



International MSc. in Business Administration
Economics of Business and Markets
Problem Set 1

Prof. Fátima Barros

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1st assignment is due on December 9th

Exercise 1

Consider two industries, each comprising 10 firms. In industry A, the largest firm has a market share of 49%. The next three firms have a market share of 7% each, and the remaining six firms have equal shares of 5% each. In industry B, the top four firms share the bulk of the market with 19% each one. The next largest firm accounts for 14%, and the smallest five firms equally split the remaining 10% of the industry.

- a. Compute the four-firm concentration ratio and Herfindahl index for each industry. Compare these measures across the two industries. Which industry do you think truly exhibits a more competitive structure? Which measures do you think gives a better indication of this? Explain.
- b. Now let the three second-largest firms in industry A merge their operations while holding on their combined 21% market share. Recalculate the Herfindahl index for industry A.

(Final Exam 2010/2011)

Exercise 2

The Herfindahl's great virtue is its simplicity. But that virtue masks two shortcomings. First, there is often no clear way to define what market is at stake. In the current investigation of the proposed alliance between British Airways and American Airlines, for example, the carriers assert that the relevant market is travel between the United States and Europe (of which their combined share is modest). European Union officials, on the other hand, have focused on travel between the United States and Britain (of which their combined share is huge). Second, even when the scope of the market is clear, the relation between the Herfindahl and market power is not. America's soft-drink industry, to take one example, is noted for price competition although only two firms, Coca-Cola and PepsiCo, control three-quarters of sales.

"The trustbusters' new tools", The Economist, 30 April 1998.

Do you agree with the statement of this article? Why?

(Final Exam 2010/2011)

Exercise 3

In the following table, you find the values of the C_4 ratio and of the *Herfindahl* Index for some industries in the United States. These indexes were calculated taking into account the sales value for each sector:

Table 1

	C_4	H
Aeronautics*	0,848	0,2350
Cement	0,335	0,0466
Wine	0,432	0,0838
Chocolate	0,795	0,2567

Source: Concentration ratios in Manufacturing, U.S. Bureau of Census, 1997

*Includes aeroplanes, helicopters, etc

- Analyze the concentration ratios values computed for each sector in table 1 and discuss the characteristics and limitations of the proposed indexes.
- “In the process of calculating the concentration ration the *Bureau of Census* does not take into account the penetration of foreign firms in the U.S market.”
How would this information influence the concentration analysis in the Aeronautics and Cements markets? (Consider the information presented in the table above). Justify your answer.

Exercise 4

Consider a market with two firms. The two firms compete in quantities and can decide whether they will produce the cooperative level of output (Q_C) or the non-cooperative level (Q_{NC}). The payoffs of these choices are given in the following table:

		Firm 2	
		Q_C	Q_{NC}
Firm 1	Q_C	7 ; 6	1 ; 10
	Q_{NC}	8 ; 2	3 ; 4

- Which is the Nash equilibrium of this game, assuming that it is played only once? Explain if this Nash equilibrium corresponds to the collusive equilibrium. Justify.

Assume now that the game is repeated an infinite number of periods. In each period t both firms observe the last period rival's production and each firm chooses the production level.

- b) Define a *trigger strategy* on quantities that will lead to the collusive equilibrium (Q_C, Q_C) in each period. For which discount rate i [discount factor] is this *trigger strategy* a Nash equilibrium of this non-cooperative repeated game? (Remember that $\delta = 1/(1+i)$ is the discount factor).

Exercise 5

Consider the Hotelling model setting. A population of 2 million consumers is uniformly distributed along the segment $[0,2]$. There are 3 possible locations for the firms that wish to enter the market and to build a plant: The middle and the extremes of the segment. Marginal costs in this industry are constant and equal to zero. Each consumer purchases a single unit of the good and supports a transportation cost equal to $(v-x)^2$, where v is the location of the firm and x is the location of the consumer. Consumers have a reservation price equal to 10. Every firm aims at covering all the market.

- a) Firm A wishes to enter the market and does not anticipate the entrance of other firms. Explain which location the firm should choose to build its plant. Calculate the optimum price level and the profit that may be obtained.
- b) Consider now that a consultant had informed Firm A that Firm B is also going to enter the market. With this additional information, what location should Firm A choose? What are the equilibrium prices and profits?
- c) Another analyst warned firm A that the information provided by the consultant is not fully correct. Firm B will enter the market only with a 35% probability. Taking into account this new information, explain which location should firm A choose? (Consider that firm A is risk-neutral).
- d) Now suppose that, independently of the results obtained in b), firm A decides to enter the market and place itself at the left end of the segment. Firm B, also decides to enter the market and chooses the opposite extreme. At an informal meeting, Firm A makes a proposal to form a cartel with Firm B. Calculate equilibrium prices and profits associated with the cartel proposal. What can you conclude?

