INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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MICROECONOMICS

advanced course

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3 Competitive Environment

Neoclassical theories analyse behaviour of an enterprise the main objective of which is to strive **to maximize profit**. Neoclassical economics is one of the main streams of economic theories which started to develop at the end of the 19th century. Neoclassical theories of the firm are based on the work of Antoine Augustine Cournot (1801-1877), who was the first economist that applied profit maximization as a factor influencing behaviour of firms; on the work of John Bates Clark (1847-1938) and Alfred Marshall (1842-1924). It was further elaborated by economists Ronald Harry Coase (1910), Edward Hastings Chamberlin (1899-1967) and Joan Violet Robinson (1903-1983). Apart from this main stream, there are modern theories focused on enterprises with separated ownership and management which enables to follow other alternative objectives. E. g. behavioural theory of the firm (the objective of the enterprise is not profit maximization but satisfactory profit amount) or managerial theories of the firm (the objective can be turnover maximization, enterprise expansion efforts and others) belong to these trends. If enterprises aim to **maximize their profit**, then, they specify a specific volume of manufactured output and if possible, they decide on prices of products and on used technologies. In their decision-making, the firms are determined by:

- ⇒ **a market restriction** which represents efficient demand for the goods produced, the market restriction is a restriction on the demand side,
- ⇒ **an economic restriction** which is represented by the production process, it is a restriction on the cost side, i.e. on the supply side,
- ⇒ **a technological restriction** which is related to the existence of a limited number of technological processes enabling the production of an identical product.

According to the neoclassical theories, the firm's objective is to maximize its economic profit. **Economic profit** $\boldsymbol{\Pi_E}$ (hereinafter referred to as $\boldsymbol{\Pi}$) is defined as the difference between total revenue and total **economic cost** $\boldsymbol{TC_E}$. Economic costs are the sum of explicit costs TC_{ex} and implicit costs TC_{im} (for details regarding economic costs see the chapter 2.2 on the page 47). **Total revenue** ($\boldsymbol{TR}$) is the product of the amount sold and market price:

$$\Pi_E = TR - TC_E, \tag{3.1}$$

where:

$$TR = P \cdot Q \tag{3.2}$$

$$TC_E = TC_{ex} + TC_{im}$$

Economic profit is not equal to ***accountable profit*** ($\boldsymbol{\Pi_A}$), which includes only explicit costs in the calculation. Then, the accountable profit is usually greater than the economic profit.

$$\Pi_A = TR - TC_{ex} \tag{3.3}$$

Normal profit (Π_N) is defined as the difference between accountable and economic profit. We can say that the normal profit corresponds to alternative costs (lost opportunity costs) since it expresses the amount of profit which would be realized by the entrepreneur in the case of the best alternative use of invested funds.

$$\begin{aligned} \Pi_N &= \Pi_A - \Pi_E \\ \Pi_N &= TR - TC_{ex} - \left[TR - \left(TC_{ex} + TC_{im} \right) \right] \\ \Pi_N &= TC_{im} \end{aligned} \tag{3.4}$$

The enterprise reaches the maximum economic profit in dependence on the competitive environment in which it operates. Basic types of competitive environment are:

⇒ Perfect competition
⇒ Imperfect competition Monopolistic competition
⇒ Oligopolistic market structure
⇒ Monopoly

3.1 Perfectly competitive market structure

Perfect competition is such a state of economy or industry when all firms are in the same position, none of them realizes any advantage against other enterprises on the market. In order to reach this state, certain assumptions must be followed:

⇒ there is an **atomistic market structure**, i.e. there is a large number of economic subjects on the supply side as well as on the demand side as a result of which enterprises become **price takers**
⇒ a manufactured **product is identical**, there are no preferences against any of supplying firms on the demand side, products or services are considered perfect substitutes
⇒ **there are no limits to entering and exiting any industry**, i.e. all production factors are perfectly mobile and available to all enterprises in the long run which enables not only to flexibly change the amount of production of individual firms but also to adjust the number of economic subjects on the market
⇒ all firms have **the same access to information**, there is full transparency of the market

The following analysis of the firm's behaviour on the market of perfect competition follows the

knowledge of the basic course of microeconomics. The main objective of the firm operating on the perfectly competitive market is to maximize profit and the main objective of the consumer is to maximize his utility (or his consumer surplus). The firm maximizes its profit if the profit function is in its local extreme, i.e.:

$\Rightarrow$ the first derivative of the profit function must be zero

$\Rightarrow$ the second derivative of the profit function must be zero

$$\frac{\partial \Pi}{\partial Q} = \frac{\partial TR}{\partial Q} - \frac{\partial TC}{\partial Q} = 0, \text{ which results in: } \frac{\partial TR}{\partial Q} = \frac{\partial TC}{\partial Q}, \text{ or } MC = MR. \tag{3.5}$$

$$\frac{\partial^2 \Pi}{\partial Q^2} < 0 \tag{3.6}$$

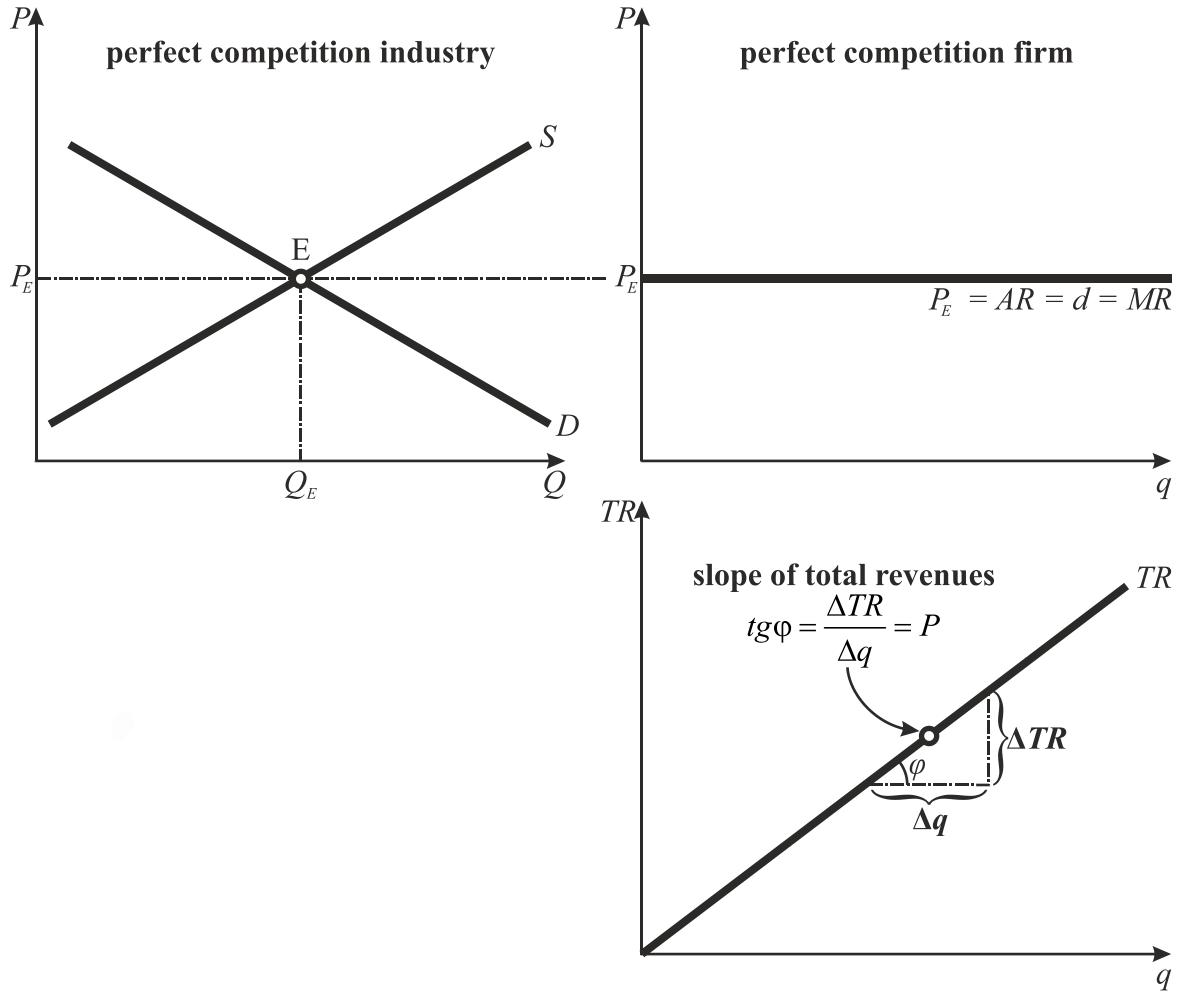
Marginal revenue (***MR***) represents an increase in total revenue arising out of the sale of an additional output unit, under perfect competition, it shall equal to the price at any production level. **Average revenue** (**AR**) represents the monetary value of revenue per each one production unit sold in average. Under perfect competition, the average revenue is then equal to the price.

$$AR = \frac{TR}{Q} = \frac{P \cdot Q}{Q} = P \text{ and } MR = \frac{\Delta TR}{\Delta Q} = \frac{\partial TR}{\partial Q} = P \tag{3.7}$$

Demand for output of one firm under perfect competition (individual demand, ***d***) is equal to the price ***P*** for which the product is realized on the market, however, individual demand is identical to marginal revenue ***MR*** and average revenue ***AR*** under perfect competition.

3.1.1 Firm in the environment of perfect competition in the short run

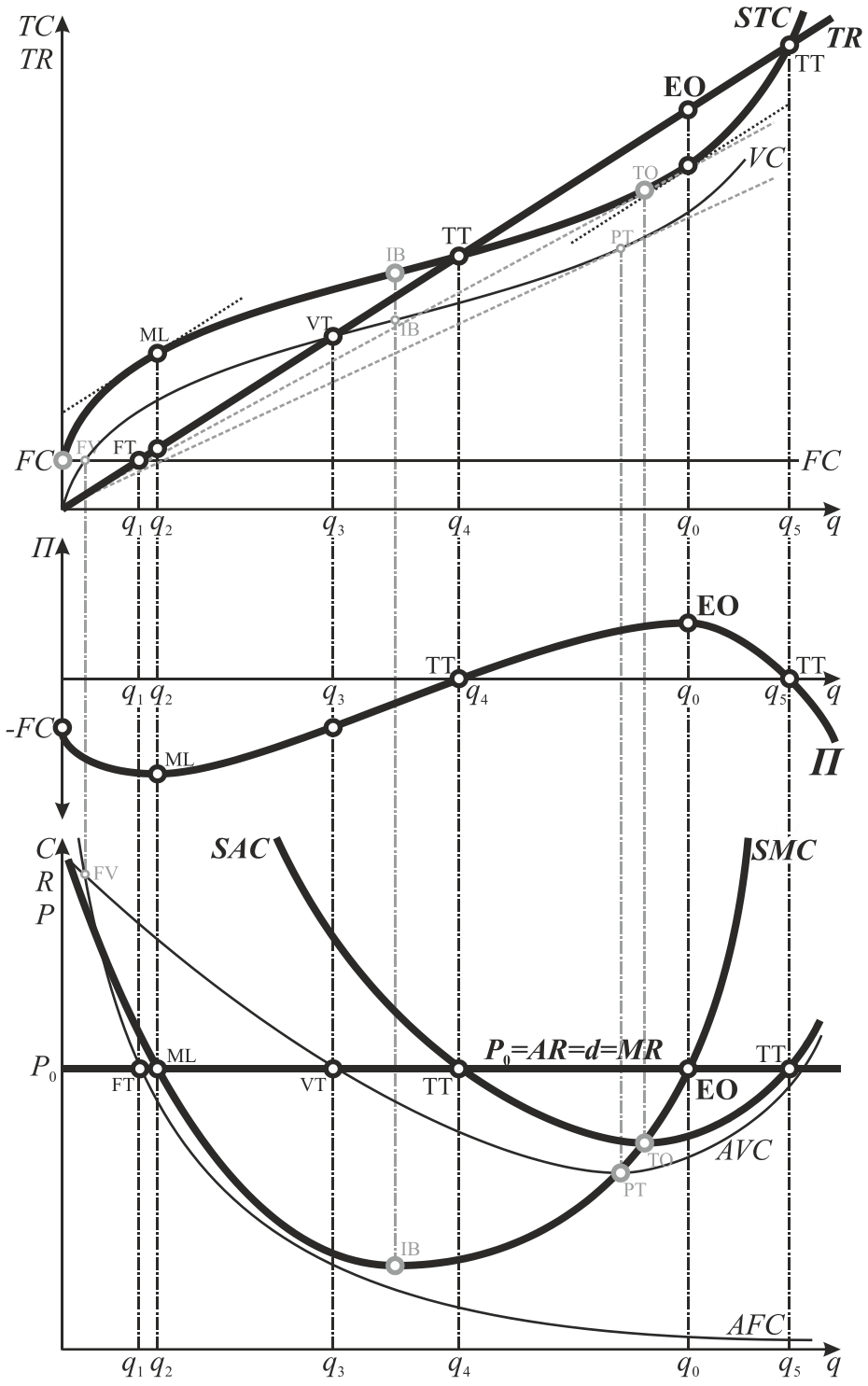
The price on the market of perfect competition is specified by the encounter of industry (market) supply S and demand ***D***. The market demand curve is made up of the horizontal sum of individual demand curves of all consumers (demanding) entering the market. The market supply curve then by the horizontal sum of individual supply curves of all enterprises (supplying) that operate on the market. The equilibrium price P_E is the price for which demanding subjects are willing to buy outputs of individual manufactures, it also represents individual demand for the firm's output *d* as well as its average revenue *AR* and marginal revenue *MR*.



3-1 Enterprise on the market of perfect competition

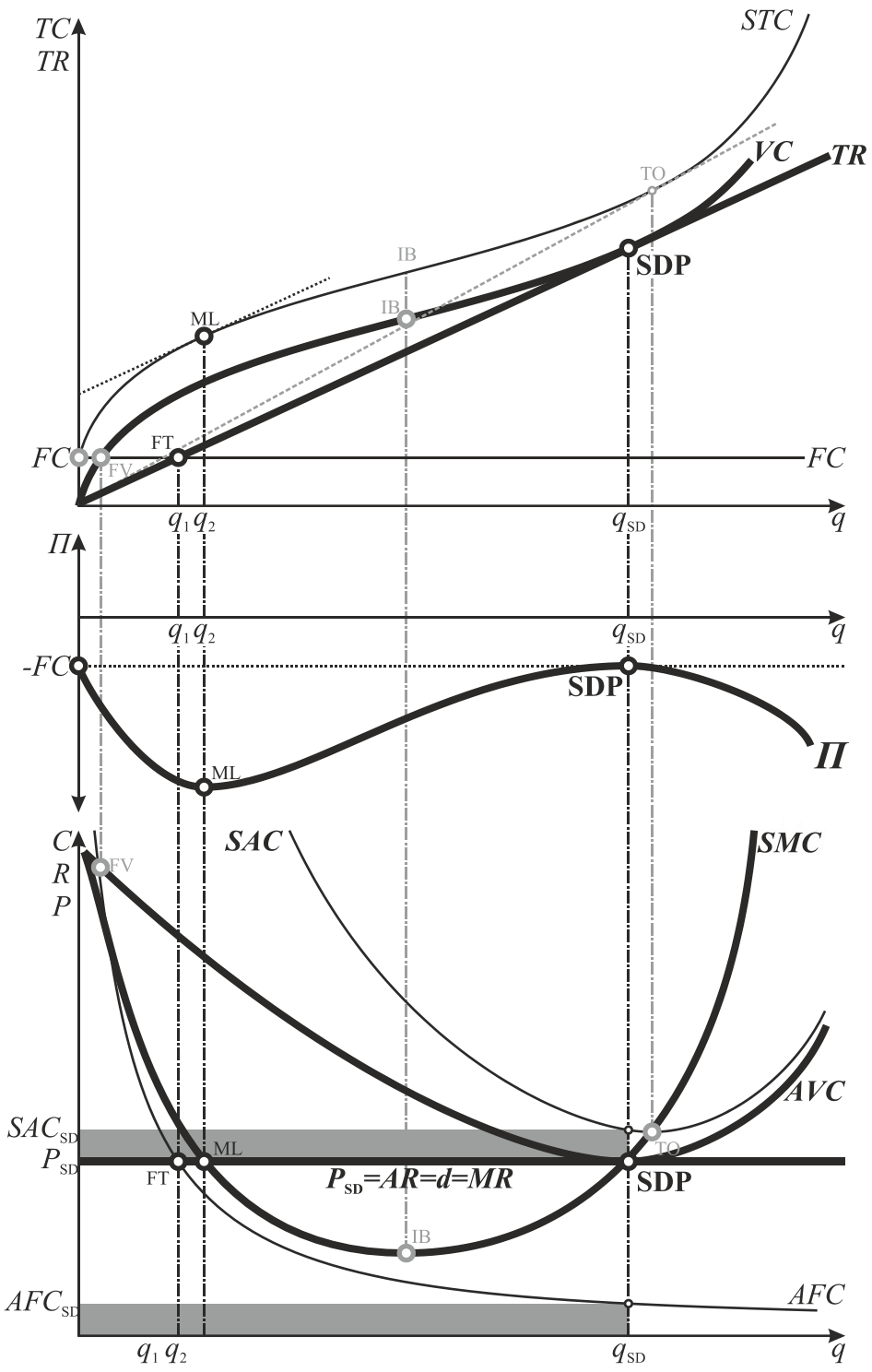
The firm reaches **maximization of economic profit *Π*** at the point **EO** while producing the quantity q_0 with the largest difference of total revenue *TR* and total costs *STC*. At the same quantity, the gradients of tangents of both curves are equal (tangents are parallel) and thus, the short-run marginal costs *SMC* are equal to the marginal revenue *MR*. The function of economic profit *Π* is in its maximum. At the point ML in the graph 3-2, while producing the quantity q_2, there is also a maximum difference between the total revenue *TR* and short-run total costs *STC* (gradients of tangents of curves are equal) and the short-run marginal costs SMC are equal to the marginal revenue *MR* but the profit function is in its minimum (the second derivative of the profit function is positive in this case). The firm maximizes absolute economic loss.

The points TT mean that for the produced quantities q_4 and q_5, zero economic profit is reached (total revenue *TR* is equal to total costs *TC*, the price *P* is equal to the short-run average costs). In the intervals $(0, q_4)$ and (q_5, ∞), the firm would reach negative economic profit or absolute economic loss.



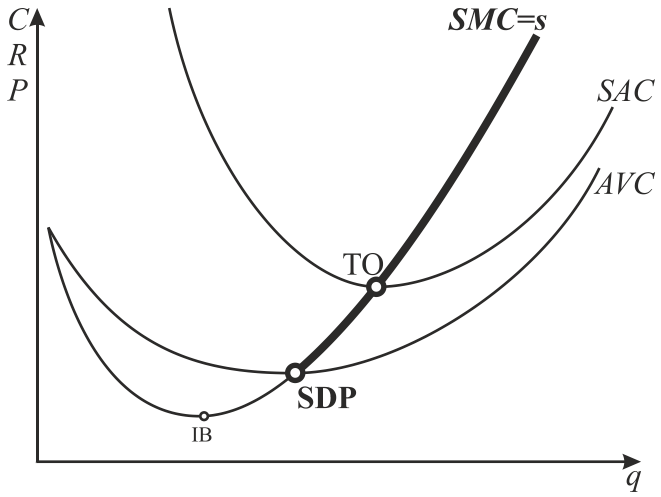
3-2 Economic profit of the firm under perfect competition in the short run

Shutdown point of the firm (**SDP**) under perfect competition in the short run depends on the existence and quantity of fixed costs *FC*. The firm starts and finishes the production if the loss of production is identical to the loss amounting to fixed costs.



3-3 Shutdown point of the firm under perfect competition in the short run

When producing the quality q_{SD}, total revenue *TR* covers only variable costs *VC*; the price P_{SD} covers only average variable costs *AVC*. The amount of absolute loss is exactly equal to the quantity of fixed costs. The shutdown (start-up) point SDP is also the first point on the curve of short-run marginal costs SMC which is identical to the course of the individual supply curve of the firm under higher levels of prices (higher than P_{SD}) (see the graph 3-4).



3-4 Curve of the individual supply of the firm under perfect competition in the short run

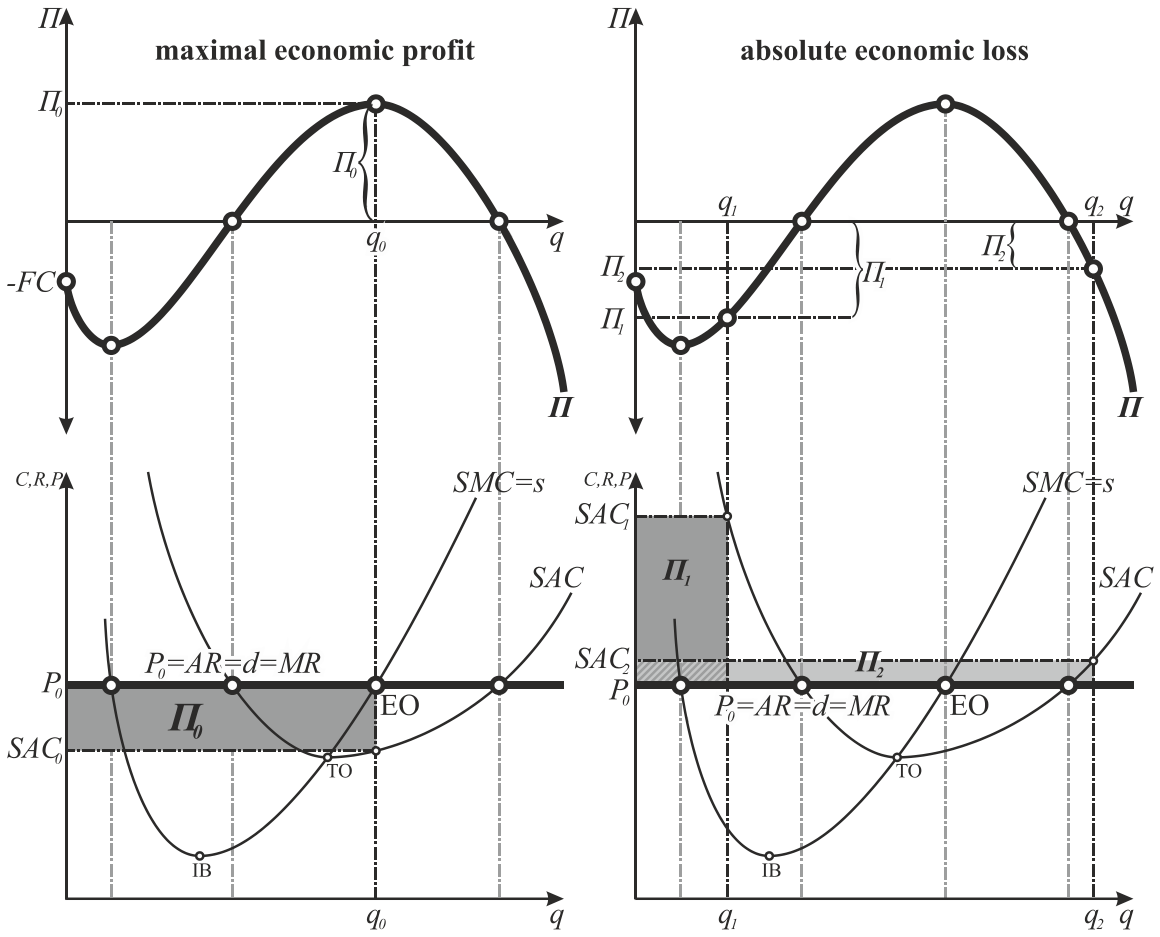
Economic profit can be described, by means of average quantities, as the difference of the price and short-run average costs at the produced quantity given multiplied by the volume of this output produced:

$$\Pi = (P - SAC) \cdot Q, \text{ when producing } q_0\text{: } \Pi_0 = (P_0 - SAC_0) \cdot Q_0 \qquad (3.8)$$

The area of a rectangle in the left lower part of the graph 3-5 represents the maximum economic profit of the enterprise which is reached at the output q_0. The fact that it really concerns the maximum economic profit is proven by the left upper part of the graph showing the course of the function of the total economic profit.

