**MANAGERIAL ECONOMICS AND INDUSTRIAL ORGANIZATION**

**May 2023**

1. Acqua Eva and Acqua Sant’Anna are two competitors and must decide the price of a bottle of water. The following game represents 4 possible price strategies and 16 possible pairs of payoffs (profits) for the firms. Find the Nash equilibrium in the simultaneous game. Do the firms prefer to play a sequential game here? If yes, is there an advantage to be the first mover?

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|  **Price Sant’Anna**Price Acqua Eva | 3 | 4 | 5 | 6 |
| 3 | 24,**24** | 30,**25** | 36,**20** | 42,**12** |
| 4 | 25,**30** | 32,**32** | 41,**30** | 48,**24** |
| 5 | 20,**36** | 30,**41** | 40,**40** | 50,**36** |
| 6 | 12,**42** | 24,**48** | 36,**50** | 48,**48** |

There is only one Nash Equilibrium, in which both firms choose a price equal to 4, and profits are 32 for both firms. If Sant’Anna chooses as first, by choosing 3 Acqua Eva will answer by choosing 4, by choosing 4 the answer will be 4, by choosing 5 the answer will be 4, by choosing 6 the answer will be 5. Therefore, the subgame perfect equilibrium foresees that Sant’Anna chooses 6 and Acqua Eva chooses 5, with profits equal to 50 (Acqua Eva) and 36 (Sant’Anna). If Acqua Eva chooses as first, instead, by choosing 3 Sant’Anna will answer with 4, by choosing 4 the reaction will be 4, by choosing 5 the reaction will be 4 and by choosing 6 the reaction will be 5. The subgame perfect equilibrium will foresee Acqua Eva choosing 6 and Sant’Anna choosing 5, with profits equal to 36 (Acqua Eva) and 50 (Sant’Anna). Both sequential games are leading to higher profits than the simultaneous game, but Sant’Anna would prefer to be second mover (gaining 50 instead of 36) and Acqua Eva would prefer to be the second mover as well (gaining 50 instead of 36).

1. Suppose that there are two firms producing complement goods (pasta and sauce, for example). The demands are respectively Qp= 9 – Pp – Ps and Qs = 9-Ps-Pp. Suppose that the marginal costs of production are equal to zero for both firms. Find the equilibrium (prices, quantities, profits). The two firms merge and become a multiproduct monopolist. Find the new equilibrium.

The profits of the two firms are, respectively πp = Pp (9-Pp-Ps) and πs = Ps (9-Ps-Pp). By making the first derivative with respect to price for both firms one gets 9-2Pp-Ps=0 and 9-2Ps-Pp=0, from which one gets the “price response functions” Pp=4.5- ½ Ps and Ps = 4.5 – ½ Pp. By solving for the system, one gets Pp=Ps=3. Qs=Qp=3 and profits equal to 9 for both firms. After the merger, the multiproduct monopolist maximizes the joint profits: πp+ πs = Pp (9-Pp-Ps) + Ps (9-Ps-Pp).

By making the first derivative with respect to Pp and Ps, respectively, one gets: 9-2Pp-Ps-Ps and 9-2Ps-Pp-Pp, from which Pp=4.5-Ps and Ps=4.5-Pp. In equilibrium, Pp=Ps=2.25, Qp=Qs=4.5 and total profits are 20.25. Since the goods are complements, the multiproduct monopolist reduces the prices and sells more, making higher profits.

3) Imagine that the University faces two type of students, A and B, with different willingnesses to pay for rent and for food. The University can choose between separate prices for the two services or mixed bundling. It is not possible to propose a pure bundling. Compute the maximum profits that can be reached in the two cases. The cost of rent is 1500 and the cost of food is 1500.

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|  | Student A | Student B |
| Seasonal price for rent | 5500 | 3000 |
| Seasonal price for food | 2500 | 6000 |

With separate prices, it is possible to set a price for rent equal to 5500 or 3000. In the first case the profits will be equal to 4000 (only student A will buy it), in the second case 3000x2-3000= 3000. Similarly, buy charging 6000 for food the profit will be 4500, while by charging 2500 the profit will be 2000. The best option is to charge 5500 for rent and 6000 for food with a total profit of 8500.

In the case of mixed bundling, it is possibile to set a price for the bundle equal to 8000, a price for the rent equal to 5500 and a price for the food equal to 6000. The profits will be 16000-6000=10000.

Alternatively, it is possible to set a price of the bundle equal to 9000, and prices of 5500 for rent and of 3500 for food (to satisfy the incentive compatibility constraint for Student B). Profits will be 14500-4500=10000

1. With reference to the graph below, comment on the meaning of qI, qE and K and on the role of points A, B and C

 qE

 A

 B C

 K qI

 See Chapter 12: Spence-Dixit Model

5) Three firms compete à la Bertrand. The demand function is P= 50-0.05Q and marginal cost is equal to 2 for all firms. Find the equilibrium. Imagine that the firms are colluding. Compute price, quantity and profit for each firm. Which is the discount factor that makes collusion feasible?

In the case of Bertrand competition, P=2, Q=960 (320 for each firm) and profits are zero for all firms. In the case of collusion 50-0.1Q=2. Therefore Q=480, P=26 and profits are 11520 (3840 for each firm).

For each firm, collusion emerges if the following condition is met:

3840/(1-δ)>11520, therefore if δ >2/3

 6) What is the merger paradox? Is it occurring in all mergers? When we do not observe it?