Exercise 6

Suppose that in a certain region there is a single breakfast cereals producer (firm A). In this region there are 2 million consumers that buy breakfast cereals. Consumers' preferences are uniformly distributed along a $[0,2]$ segment, where 0 represents the healthiest cereals variety and 2 represents the sweetest cereals variety. Due to technological restrictions, firms can only introduce products at

points {0, 1, and 2} of the segment. These points represent three different segments: Health (0), Familiar (1) and Children (3).

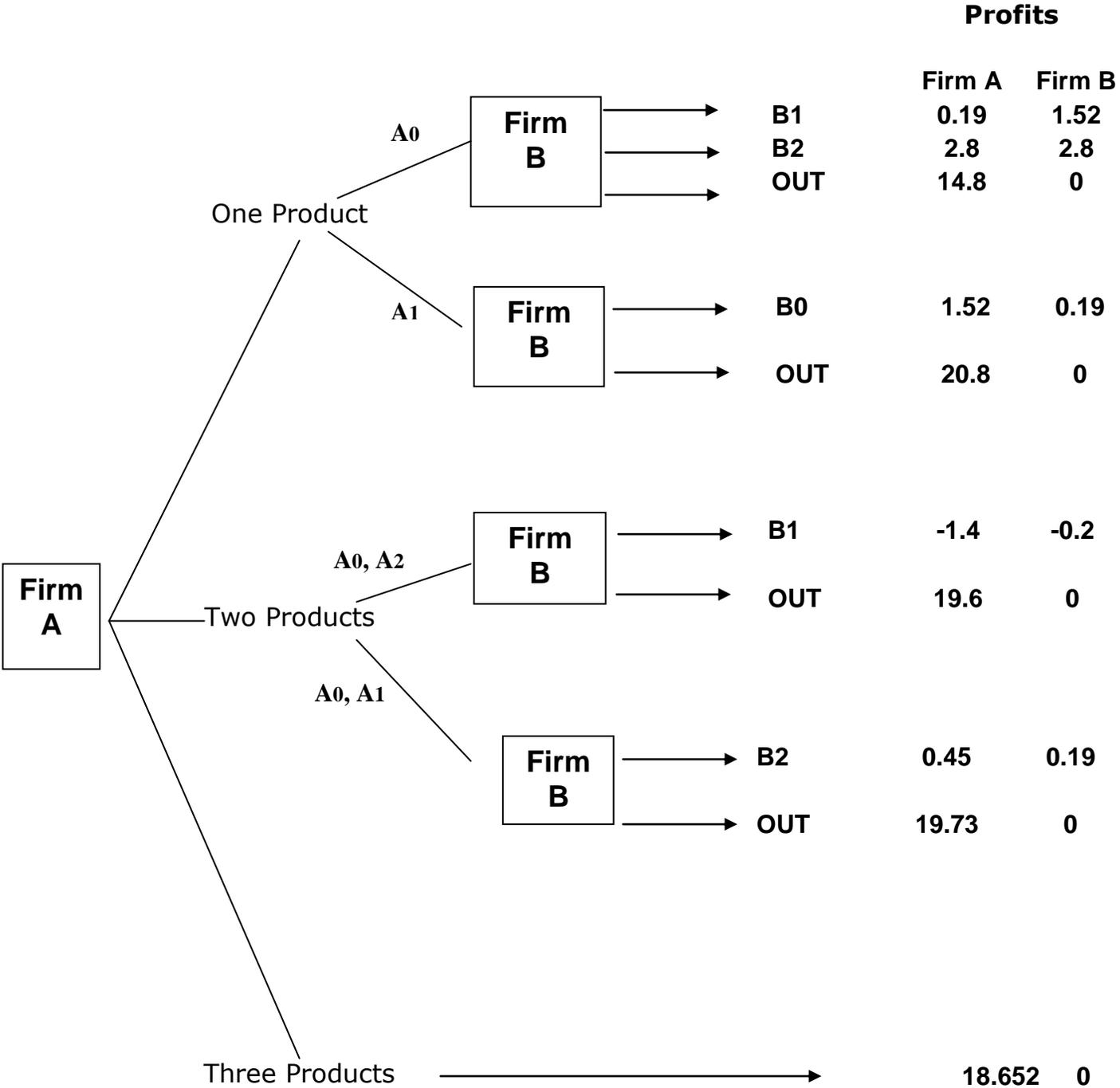
Firms in this market have negligible marginal costs, but incur significant sunk costs to introduce one variety of cereals in the market (R&D and Marketing expenses) that amounts to 1,2 million euros per variety.