3.1.1.1 Choosing a sub-optimal quantity of manufactured output

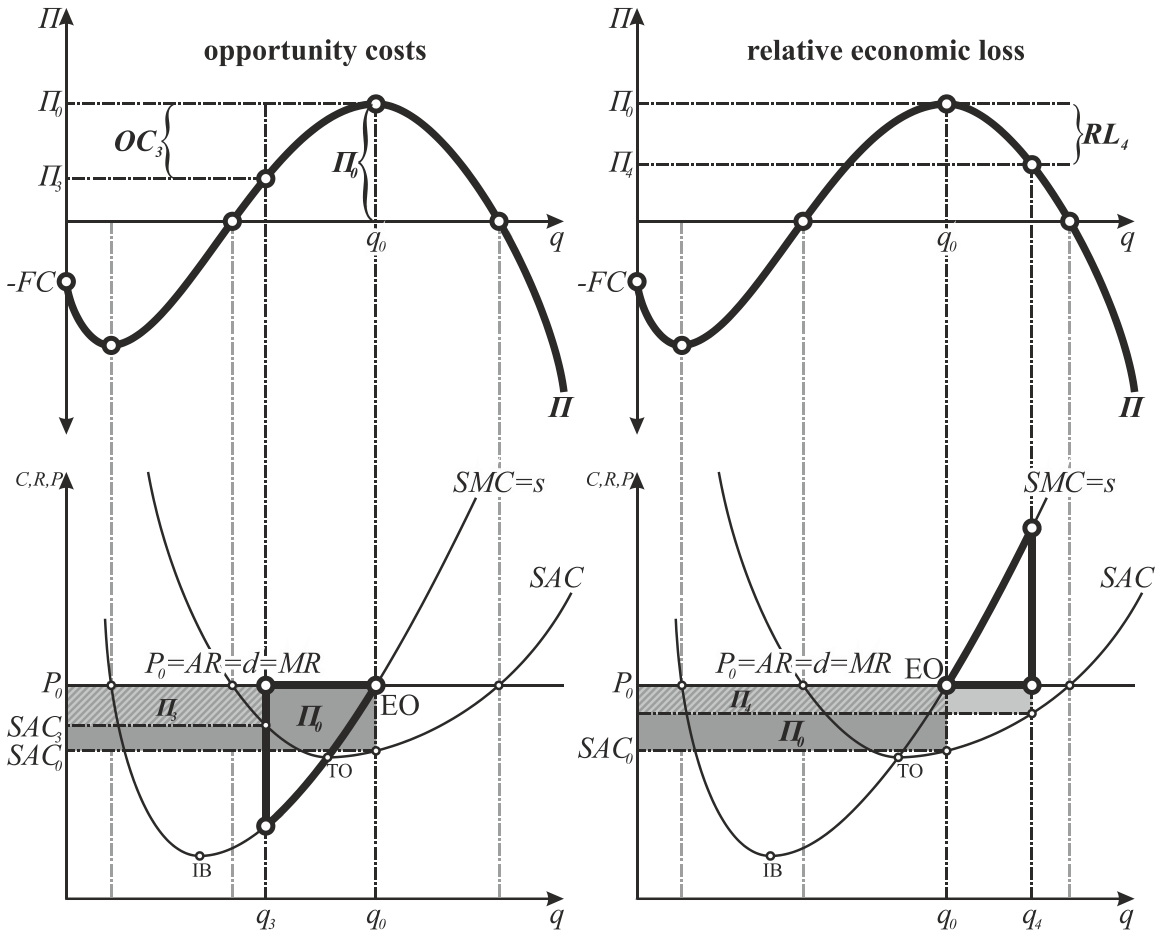
If the firm does not fulfil the optimal volume of manufactured quantity and produces the quantity in the intervals where short-run average costs exceed the price ($SAC > P$), then, it realizes **absolute economic loss** ($\Pi < 0$). When producing the quantity q_1, the firm reaches absolute economic loss in the amount $\Pi_1 = (P_0 - SAC_1) \cdot Q_1$, when producing the quantity q_2, the firm reaches absolute economic loss $\Pi 2$.



3-5 Economic profit and absolute economic loss of the firm under perfect competition in the short run

Opportunity costs (***OC***) represent a loss of profit arising out of a failure to follow the optimal production volume if the firm produces the quantity smaller than optimal quantity and at the same time, short-run average costs for the given level of output are lower than the price ($SAC < P$). When producing the quantity q_3, the firm reaches the level of positive economic profit Π_3 which is lower compared to the maximum profit Π_0 by the amount of lost opportunity costs OC_3. This lost opportunity is graphically specified by the difference of marginal revenue *MR* and marginal costs *SMC* in the interval of produced output $\langle q_3, q_0 \rangle$.

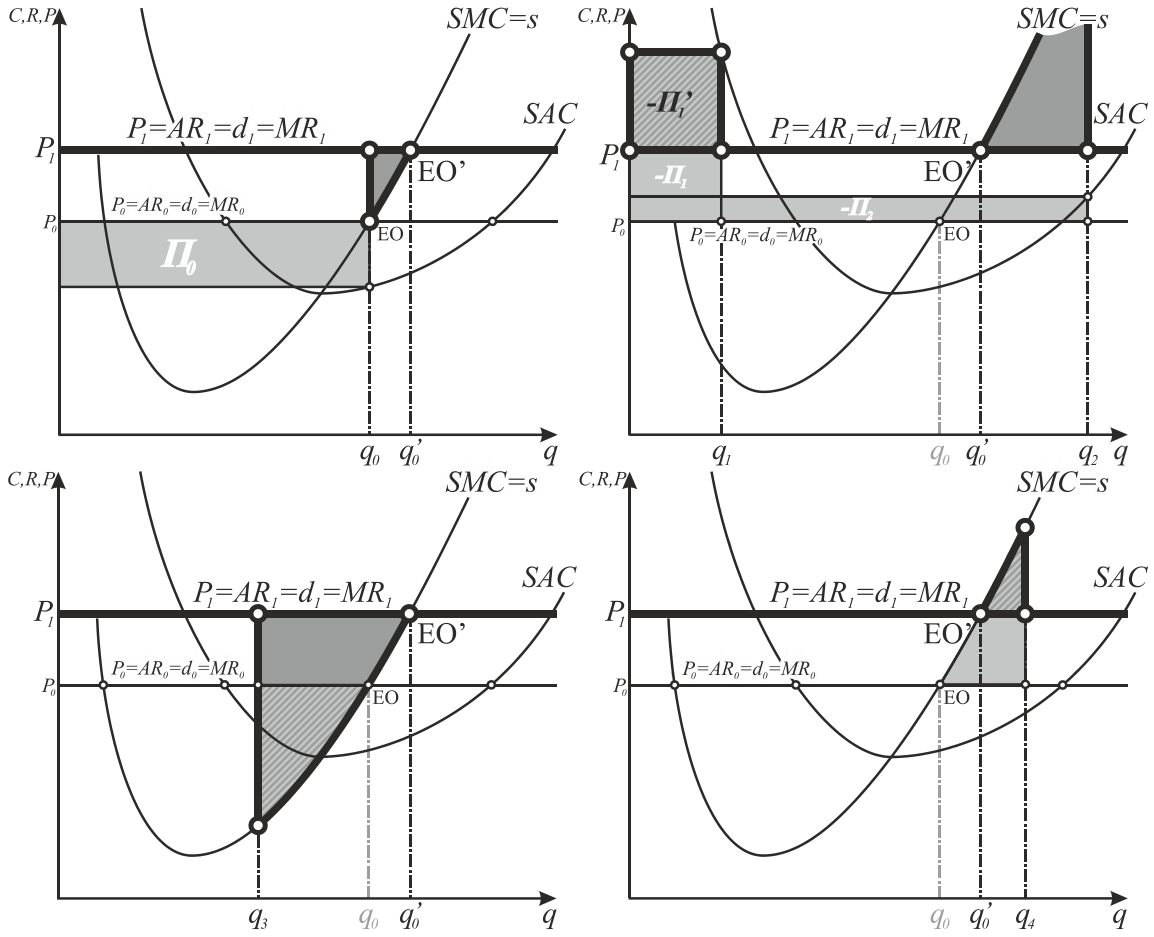
If the firm produces the quantity higher than the optimum, and at the same time, short-run average costs are lower than the price for the given production level ($SAC < P$), then, it realizes **relative loss** (***RL***) which represents a loss of profit against the maximum profit. When producing q_4, the firm reaches positive economic profit Π_4, which is lower than the maximum profit. The difference between Π_0 and Π_4 represents the amount of relative loss – it can be graphically expressed by the area bordered by marginal revenue *MR* and marginal costs *SMC* in the interval of produced output $\langle q_0, q_4 \rangle$.



3-6 Opportunity costs and relative economic loss of the enterprise under perfect competition

Increasing the market price from P_0 to P_1 shall result in increasing the optimum quantity produced from q_0 to q_0' so that the condition of economic profit maximization would be observed.

If the firm does not change the size of produced quantity, it shall realize lost opportunity costs (shown by the area in bold in the left upper part of the graph 3-7). At the volume of the output q_1, an increase in the price to P1 shall cause a decrease in absolute economic loss. When producing the amount q_2, an increase in the price shall result in changing absolute loss to relative loss, the firm shall achieve positive economic profit which is not maximal (right upper part of the graph 3-7). For the quantity q_3, an increase in the price shall result in increasing the lost opportunity, for the produced quantity q_4, an increase in the price shall decrease relative loss (two lower parts of the graph 3-7).

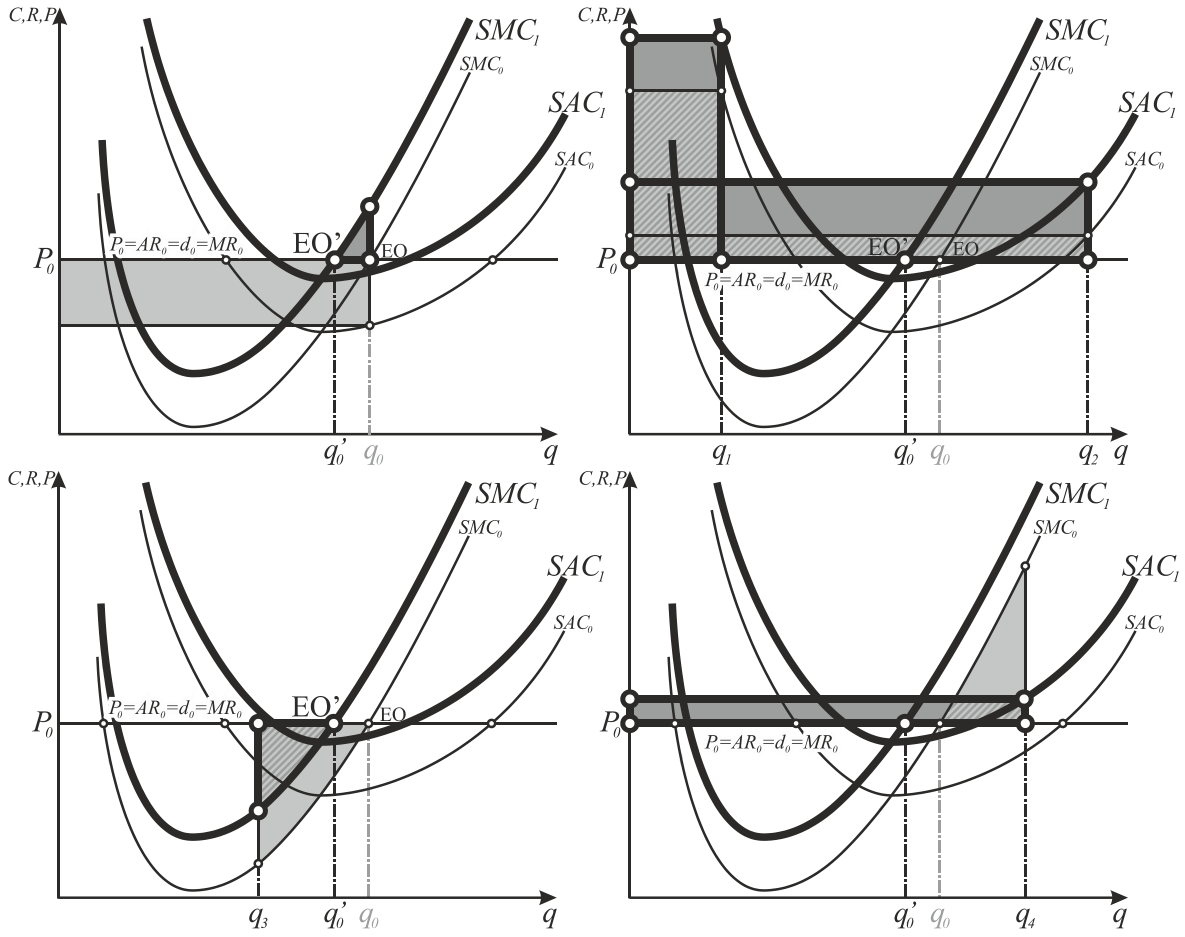


3-7 Impacts of an increase in the market price on the enterprise outputs under perfect competition

An increase in prices of production inputs (e.g. rising wage rates) shall result in moving marginal and average costs vertically upwards (for details see the page 52). When the market price of the final product P_0 remains unchanged and the condition of economic profit maximization is observed, the firm shall decrease the production to the quantity q_0'.

If the firm does not change the volume of manufactured output, it shall realize relative loss arising out of higher quantity produced (see the left upper part of the graph 3-8). However, the originally realized economic profit is also substantially lower with regard to higher production costs when the output quantity is decreased to q_0'.

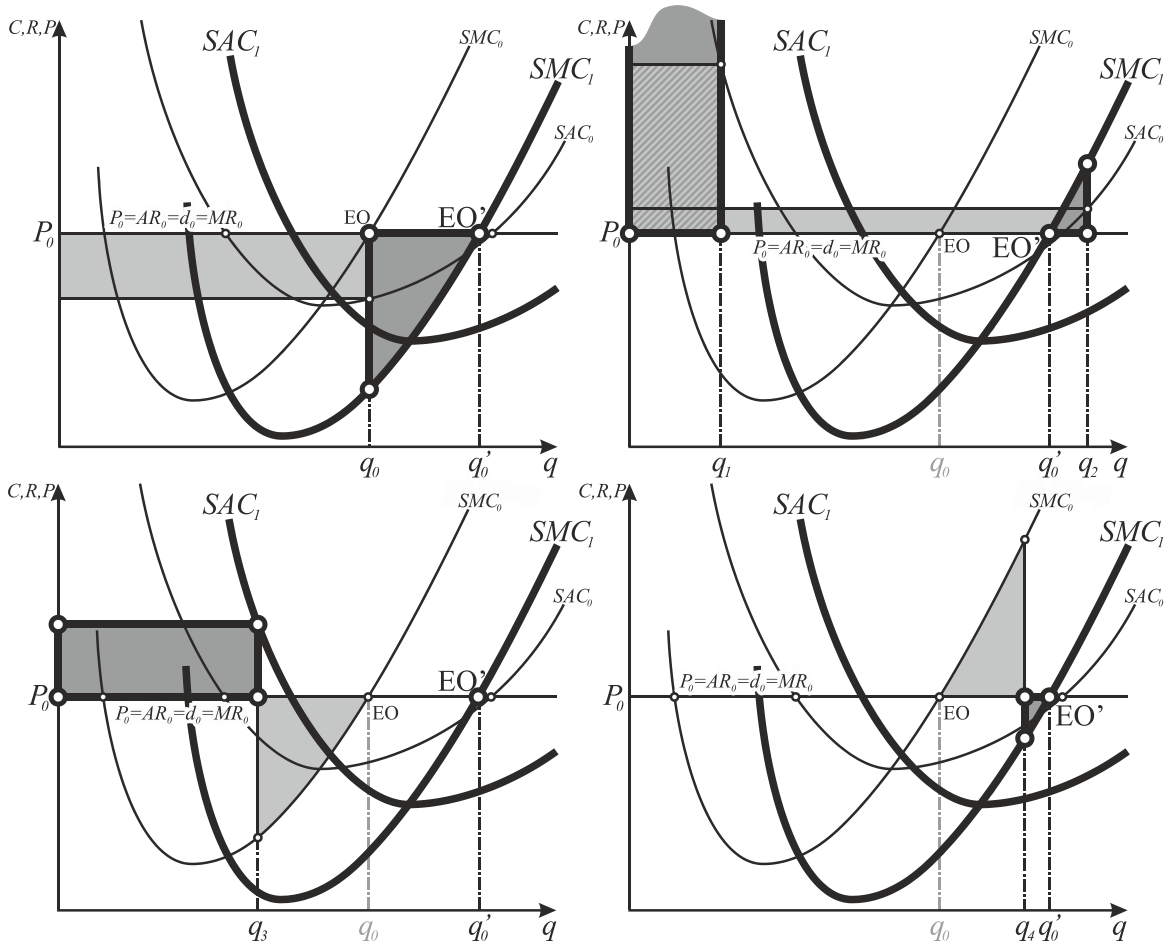
When producing q_2, absolute loss (from the original size indicated by means of a light-grey rectangle to the size of a dark-grey rectangle) shall be increased when input prices are increased. When producing q_3, an increase in the price of inputs shall result in decreasing the lost opportunity since the amount of economic optimum is decreasing while approaching the volume of production q_3. When producing the quantity q_4, an increase in prices of inputs shall result in a decrease in economic profit up to negative values, relative loss passes over to absolute loss since the optimal production volume keeps on moving away from the output q_4.



3-8 Impacts of the wage rate increase on the enterprise outputs under perfect competition

Economic and technological progress caused by the use of better technologies in the production moves the minimum of average costs (technological optimum) down to the right (for details see the page 50). For the production of optimal quantity, it means an increase in the production to q_0' against the original state q_0.

If the production is not increased, it shall mean a decrease in the profit by the lost opportunity indicated in the graph 3-9up on the left as the area of the dark-grey part. When producing irrationally small quantity of output q_1, absolute loss of the enterprise is naturally deepening as a result of the technological change since the produced output moves away from the optimal quantity produced. When producing the quantity q_2 after the technological change, the firm shall achieve positive economic profit (but not maximal), the original absolute loss passes over to relative loss (area of the dark-grey part in the graph 3-9 up to the right). On the contrary, when producing the quantity q_3, the technological change led to a fall in economic profit to negative values and the original lost opportunity deepens to absolute economic loss. The quantity q_4, which was originally higher than the optimum quantity and meant the existence of relative loss, is ahead of the optimum quantity after the technological change and it represents the lost opportunity (area of the dark-grey part in the graph 3-9 down on the right).



