

1. Suppose that there are 100 identical banks that compete *à la Bertrand*. The inverse demand function is P =300 – 15 Q. Marginal cost is 5.

Compute di market equilibrium. Suppose that 2 banks merge and are able to reduce marginal costs from 5 to 2. What will be the new equilibrium, under the assumption that price can be only an integer number? (i.e., 2, 3, 4, 5. A price such as 5.5 is not possible!!!). Compute also the Lerner Index before and after the merger.

The Bertrand model with homogeneous goods is characterized with a price equal to 5. Quantity will be 19.66 and profits will be equal to zero for all banks.

In the case of the merger we have an asymmetric Bertrand model. Only the firm resulting from the merger will survive, and will charge a price below the marginal cost of the remaining banks. Since only integer numbers can be used, the price will be 4 (4.99 is not possible), Q=19.73 and profits will be (4-2) x 19.73=39.46. The Lerner Index was zero before the merger, because price equals marginal costs, and will be (4-2)/4=0.5 after the merger.

1. There are 3 producers of olive oil. The demand is P=15-2Q while the marginal costs are equal to 1 for firms A and B and equal to 3 for firm C.

Find the equilibrium in the following four cases

* There is a collusive agreement between all three firms
* There is a collusive agreement between A and B
* The firms compete by choosing price as the strategic variable
* The firms compete by choosing quantity as strategic variable

The collusive agreement of all 3 firms probably will imply the monopoly price in correspondence of a marginal cost equal to one (the lowest). 15-4Q=1. Q=3.5, P=8. It is likely that the three firms will divide asymmetrically the market shares, with firm A and B having a higher share than firm C. The total profit will be “close” to (8-1) x 3.5=24.5. Since one firm has a marginal cost of 3 it will be below that limit.

The collusive agreement of A and B only will be at a price slightly below 3, the marginal cost of firm C. Q=6 and profit will be (3-1) x 6=12, and will be split equally between A and B.

If the firms compete à la Bertrand, only firms A and B will survive, will charge a price equal to 1 an will make zero profits. Q will be equal to 7.

If the firms compete à la Cournot, we have an asymmetric model. P=15-2q1-2q2-2q3.

By setting for each firm the marginal revenue equal to the marginal cost we obtain the reactions functions. From the first order conditions: 15-4q1-2q2-2q3=1; 15-4q2-2q1-2q3=1; 15-2q1-2q2-4q3=3 we obtain

q1=3.5 – ½ q2 – ½ q3; q2=3.5 – ½ q1 – ½ q3; q3=3 – ½ q2 – ½ q1.

We can set q1=q2 (by symmetry), therefore q3=1 and q1=q2=2. Total quantity will be 5, price will be 5 and profits will be 8 for firms A and B, and 2 for firm C, totaling a value of 18.

1. Imagine that a monopolist (firm A) faces the demand function P= 120-Q and that marginal costs are equal to 80. Find the initial equilibrium. Imagine that a process innovation is reducing marginal costs from 80 to 60. Compute the new profits in the following two cases:
* Innovation is made by the monopolist and there is no entry
* Innovation is made by an entrant that enters and compete *à la Cournot* with firm A.

 How much will the monopolist be willing to spend to get the innovation?

In the initial monopoly, equating marginal revenue with marginal costs: 120-2Q=80, we get Q=20, P=100 and profits equal to 400. After the innovation: 120-2Q=60, Q=30, P=90 and profits will be equal to (90-60) x 30=900. If the entrant gets the innovation, we have an asymmetric duopoly.

πE= (120- qE-q1-60) qE and π1= (120- qE-q1-80)q1. By making the first derivatives of profits with respect to the quantities one gets: 120-2qE-q1-60=0 and 120-2q1-qE-80=0 from which we obtain the two reaction functions: qE=30-1/2q1 and q1=20-1/2qE. By solving for the system of two equations with two unknown variables, we get qE=26.66, q1=6.66, P=86.88 πE=711 and π1=44.

By innovating, the monopolist increases profits from 400 to 900. By not innovating, profits will reduce to 44, so the incentive to innovate is 900-44=856.

 6) Describe the three types of price discrimination and make some examples in which firms use them in the real world.