



International Master of Science in Business Economics

Economics of Business and Markets

Problem Set 1

Fátima Barros

November 23, 2009

Exercise 1

“Portuguese Competition Authority decided to investigate the acquisition of the insurance business of *Seguros e Pensões* (MillenniumBCP) by *Caixa Seguros* (CGD). The main concern with this acquisition, in July 2004, was the fact that Caixa Seguros would get a dominant position in the market (...).

Assume that the market shares of the largest insurance companies (in the non-life segment), before and after the acquisition, are the following:

<i>Company</i>	<i>Market share before acquisition*</i>	<i>Empresa</i>	<i>Market Share after acquisition*</i>
Seguros e Pensões	21%	Caixa Seguros	43%
Caixa Seguros	20%	Tranquilidade	15%
Tranquilidade	18%	Axa Portugal	4%
Axa Portugal	5%	Totta	2%
Totta	2%	Allianz	1%
Allianz	1%		

- Compute the values of Herfindhal and C4 indexes for each situation and explain the differences you might find.
- Explain the concern of the Competition Authority *vis à vis* this acquisition process. Which arguments could you present in favor of the acquisition?

(Final exam, 2008)

Exercise 2

- “ATP is a company owned by the major US airlines whose main purpose is to disseminate price information to airlines and to operators such as travel agents, using computer reservation systems. Such information is fed to the ATP by each

*company, and it contains several elements, such as the fare and the route to which the fare is applied, the possible restrictions to this fare (for instance, which type of consumer can buy it, if advance payment is required, if a minimum number of days of stay are required and so on), **first and last ticket dates** (which indicate the period during which the fare can be sold), and **first and last travel dates** (which indicate when the travel for which the fare applies should take place).”*

In Massimo Motta, “Competition Policy”, 2004

The Justice Department in the USA accused airlines companies of using ATP to sustain collusive behavior. Explain the argument that sustains this accusation.

- B.** *"Coffee producers agreed to limit supplies in an effort to increase world prices, which have been at the lowest level in the past seven years. The current average coffee price is about 68 cents a pound. According to the plan, producers would hold back 20% of their exports until the price index reaches 95 cents. The plan is backed by the main members of the Association of Coffee Producing Countries, including Brazil and Columbia. This fact has led analysts to believe the plan has some credibility. In fact, future prices rose on reports that an agreement had been reached. Consumers, however, seem more skeptical. "In the short term, it may lead to a price rally, but in the long run there is no alternative to market forces", said B. Hubert of Kraft Jacobs Suchard, one of Europe's largest coffee importers. In Brazil, reactions to the agreement were mixed. While small producers seemed happy with the idea of a price increase, large producers were concerned with the need to reduce exports."*

Make a comment about this text taking into account your knowledge about collusion among firms. In particular, try to explain producers' reactions in Brazil.

(Final exam, 2008)

Exercise 3

Suppose you are the only manufacturer of surfboards which are sold in two separate markets: California and Hawaii, each one with fifty consumers. You have one factory that produces an unlimited number of surfboards with the following total cost $TC_i(q_i) = 3q_i + 5$.

Individual demand in each market is: $P_H = 30 - 0,5q_H$; $P_C = 40 - q_C$

- a) Assume that aggregate demand is $Q_H = 3000 - 100P$ in California and in Hawaii is $Q_C = 2000 - 50P$. If you could not discriminate between the two types of demand which price would you charge? Compute your profits in this situation.
- b) Assume that you have two selling stores (one in California and another in Hawaii) and you can practice different prices in each one. Which prices would you chose?

- c) Could your price strategy in b) be compromised if surfboards could be shipped from one place to the other at a unit cost of 4? Explain without making any computation.
- d) Suppose now that the two markets are **completely separated**. Build and specify one possible pricing strategy that allows you to get the maximum possible profit (capturing the entire consumer's surplus).

