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Q1: In France, the market for bottled water is controlled by two large firms, Perrier and Evian. Each firm has a fixed cost of $1 million and a constant marginal cost of $2 per liter of bottled water ($1= 1 euro). The following table gives the market demand schedule for bottled water in France.

marginal cost means (spent on additional quanitity)

|  |  |
| --- | --- |
| Price of bottled water | Quantity of bottled water demanded |
| 10 | 0 |
| 9 | 1 |
| 8 | 2 |
| 7 | 3 |
| 6 | 4 |
| 5 | 5 |
| 4 | 6 |
| 3 | 7 |
| 2 | 8 |
| 1 | 9 |

a) Suppose tche two firms form a cartel and act as a monopolist. Calculate marginal revenue for the cartel. What will the [monopoly](https://moodle.unive.it/mod/resource/view.php?id=40624) price and output be? Assuming the firms divide the output evenly, how much will each produce and what will each firm's profit be?

b) Now suppose Perrier decides to increase production by 1 million liters. Evian doesn't change its production. What will the new market price and output be? What is Perrier's profit? What is Evian's profit?

c) What if Perrier increases production by 3 million liters? Evian doesn't change its production. What would its output and profit be relative to those in part b)?

d) What do your results tell you about the likelihood of cheating on such agreements?

a. The accompanying table calculates total revenue and marginal revenue for the cartel. The cartel maximizes profit by producing whenever marginal revenue is greater than marginal cost (which here is $2). That is, the cartel produces a quantity of 4 million liters and sells them at a price of $6 per liter.

If the firms divide production equally, each produces 2 million liters and has a revenue of:

2 million × $6 = $12 million.

Since the fixed cost of production is $1 million and each liter’s marginal cost is $2, each firm has profit of

Each firm Profit = Total Revenue – Total Cost

Profit π = P x Q - Cost

= Total Profit – Fixed Production cost - Quantity of Production × Fixed Marginal Cost

= $12 million - $1 million – (2 million × $2)

=$11million – ($4million) = $7million

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data Coordination | Price of bottled water (per liter) | Quantity of bottled water demanded (millions of liter) | Total Revenue (millions)  P x Q | Marginal Revenue (millions)  change in total **revenue** by the change in quantity sold |
| A | 10 | 0 | 0 | MR= ∆TR/∆Q |
|  |  |  |  | = 9-0/1 = 9 |
| B | 9 | 1 | 9 |  |
|  |  |  |  | 7 |
| C | 8 | 2 | 16 |  |
|  |  |  |  | 5 |
| D | 7 | 3 | 21 |  |
|  |  |  |  | 3 |
| E | Sells at 6 $ per liter | 4  = 2 mil production each | 24  = 12mil each | *MC= 2$* |
|  |  |  |  | 1 |
| F | 5 | 5 | 25 |  |
|  |  |  |  | -1 |
| G | 4 | 6 | 24 |  |
|  |  |  |  | -3 |
| H | 3 | 7 | 21 |  |
|  |  |  |  | -5 |
| I | 2 | 8 | 16 |  |
|  |  |  |  | -7 |
| J | 1 | 9 | 9 |  |

**b**. If Perrier increases production by 1 million liters, the total produced now is 5 million liters (see F) and the price is $5.

Perrier now produces 3 million liters and so has profit of

Profit = (Quantity x Price) – [Total Cost]

Profit = (Quantity x Price) – [Fixed Cost + Variable Cost]

Profit = (Quantity x Price) – [Fixed Cost + (Quantity x MC)]

Profit = (3 million × $5) – [$1 - (3 million × $2)] = $8 million.

Evian’s profit, however, falls to (2 million × $5) - $1 million - (2 million × $2) = $5 million.

**c.** If Perrier increases production by 3 million liters, the total produced is 7 million liters and the price is $3. Perrier produces 5 million liters and so has profit of (5 million × $3) - $1 million - (5 million × $2) = $4 million. This profit is lower than in part b. This implies that although Perrier has an incentive to increase production somewhat, it does not have an incentive to increase production dramatically.

**d.** Since each firm can significantly increase its profit by moderately increasing production, the likelihood of cheating is high.

