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.

|  |  |
| --- | --- |
| 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 the 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?

1. See figure.
2. If Perrier increases production, the new total output will be 5 million liters, corresponding to a market price of $5 per liter. As a result, its profit will increase at the expense of Evian’s one, which will decrease (see figure).
3. If Perrier increases production by 3 million liters, its output will rise to 5 million liters and his profits will fall with respect to both the first and the second situation (see figure). This way, both firms’ profits – and, as a result, also those of the cartel as a whole – will decrease, generating a loss. This means that it is convenient for a firm to increase its production up to when MR is equal or greater than MC. It is not surprising that, at the price of 5, MR is equal to and therefore lower than MC (=2).
4. Since both firms gain an advantage by increasing production up to a certain point (not too much), it is likely that both of them cheat, disrespecting the agreement and trying to increase their own profits.

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.

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.

c) Cars powered by hydrogen are developed.

1. The oligopoly is threatened by external competitors that reduce the cartel’s market power, causing prices and profits to fall for OPEC. As a result, the members of the cartel will have an incentive to engage in a noncooperative behaviour, increasing prices in the attempt to cover their own losses.
2. If different OPEC countries possess oil reserves of different sulfur content they will be faced by different costs of production and, therefore, those with the highest costs will try to increase prices to cover these expenses. This results in a difficulty in finding a unique price for the cartel, since its heterogeneous nature leads different countries to have different incentives and makes cooperation difficult.
3. Cars powered by hydrogen constitute a close substitute for gasoline and this undermines the cartel’s market power. In fact, the demand for gasoline will fall and so will do the cartel’s profits, causing some members to disrespect the agreement in the attempt of covering the losses caused by this event.

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.

1. The optimal quantity that maximizes monopolist’s profit can be defined by equalizing marginal revenue and marginal cost (see figure). Once found the optimal quantity, we have to substitute it in the indirect demand curve to find the optimal price (see figure).
2. Profit corresponds to the difference between total revenue and total cost and, graphically, it is the rectangle having QM as base and the difference between PM and MC as height (see figure).
3. Monopoly generates inefficiency because, by gaining profits, the monopolist hurts consumers by reducing consumer surplus. However, the loss in consumer surplus is greater than the gain in profit for the monopolist, therefore monopoly represent a loss for society. In fact, if the market was perfectly competitive the price would be equal to MC and the quantity traded (QC) would correspond to the point where the demand curve and the MC curve intersect. On the contrary, monopoly reduces output and increases price, resulting in missed opportunities because the difference in output between QC and QM would not be traded even though the consumers’ willingness to pay is greater than marginal cost. As a result, there is a deadweight loss corresponding to the grey triangle in the graph (see figure).

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.

1. See figure.
2. The cooperative solution entails that neither firm advertises, since they will both reduce the quantity of advertising, abandoning the possibility of stealing customers from the other, to have a long-term advantage.
3. The Nash equilibrium consists of both firms advertising and earning $1.5 million; this is the likely outcome because both firms will try to increase their own profit at the expense of the other. However, if they both engage in a noncooperative behaviour they will end up being worse off in the long run, renouncing to the possibility of earning $2 million because they fear that the other firm cheats.