**MANAGERIAL ECONOMICS AND INDUSTRIAL ORGANIZATION**

**January 2023**

1) Consider the following game with two players, A and B. If they both confess, A will be sentenced to 5 years in prison and B will be sentenced to 8 years in prison. If they do not confess, A will be sentenced to 5 years in prison, while B will be released. If only one of the two confesses, he will be sentenced to 2 years in prison, while the other will get a sentence of 15 years. Indicate:

* 1. The Nash equilibria of the game;
  2. How the answer changes if all the penalties for those who confess are doubled
  3. How the answer changes if all the penalties for those who confess are tripled

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| a) Player B  Player A | Strategy C | NC strategy |
| Strategy C | (-5, -8) | (-2, -15) |
| NC strategy | (-15, -2) | (-5.0) |

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| b) Player B  Player A | Strategy C | NC strategy |
| Strategy C | (-10, -16) | (-4, -15) |
| NC strategy | (-15, -4) | (-5,0) |

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| c) Player B  Player A | Strategy C | NC strategy |
| Strategy C | (-15, -24) | (-6, -15) |
| NC strategy | (-15, -6) | (-5,0) |

As the penalties for the confessor change, the Nash equilibrium shifts from (C,C) to (C, NC) and then to (NC, NC).

2) The owner of the only movie theatre in a city learns that the individual demand function of each of his customers is p1 = 40-2q1. There are 100 customers. The marginal cost of production is 20. Determine the price policy that maximizes the monopolist’s profit, assuming that a **two-part tariff** can be applied.

Now suppose that the 100 customers are divided into two types: 60 have the individual demand function equal to p1=40-2q1 and 40 have the individual demand function equal to p2 = 68-3q2.

Determine the optimal choice in the case of two-part tariff discrimination for the two types of customers.

The optimal rate corresponds to a price per show equal to the marginal cost and to a fixed-fee (an entry card) equal to the consumer surplus at a price equal to 20. For p1 = 20, Q = 1000 and the surplus corresponds to a triangle of area (40 -20) x1000 / 2 = 10,000.

In the case of discrimination, there are two groups with demands equal to q1 = 1200-30p1 and q2 = 40 (22.66-1/3 p2) = 906.66-13.33p2, hence the inverse demands:

p1=40–1/30 q1 and p2=68–0.075q2

With a two-part tariff, there is a price equal to the marginal cost and a fixed fee equal to the consumer surplus. At a price of 20, q1 = 600 and q2 = 640. Consumer surpluses are respectively (40-20)x600/2 = 6000 and (68-20) x640 / 2 = 15360, therefore each type one consumer pays a fixed-fee equal to 100 and each type two consumer pays a fixed fee equal to 384. The total profit is therefore equal to the sum of the two fixed fees, for a total of 21360.

3) Consider a duopoly with differentiated products and quantity competition, where the demand functions are respectively: p1=12-y1-0.5y2 and p2=12-y2-0.5y1 and costs are respectively C1=3+2y1 and C2 = 3 + 2y2.

a) Find the equilibrium (quantity, prices, profits).

Now assume that the firms merge and that the new costs are equal to C = 5+y1+y2-0.2y1y2.

b) Find the new optimal quantities, the corresponding prices and the profit of the company resulting from the merger.

c) Comment on the results obtained by discussing how the new cost function affects them.

Given the following profit functions:

π 1=(12-y1-0.5y2) y1-3-2y1 , π 2= (12-y2-0.5y1) y2-3-2y2 and setting the first derivative equal to zero we obtain the reaction functions:

d π 1 / dy1 =0;12-2y1-0.5y2-2=0 from which one gets y1 = 5-1/4 y2

d π 2 / dy2 =0;12-2y2-0.5y1-2=0 from which we obtain y2 = 5-1/4 y1

Equalizing the two reaction functions: y1 =y2 =4;p1=p2= 6 and π 1= π2 = 13.

After the merger, there is a multi-product monopoly.

π = π 1+ π 2 =(12-y1-0.5y2) y1+(12-y2-0.5y1) y2- (5+y1+y2-0.2y1y2).

Setting the first derivatives with respect to y1 and y2 equal to zero, one obtains:

d π /dy1=0; 12-2y1-0.5y2-0.5y2-1+0.2y2=0 and

d π /dy2=0;12-2y2-0.5y1-0.5y1-1+0.2y1= 0.

By equating, we get y1 = y2 = 3.93, p1=p2=6.10 and π = 38.

Quantities and prices do not change much, while profits increase substantially.

The new cost function is associated with lower fixed costs (5 versus 3 + 3) and lower marginal costs (1-0.2y instead of 2). Furthermore, the -0.2y1y2 component indicates the presence of economies of scope (or of diversification). All this explains how the quantity is not reduced by much, as should be expected in the case of a transition from a duopoly to a monopoly. The reduction of marginal costs and the presence of economies of diversification have the effect of increasing the quantity produced and counterbalance the tendency to reduce the quantity of a monopoly.

4) Consider an industry in which firm A sales are 50, firm B sales are 20, and the sales of firms C, D and E are equal to 10 each. Compute the CR3 ratio and the Herfindahl index. How the above concentration measures change if firm A and B merge and firms C, D and E double their sales?

In the initial situation, CR3 is equal to 0.8 and H=0.52+0.22+3x0.12=0.32. After the merger and the increase of sales of firms C, D and E, the new sales of the market are 70+20+20+20=130. Therefore, CR3 becomes (70+20+20)/120=0.846 and H becomes H=0.53852+3x0.1542=0.36.

5) Represent in the two graphs below two duopoly equilibria with symmetrical firms, one relating to the case of simultaneous choices of quantity and differentiated products, the other relating to the case of simultaneous choices of price and differentiated products. Show the two new equilibria in the graph after an increase in marginal costs occurs for one of the two firms.

P2

Q2

B

A

B A

Q1 P1

The graphs show the reaction functions and initial equilibria (symmetrical) at points A.

In the case of quantity choices, assuming that firm 1 records an increase in marginal cost, firm 1's reaction function shifts parallel down and to the left and consequently the equilibrium goes from A to B: Firm 1 reduces the quantity, Firm 2 increases it, and the equilibrium price rises.

In the case of price choices, assuming that firm 1 records an increase in marginal cost, firm 1's reaction function shifts parallel down and to the right and consequently the equilibrium goes from A to B. Both firms raise the price, but at a different intensity.

6) Price and non-price vertical restraints