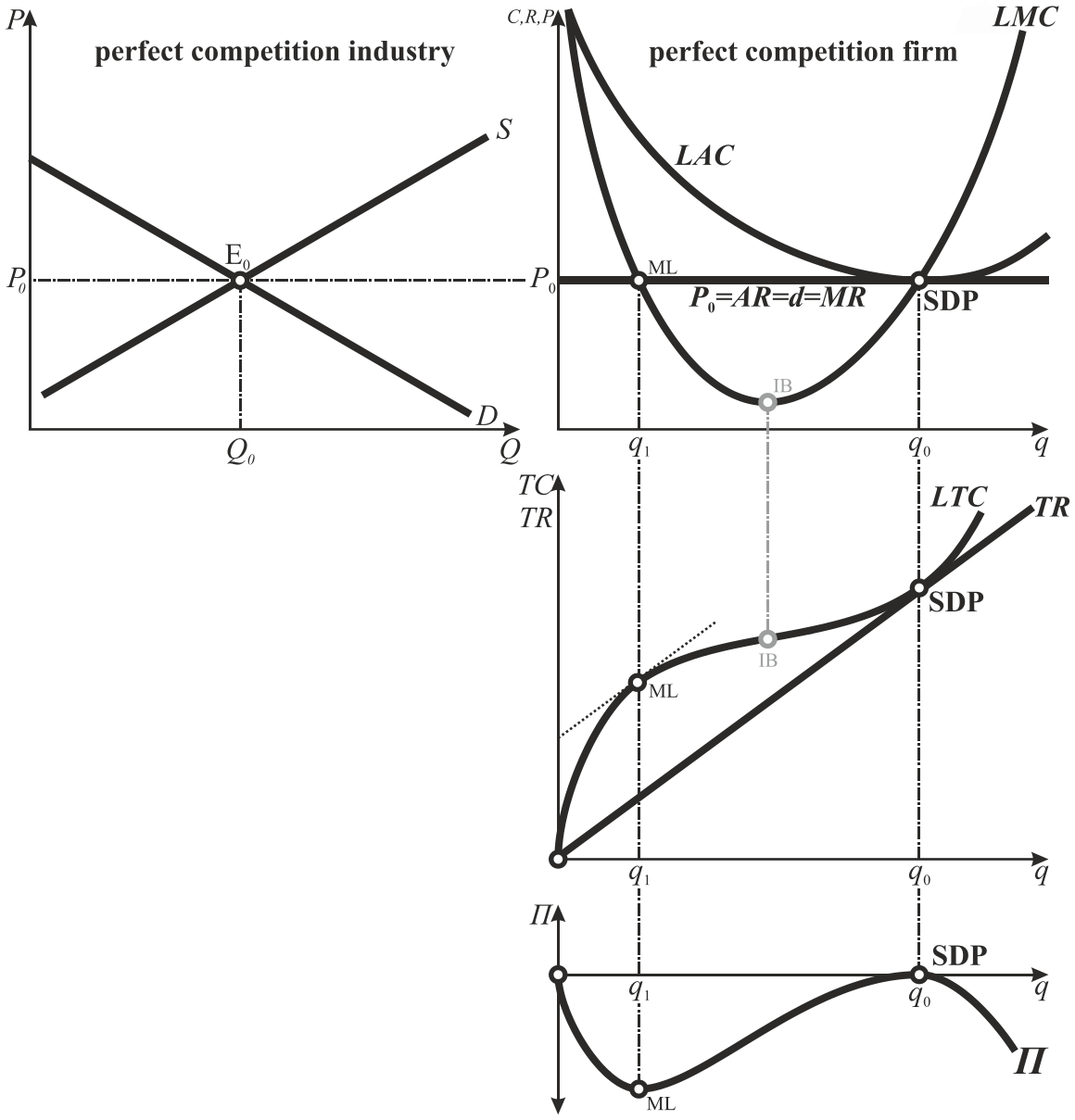
3-9 Impacts of technological progress on the enterprise outputs under perfect competition

3.1.2 Firm in the environment of perfect competition in the long run

The long run has an impact on the market arrangement of perfect competition through the assumption of free entrance and exit from the industry. With regard to the alternative use of valuable production factors, it is possible to enter or leave the industry on the basis of economic profit development in the long run. If firms in perfectly competitive industry reach positive economic profit, new firms shall enter the industry; in case of reaching negative economic profit, the firms shall contrarily leave the industry.

The firm as well as the industry reach the equilibrium at the moment when the firms reach **zero economic profit** $\Pi = 0$ (while observing conditions of profit maximization $MR = LMC$), i.e. if there is no more profitable alternative of using production sources. When the economic profit is zero, the motivation of enterprises to enter the industry or leave it is being lost and the number of firms operating on the market is thus stabilized. This point is also the **start-up point in the long run** (entrance of the firm into the industry) or the shutdown point in the long run (exit of the firm from the industry):

$$\Pi = 0 \Rightarrow P = LAC \text{ and at the same time } MR = LMC \tag{3.9}$$



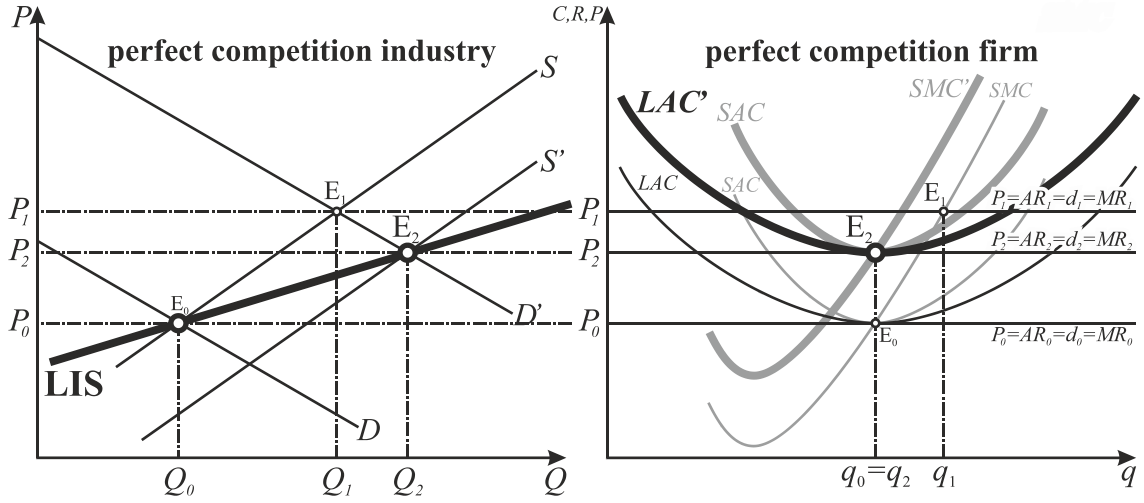
3-10 Economic profit of the firm under perfect competition in the long run

While the market supply of perfectly competitive industry was the simple horizontal sum of individual supplies of all producers in the short run, the number of producers operating on the market fluctuates in the long run. A **long-run industry supply curve** (**LIS**) is therefore defined as a set of long-run equilibrium points of the industry of perfect competition. Its construction must take into account not only a change in the number of firms in the industry of perfect competition given but also the development of prices of production inputs associated with a changing number of enterprises that demand them.

The long-run industry supply curve LIS is ascending if an increase in the market demand for the product from *D* to *D*' leads to:

⇒ in the short-run, when the number of firms in the industry is constant, increasing the price of the product from P_0 to P_1. Based on the output optimization, the firm shall increase the volume of manufactured output from q_0 to q_1 and shall realize positive economic profit.

⇒ in the long-run, entering of new firms into the industry (*S* is increasing) which shall result in increasing the demand for production inputs and subsequently **increasing the price of production inputs**. Rising prices of production inputs result in increasing long-run costs of perfectly competitive firms from *LAC* to *LAC'*. The more firms enter the industry the more the market supply grows (and the market price of the final product falls), the more the prices of production inputs grow and as a result also long-run average costs of firms. The industry finds its new long-run equilibrium E_2 in the situation when the decreasing market price in economic optimums of perfectly competitive producers exactly covers their long-run average costs. In this situation (E_2), the economic profit of firms is zero and an influx of firms into the industry is stopped. The market supply stops growing (*S'*), the market price stops falling (P_2), the prices of production factors do not rise and thus they stop increasing the long-run costs of firms (*LAC'*).



3-11 Supply of perfectly competitive industry in the long run

If prices of production inputs are constant, i.e. if an increase in the industry output does not lead to any change in the prices of inputs (e. g. because production inputs are not used and their supply is perfectly elastic), the long-run industry supply curve LIS is horizontal at the level of the production price. The industry with decreasing costs, or if increasing the industry output leads to decreasing the price of inputs (e. g. since the increasing demand for production inputs enables their more efficient and cheaper purchase), is characterized by a descending long-run industry supply curve LIS.

3.2 Imperfectly competitive market structures

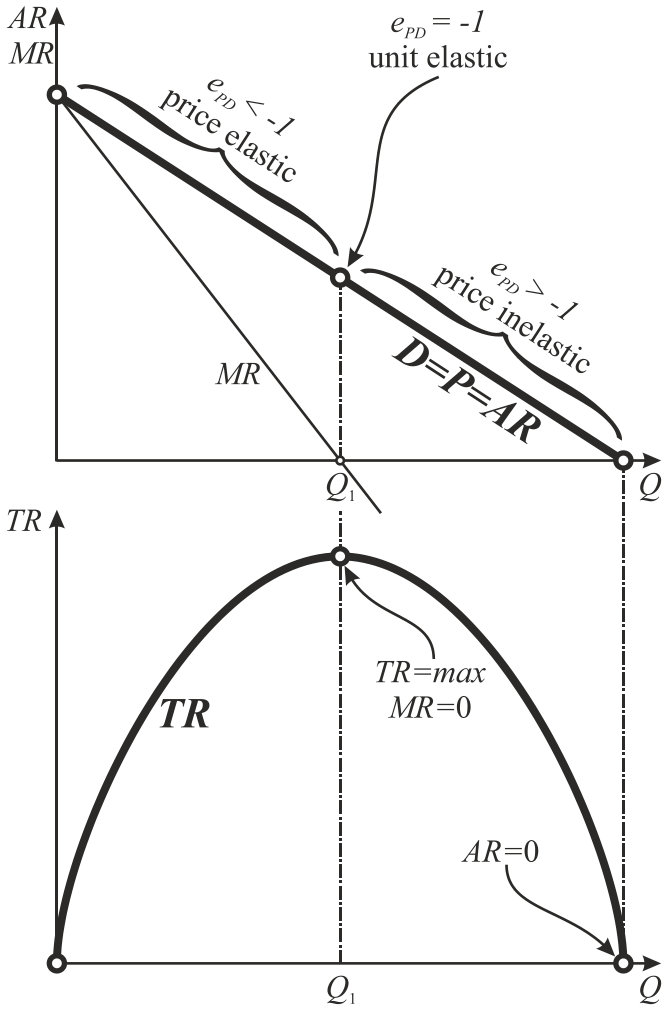
Imperfectly competitive markets represent the situation when there is at least one seller or buyer that can influence the product price size on the market. On these market, there are certain "imperfections":

- ⇒ firms offer a differentiated product
- ⇒ demand for the firm's output is decreasing which enables the firms and consumers to influence the price of output – economic subjects become **price makers**
- ⇒ there are barriers preventing firms from entering the industry
- ⇒ formed mainly by **costs** associated with acquiring capital goods and purchasing production technologies
- ⇒ associated with the **size of firms** on the markets of imperfect competition (in some cases, more competitors shall not "get" on the market)
- ⇒ given by the **production technology** or other production inputs of which only a limited group of firms disposes (or they are wholly owned by the only enterprise)

The creation of **market power of firms** on the market of imperfect competition is supported by factors of exclusive ownership of production factors, enforcing increasing returns to scope, patents, licences and concessions or imperfect information or limited access to it. An essential feature of imperfect competition is a **descending individual demand curve** for the production of one firm. The price elasticity of demand e_{PD} has an impact on the course of total revenue *TR* and marginal revenue *MR* the curve of which falls twice as fast as the demand curve, i.e. average income curve *AR*.

$$MR < P$$

$$MR = P \cdot \left(1 + \frac{1}{e_{PD}}\right) \tag{3.10}$$



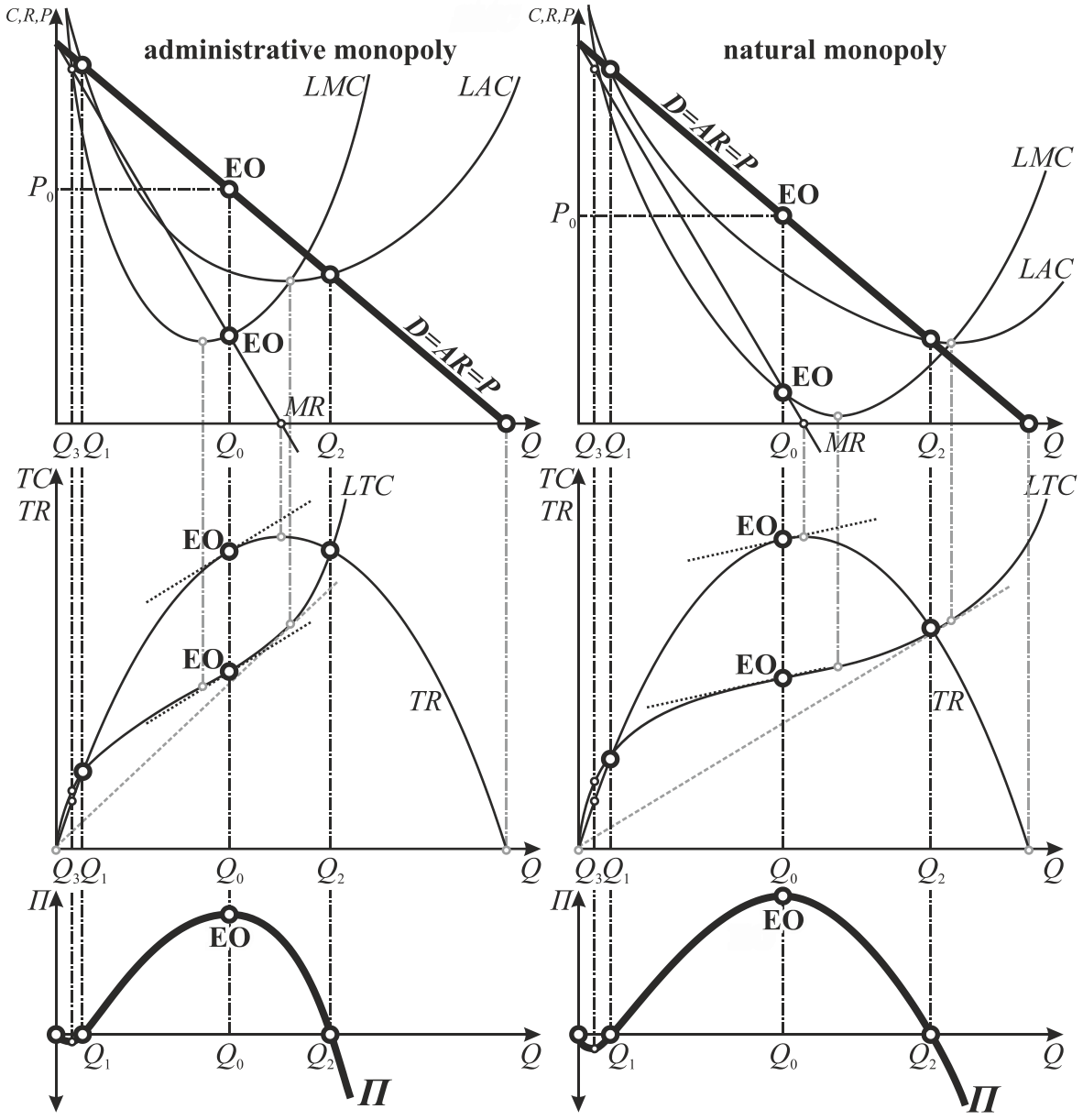
3-12 Revenue variables of the enterprise in imperfectly competitive market structures

3.2.1 A monopoly firm

A monopoly representing an advantage on the supply side is characterized as a market structure with **the only firm** in the industry (it forms industry supply and it also satisfies the industry market demand). A monopoly firm produces – in neoclassical conception – in order to **maximize its profit**. **The product**, which is produced by the firm, does not have its **close substitutes**. There are **strong barriers** preventing firms from entering the industry which cannot be usually efficiently overcome. An example of a monopoly in the Czech economic reality is the Czech Post as the only carrier of letter post in the territory of the Czech Republic, energy distribution network of the Czech Republic and operator of the Druzhba pipeline in the territory of the Czech Republic and others.

A natural monopoly is the only manufacturer producing on the supply side for which a descending part of the long-run average cost curve is typical, i.e. the minimum of *LAC* corresponds to higher output then required by the demand. In this case, barriers preventing other firms from entering the industry are given by high production technology as a result of which the natural monopoly has the lowest production

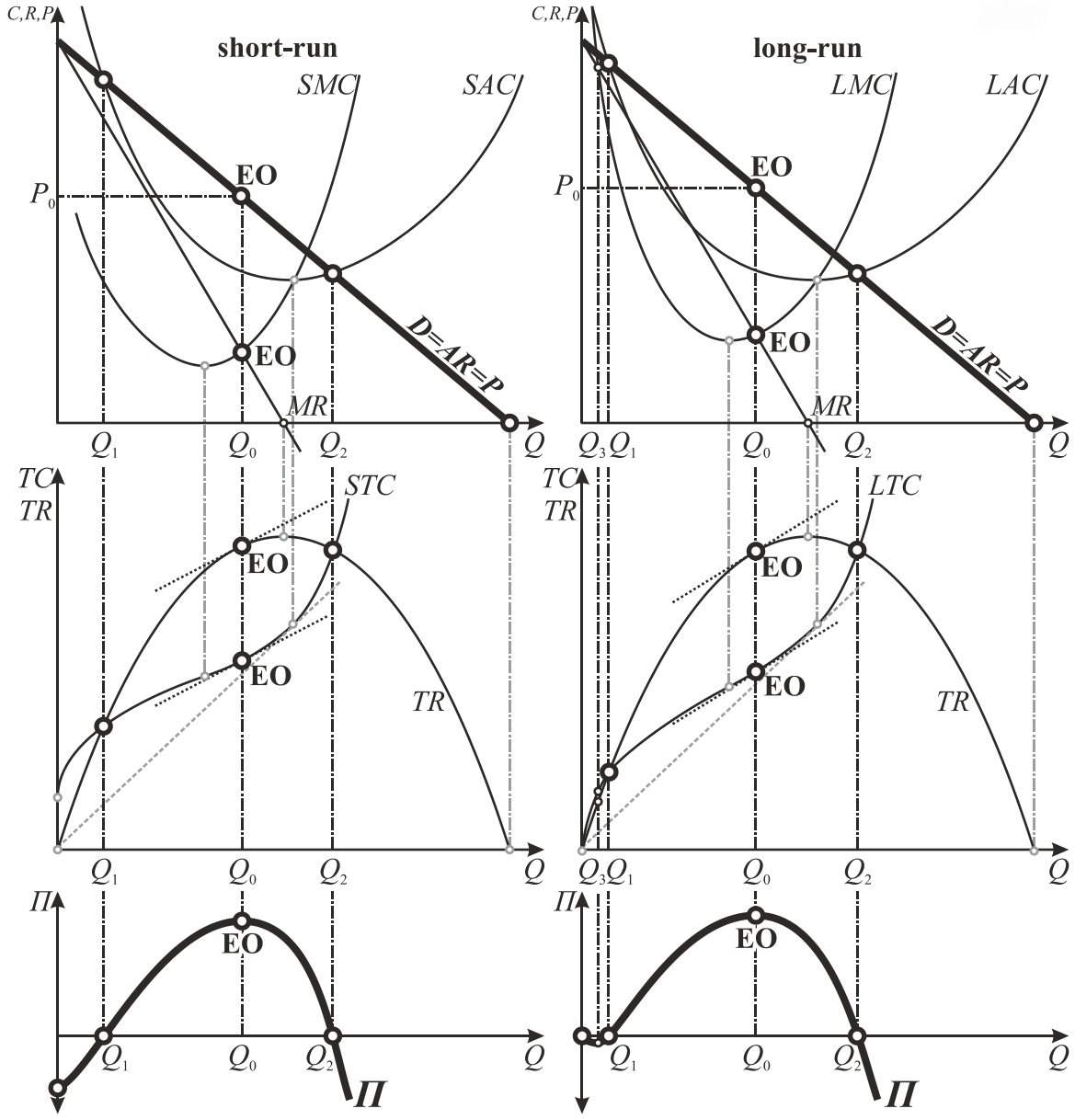
costs. **An administrative monopoly** is the only firm supplying to the market since the minimum *LAC* cannot usually correspond to the smaller output than required by the demand (a comparison can be seen in the graph 3-13). Barriers preventing firms from entering the industry are then of administrative character (the firm owns an exclusive licence, patent, concession and others). A **monopsony** is a type of monopoly acting on the demand side, the most common example is acting of this market structure on the labour market (for details see the page 141).



3-13 Profit maximization of an administrative and natural monopoly

In the neoclassical conception – as above-mentioned – the primary purpose of a monopoly is to maximize economic profit. Conditions of economic profit maximization of a monopoly are formally identical to conditions of economic profit maximization under perfect competition (see the equation (3.5) and (3.6) on the page 70), though, there is a difference in the method of their enforcing.

The monopoly specifies the quantity of output Q_0 based on the equality of marginal cost *MC* and marginal revenue *MR*. Subsequently, it specifies the highest price P_0 which the consumers are willing to pay for the total monopoly quantity Q_0 (so called a monopoly price). As a result of this, the monopoly reaches positive economic profit in the short-run as well as in the long-run (see the graph 3-14).



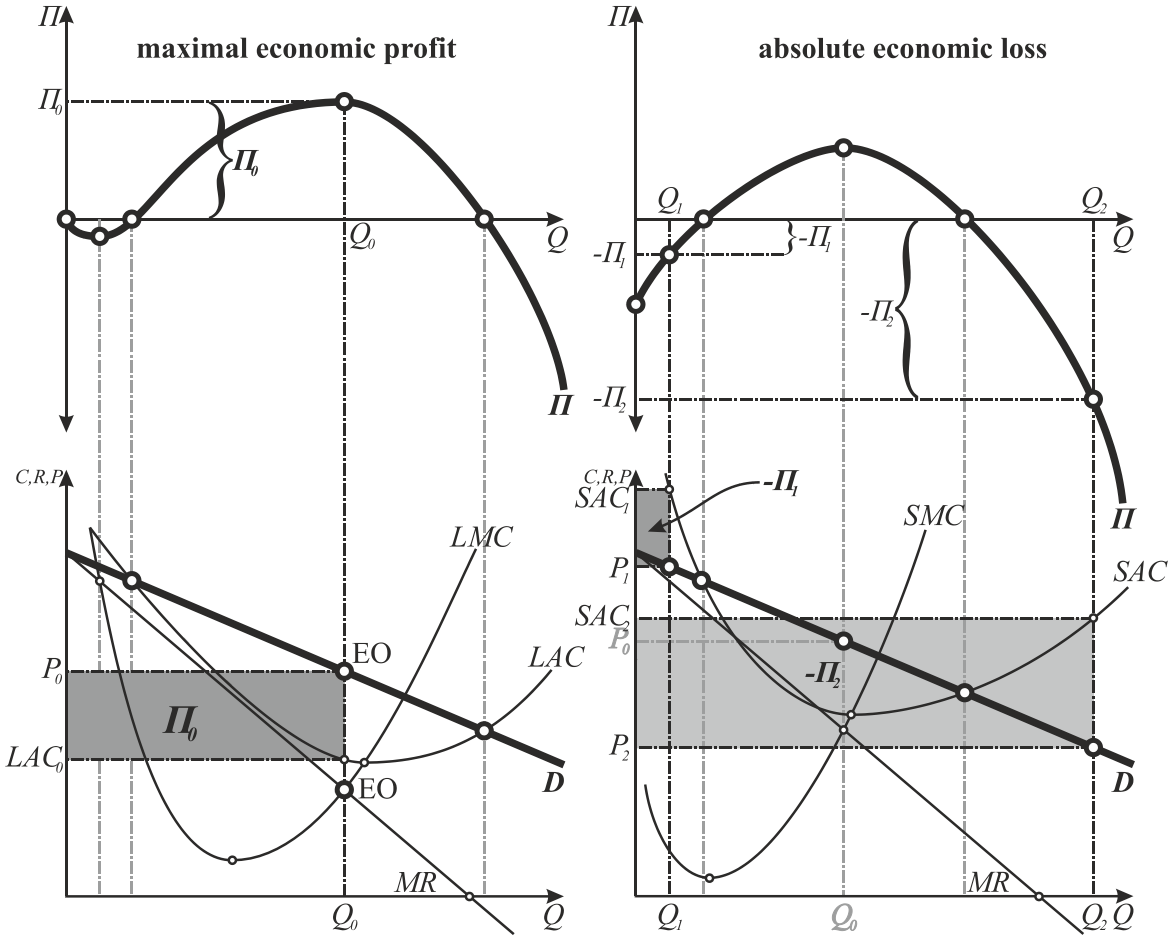
3-14 Monopoly profit maximization in the short-run and the long-run

On the same basis, the administrative monopoly as well as the natural monopoly reach maximum economic profit (a comparison is shown in the graph 3-13). The only substantial difference is the position of the enterprise's technological optimum, i.e. *LAC* minimum (as explained on the page **Chyba! Záložka není definována.**).