(Final exam, 2008)

Exercise 4

You are a pricing analyst for QuantCrunch Corporation, a company that recently spent \$10.000 to develop a statistical software package. To date, you only have one client. A recent internal study revealed that this client's demand for your software is $Q^d=100-0.1P$ and it would cost you \$500 per unit to install and maintain software at this client's site. The CEO of your company recently asked you to construct a report that compares:

- a. the profit that results from charging this client a single per-unit price with
- b. the profit that results from charging \$900 for the first 10 units and \$700 for each additional unit of software purchased.

Construct this report and include in your report a recommendation that would result in even higher profits.

Exercise 5

Suppose that in a certain region there is a single breakfast cereals producer. Consumers in this region have preferences that are uniformly distributed along a (0,2) segment, where 0 represents the sweetest type of cereals and 2 represents the healthiest type of cereals. In this market there are 1000 consumers that will buy one unit of the product if and only if the total price is lower than their reservation price that is 15 euros. Due to technological restrictions firms can only introduce products at points {0, 1 or 2} of the segment.

The firms in this market have negligible marginal costs and they want to cover the entire market.

Each consumer buys a single unit and incurs in a "disutility cost" that is equal to $(v-x)^2$, where v is the firm's location in terms of its product variety and x is the consumer location in terms of its preferences.

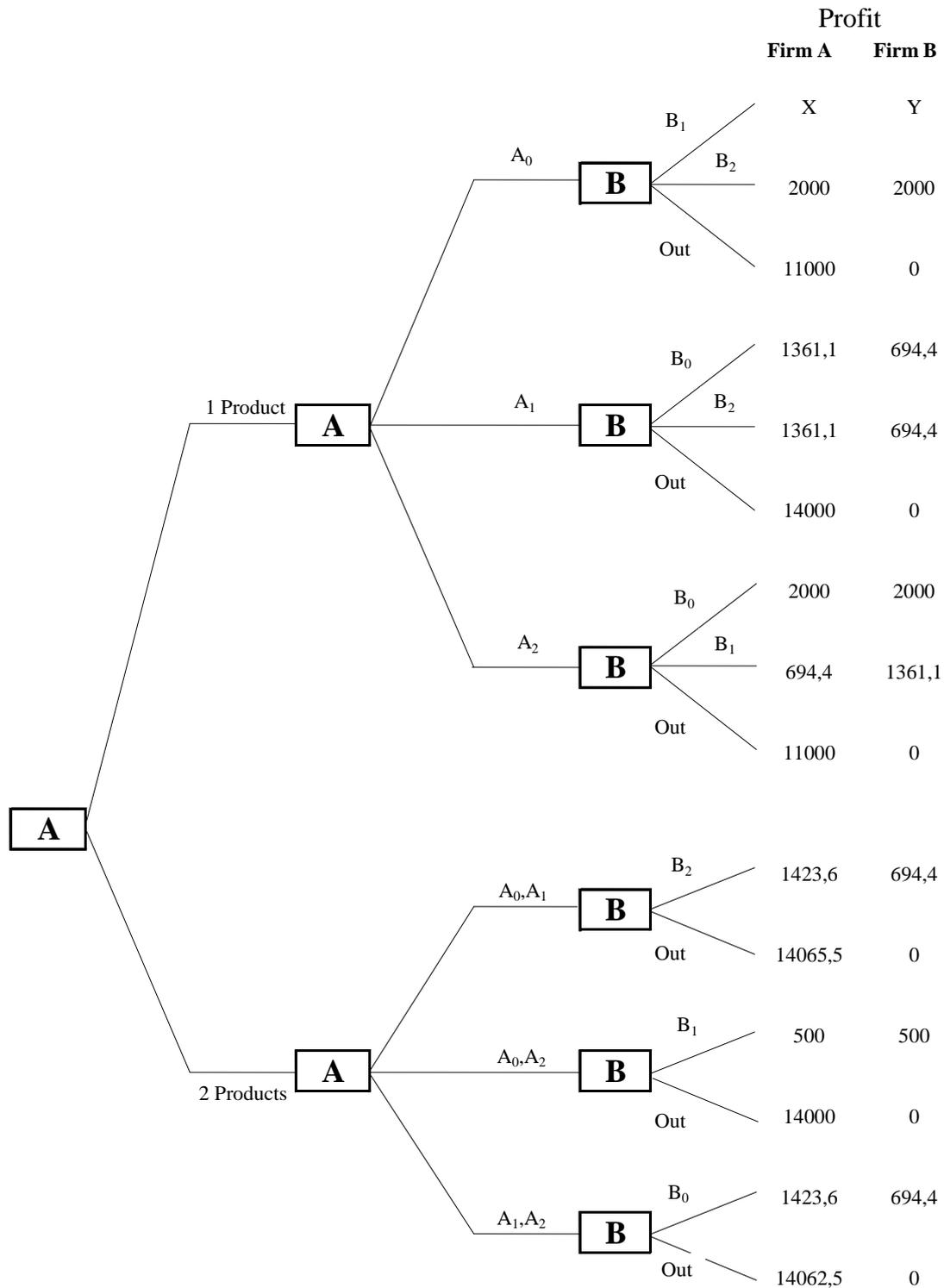
Two firms are considering to enter in this market. Assume that firm A is the first deciding to enter and deciding about the products variety she will sell. Firm A can choose to sell one or two products. After firm A entry, firm B decides if she wants to enter or to stay out and, in case of entry, firm B must choose the variety of its product. In the picture you can find the profits that both firms get in all possible cases.