Each consumer buys a single pack of breakfast cereals and incurs in transportation costs that are equal to $(v-x)^2$, where v is the firm's location in terms of its product variety and x is the consumer's location in terms of his preferences. Consumer's reservation price, i.e. the maximum price he/she is willing to pay for a cereal pack, is 12 euros. Assume that the market must be always covered which implies that all consumers will always buy one unit.

Figure 1 represents a sequential game in the above described market, where Firm A plays first and can choose to introduce one, two or three products. Once Firm A has made its decision, a potential entrant, Firm B, observes Firm A's choice and decides about to enter the market (or to stay out). If Firm B enters it will choose only one product. Firms' profits are presented in Figure 1.

Taking into account this information, answer the following questions:

- a) Suppose that Firm A is alone in the market and does not anticipate the entrance of any other firm in the future. How many products should firm A introduce and which location(s) should it choose? What is (are) the equilibrium price(s) for its product(s)?
- b) Suppose that there is a potential rival, Firm B, which in case of a positive decision to enter the market will choose a single product. If firm A has followed the strategy presented in a) should Firm B enter the market? If your answer is positive, state the optimal location for firm B and calculate the equilibrium prices and profits for both firms.
- c) Find the equilibrium prices in the case where firm A chooses to introduce products in segments 0 and 1.
- d) Find the Nash Equilibrium (in terms of product variety choice) of this sequential game. Which are the equilibrium prices? What can you conclude?

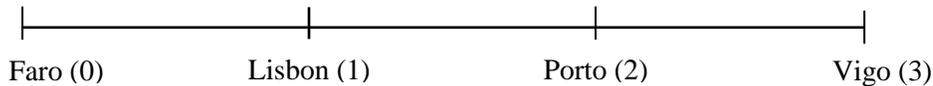


Units: millions

Exercise 7

Consider the market for *cheap* mobile phones in Portugal, which is thought to be disputed among firms Alca-Tell and Sam-Sing. In order to enter the market and sell mobile phones firms need to set up a store. For the purpose of the exercise, consider that marginal costs are zero and that there is **no installation cost** to set up a store in the market.

There are **four possible equidistant locations** for the stores, namely Faro, Lisbon, Porto and Vigo. The relevant market for this product has **N customers** uniformly distributed along the range [1, 2]. Hence, there are **no customers between Faro and Lisbon, and no consumers between Porto and Vigo**.



Customers decide to buy from the store that minimizes their total cost, that is, the price charged by the firm plus transportation costs, which are supported by customers. Those transportation costs are equal to $(v-x)^2$, where 'v' is the location of the firm and 'x' the location of the customer. Consumers will only buy the product if that total cost is lower than their **reservation price, equal to 6 €**.

Initially firms simultaneously choose their locations and, in a second step, simultaneously set their prices. Consider along this exercise that the same location can only be occupied by one firm.

- One student of EBM made an exercise aiming to find the equilibrium prices when one firm is located in Lisbon and the other in Porto. He conclude that equilibrium prices are equal to 1€. Compare this result in terms of prices and profits with the case where the two firms occupy the extremities of the market (Faro and Vigo). Interpret the result.
- If both firms decide to set up a cartel, which locations will they choose? Determine the equilibrium prices and profits for the cooperative outcome.

Imagine now that consumers will be buying this product once every year. Moreover, at the beginning of every year, both firms **repeat their simultaneous decision process on locations and prices**.

A market research team concluded that profits in the collusive solution are equal to **2,875*N** for both firms, and that the deviating firm can earn a profit of **4,75*N** if it serves all the market. Furthermore, the Nash equilibrium of the static game yields profits equal to **1,5*N** for both firms.

- For which annual discount rate 'r' can a trigger strategy implement the collusive outcome as a Nash equilibrium of this non-cooperative repeated game? (Remember that $\delta = 1/(1+r)$ is the discount factor).

(Final Exam 2010/2011)