3.2.1.1 Choosing a sub-optimal quantity of manufactured output

While the monopoly always reaches the economic maximum in the long run while achieving the maximum economic profit (see the left part of the graph 3-15), in the short run, selecting the monopoly output size can be suboptimal which leads to the implementation of lower levels of economic profit. There is **absolute economic loss** if the monopoly produces an irrationally small (Q_1 in the right part of the graph 3-15) or irrationally large (Q_2 in the right part of the graph 3-15) production quantity for which the average costs SAC exceed the price P_2, which the demand D is willing to accept, in the short run. The absolute loss size is given by:

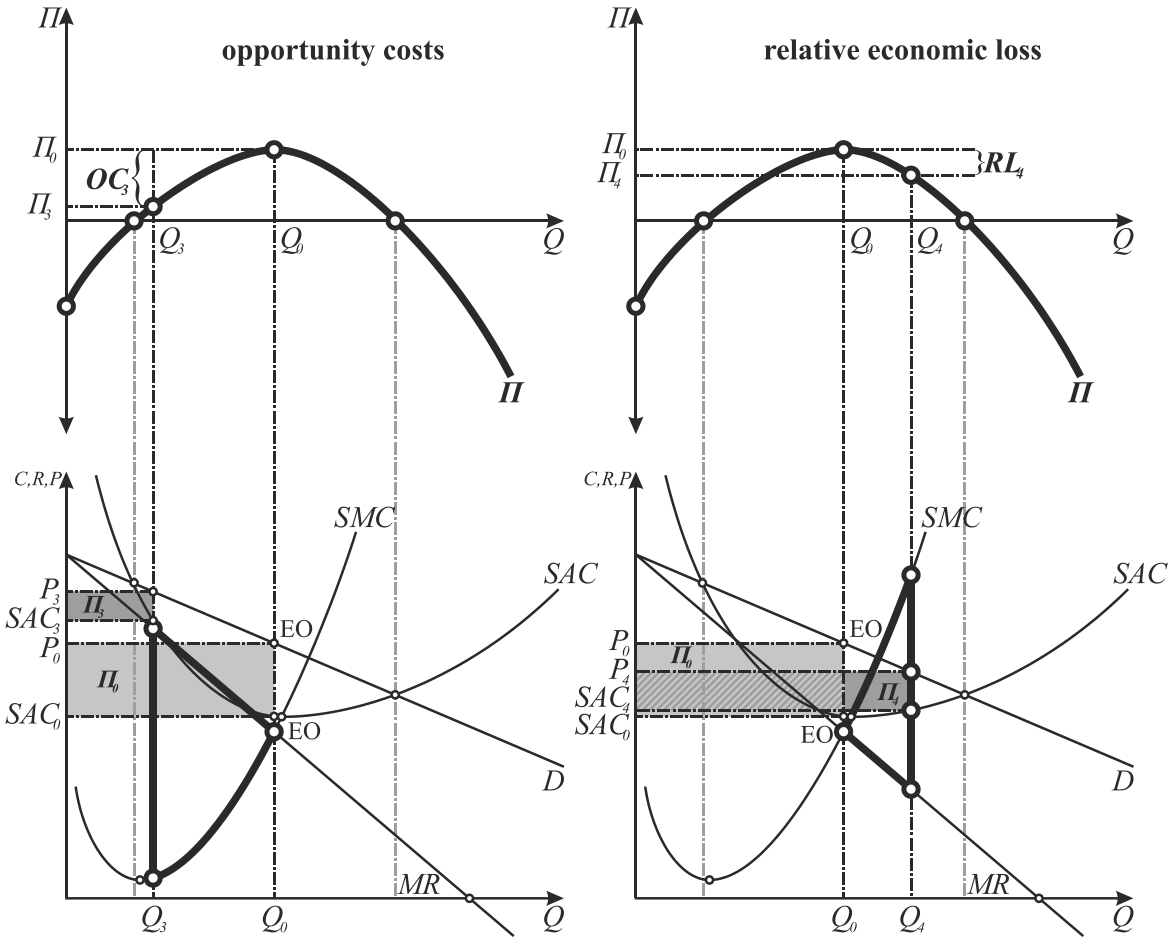
$$\Pi_2 = \left(P_2 - SAC_2\right) \cdot Q_2 \Rightarrow \Pi_2 < 0 \tag{3.11}$$



3-15 Economic profit and absolute economic loss of a monopoly

If the monopoly produces smaller production quantity Q_3 compared to the optimum quantity Q_0 and at the same time, average costs *SAC* for producing the given quantity Q_3 are lower than the maximum price P_3, which the market demand *D* is willing to accept, **opportunity cost** (**OC**) is realized for a short time. It is represented by the difference between the maximum profit Π_0 when producing the optimum quantity Q_0 (sold for P_0) and the profit Π_3 which the monopoly reaches when producing the quantity Q_3, which it offers for the price P_3. The opportunity cost size is determined by the area between the short-run

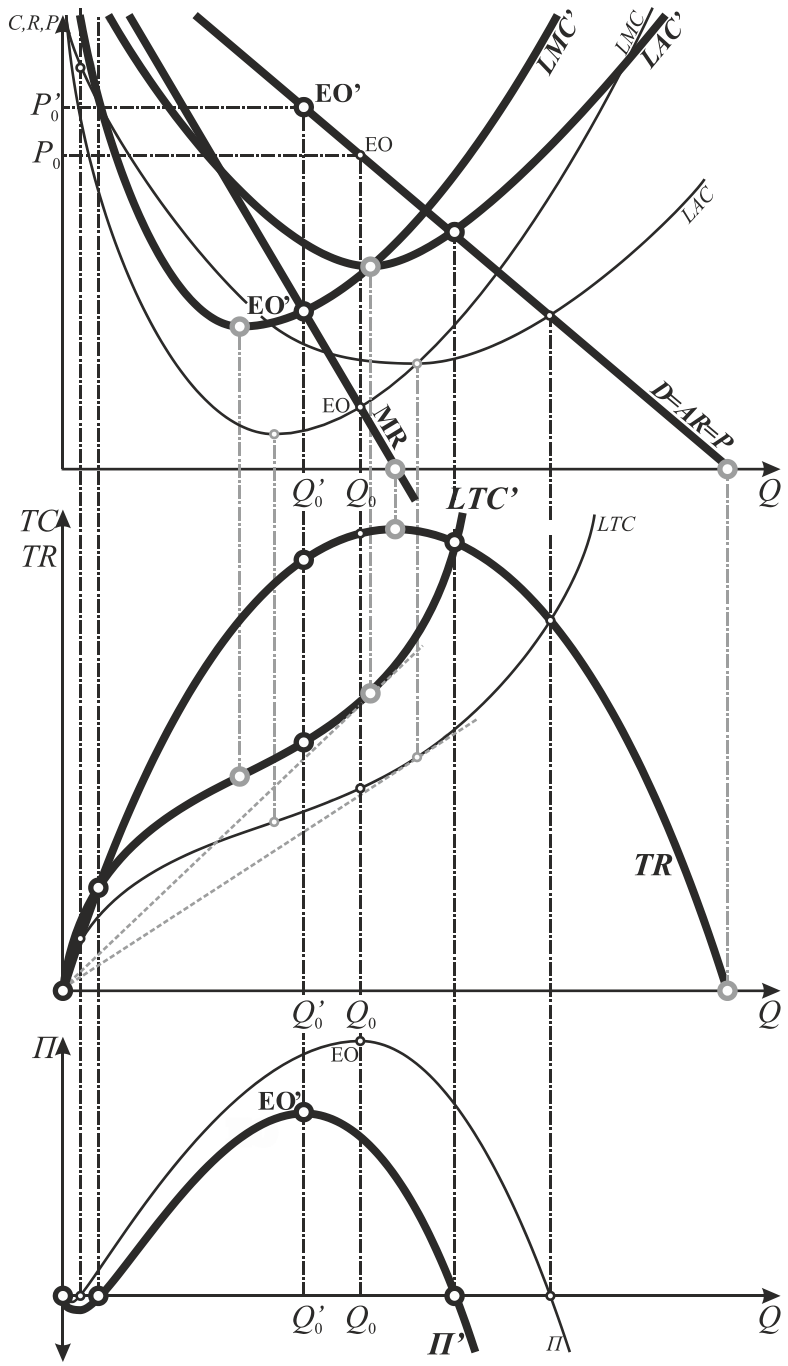
marginal cost and marginal revenue in the interval $\langle Q_3, Q_0 \rangle$ drawn in bold in the graph 3-16 on the left.



3-16 Opportunity costs and relative economic loss of the monopoly

When producing the quantity Q_4, when higher than optimal output quantity Q_0 is produced and at the same time, average costs *SAC* spent on producing the quantity Q_4 given are lower than the price P_4, **relative loss** (**RL**) is realized in the short run. Its size is given by the difference between the maximum profit Π_0 when producing the optimum quantity Q_0 (sold for P_0) and the profit Π_4 which the monopoly reaches when producing the quantity Q_4 sold for the price P_4. The relative loss can be graphically expressed as the area of space between short-run marginal cost and marginal revenue in the interval $\langle Q_0, Q_4 \rangle$ drawn in bold in the graph 3-16 on the right.

Now, let's pay our attention to the impact of the wage rate amount on the output level and on the development of long-run economic profit of a monopoly enterprise. In the case of the monopoly market structure, an **increase in wages** shall result in a change in cost quantities as mentioned in the chapter 2.3.5 on the page 59.



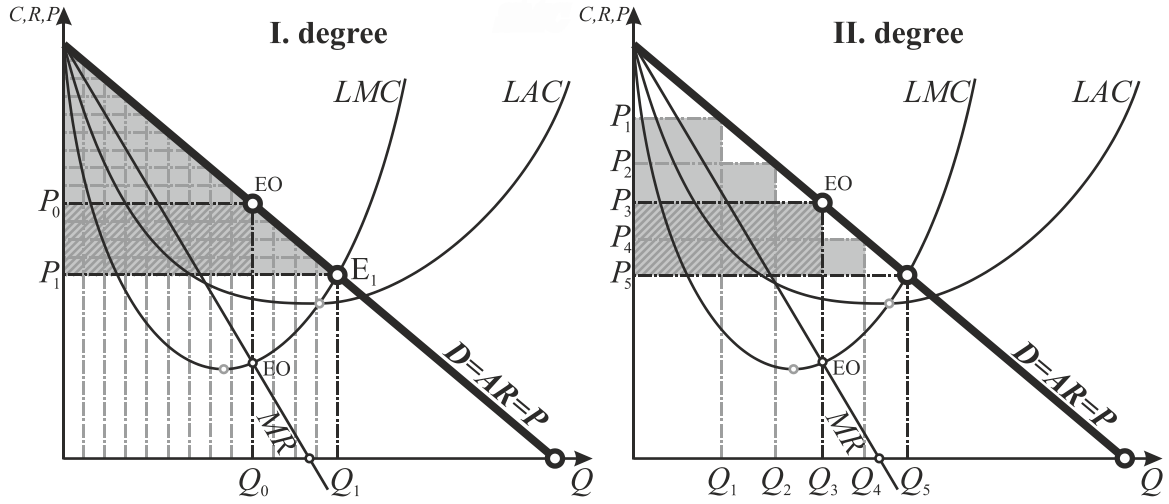
3-17 Impacts of increasing wage rates on the monopoly functioning

With regard to the fact that we suppose *ceteris paribus* that all other variables in economics remain unchanged, there shall be a decrease in the monopoly quantity produced to Q_0' as a result of an increase in wage rates. At higher wage rates, the monopoly shall be motivated to an increase in the price of the final product from P_0 to P_0' associated with a decrease in the total revenue. An increase in the size of total costs and a decrease in the total revenue implemented shall result in decreasing the monopoly profit level.

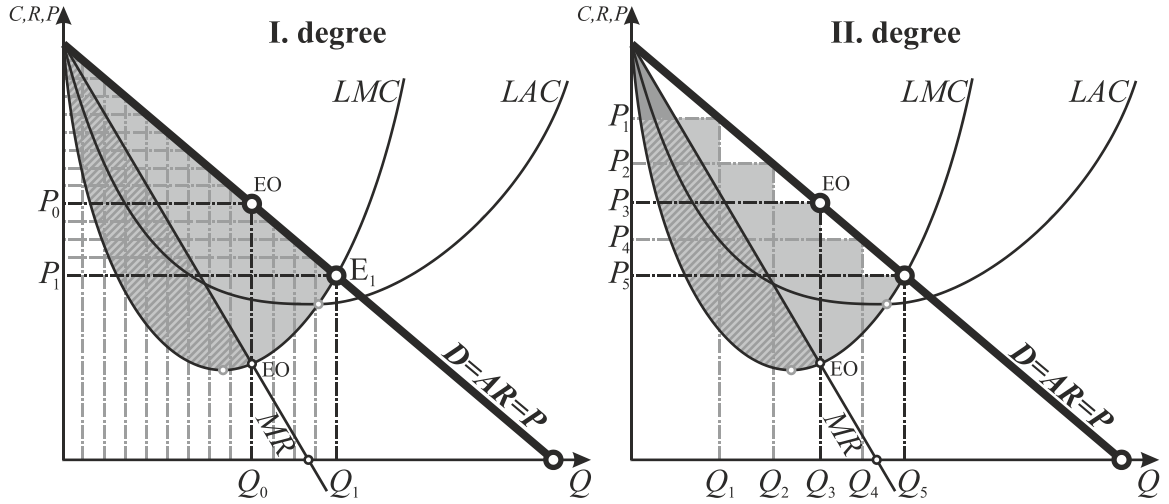
3.2.1.2 Price discrimination

Price discrimination represents a situation when a monopoly firm (or other imperfectly competitive manufacturer) uses its market position and sells various units of its production for various prices.

⇒ For **first-degree price discrimination**, it applies that a monopoly firm shall specify the maximum price for each consumer which they are willing to pay for each unit of production bought. A typical example of application of this type of price discrimination is an auction sale. This degree of price discrimination is sometimes called as perfect price discrimination since the monopoly firm transfers the whole level of its consumer surplus to its economic profit. The size of the monopoly profit without discrimination (area hatched in the graph 3-19 on the left as differences between long-run marginal costs and marginal revenue added together for all units of produced outputs Q_0) shall be increased (on the light-grey area determined by long-run marginal costs and market demand).



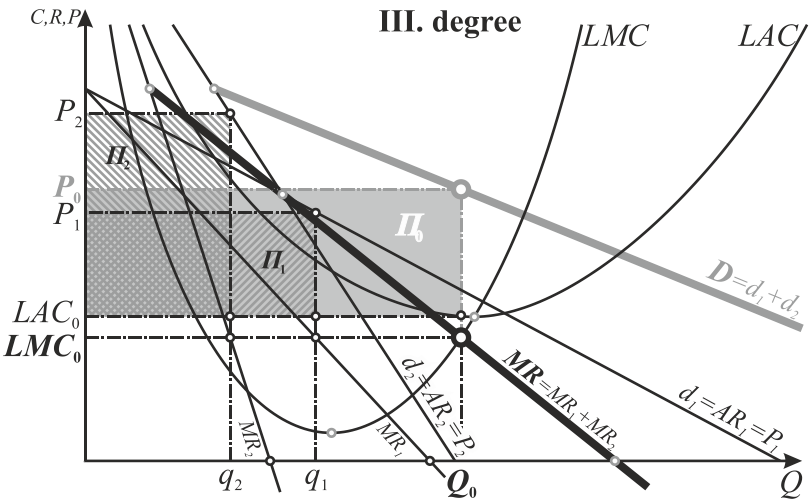
3-18 Consumer surplus at the I. and II. degree price discrimination



3-19 Economic profit of the monopoly at the I. and II. degree price discrimination

⇒ **Second-degree price discrimination** means that a monopoly firm sells individual output levels for various prices but each individual that buys a certain quantity of goods pays the same price. It is the discrimination dependent on the quantity sold. The most common example of this type of discrimination is application of quantity discounts to the output purchase exceeding a certain limit. With the second-degree price discrimination, a monopoly firm can get a part of consumer surplus (however, not the whole consumer surplus as in the case of the first-degree price discrimination). The size of the monopoly profit without discrimination (area hatched in the graph 3-19 on the right as differences between long-run marginal costs and marginal revenue added together for all units of produced output Q_0) shall be increased (on the light-grey area determined by long-run marginal costs and price specified for the accumulated quantity of monopoly production given).

⇒ **Third-degree price discrimination** is present if a monopoly firm sells products to various groups of consumers for various prices while selling all production units to each consumer's group for the same price. A decisive factor for dividing consumers into groups is price elasticity of their demand (or sensitivity of consumers to price changes). Examples are *business class* and *economy class* air tickets and others. In case of the third-degree price discrimination, a monopoly firm initially specifies the optimal total quantity of output Q_0 based on an intersection point of marginal income and marginal cost (marginal income falls twice as fast as the total market demand for monopoly production which is also the horizontal sum of partial demands: more elastic d_1 and less elastic d_2). This total quantity Q_0 sold is subsequently divided by the monopoly between both the markets by means of compensating long-run marginal cost LMC_0 on both markets with marginal revenue. Only for these individual quantities (q_1 and q_2), the monopoly specifies prices: higher prices for consumers with lower elasticity of demand (P_2 for demand d_2) and lower prices for consumers with more elastic demand (P_1 for demand d_1). Thanks to this mechanism, the monopoly firm gets a part of consumer surplus. The size of monopoly profit of the enterprise applying the third-degree price discrimination shall be increased against profit without discrimination ($\Pi_0 < \Pi_1 + \Pi_2$).



3-20 Economic profit of the monopoly at the III. degree price discrimination

3.2.2 Oligopoly market structure

The oligopoly market structure is characterised by the existence of several firms which can **influence product prices** on the market. When deciding on the production volume size and price, they must consider the existence of potential competitors, i.e. firms become **mutually dependent** on each other. The degree of this mutual dependence differs on individual markets and it can depend on the range of product differentiation, amount of barriers preventing the entrance and exit from the industry, concentration rate and on a number of other market characteristics (e.g. a human factor, information channels and others).

Based on the side on which an oligopoly subject operates, we can distinguish between a supply **oligopoly** and a demand **oligopsony**. According to the type of produced product, we can define:

⇒ **homogeneous oligopoly** when firms produce a homogeneous product

⇒ **differentiated oligopoly** when firms offer a differentiated product

The situation when two firms compete on the market is solved by means of **duopoly models** in the economic theory. The duopoly models can be classified according to the relationship between firms, according to the mutual reaction of firms and according to a variable (quantity or price of manufactured output) which they primarily define.