- a) Compute the equilibrium prices in order to find the values X and Y in the figure.
- b) Consider that firm B, when making the entry decision, only knows the number of products firm A decided to introduce in the market but it does

not know which product variety firm A will choose. Firm B knows the following:

- If firm A enters with one product, she will choose location 0 with 40% probability and location 1 with 60% probability;
- If firm A enters with two products, will choose locations 0 and 1 with probability 40% and locations 0 and 2 with probability 60%.

Assuming that firm B is risk neutral, determine the equilibrium of this game.
(Final Exam 2008)



Economics of Business and Markets

International MSc. In Business Administration

Solutions of Problem Set 1-2009

Exercise 1

- a) The values of the Herfindahl (H) and the C4 indexes can be computed by using the respective formulas:

$$H = \sum_{i=1}^n s_i^2 \quad C4 = \sum_{i=1}^4 s_i$$

The variable s_i represents the market share, and in the case of the C4 we choose the combined market share of the 4 largest firms.

For this particular exercise we can compute each of these indexes before and after the acquisition of the insurance business of “Seguros e Pensões”.

Situation 1 $H = 0,21^2 + 0,2^2 + 0,18^2 + 0,05^2 + 0,02^2 + 0,01^2 = 0,1195$

Situation 2 $H = 0,43^2 + 0,15^2 + 0,04^2 + 0,02^2 + 0,01^2 = 0,2095$

Situation 1 $C4 = 64\%$

Situation 2 $C4 = 64\%$

In terms of the Herfindahl index, we see that this concentration measure increased its value from 0,1195 to 0,2095. This increase is mainly due to the presence of a larger player (43%) after the acquisition process. Since this measure is based on the sum of the squared market shares, it will be sensitive to the distribution of market shares, being larger if the distribution is more asymmetric.

In terms of the C4 index, we observe that this measure didn't change its value, although there was a merger of 2 firms that were among the 4 biggest. With this acquisition it would have been natural to expect an increase in the C4 index. Nevertheless it remains constant. This is due to the fact that the combined market share of the previous 4 biggest firms decreased by a percentage equivalent to the market share of the firm that entered the top 4 in situation 2 (Totta with a market share of 2%).

- b) The concern of the Competition Authority is linked to the market position that Caixa Seguros gained with this acquisition. One first evidence of this dominant position may be that the joined market share of Seguros e Pensões and Caixa Seguros before the acquisition (21% + 20%) is less than the new market share of Caixa Seguros (43%). This increase of 2% can be a first reflex of the new dominant position. On the other hand, its largest competitor suffered a loss in market share of 3%.