Q2: Over the last 40 years the Organization of Petroleum Exporting Countries (OPEC) has had varied success in forming and maintaining its cartel agreements. Explain how the following factors may contribute to the difficulty of forming and/or maintaining its price and output agreements.

a) New oil fields are discovered and increased drilling is undertaken in the Gulf of Mexico and the North Sea by nonmembers of OPEC.

With the discovery of new oil by nonmembers of OPEC, there is increased competition. This will lead to a fall in market price and make the cartel agreement harder to maintain.

b) Crude oil is a product that is differentiated by sulfur content: it costs less to refine low-sulfur crude oil into gasoline. Different OPEC countries possess oil reserves of different sulfur content.

The OPEC countries sell a differentiated and complex product. This complicates the decision about what prices to set for what types of oil and makes enforcement of a cartel agreement more difficult. Much of the conflict within OPEC rests on the price differential that is set between high- and low-quality oils.

c) Cars powered by hydrogen are developed.

The development of a hydrogen-powered car would make it more difficult to form or maintain an agreement. Remember that a cartel essentially acts like a monopoly. A cartel’s (or a monopoly’s) market power is eroded if there is entry of new firms or the development of substitute products.

Q3: A monopolist produces a good with total cost given by

TC(Q)=1000+10Q

The demand Function for this specific good is P(Q)=150-2Q.

a) Calculate the quantity and price that maximize monopolist's profit and represent them graphically.

b) Calculate the monopolist's profit and represent it graphically in the same graph of point a).

c) Is there a deadweight loss? Explain the source of inefficiency.

TC (Q) = 1000 + 10Q and P (Q) = 150 - 2Q

MC (Q)=10 MR (Q)=150 - 4Q

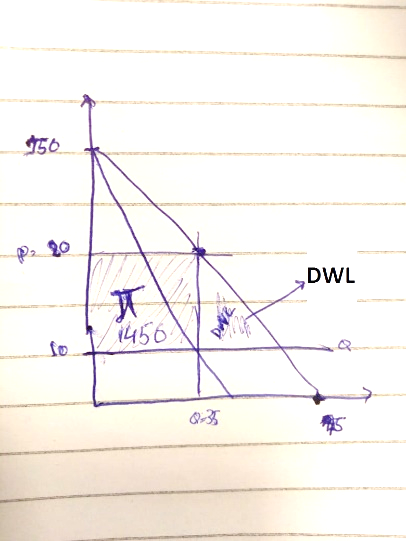
1. MR=MC

150 – 4Q = 10

Q = 35 &

P=150-4Q

P=150-4X35= 150-70

P=80

1. Profit

π = P x Q – TC

π = 80 x 35 – {1000 + 10 (35)}

π = 2800 – 1350

π = 1450 Profit

1. Deadweight Loss – Some trades do not take place even though the willingness to pay of consumers is higher than the cost of production, so a deadweight loss is created.

Q4: Philip Morris and R.J. Reynolds spend huge sums of money each year to advertise their tobacco products in an attempt to steal customers from each other. Suppose each year Philip Morris and R.J. Reynolds have to decide whether or not they want to spend money on advertising.

If neither firm advertises, each will earn a profit of $2 million. If they both advertise, each will earn a profit of $1.5 million. If one firm advertises and the other does not, the firm that advertises will earn a profit of $2.8 million and the other firm will earn $1 million.

a) Use a payoff matrix to depict this problem.

b) Suppose Philip Morris and R.J. Reynolds can write an enforceable contract about what they will do. What is the cooperative solution to this game?

c) What is the Nash equilibrium without an enforceable contract? Explain why this is the likely outcome.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Payoff matrix Outcomes are profits in million dollars –  (x,y) x – represents P.M spendings’ while y – represents R.J. spendings’ | | | | |
| Firms |  | R.J. Reynolds | | |
| Philips Moris | Choices | Advertises |  | Not Advertises |
| Advertises | 1.5, 1.5 |  | 2.8, 1 |
|  |  |  |  |
| Not Advertises | 1, 2.8 |  | 2, 2 |

1. Each firm should not advertise – so that they would earn the highest possible profit i.e. 2 million dollars.
2. Using game theory according to Nash equilibrium each firm will advertise and divide the profit equally and the market will be “non-price competitive market economy.”