3-1 Duopoly models

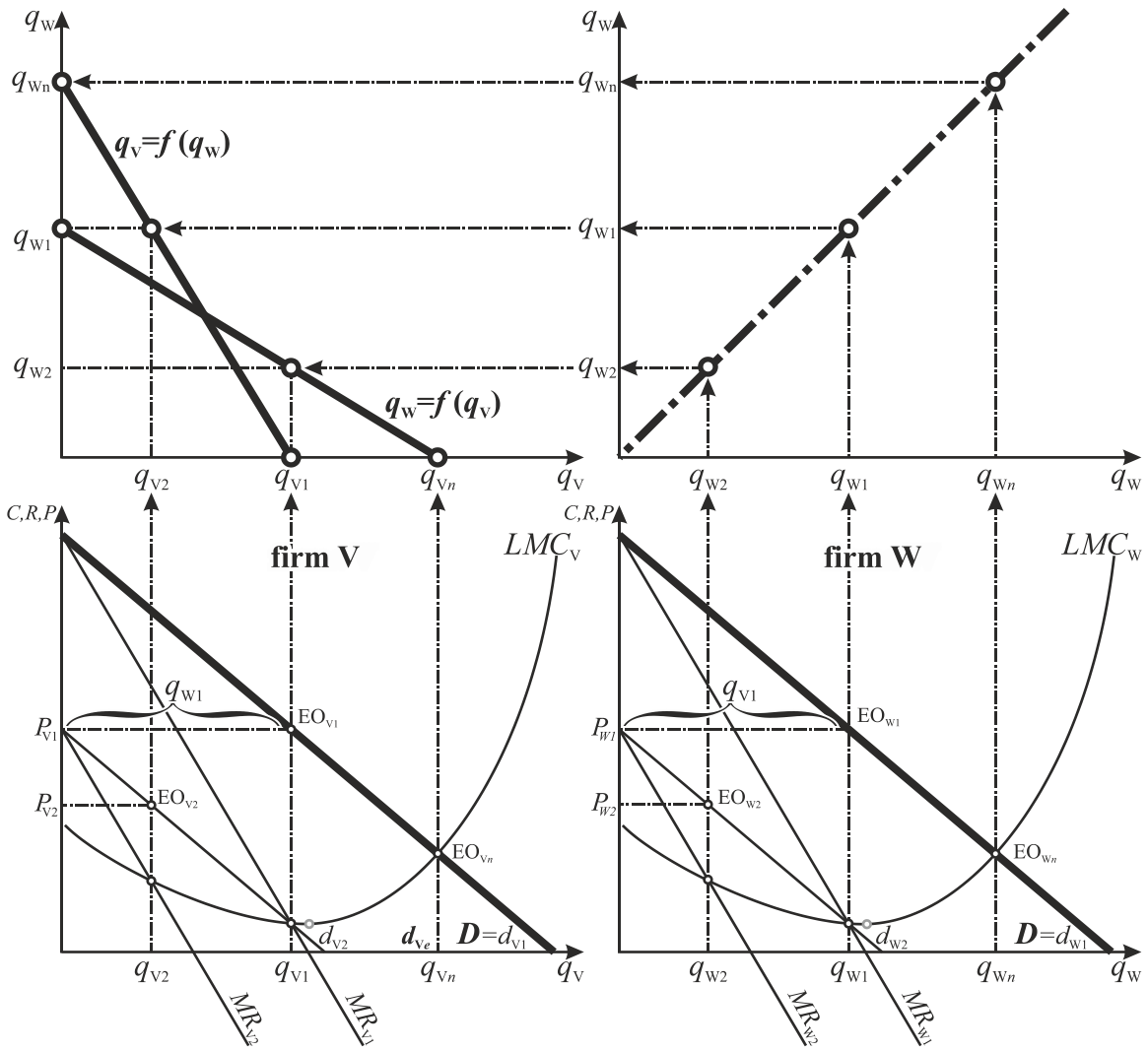
Relationship of firms	Reaction	Optimization	Model	Chapter part

competition	simultaneous	simultaneously Q	Cournot model	3.2.2.1
		simultaneously P	Bertrand model Sweezy model	3.2.2.3 3.2.2.5
	sequential	leader Q	Stackelberg model	3.2.2.2
		leader P	Dominant firm model	3.2.2.6
cooperation	cooperative	collectively Q	Quantitative cartel	3.2.2.4
		collectively P	Price cartel	3.2.2.4

3.2.2.1 Cournot model

The Cournot model deals with output maximization as a starting quantity. Its author, French economist **Augustin Antoine Cournot** (1801-1877), laid the ground of marginal theory of a firm (defined marginal revenue as the first derivative of total revenue, economic monopoly optimum as the equality of marginal revenue and marginal cost and others). The assumptions of the Cournot model applicability include the existence of two firms which produce a homogeneous product, compete with each other and are equally strong which is expressed by means of identical cost functions. Both the firms know the market demand curve. When deciding on the output size, each of the firms considers the **production quantity of its competitor as constant** and invariable. From this point of view, the Cournot model is static. As an example of the Cournot model, we can consider e.g. opening of the second multiplex in Liberec.

To specify prices and produced quantities of individual firms, so called **reaction curves** must be defined. The reaction curves (reaction functions) express an impact of a change in the production of the firm V on the quantity produced by the firm W and vice versa. The reaction curve then defines output of the first firm as the function of output of the other firm: $q_V = f(q_W)$ a $q_W = f(q_V)$. Each point on the reaction curve of the firm V determines the production volume which maximizes economic profit of this firm under the production volume of the firm W given.



3-21 Derivation of reaction curves of duopoly firms

Extreme points of reaction curves on axes represent a situation when there is only one of firms on the market:

- ⇒ the point q_{V1} is the quantity of manufactured output of the firm V on the market if the produced quantity of the rival firm W is zero
- ⇒ on the contrary, the point q_{Wn} is the situation when the whole market is occupied by the firm W and there is no market share left for the firm V (it is a hypothetical situation in which the firm W would produce output in the volume of products of perfect competition)
- ⇒ on the line between those two extreme points, there are all potential reactions of the firm V to various produced quantities of the firm W. Symmetrically, the reaction curve of the other firm is created since in the Cournot model, it is not decisive what firm shall enter the market as first.

The reaction curves can be analytically derived so that we come out of the assumption of the linear

market demand function given by the equation (3.12):

$$P = a - b \cdot Q, \text{ where } Q = q_V + q_W \tag{3.12}$$

The profit functions of both the duopoly firms considered can then be written as:

$$\begin{aligned} \Pi_V &= f(q_V, q_W) = P \cdot q_V - LAC_V \cdot q_V = [a - b \cdot (q_V + q_W) - LAC_V] \cdot q_V \\ \Pi_W &= f(q_V, q_W) = P \cdot q_W - LAC_W \cdot q_W = [a - b \cdot (q_V + q_W) - LAC_W] \cdot q_W \end{aligned} \tag{3.13}$$

According to the equation (3.5), the condition of economic profit maximization is the equality of the first partial derivative of the profit function according to the quantity to zero:

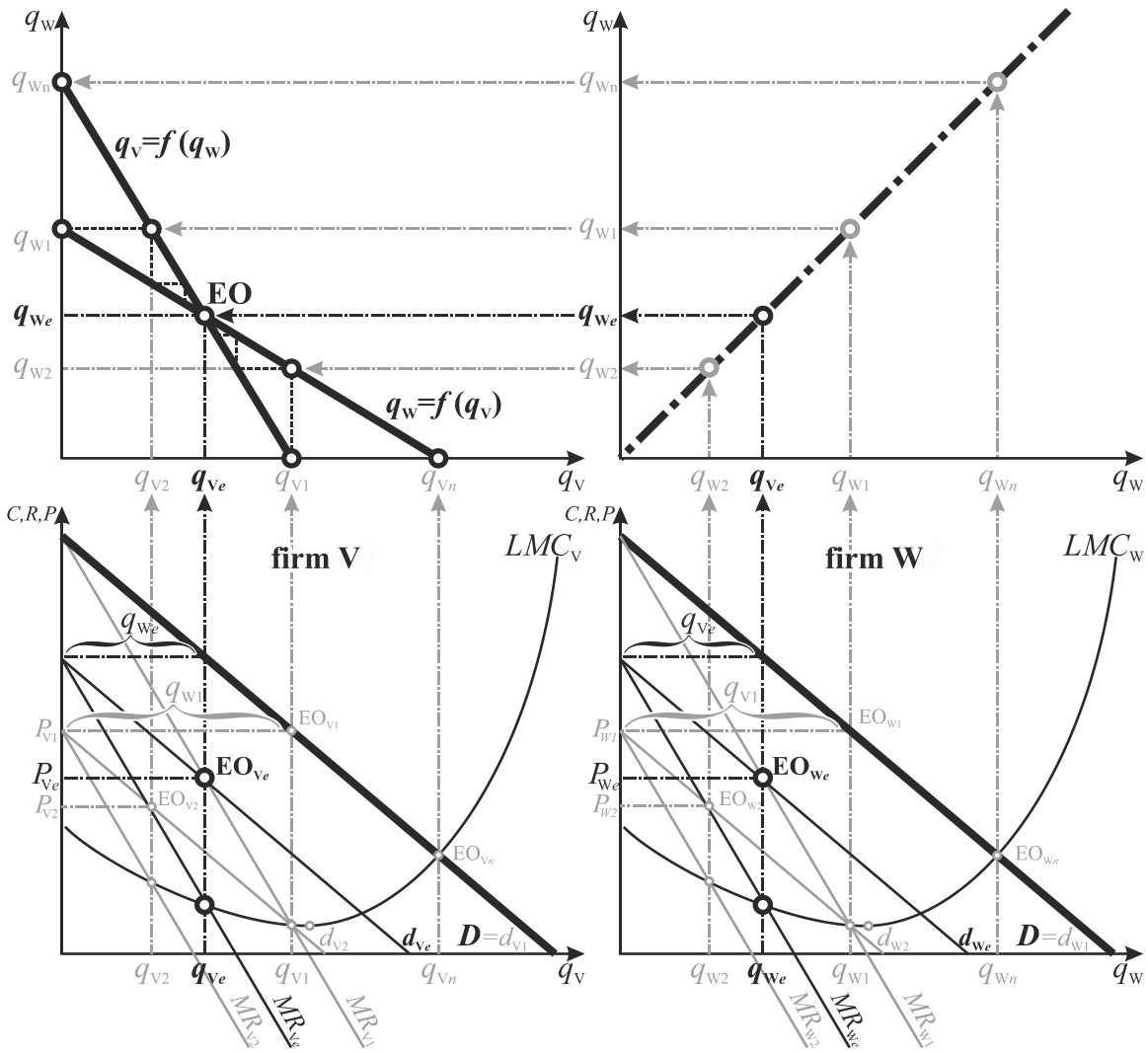
$$\begin{aligned} \frac{\partial \Pi_V}{\partial q_V} &= a - 2b \cdot q_V - b \cdot q_W - LAC_V = 0 \Rightarrow q_V = \frac{a - LAC_V}{2b} - \frac{q_W}{2} \\ \frac{\partial \Pi_W}{\partial q_W} &= a - 2b \cdot q_W - b \cdot q_V - LAC_W = 0 \Rightarrow q_W = \frac{a - LAC_W}{2b} - \frac{q_V}{2} \end{aligned} \tag{3.14}$$

The function q_V, which we have got from the partial derivative, follows the condition of dependence of the produced quantity of the firm V on the volume of the production of the firm W while maximizing the profit of the firm V and can be considered as the reaction curve of the firm V. The same conclusion is analogously applied to q_W. The Cournot model reaches the equilibrium in the intersection point of the reaction curves of both the firms, thus, the produced quantity of the firm V can be derived:

$$\begin{aligned} q_V &= \frac{a - LAC_V}{2b} - \frac{1}{2} \cdot \left(\frac{a - LAC_W}{2b} - \frac{q_V}{2} \right) \Rightarrow q_{Ve} = \frac{a - 2 \cdot LAC_V - LAC_W}{3b} \\ q_W &= \frac{a - LAC_W}{2b} - \frac{1}{2} \cdot \left(\frac{a - LAC_V}{2b} - \frac{q_W}{2} \right) \Rightarrow q_{We} = \frac{a - LAC_V - 2 \cdot LAC_W}{3b} \end{aligned} \tag{3.15}$$

Provided that both the firms in the Cournot duopoly have absolutely identical cost functions, both the firms shall produce the same quantity. By inserting into the market demand function, we then get the production price in the Cournot model which is common for both the firms.

$$P_e = a - b \cdot (q_V + q_W) = \frac{a + LAC_V + LAC_W}{3} \tag{3.16}$$



3-22Cournot's duopoly model

Seeking the Cournot duopoly equilibrium can be graphically shown by means of dashed lines in the left upper part of the graph 3-22. If the firm V is the first to enter the market, we shall come out of the intersection point of its reaction curve with the horizontal axis. The firm V shall realize the output q_{V1} to which the firm W shall react according to its reaction curve of production q_{W2}. The firm V does not control the whole market any more (the firm W satisfied q_{W2} of customers), therefore, it must decrease its output along its reaction curve q_V. The lower output of the enterprise V enables the competitor W to increase the volume of its production according to the reaction curve q_W… This process proceeds until both the producers reach the equilibrium output at the point EO.

The Courtnot equilibrium occurs after a series of actions and reactions of the firms when at the given production volumes of individual firms, none of these firms can increase its profit by changing the production volume, i.e. both the firms maximize their profits and none of them is motivated to changing the output. The Cournot equilibrium occurs at the point [q_{Ve}, q_{We}], i.e. at the intersection point of reaction curves. It is stable equilibrium at a lower price than it would be in the monopoly, however, on the other

hand, higher than the one which would stabilize in a perfectly competitive environment.

3.2.2.2 Stackelberg model

The Stackelberg model adopts the assumptions of the Cournot model and incorporates estimated reactions of competitors into it. The model was created by **Heinrich Freiherr von Stackelberg** (1905-1946), German economist, who constructed a model of a leading firm within exploring theories of games (see the chapter 3.3.3 on the page 114) and market structures. In the given model, two firms produce a homogeneous product, they mutually compete on the market but there is information asymmetry. One firm (**active, leading**, firm V) knows how the other firm (**passive, follower,** firm W) shall react to its changes in the output volume and price. The other firm (follower) further considers the existing price and output volume of the leading firm as constant and invariable factors. The leading firm then realizes an advantage in the form of higher profit. An example from the Czech Republic can be the milk market occupied by large-scale producers whose output is only completed by small private agriculturists.

If we come out of the economic profit function of the firm V – equation (3.13) – and from the formulation of the reaction curve of the firm W – equation (3.14) – we can write the profit function of the firm V as:

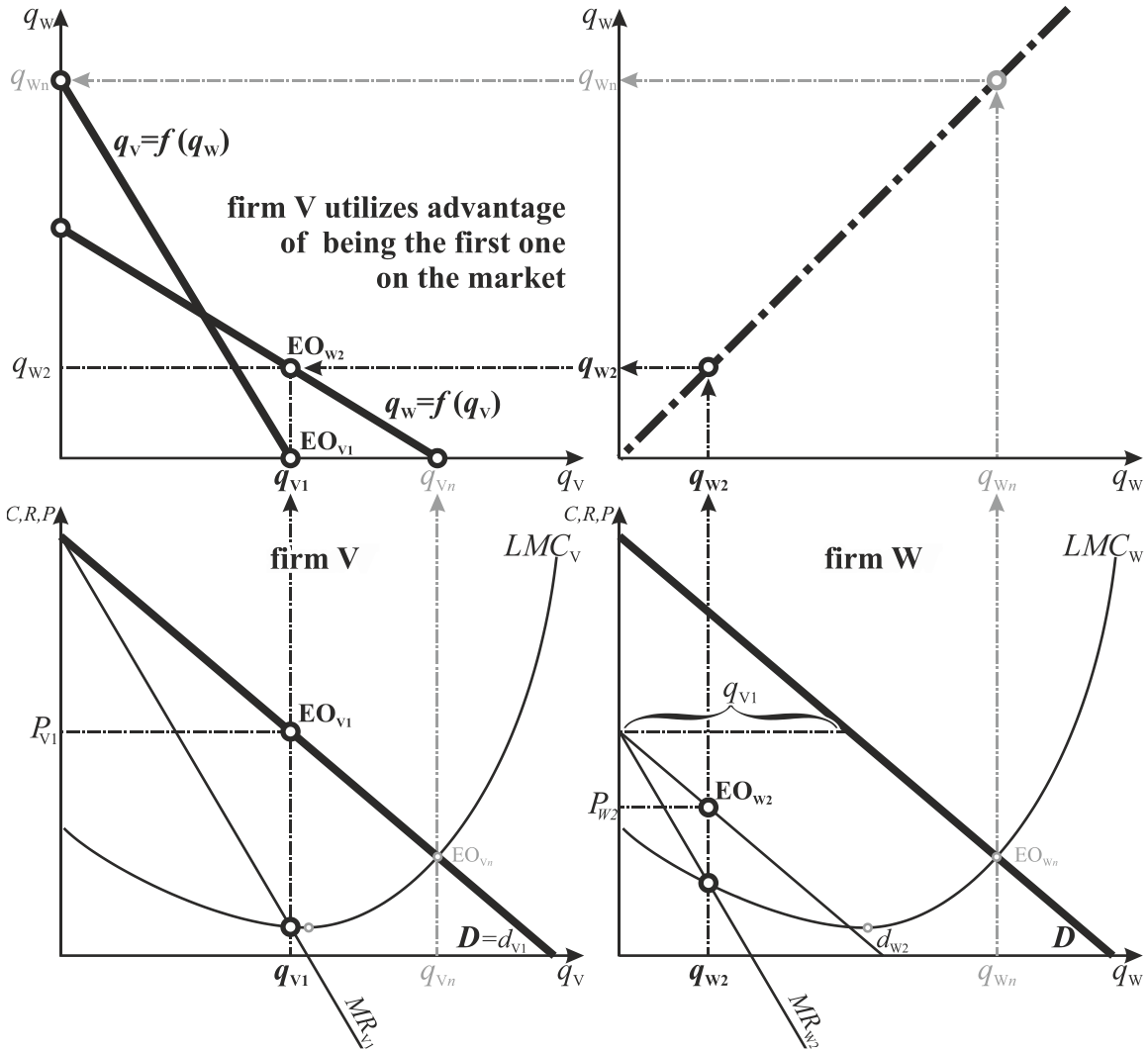
$$\begin{aligned} \Pi_V &= [a - b \cdot (q_V + q_W) - LAC_V] \cdot q_V \\ \Pi_V &= \left\{ a - b \cdot \left[q_V + \left(\frac{a - LAC_W}{2b} - \frac{q_V}{2} \right) \right] - LAC_V \right\} \cdot q_V \\ \Pi_V &= \frac{a \cdot q_V}{2} - \frac{b \cdot q_V^2}{2} + \frac{LAC_W \cdot q_V}{2} - LAC_V \cdot q_V \end{aligned} \tag{3.17}$$

The firm V behaves as a leading firm when specifying the quantity and prices of its production while trying to maximize its profit [q_{V1}, P_{V1}]. The leading firm again looks for the output q_{V1} at which the partial derivative of the profit function shall be equal to zero:

$$\frac{\partial \Pi_V}{\partial q_V} = \frac{a}{2} - b \cdot q_V + \frac{LAC_W}{2} - LAC_V = 0 \Rightarrow q_{V1} = \frac{a - 2 \cdot LAC_V + LAC_W}{2b} \tag{3.18}$$

The firm W is a passive follower (accepts the production size of the firm V) and determines its optimum q_{W2} at the price P_{W2} based on the course of its reaction curve:

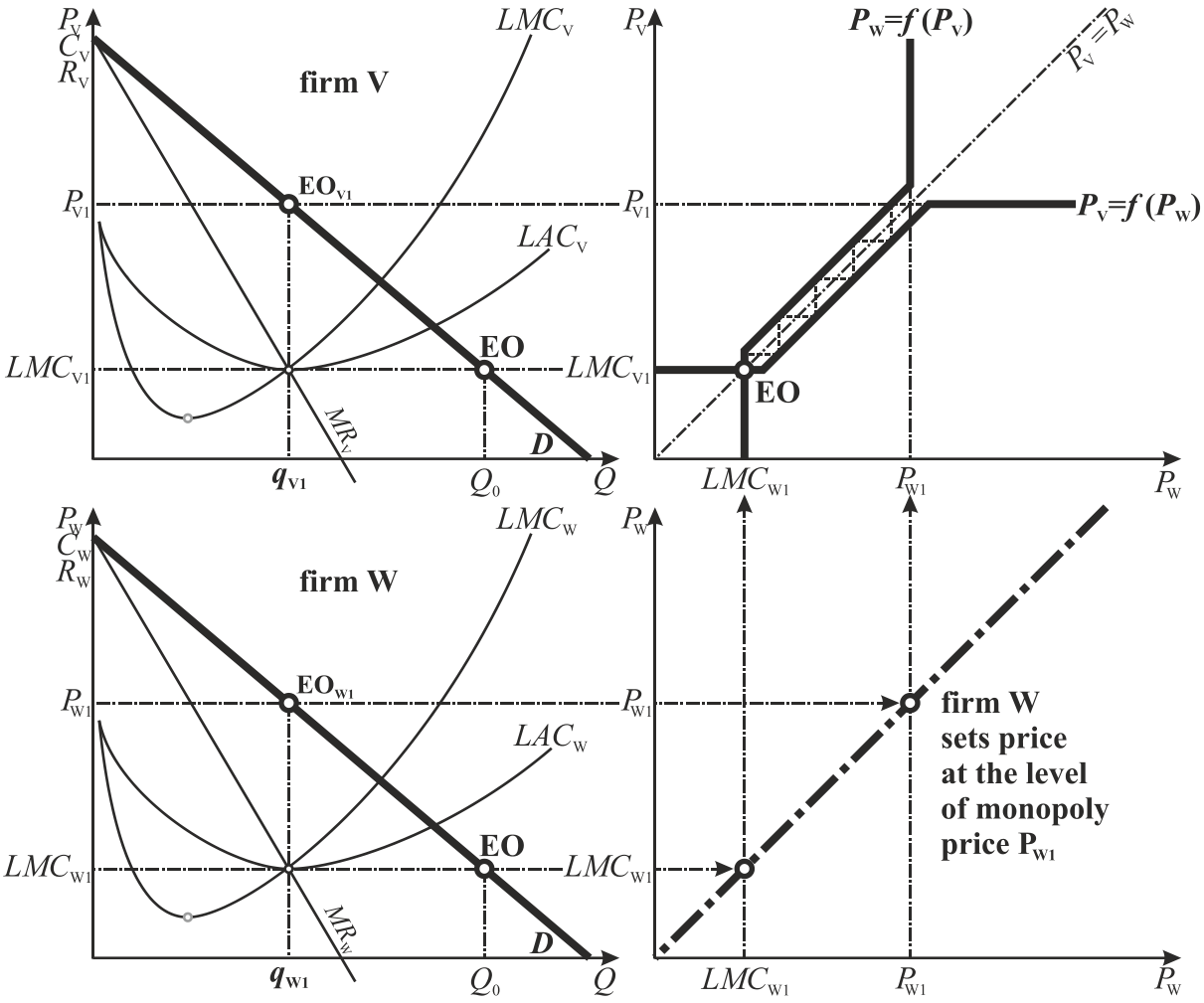
$$\begin{aligned} q_W &= \frac{a - LAC_W}{2b} - \frac{q_V}{2} \Rightarrow q_W = \frac{a - LAC_W}{2b} - \frac{1}{2} \cdot \frac{a - 2 \cdot LAC_V + LAC_W}{4b} \Rightarrow \\ &\Rightarrow q_{W2} = \frac{a + 2 \cdot LAC_V - 3 \cdot LAC_W}{4b} \end{aligned} \tag{3.19}$$



3-23 Stackelberg's model of duopoly

3.2.2.3 Bertrand model

The Bertrand model comes out of the existence of two firms on the market which produce a homogeneous product and mutually compete on the market (e.g. ordinary bakery suppliers supplying into supermarket chains). The firms determine prices of their production concurrently and independently and consider the prices of their competitors as given and invariable. The firms on the market are of the same size which is reflected by identical cost functions. The Bertrand model was created by **Joseph Louis François Bertrand**, French mathematician (1822-1900), who worked in the area of the number, probability and economy theory. The model was created as a critical reaction to the Cournot model. Bertrand argued that the Cournot model must be modified since in his opinion, firms usually choose prices of their outputs first (not their volumes). It means that when deciding on prices of output units, each of firms comes out of the assumption that the competition shall leave its prices unchanged. In this relation, the Bertrand reaction curve shows how the firm should optimally react to price changes of its competitors in order to maximize its profit.