One argument in favor of this acquisition is that the C4 index didn't change, meaning that market power of the group of the four largest firms did not suffer any alteration.

Another argument in favor of this acquisition can be seen in the fact that it may imply economies of scale for Caixa Seguros, which would allow it to practice price

reductions. As a consequence, its competitors would be induced to follow these price movements, causing an increase in the consumer's welfare.

Furthermore, you can argue about the definition of the relevant market for this case:

- Since insurance companies serve more than just the non-life segment, you can argue that the concentration measures should have been based on the market shares when including all the services (life and non-life)
- With the proximity to Spain and the extended economic relationships between Portugal and Spain, there are reasons to believe that the Iberian market should be the relevant market. Considering the integrated market of Portugal and Spain would reduce significantly the values computed in a).

Exercise 2

Here you can find some arguments that you have presented to answer the following two questions:

- a) ATP and the US airlines
 - The existence of the joined information system can indicate an attempt to have a **cooperative pricing** scheme.
 - Since it will probably be updated in short time intervals, this shared information allows the US airlines to monitor closely the pricing strategies of their competitors. A frequent update of the information allows penalizing deviations from other firms after a small time interval, reducing the benefits of deviating.
 - Moreover, the stipulation of specific dates (first and last travel dates) creates a specific time frame that the airlines need to comply with. If a company violates these dates, its competitors can construct a penalization (through an aggressive pricing schedule).
- b) As studied during the course, situations of collusion occur when firms in a situation of oligopoly (with a reduced number of firms) try to establish conditions in order to increase the joint profits. This is usually obtained by limiting the production levels, and by this, increasing the market price. This makes it possible to all of the members of the agreement to obtain higher revenues.

The argument of Mr. Hubert refers to the instability of collusions in the real world. This derives from the fact that one member may have an incentive to violate the agreement, producing a larger amount than the one fixed in the agreement, and taking advantage of the higher market prices. If all of the members deviate, producing more than agreed, the equilibrium should tend to a situation with lower prices for the consumers.

The producers' reactions in Brazil can be seen as a consequence of this. While small producers will benefit from this agreement among the coffee producing countries, producing potentially more and selling it at higher prices, large producers face a risky situation. They can either, follow the agreement and hope to benefit from higher market prices, or they can decide to deviate, producing more than agreed and win even more. However, if several large producers decide to deviate from the agreement, world prices should fall, and maybe even below their current level.

Exercise 3

- a) Since the firm does not identify clearly the two types of consumers, it will try to maximize its profits taking into account the aggregate demand:

$$Q_{TOTAL} = Q_H + Q_C = 5000 - 150P$$

The inverse aggregate demand function will be given by

$$P^D = \frac{100}{3} - \frac{1}{150}Q$$

The objective of the monopolist will be to maximize its profit, knowing the functional form of the aggregate demand function

$$\underset{Q}{Max} \quad \Pi = \left(\frac{100}{3} - \frac{1}{150}Q \right) Q - (3Q + 5)$$

FOC:

$$\frac{100}{3} - \frac{2}{150}Q = 3 \Leftrightarrow Q = 2275 \Rightarrow P = \frac{109}{6}$$

The profit of the firm that results from this equilibrium is

$$\Pi = \frac{109}{6} \cdot 2275 - (3 \cdot 2275 + 5) = 34499,1(6)$$

- b) Being able to discriminate between two separated markets, the monopolist will practice a third degree price discrimination, which results from the following problem:

$$\underset{Q_C, Q_H}{Max} \quad \Pi = (40 - 0,02Q_C)Q_C + (30 - 0,01Q_H)Q_H - (3(Q_C + Q_H) + 5)$$