3-24 Bertrand duopoly model

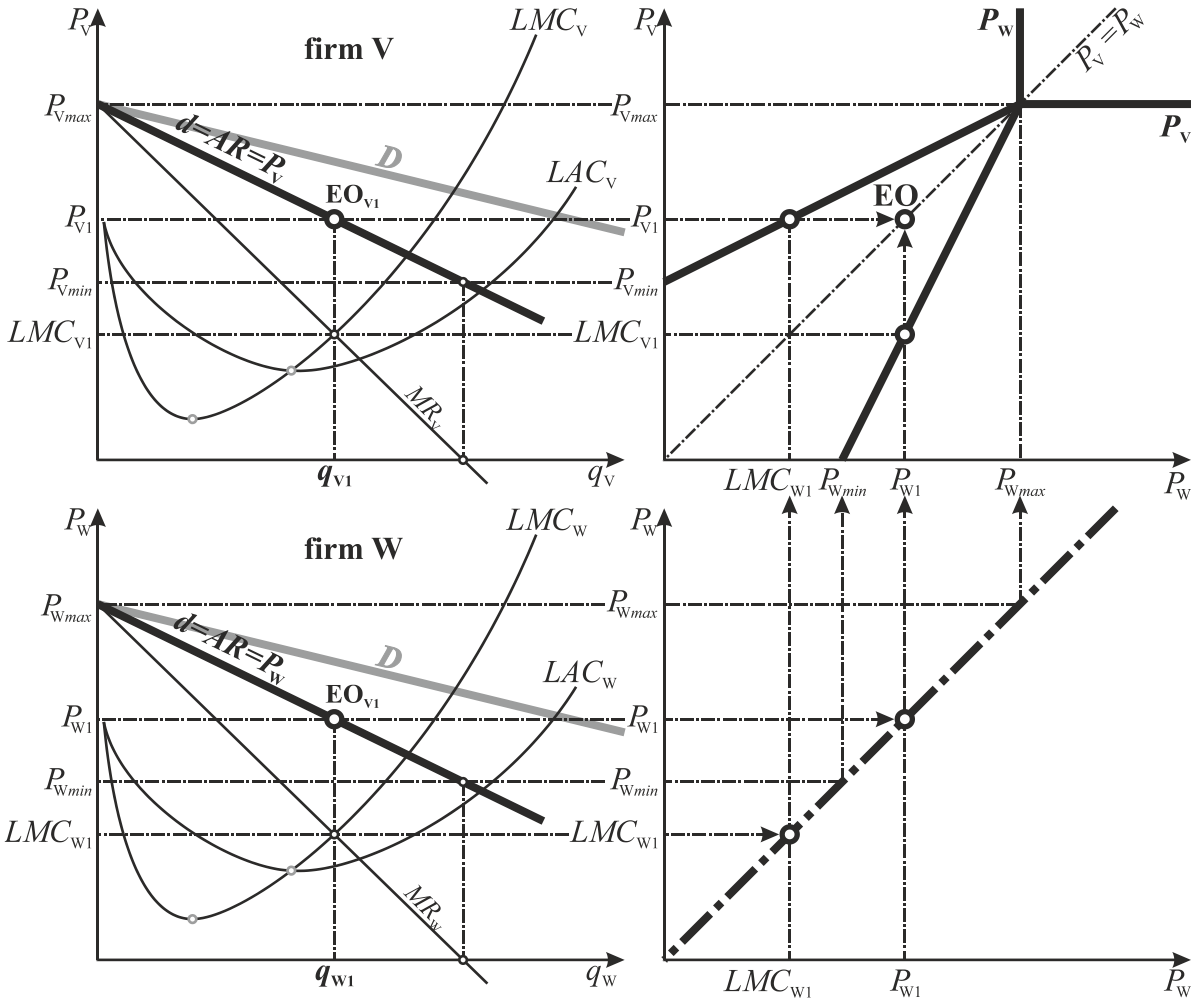
To present the Bertrand duopoly model, it is possible to consider that the firm W chooses its profit-maximizing price at the level of monopoly price. When the firm V enters the market, it expects that the firm W shall change its price. Therefore, it shall decrease its price a bit and wins the whole market on its side. In the following period, the firm W reacts by decreasing its prices below the price level of the firm V and expects that the firm V shall change its price and thus, the firm W wins the whole market back. The firm V reacts in the similar way and the price war shall continue up to the level of competitive prices, i.e. the level of marginal costs. Economic profit of firms in the Bertrand model is zero at the point EO.

3.2.2.4 Cartel

A cartel is explicit collusion of firms in the market environment of oligopoly. It is an agreement between firms which can be of formal or informal character and whose objective and purpose is to determine prices, total production volumes in the industry, market shares or profit distribution. The cartel represents the oligopoly market structure with two enterprises (in practice, it is often substantially more firms) which enter into **non-public agreements**. Cartel agreements fall within illegal behaviour of firms

and if the existence of a cartel agreement is proven, it is considered a crime which is sanctioned.

A price cartel is based on the assumptions of the Bertrand model (two mutually competing, equally strong firms producing a homogeneous product) but moreover, it considers the possibility that both the producers undertake in the cartel agreement not to sell their output for lower than agreed cartel prices.



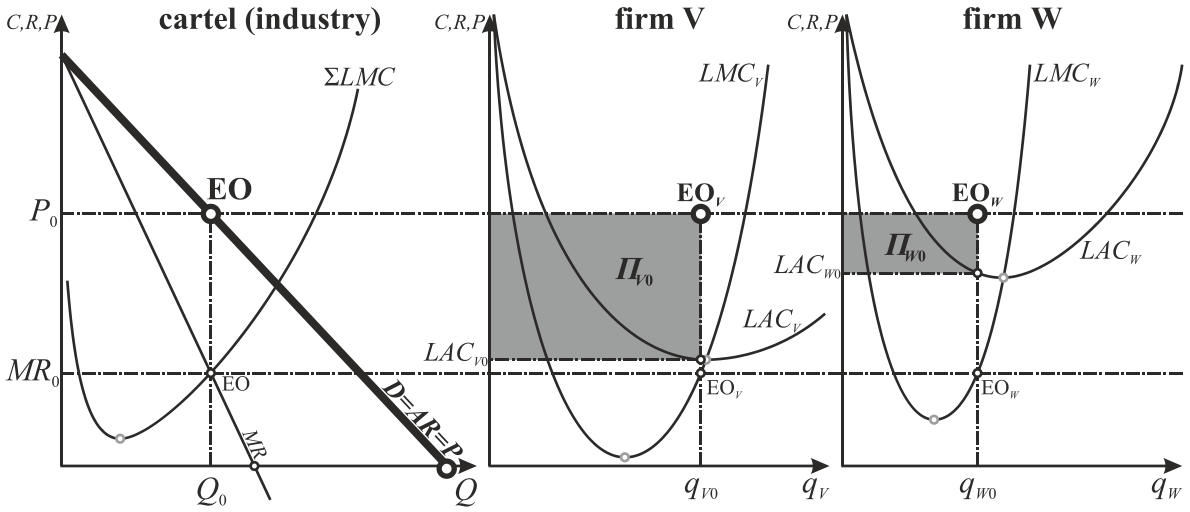
3-1 Collusive oligopoly – price cartel

In the graph 3-25, the interval within which the collusive cartel price can move is bordered by the prices P_{max} and P_{min} for both the firms (V and W) joint in the cartel. The limit P_{min} comes out of a simple consideration that none of imperfectly competitive firms shall be willing to accept the price in the non-elastic part of demand under the condition of profit maximization since marginal revenue of the enterprise would be negative at this price level.

Under the assumption of identically strong firms (i.e. with the same cost curves), the price of the price cartel shall correspond to the monopoly price, the market demand D shall be evenly divided between both (all) members of the cartel agreement, all firms in the price cartel maximize their economic profit on their partial markets and produce practically identical output quantities (q_{V1} and q_{W2}). In the recent

Czech and European economic history, there is a number of examples of price cartels, e. g. cartels of petrol stations in the northern Bohemia in the 1990's, a cartel of sixteen producers of bathroom accessories operating from 1992 to 2004, or a cartel of eleven airlines in the freight transport disclosed in 2010.

A quantitative cartel represents a very similar type of oligopoly collusion. Enterprises also produce a homogeneous output but their market power (as well as their costs) can be different. The firms conclude an agreement on the total quantity produced Q_0 which they determine in order to **maximize their common economic profit**.



3-25 Collusive oligopoly – quantitative cartel

The quantitative cartel proceeds practically in the same way as the monopoly which maximizes profit. Marginal costs of the cartel are the horizontal sum of firm's costs ($\Sigma LMC = LMC_V + LMC_W$). The demand D is market demand, marginal revenue of the cartel falls twice as fast as demand. At the point EO, the cartel maximizes economic profit, and outputs of the whole cartel are divided among the firms joint by a cartel agreement based on compensating marginal revenue MR_0 with marginal costs of individual firms (LMC_V or LMC_W). Economic profit of the cartel can be written as:

$$\Pi = \Pi_V + \Pi_W = P \cdot (q_V + q_W) - LAC_V \cdot q_V - LAC_W \cdot q_W \qquad (3.20)$$

The firms shall sell the produced quantity q_{V0} and q_{W0} ($q_{V0} + q_{W0} = Q_0$) for the price P_0 and realize firm's economic profits Π_{V0} and Π_{W0}.

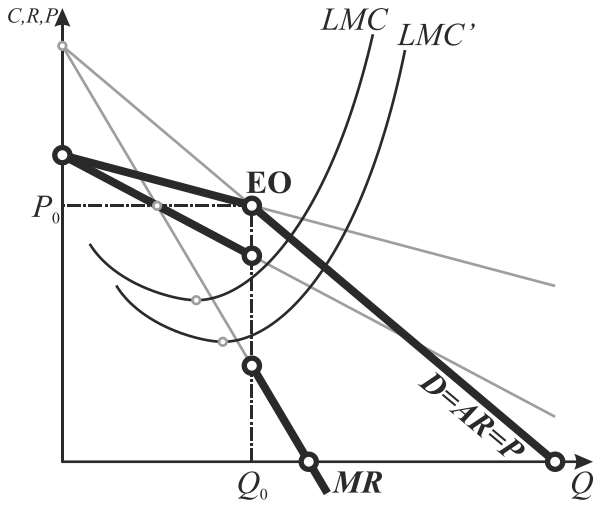
Though, the situation in the graph 3-26 is not stable since the firms joint in the quantitative cartel produce outputs (q_{V0} or q_{W0}) in the interval where their marginal costs are lower than the specified cartel price P_0. By not observing the quantitative quota agreed and by increasing the produced quantity (above q_{V0} or q_{W0}), individual firms can reach higher economic profit in the short run, however, they cause

a collapse of the cartel agreement as well since the higher volume of output than Q_0 is not saleable for the price P_0 on the market. E. g. market-sharing agreements and others can be included in quantitative cartels.

3.2.2.5 Sweezy's kinked-demand curve model

The kinked-demand curve model deals with the analysis of price non-flexibility of firms on the market. The kinked-demand curve theory of oligopoly was created by **Paul Marlor Sweezy** (1910-2004). It explains why oligopoly prices tend to be more stable compared to prices in other market structures. In the Sweezy model, each firm supposes while determining the level of production and price that when it decreases prices of its production, other firms shall follow by decreasing their own prices. When the firm increases prices of its production, it shall not be followed by other firms. The kinked-demand curve consists of the part which expresses the absence of competitors' reaction to the price increase (for the quantity lower than Q_0) and from the part which expresses competitors' reaction to the decrease in the production price (for the quantity higher than Q_0). A typical example of the Sweezy's model is behaviour of supermarkets while specifying prices of basic foodstuff (typically bakery, milk products and others).

For the case of the kinked-demand curve, the **marginal revenue curve is not continuous**. Therefore, the firm can get into a situation when the optimum quantity of production cannot be specified based on the concurrence of *LMC* and *MR* in pursuit of maximizing economic profit. In these cases, Q_0 is the optimum quantity of production and P_0 is the optimum price which corresponds to the deflection point of the demand curve EO. The Sweezy's kinked-demand curve model clarifies price rigidity following a change in cost curves (movement of *LMC* to *LMC'*) even in the case of changing demand curves if the deflection point remains at the same price level.

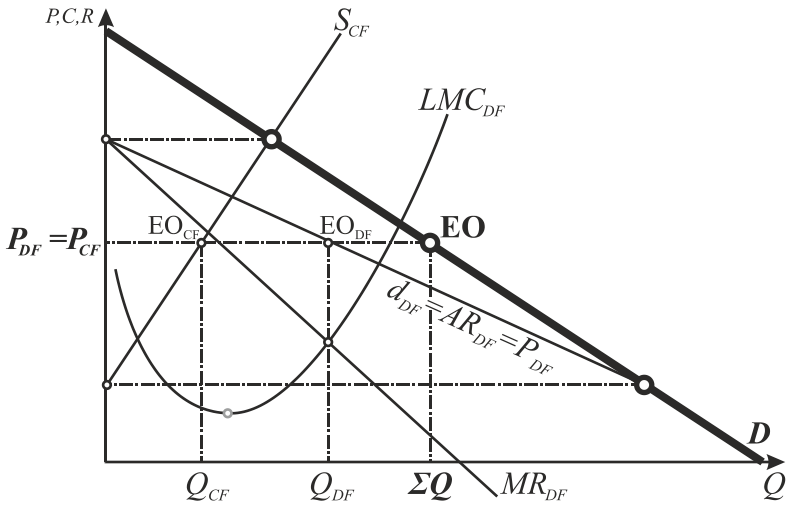


3-26Oligopoly with the kinked-demand curve

3.2.2.6 Dominant firm oligopoly

A dominant firm oligopoly (**DF**) or price leader oligopoly describes a situation when there is one

dominant firm, which determines the volume of production Q_{DF} and price of production P_{DF} with the purpose to maximize its profit, as well as a numerous number of small firms on the so called competitive fringe (**CF**), which accept the determined price of production, on the market. When specifying the price, the dominant firm must consider probable supply of the competitive fringe S_{CF}. **Residual demand for the dominant firm production d_{DF}** is the horizontal difference between the market demand D and supply of firms of the competitive fringe S_{CF} at individual price levels.



3-27 Price-leadership oligopoly

The dominant firm maximizing its profit specifies the size of produced quantity at the level Q_{DF} and price of production in the amount P_{DF}. The firms of the competitive fringe accept the price of production specified by the dominant firm $P_{CF} = P_{DF}$ and they complete the quantity produced by the dominant firm Q_{DF} with their own production Q_{CF} up to the size of market demand $\Sigma Q = Q_{DF} + Q_{CF}$.

In the Czech Republic, e. g. the market of companies delivering package shipments, services of so called ground telephony services (fixed telephone lines) and others can be included in classical examples of the dominant firm oligopoly.

3.2.3 Monopolistic competition

Monopolistic competition is a type of imperfect competition when there is a **huge number of producers** whose activities are dependent on other firms on the market. An essential feature of monopolistic competition is **product differentiation** which can consist e. g. in the position of a firm (a competitive advantage in the form of locality), higher prices, product quality, related services, marketing communication (a competitive advantage of a well-established brand) and others whereas products of the firm are close substitutes.

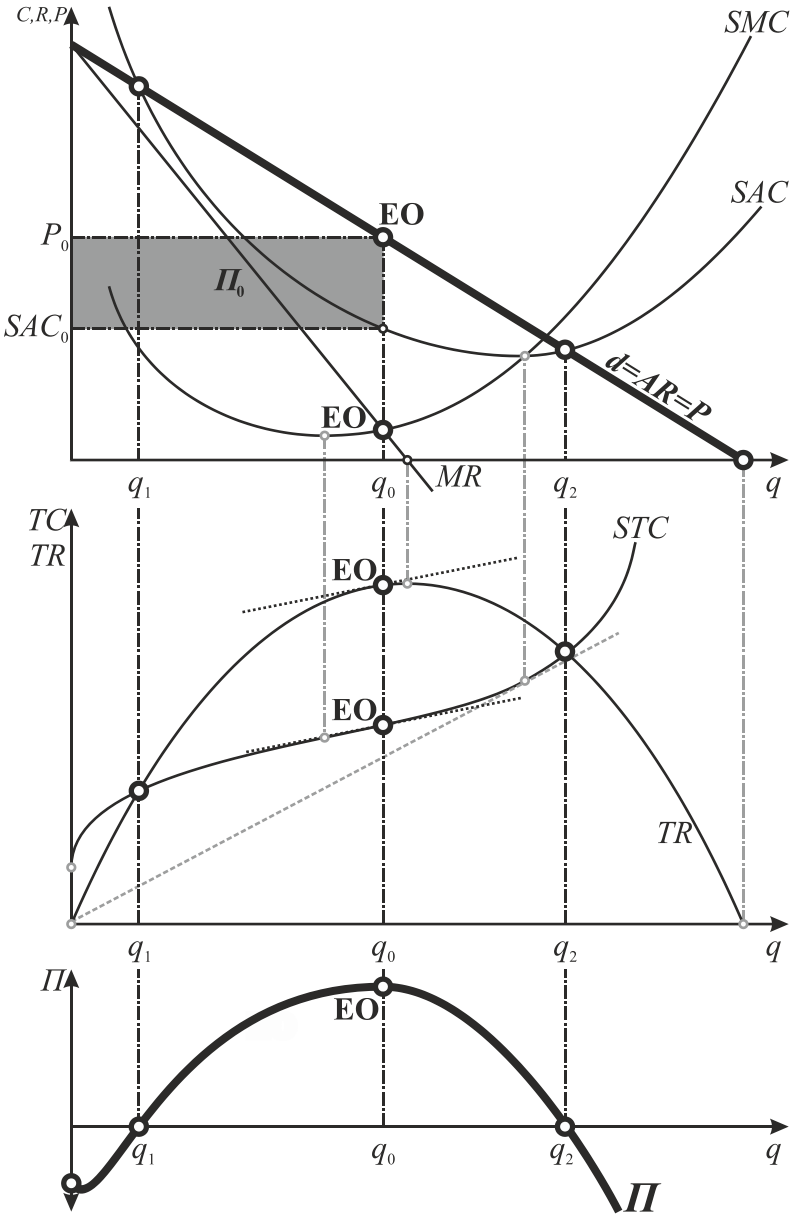
The producer's monopoly power within the products produced by them results from product

differentiation when the firm can be a price setter in a limited sense. Since products of various producers are close substitutes, there is usually relatively **small price differentiation** in the industry. The cross elasticity of demand for production of one firm with regard to prices of substitution products of other firms is very high within the monopolistic competition and so is **the price elasticity of demand for production of each firm**. Especially in the long run, there is another significant condition for the functioning of monopolistic competition in the form of small barriers preventing firms from entering and leaving the industry, which can be easily overcome in the long run.

E. g. confection, footwear, consumer electronics, wristwatch, perfume markets and others are considered suitable examples of the monopolistic competition industry.

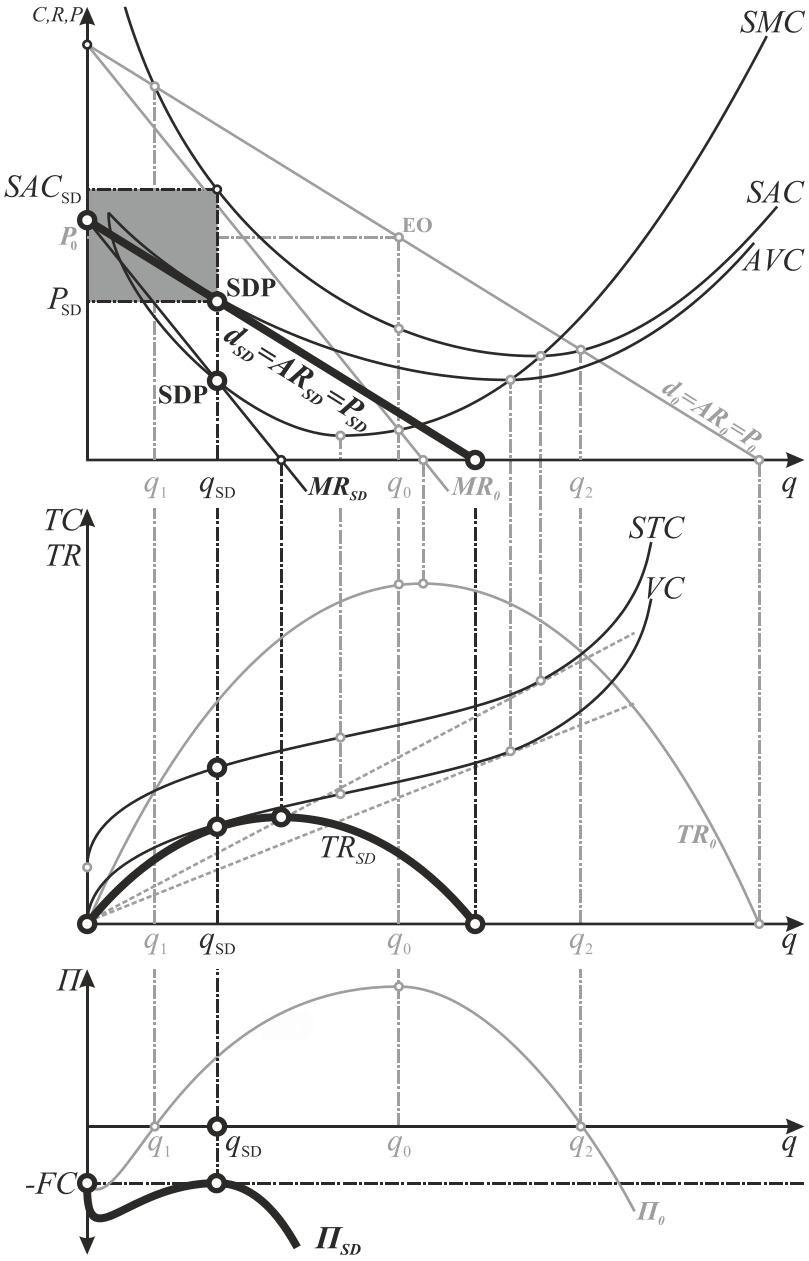
3.2.3.1 Monopolistic competition in the short-run

In the short run, the firm under monopolistic competition maximizes its profit by manufacturing the product q_0 based on the concurrence of its short-run marginal cost *SMC* and marginal revenue *MR*. It specifies the price at the level P_0 and achieves profit amounting to Π_0. The demand *d* represents a part of the total market demand *D* falling to the firm given.



3-28Maximization of economic profit of the enterprise under monopolistic competition in the short run

For the firm under monopolistic competition, a **shutdown (start-up) point** (**SDP**) can be defined on the same principle as in the case of a perfect competitor in the short run.



3-29 Shutdown point of the enterprise under monopolistic competition in the short run

In the short run, the enterprise in the monopolistic competitive industry could get into the situation of the shutdown point even though it is a price setter to a certain extent, i.e. in the case when the demand for products of the mentioned firm significantly decreases. For the enterprise, a decrease in individual demand for production of the firm under monopolistic competition from the original level d_0 to d_{SD} (see the graph 3-30) means a decrease in average revenue from AR_0 to AR_{SD} and a related decrease in marginal revenue from MR_0 to MR_{SD}. The enterprise in the neoclassical conception continues to maximize its economic profit and looks for an intersection point of marginal revenue MR_{SD} with short-run marginal costs *SMC*.

For the optimum quantity of production in the situation of the shutdown point q_{SD}, it is characteristic for

monopolistic competition that it is the quantity at which marginal cost curves and marginal revenue curves intersect but also at which average revenue curves (i.e. individual demands) and average variable cost curves touch and at which they also touch the total revenue and variable cost curves.

It applies to the shutdown point that at the optimum quantity q_{SD} produced, the price is P_{SD} and the firm covers only its variable costs *VC* with total revenue TR_{SD} since P = AVC. The total absolute economic loss Π_{SD} is equal to the size of fixed costs:

$$SMC = MR \text{ and at the same time } P_{SD} = AVC \Rightarrow \Pi_{SD} = -FC \tag{3.21}$$

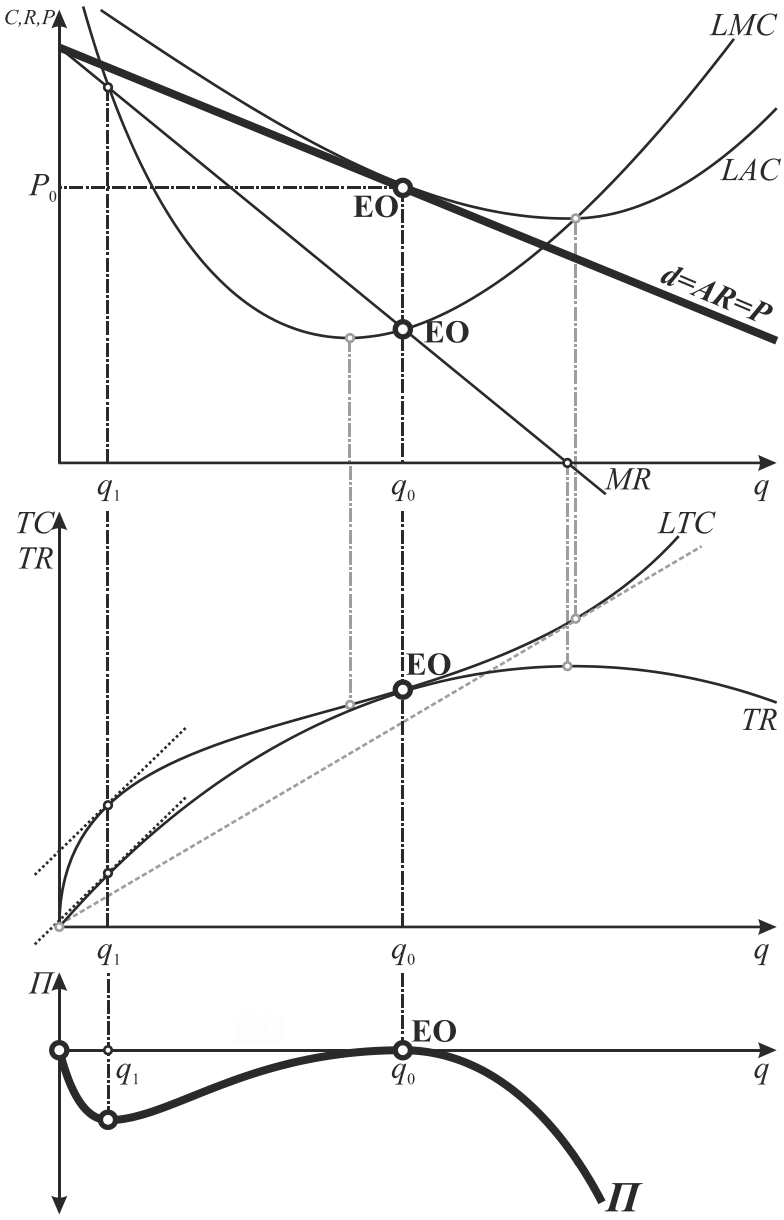
3.2.3.2 Monopolistic competition in the long run

In **the long run**, the monopolistic competition undergoes similar development as perfect competition. Very small barriers preventing firms from entering and leaving the industry in the long run enable new firms to enter the industry in the case when the firms in the industry reach positive economic profit (if the firms achieve economic loss in the industry, they can leave the industry without any large additional costs and allocate free production sources in the alternative production sector).

$$\begin{aligned} &\Pi > 0 \Rightarrow P > LAC \text{ and at the same time } MR = LMC \Rightarrow \text{ firms enter the industry} \\ &\Pi < 0 \Rightarrow P < LAC \text{ and at the same time } MR = LMC \Rightarrow \text{ firms leave the industry} \\ &\Pi = 0 \Rightarrow P = LAC \text{ and at the same time } MR = LMC \end{aligned} \tag{3.22}$$

The entrance of new firms in the industry shall lead to a decrease in the individual demand curve of each firm in the industry (a decrease in market share of each producer on the market) as well as to another increase in the price elasticity of the individual demand curve. On the contrary, the exit of firms shall increase individual demand curves of the firms which have remained in the industry and the price elasticity of demand shall be decreased as a result of a decrease in the number of available substitutes.

The **long-run equilibrium** is achieved if the firms striving for profit maximization in the industry of monopolistic competition reach zero economic profit (however, accountable profit is usually positive in this situation), i.e. when producing the quantity q_0 at the price P_0 which covers *LAC* (point EO). Graphically, it applies to the long-run equilibrium that an individual demand curve for the optimal quantity produced is a tangent of long-run average costs.



3-30Maximization of economic profit of the enterprise under monopolistic competition in the long run

3.3 Alternative objectives of the enterprise

According to the neoclassical theories, the firm's objective is to maximize economic profit. **Theories of alternative objectives of the firm** were created as the response to changed conditions which led to real difficulties or even to the impossibility of reaching the economic profit maximization. These changes in conditions are associated mainly with ownership structures of firms. Management of large firms is influenced not only by their owners but also by professional managers, employees or other interest groups. The effort to enforce interests of these groups leads to problematic implementation of the objective of profit maximization. So called **managerial theories of the firm** deal with issues arising out

of separation of ownership and management. **Behavioural theories of the firm** study activities of interest groups within corporations and their impact on behaviour of large firms. And finally, **game theories** represent one of basic tools for analysing strategic decision-making of firms.

3.3.1 Managerial theories of the firm

Managerial theories of the firm study issues regarding separation of ownership and management of the firm in the case when owners and managers follow their own different objectives. A consequence of real separation of owners and managers in the firm can be the emergence of so called principal-agent problem, see the chapter 5.3.1 on the page 177).

3.3.1.1 Simple managerial model

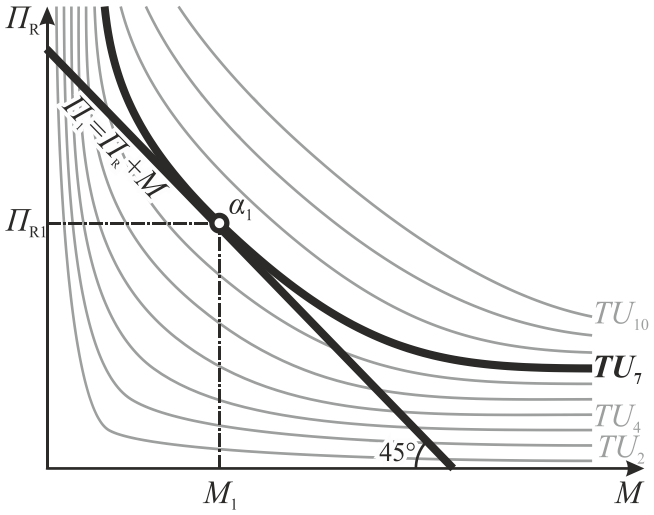
A simple graphical solution of manager's dilemma in the case of separation of ownership and management of the enterprise is provided by a simple managerial model. Profit maximization remains to be the objective of the firm's owners, the objective of managers is to maximize their utility which is dependent on the profit amount and supplementary managerial benefits. The firm's profit in a simple managerial model is divided in reported profit ($\boldsymbol{\Pi_R}$) and supplementary revenue and benefits of managers ($\boldsymbol{M}$). The existence of supplementary revenues and benefits of managers means decreasing the total economic profit of the firm Π since in the firm controlled by managers, costs are increased by supplementary revenues and benefits of managers M.

$$\Pi = \Pi_R + M \tag{3.23}$$

A profit line connects various combinations of reported profit and supplementary benefits of managers which represent the same level of the profit Π achieved. With regard to its equation, it is clear that the slope of the profit line shall always be 45°. **An indifference curve** connects all combinations of reported profit Π_R and supplementary managerial benefits M bringing the same level of utility TU to the manager. An intersection point of the profit line Π_1 (in the graph 3-32) with a vertical axis of reported profit when there are no supplementary revenues and benefits of managers ($M = 0$) corresponds to maximization of profit Π_R reported to the enterprise owners. For the firm owner, a corner solution would be optimal. For the manager, the second corner solution is a short-run optimum when all economic profits of the enterprise are changed to managerial benefits. However, the enterprise owner shall soon remove this manager from the executive function.

If the firm's manager looks for optimal distribution of economic profit between his benefits and reported profit, he shall probably aim at combining managerial benefits M_1 with reported profit in the amount Π_{R1}. **An optimal solution** α_1 is a situation when the profit line Π_1 touches the farthest indifference curve

TU_7.

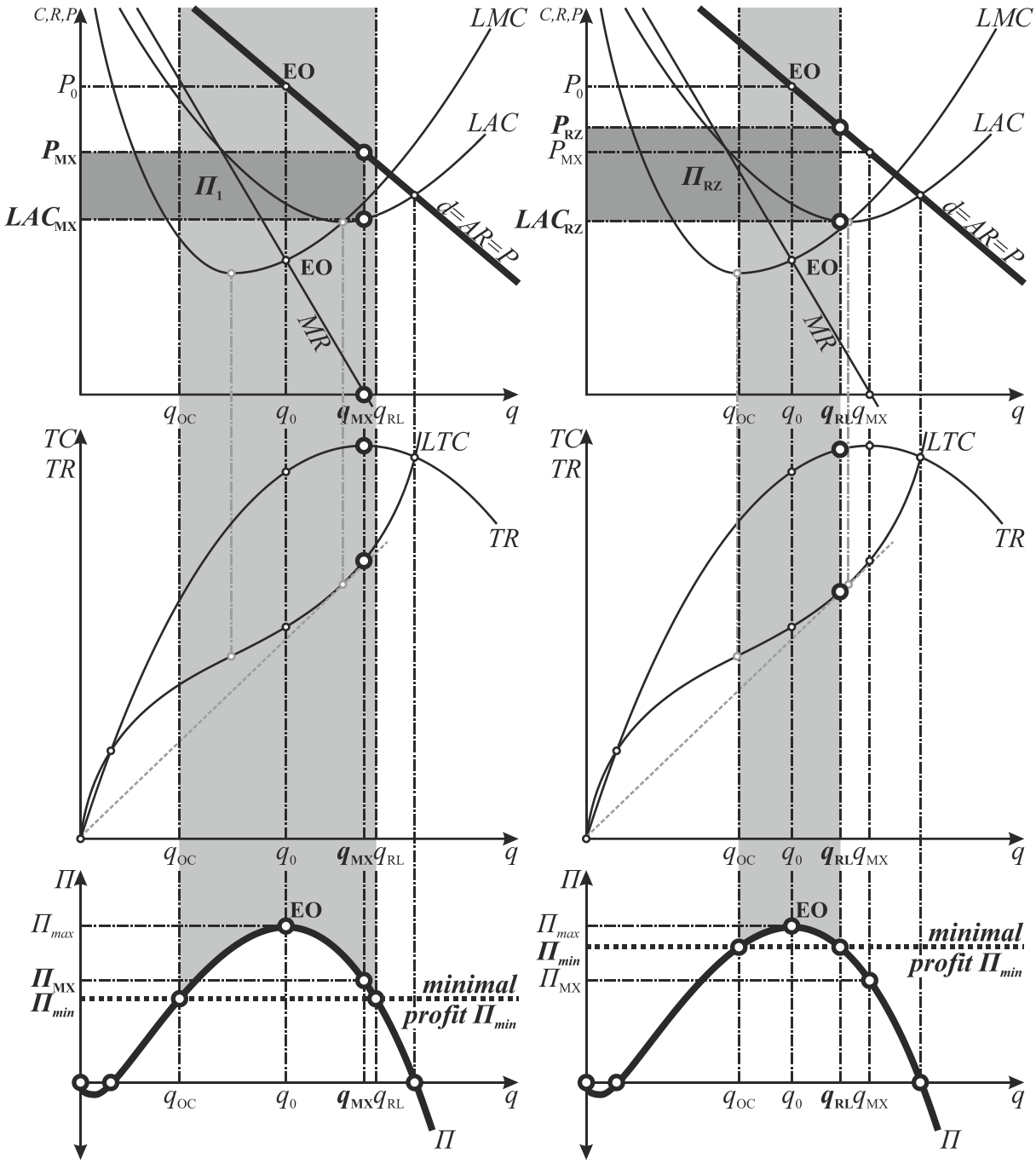


3-31 Simple managerial model

3.3.1.2 Baumol's model of a turnover-maximizing firm

Another model falling within managerial theories of the firm is the Baumol's model of a turnover-maximizing firm. The model was defined by **William Jack Baumol** (1922), an American economist, in the article called *"On the Theory of Oligopoly"* in 1958. In Baumol's opinion, the goal of the firm's owners is to maximize economic profit Π. The goal of managers is to maximize turnover of the firm (i.e. total revenue maximization $TR = P \cdot Q$) since they strive to maximize the enterprise's share in a slightly competitive market. However, turnover maximization is subject to the restriction of levels of the minimum required profit Π_{min} as income for owners. This minimum profit is usually based on interest rates on the capital market (see the chapter 4.2 on the page 150).

The firm reaches the turnover maximum if its marginal revenue is equal to zero ($MR = 0$) and price elasticity of demand is unitary ($e_{PD} = -1$). The profit must not fall below the minimum required profit Π_{min}. The minimum required profit is determined by the interval of possible produced quantity (q_{OC}, q_{RL}) shown in grey on both graphs 3-33.



3-32 Baumol's model

If the produced amount which corresponds to the turnover maximization q_{MX} lies within this interval (graph 3-33 on the left), the firm shall produce the quantity q_{MX} and realize the profit $\Pi_{MX} > \Pi_{min.}$ If the produced amount which corresponds to the turnover maximization q_{MX} lies outside this interval (graph 3-33 on the right), the firm shall produce the quantity q_{RL} and realize the profit $\Pi_{RL} = \Pi_{min.}$

3.3.1.3 Williamson's model of managerial discretion

A number of assumptions of the Baumol's model validity are also identical to the Williamson's model of managerial discretion: slightly competitive environment, separated ownership and management of

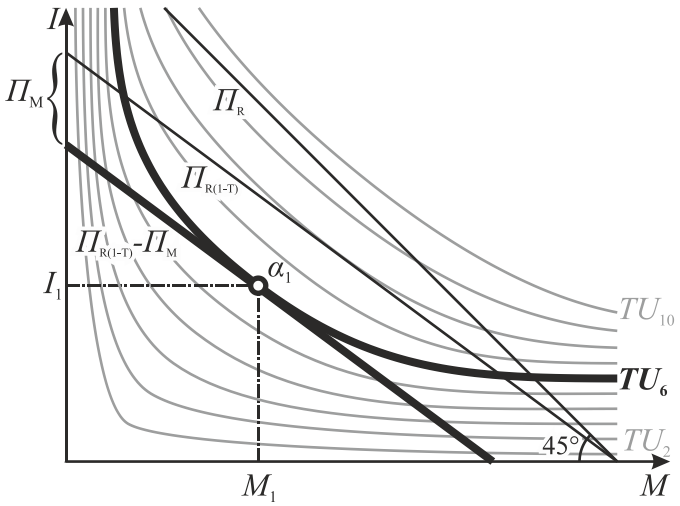
the enterprise, minimum profit constraints determined by the capital market. **Oliver Eaton Williamson** (1932), an American economist and recipient of the 2009 Nobel Memorial Prize, belongs among main representatives of the school of ownership rights falling within new institutional economics. The subject of the school of ownership rights became interpretation of the task of institutions and ownership rights in economic environment. The managerial utility function is determined by three variables:

- ⇒ **additional wage spending** S which represents the possibility of increasing wages and manager's and workers' remuneration,
- ⇒ **emoluments *M*** which include using a company car, office, personal assistant and others,
- ⇒ possibility of **discretionary decision-making on investments of the enterprise *I***, i.e. above the framework of investments necessary for achieving the minimum required profit.

$$U = f\left(S, M, I\right) \text{ under the condition } \Pi_R \geq \Pi_M + T \,, \tag{3.24}$$

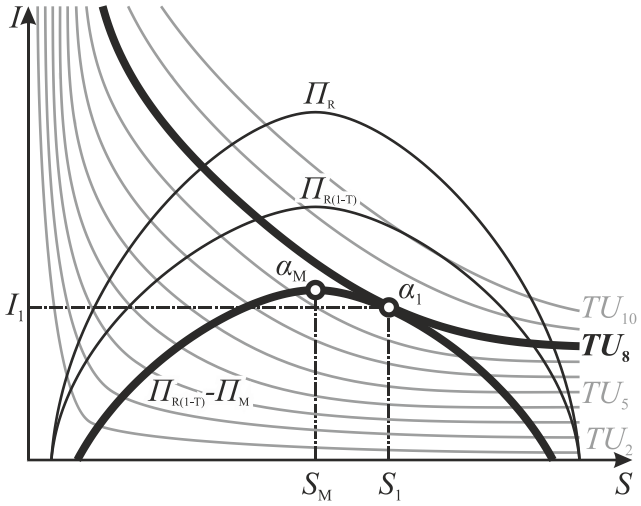
where Π_R is reported profit which is equal to the real profit Π decreased by emolument costs: $\Pi_R = \Pi - M$, Π_M is the minimum profit restraint, T is a tax, $S = \Pi_X - \Pi$, where Π_X is the maximum profit level possible, emoluments are given as $M = \Pi - \Pi_R$ and investments of the enterprise as $I = \Pi_R - \Pi_M - T$.

The number of variables of this model does not enable a complete graphical solution. A simple graphical representation can be used if we consider **zero additional wage spending on workers**. The line of reported profit Π_R (difference between real profit Π and emolument costs M) shall turn into the position $\Pi_{R(1-T)}$ after taxation and fall to the level $\Pi_{R(1-T)} - \Pi_M$ after deducting the minimum profit restraint. This line represents the size of reported profit after taxation above the framework of the minimum profit restraint. Indifference curves represent all combinations of emolument costs and free investment funds which bring the same level of satisfaction to the manager. In order to maximize the utility, the manager shall choose the optimal combination of costs α_1 when the size of managerial benefits is M_1 and the size of investment costs is I_1. Graphically, the point of contact of the line of reported profit after taxation above the framework of the minimum profit restraint with the farthest indifference curve TU_6 is the optimum (see the graph 3-34).



3-33 Williamson's model

If we simplify the graphical representation of the Williamson's model by means of the assumption of **zero emoluments** *M*, manager's utility shall depend on the size of additional wage spending S and the size of discretionary investments I. The profit changes with changes in the volume of production and expenditure on staff. When the production grows, production costs are normally increasing. In case of expenditure on staff, it is supposed that it has a certain positive impact on demand, and therefore, while increasing, a higher price can be applied to the same volume of production. Therefore, when the volume of production and expenditure on staff grow, the profit is increased. However, it applies only to a certain extent when increasing the production costs and necessity of a gradual decrease in prices for increasing sales volume result in decreasing profits (see the graph 3-35).



3-34 Williamson's model

We shall get the curve $\Pi_{R(1-T)} - \Pi_M$ by deducting a tax and minimum profit restraints from the curve of reported profit. The point α_M corresponds to the maximum achievable profit after taxation and deduction of the above-mentioned minimum required profit. The slope of indifference curves depends on the relation between additional expenditure on staff and free investment funds and it reflects manager's

preferences. The manager's goal is to maximize utility, therefore, he opts for such a combination of S and I which shall be on the highest indifference curve achievable. This is in compliance with the combination α_1 when additional expenditure on staff is S_1 and free investment funds have the volume I_1. But the reported profit would be maximized in the combination α_M.

When using the Williamson's model – compared to a profit-maximizing firm – the firm shall realize real economic profit lower that the highest possible economic profit. The manager shall realize positive emolument costs, he shall choose a higher range of expenditure on staff and lower volume of free investment funds. Higher volume of manufactured output than the one which would be produced by an economic profit maximizing firm is associated with the higher amount of expenditure on staff.