FOC:

$$\begin{cases} 40 - 0,04Q_C = 3 \\ 30 - 0,02Q_H = 3 \end{cases} \Leftrightarrow \begin{cases} Q_C = 925 \\ Q_H = 1350 \end{cases}$$

$$\begin{cases} P_C = 40 - 0,02Q_C = 21,5 \\ P_H = 30 - 0,01Q_H = 16,5 \end{cases}$$

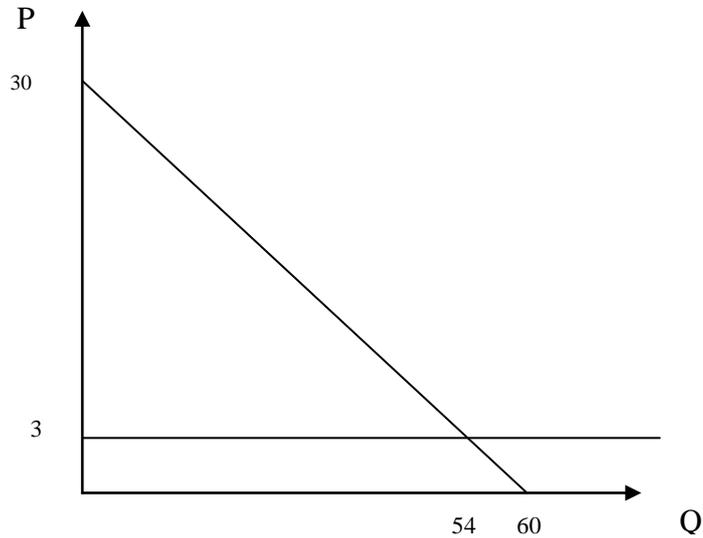
The monopolist should practice a price equal to 21,5 in California and equal to 16,5 in Hawaii.

- c) Yes, the pricing strategy could be compromised. If the consumers would ship the surfboards with a unit transport cost of 4 from Hawaii to California. They would still make some profit ($16,5 + 4 = 20,5 < 21,5$) if they engaged in this business. In this case the pricing strategy would not be practicable.
- d) A pricing strategy that allows extracting the entire consumer surplus is a two-part pricing schedule. To extract all the consumer surplus, the producer will

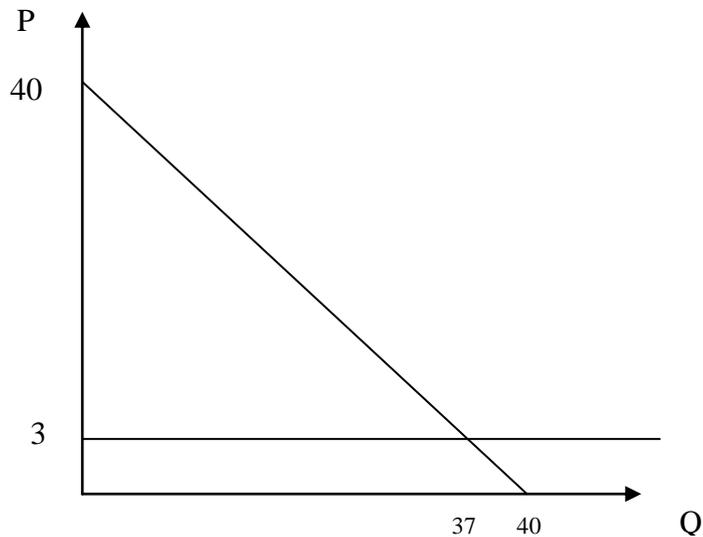
charge a price equal to its marginal cost ($P=3$) and stipulate a fee equal to the individual consumer surplus when the price is equal to 3.

In order to compute the fixed part of the two-part pricing schedule it is useful to draw the individual demands for each of the consumers.

Individual demand in Hawaii:



Individual demand in California:



This pricing schedule will result in the following policy:

Hawaii:

$$P_H = 3$$

$$Fee_H = \frac{27 \cdot 54}{2} = 729$$

California:

$$P_c = 3$$

$$Fee_c = \frac{37 \cdot 37}{2} = 684,5$$

Profits for the firm will be given by:

$$\begin{aligned} \Pi &= (729 + 54 \cdot 3)50 + (684,5 + 37 \cdot 3)50 - 3(54 \cdot 50 + 37 \cdot 50) - 5 \\ &= 44550 + 39775 - 3 \cdot 4550 - 5 = 70670 \end{aligned}$$

Exercise 4

- a) We should start noticing that for the purpose of this exercise, the expenditure in the development of the statistical package will be considered as sunk costs, since it is a cost that cannot be recuperated by the firm.

When serving that single client, the firm will be able to act as a monopolist. The problem can be expressed by the following relations:

Inverse demand function: $P = 1000 - 10Q$

$$\underset{Q}{Max} \quad \Pi = (1000 - 10Q)Q - 500Q$$

$$FOC \quad 1000 - 20Q = 500 \Leftrightarrow Q = 25$$

$$P = 1000 - 10Q = 800$$

$$\Pi = 750 \cdot 25 - 500 \cdot 25 = 6250$$

Hence, a single per-unit price schedule will result in a profit equal to 7500 for QuantCrunch Corporation.

- b) If we compute the result of the second degree price discrimination schedule presented in the exercise, we find the following:

With a per-unit price of 900 for the first 10 units and 700 for each additional, the consumer will decide to consume a total of 30 units of the good, paying \$900 for the first 10 units and \$700 for 20 units. This consumption level yields a profit of 8000 to the firm.

$$\Pi = 900 \cdot 10 + 700 \cdot 20 - 500 \cdot 30 = 9000 + 14000 - 15000 = 8000$$

We can construct a better solution for the firm if we realize that it is possible to extract the entire consumer surplus.

Although it is possible to construct several examples, we will consider the following price schedule:

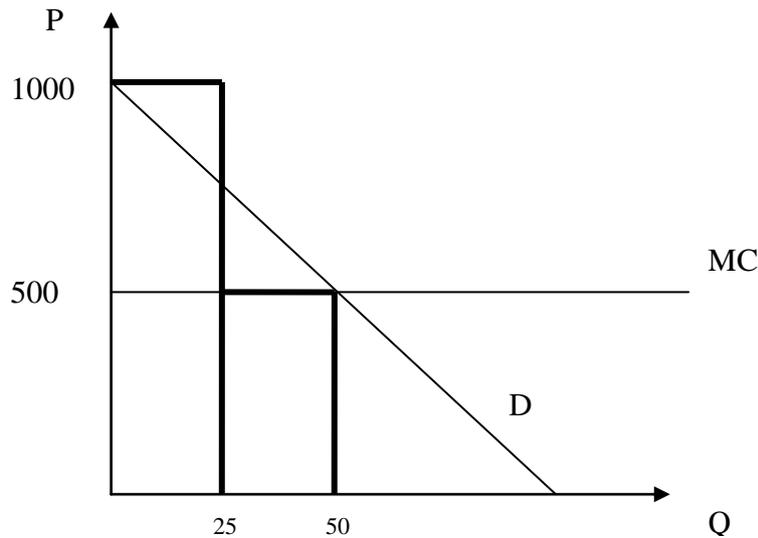
Per-unit price of 1000 for the first 25 units and 500 for each additional unit.

With this pricing, the consumer will choose to consume 50 units of the good (paying 1000 for the first 25 units and a unit-price of 500 for the remaining 25 units).

The profit for the firm in this case is given by

$$\Pi = 1000 \cdot 25 + 500 \cdot 25 - 500 \cdot 50 = 25000 + 12500 - 25000 = 12500$$

Graphical representation:



Exercise 5

- a) We start the exercise by finding the indifferent consumer. Knowing that firm A will introduce its product on point “0” ($v_A=0$) and firm B on point “1” ($v_B=0$), we get the following expression for the indifferent consumer at position x :

$$P_A + (0-x)^2 = P_B + (1-x)^2 \quad \Rightarrow \quad x(P_A, P_B) = \frac{1}{2} + \frac{P_B - P_A}{2}$$

The demand for firm A will be given by $[500 \cdot x(P_A, P_B)]$, whereas the demand for firm B can be obtained from $[500 \cdot (2 - x(P_A, P_B))]$.

Each firm will try to maximize its own profits, taking the competitor’s price as given. This problem is summarized in the following mathematical problem:

Firm A:

$$\underset{P_A}{\text{Max}} \quad \Pi_A = P_A [500 \cdot x(P_A, P_B)] = 500 \cdot P_A \left[\frac{1}{2} + \frac{P_B - P_A}{2} \right]$$

$$FOC \quad 500 \cdot \left[\frac{1}{2} - P_A + \frac{P_B}{2} \right] = 0 \Leftrightarrow \frac{1}{2} - P_A + \frac{P_B}{2} = 0$$

Firm B:

$$Max_{P_B} \quad \Pi_B = P_B [500 \cdot (2 - x(P_A, P_B))] = 500 \cdot P_B \left[\frac{P_A - P_B}{2} + \frac{3}{2} \right]$$

$$FOC \quad 500 \cdot \left[\frac{3}{2} - P_B + \frac{P_A}{2} \right] = 0 \Leftrightarrow \frac{3}{2} - P_B + \frac{P_A}{2} = 0$$

The values for each of the prices result from solving the system with the two optimal conditions that come from the maximization problems:

$$\begin{cases} \frac{1}{2} - P_A + \frac{P_B}{2} = 0 \\ \frac{3}{2} - P_B + \frac{P_A}{2} = 0 \end{cases} \Leftrightarrow \begin{cases} P_A = \frac{5}{3} \\ P_B = \frac{7}{3} \end{cases}$$

These prices result in the following profits for the two firms:

$$\text{Firm A: } X = \Pi_A = 500 \cdot \frac{5}{3} \left[\frac{1}{2} + \frac{\frac{7}{3} - \frac{5}{3}}{2} \right] = \frac{6250}{9} = 694, (4)$$

$$\text{Firm B: } Y = \Pi_B = 500 \cdot \frac{7}{3} \left[\frac{\frac{5}{3} - \frac{7}{3}}{2} + \frac{3}{2} \right] = \frac{12250}{9} = 1361, (1)$$

b) The solution to this problem results from applying backwards induction.

This means that we will start with the decision made by firm B. Since it faces a situation of uncertainty and is risk neutral, we can analyze its decision by computing the expected value of playing the different strategies (B₀, B₁, B₂).

$$\text{Strategy B}_0: E(\Pi_B) = 0,4 \cdot 0 + 0,6 \cdot 694,4 = 416,64$$

$$\text{Strategy B}_1: E(\Pi_B) = 0,4 \cdot 1361,1 + 0,6 \cdot 0 = 544,44$$

$$\text{Strategy B}_2: E(\Pi_B) = 0,4 \cdot 2000 + 0,6 \cdot 694,4 = 1216,64$$

As a result, firm B should choose strategy B₂ if firm A enters with one product.

When firm A chooses to enter with two products, firm B will have the following expected payoffs:

$$\text{Strategy B}_0: E(\Pi_B) = 0,4 \cdot 0 + 0,6 \cdot 0 = 0$$

$$\text{Strategy B}_1: E(\Pi_B) = 0,4 \cdot 0 + 0,6 \cdot 500 = 300$$

$$\text{Strategy B}_2: E(\Pi_B) = 0,4 \cdot 694,4 + 0,6 \cdot 0 = 277,76$$

Taking these results, firm B will choose to play strategy B₁.

Now, when turning to the decision of firm A, it knows that firm B will choose to play strategy B₂ if firm A enters with one product and B₁ if it enters with two products. In the case of entering with two products, firm should choose the locations A₀ and A₂ (since firm B will play B₁), providing firm A a payoff of 500.

As a result, firm A should decide to enter with one product in A₀ (which results in a higher profit for firm A), yielding both firms a payoff of 2000.