3.3.2 Behavioural theories of the firm

Behavioural theories of the firm are based on the assumption that a complicated structure of large firms leads to the existence of various interest groups whereas owners of firms, management and regular workers are considered basic groups. The complicated structure of the firm does not enable the firm to follow maximization of some quantities as its goal, however, it always tries to reach a certain compromise among goals of individual interest groups. A satisfactory level of each partial variable is considered as an optimum. Decisions of the firm are subject to objectives in the five main areas:

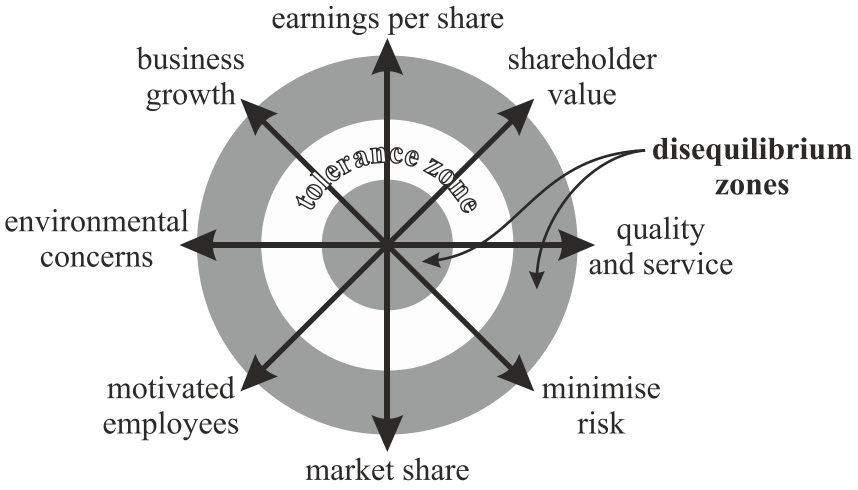
- ⇒ production (production continuity, achieving a certain volume of production)
- ⇒ stock (absolute level of stock, certain required range of its movement)
- ⇒ sales (in value or physical units)
- ⇒ market share
- ⇒ economic profit

Among behavioural models, we include especially the model of an American economist **Herbert Alexander Simon** (1916-2001, recipient of the 1978 Nobel Memorial Prize in Economic Sciences) from 1959 when the initial **objective of the firm is to survive on the market**. In practice, this goal is transformed into seeking solutions which are convenient for all interest groups in the firm. The model is more likely focused on processes through which the firm accepts its decisions than on results of these processes.

3.3.2.1 Doyle's model of tolerance zones

The Doyle's model of tolerance zones of 1994 whose author is an Englishman **Peter Doyle** (1943-2003) extends the Simon's model by specifying eight basic objectives which the firm follows at the same time. Various interest groups in the firm identify themselves with various objectives. The movement on the

ray towards the centre represents the enterprise's orientation on fulfilling an appropriate objective. Imbalanced situations correspond to an external as well as internal zone. **The external zone** of intolerance shows that too much emphasis on one of eight objectives is not suitable since it brings excessive alternative costs which arise out of the inability to achieve other objectives. **The internal zone** shows that the firm does not meet minimal expectations of some (or none) of interest groups working in its organizational structure. **The zone of tolerance** expresses negotiating space which is available to managers in order to coordinate various (sometimes also conflict) objectives of interest groups. The management task is to extend this negotiating space in the interest of stable existence of the firm on the market by e.g. seeking common interests of groups, improving communication between groups, strengthening informal relations and others.



3-35 Doyle's model

3.3.3 Game theory

Models based on the game theory show very simplified strategic situations. In terms of possible mutual cooperation, we divide them into cooperative and non-cooperative economic games. Each game is characterized by means of three basic elements:

- ⇒ A **player** is a participant in the game who chooses a strategy.
- ⇒ A **strategy** means an activity for which the player can decide.
- ⇒ A **result** is a final gain of the game for each player. A so called payoff matrix is used for recording results of games.

The final equilibrium in the game theory can be described by means of so called Nash equilibrium when the Nash equilibrium is such a situation when none of players can improve his situation by a one-side change in the strategy chosen. John Forbes Nash Jr. (1928), an American mathematician and recipient

of the 1994 Nobel Memorial Prize, proved in his work called "*Equilibrium Points in N-Person Games*" (1950) that each final game has at least one such solution. The Nash equilibrium in the game theory need not always mean the Pareto-efficient situation, however, the Pareto-efficient situation always expresses the Nash equilibrium.

There are several basic types of games (in diagrams, the result of Martin's strategy is always indicated in bold):

3.3.4 Cooperative and non-cooperative games

The game can be specified as non-cooperative in the case when each player tries to maximize his result regardless the impact it has on his opponents. In non-cooperative games, individual players decide entirely independently. An example of the non-cooperative game is the **prisoner's dilemma**.

		Martin	
		confess	**deny**
Nancy	confess	12 | **12**	0 | **24**
	deny	24 | **0**	6 | **6**

3-36 Prisoner's dilemma

If Nancy and Martin put themselves in prison on reasonable suspicion of having committed an offence, their "payoff matrix" looks as shown in the scheme 3-37. If Martin decided to cooperate and confess his participation in committing an offence, he shall be facing a twelve-year prison term if Nancy also cooperates or he shall be released if his cooperation with an investigator leads to convicting Nancy who refuses to cooperate. If Martin decided to deny and negate his participation in committing an offence and Nancy cooperated with an investigator on the case and confessed, Martin would be convicted and would go to prison for 24 months. If both Martin and Nancy denied, they would both stay in prison for 6 months. What shall be Martin's optimal strategy and what variation shall Nancy opt for?

The strategy preferred for Martin, who selects from possible results 0, 6, 12 or 24 months spent in prison, is naturally an alternative when he shall be immediately released, i.e. the strategy to confess and cooperate with an investigator. From possible results of 0, 6, 12 or 24 months spent in prison, Nancy analogously prefers the possibility of immediate release, i.e. the strategy to confess. Due to this fact, they shall both spend 12 months in prison since they shall both confess to committing the offence given.

Due to the fact that the players in the prisoner's dilemma cannot "harmonize" their statements (it is a non-cooperative game), though the Nash equilibrium occurs in the form of cooperation of both suspects with the investigator, this solution is not Pareto-efficient. If the cooperation between Nancy and Martin was enabled (a cooperative game), they would agree on the strategy to deny while reaching not only the Nash equilibrium but also the Pareto-optimal solution.

A classical example of a cooperative game is a **battle of sexes** or Bach or Stravinsky based on the assumption that Martin and Nancy prefer a common concert experience to individual visits to shows of their favourite performers, Martin personally prefers Beyoncé, Nancy prefers Sting.

		Martin	
		Beyoncé	**Sting**
Nancy	Beyoncé	200 | **100**	0 | **0**
	Sting	0 | **0**	100 | **200**

3-37 Battle of sexes

In case of a non-cooperative game, each of players shall visit the concert individually, Martin shall go to see Beyoncé and Nancy Sting. The result of this strategy shall be the fact that neither of them shall enjoy this cultural experience. If they cooperate and opt for the final strategy after mutual agreement, then, they shall visit together either Beyoncé's or Sting's concert. If the game was repeated, they would also visit together the concert of the other one of favourite singers

3.3.5 Symmetrical and asymmetrical games

Symmetrical games are such games for which results of various combinations of individual strategies are identical to all players, therefore, it does not depend on the player who realizes the above-mentioned strategy. Payoff matrices of symmetrical games are symmetrical around the axis of the second quadrant and fourth quadrant. Examples are the **prisoner's dilemma,** a battle of sexes or a **game of chicken**.

		Martin	
		gets out of way	**does not get out of way**
John	gets out of way	50 | **50**	-100 | **100**
	does not get out of way	100 | **-100**	-500 | **-500**

3-38 Game of chicken

In case of the game of chicken, it depends on the fact who of players shall loose his nerves as first, succumb to pressure, get out of way and become a traitor. The game is well-illustrated by means of an example when Martin meets John in the narrow doors. If Martin gets out of his way and John does not get out of way, John becomes a winner and Martin becomes a traitor. If both the players get out of their way, an embarrassing moment happens but there is no collision (both the players are traitors). If neither of players gets out of way, they shall collide in the door. It is clear that the game of chicken is a non-cooperative game.

Asymmetrical games differ by the fact that their payoff matrix gives various results of selected game strategies to players. One of players in the asymmetrical game usually employs a dominant position which enables him to realize a better result against other players.

3.3.6 Zero and non-zero sum games

For zero sum games, it is characteristic that the total result for all players and for each combination of strategies is equal to zero or a winning player gains his utility to the detriment of other players. Typical examples of zero sum games are a chess game, go or poker or other slot machines or scissors, paper, stone.

Non-zero games are more common in the economic reality. A gain of one of players in the case of non-zero-sum games need not be compensated by a loss of another player, the total result for all players and for each combination of strategies reaches non-zero values (positive or negative). The above-mentioned prisoner's dilemma, revenue from realization of stock-exchange transactions are examples of non-zero sum games.

3.3.7 Simultaneous and sequential games

In simultaneous games, deciding on selecting strategies of individual players proceeds simultaneously (e. g. prisoner's dilemma, game of chicken, scissors, paper, stone and others). In sequential games, individual players select their optimal strategies gradually and with regard to the strategies selected in the previous turns of their co-players (e. g. poker, chess, whist and others).

3.3.8 Repeated and non-repeated games

A non-repeated game means a one-time selection of a game strategy by each player (the whole game proceeds only once), a repeated game enables players to learn more and consider experience from the course and results of previous games in the following decision-making.

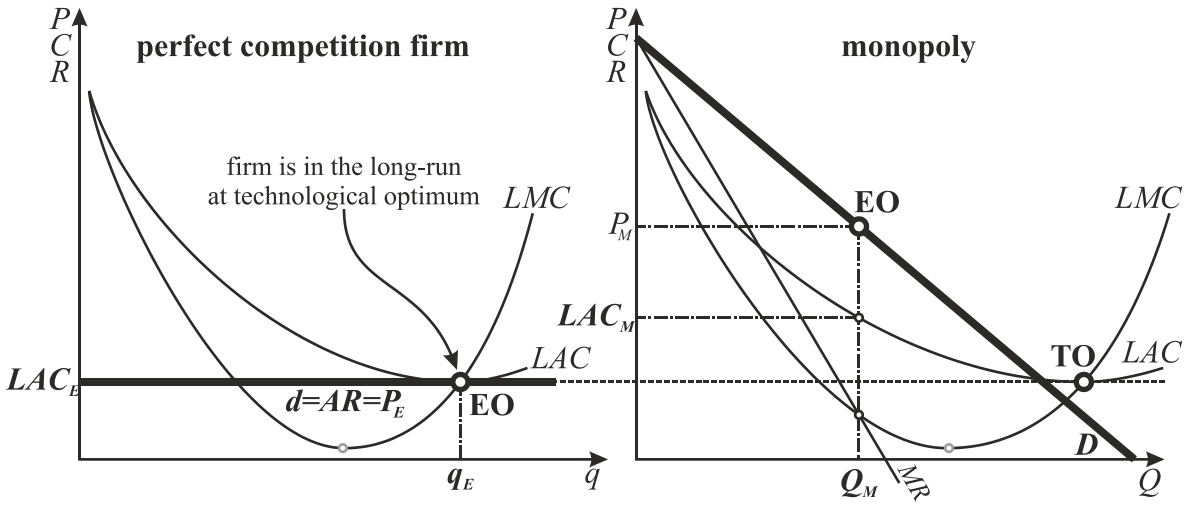
3.3.9 Games with perfect, complete and incomplete information

A game with perfect information means such a game when all players dispose of the same information regarding the game, including turns, which are realized by their opponents. A chess game can be an example. A game with complete information can be e. g. prisoner's dilemma, i.e. a situation when each of players disposes of information about the game, strategies and payoff matrices but does not know moves of his co-players. A game with incomplete information is e. g. poker where players do not know strategies of their co-players.

3.4 Competitive efficiency

Productive efficiency of competitive environments in the long run expresses efficiency with regard to the use of production factors in the production. **Productive efficiency** occurs if firms produce such an extent of production under which long-run average costs are minimized. In the long run, perfectly competitive markets optimize production in the **technological optimum** while producing outputs with minimal long-run average costs. It is caused by the development of a perfectly competitive market when perfectly competitive firms are pushed towards zero economic profit which in the long run, stimulates technical and economic progress and leads to the complete use of the effect of increasing returns to scope. Perfectly competitive markets are productively efficient.

In the long run, a monopoly firm as one producer on the market is not forced to decrease costs or change the volume of outputs and prices. A monopoly firm maximizes its economic profit while producing monopoly quantity with long-run average costs higher than minimal costs on a long-term basis. Since the market does not put such pressure to the monopoly, oligopoly or firm in monopolistic competition which would enforce them to produce in the long-run technological optimum, they do not produce imperfectly competitive market structures at the level of the lowest long-run average costs and therefore, they are **productively inefficient**. We can say that the productive efficiency of the market structure decreases with its increasing imperfectness.

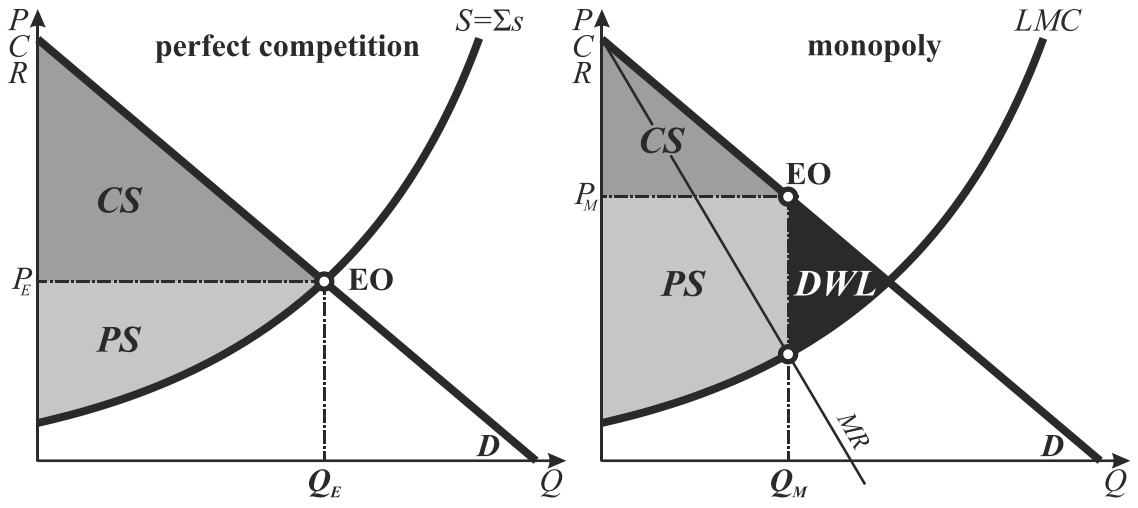


3-39 Comparing the productive efficiency of perfect competition and monopoly

Allocative Efficiency means that the quantity of manufactured output corresponds to the quantity which is demanded at a specific market price. The allocative efficiency of market structures can be quantified by means of surplus of economic entities in relation to the volume of manufactured output and market price of the production. **In the perfect competition**, which specifies the volume of production and price on the concurrence of industry supply and industry demand, consumer surplus (*CS*) of all consumers is maximized on the market (consumer efficiency of perfect competition) and at the same time, producer

surplus (*PS*) is also maximized. The producer surplus represents differences of market prices of production and marginal costs of production of each additional unit added together for all production units. In the perfect competition, we can speak of the **Pareto-efficient situation** which is the state when any of possible rearrangements of economic entities cannot mean that any of the entities shall prosper better without another entity prospering worse. The producer as well as the consumer maximize their surplus at optimal quantities and prices and none of these two parties can increase its surplus without decreasing the surplus of the other party. Under the conditions of efficiency, surplus of one entity can be increased only by decreasing the surplus of the other entity.

The allocative inefficiency of a monopoly is determined by the amount of produced monopoly quantity which the firm sells for a monopoly price. Compared to the perfect competition, the consumer surplus is lower for reasons of lower produced quantity and higher market price, as a result of the possibility of applying market power, the producer surplus is, compared to the perfect competition, higher since the part of the producer surplus is realized to the detriment of the consumer surplus. A consequence of imperfect competition functioning as a whole on the market is also so called **deadweight loss** (***DWL***) which represents a loss of surplus which was not realized on the consumer's side or producer's side. The deadweight loss as a loss caused by the monopoly present in the economy represents a part of consumer surplus *CS* (as expression of consumer inefficiency) and a part of surplus of producer *PS* which is not realized due to the presence of the monopoly. In the case of the monopoly, the deadweight loss is the highest of all types of analysed market structures. With increasing imperfectness of the market structure, the deadweight loss increases and the allocative efficiency of the market decreases. All types of imperfect competition market structures are **allocatively inefficient**.



3-40 Comparing the allocative efficiency of perfect competition and monopoly

3.4.1 Production and consumption efficiency

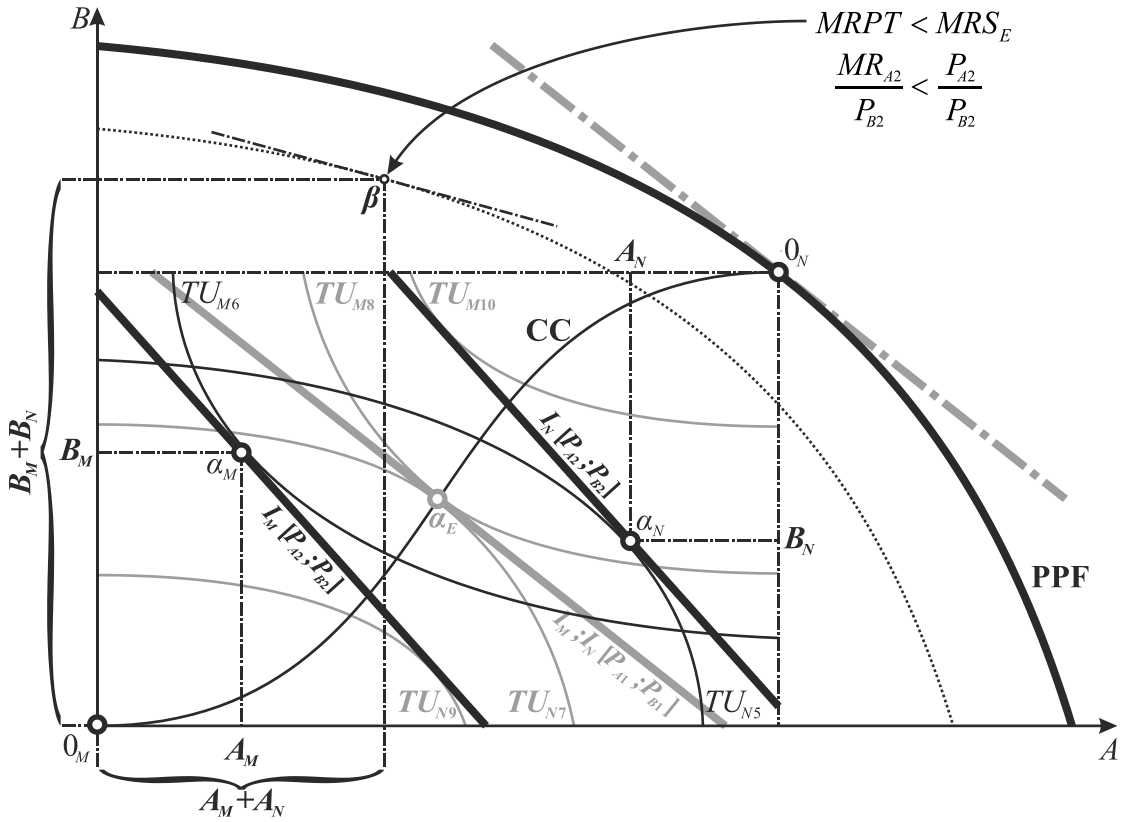
Perfectly competitive markets with regard to the conditions, which are specified, are productively efficient as well as consumptively efficient, i.e. we can speak of **production and consumption efficiency** of perfectly competitive markets. It applies that:

$$MRPT = MRS_E = MRS_C \tag{3.25}$$

Imperfectly competitive markets are productively and allocatively inefficient. If economic entities with certain monopoly power, i.e. entities, which can influence the market price of production, occur on the market, the **equality between the market price of production and marginal revenue** arising out of sales of an additional output unit **shall not apply to these markets.** For imperfectly competitive markets, it applies that $P \neq MR$, more accurately $P > MR$. An imperfectly competitive firm maximizes its profit under the equality of marginal costs and marginal revenue (lower than the price). In this situation, **relative prices do not reflect relative marginal costs** and the price system does not bring information necessary for ensuring efficiency. If the product is produced under the conditions of imperfect competition, then, it applies:

$$MRPT = \frac{MR_A}{P_B} < \frac{P_A}{P_B} = MRS_E \quad \Rightarrow \quad MRPT < MRS_E \tag{3.26}$$

The inequality of marginal rate of product transformation and marginal rate of substitution results in producing smaller quantity of the product A (monopolized product) and higher quantity of the product B (perfectly competitive product) than it would correspond to preferences of consumers and production technology. **Imperfect competition liquidates a uniform criterion of decision-making of consumers and producers,** and subsequently, rules of efficient allocation of sources are broken. Consumers decide based on the development of prices of goods whereas producers control their behaviour based on the development of marginal revenue, each party on the market reacts to a different group of relative prices.



3-2Comparing the production and consumption efficiency of perfect competition and monopoly

The graph 3-42 expresses the production and consumption inefficiency of the monopoly market structure compared to the production and consumption efficiency of perfect competition (grey) in the model 2-2-2-2 (for details see the chapter 2.6 on the page 65), a full grey line segment represents budget constraints of consumers *M* and *N* the slope of which is given by the rate of the goods *A* and *B* and expresses the marginal rate of substitution in exchange MRS_E. The slope of budget constraints is also equal to:

- ⇒ marginal rate of substitution in consumption MRS_C since the point α_E lies on the contract curve CC and it is consumptively efficient,
- ⇒ marginal rate of product transformation *MRPT* expressed as a tangent gradient of the limit of production possibilities with which the condition of production-consumption efficiency (budget line going through the point α_E is parallel with the tangent to the limit of production possibilities at the point 0_N) is followed.

The graph 3-42 further shows how the higher monopoly price of the goods *A* (i.e. the price P_{A2}) changes the gradient of budget lines of the consumers *M* and *N*. As a result of the higher price $P_{A2} > P_{A1}$, budget constraints of consumers become steeper. At the higher monopoly price, the demanded quantity of the product *A* naturally decreases (both the consumers demand only $A_M + A_N$), the share of their costs

directed to the goods *A* shall be decreased compared to perfect competition (movement on the elastic part of the demand curve), and the demand for relatively cheaper good *B* shall increase (as a result of this, its price shall also increase from P_{B1} to P_{B2}). The original (grey) budget constraint of consumers is divided into two lower and steeper budget lines (I_M and I_N) the gradient of which reflects a new rate of market prices P_{A2}/P_{B2} and the position of which indicates a real loss of revenue of consumers as a result of increasing prices of both commodities.

From the efficient allocation at the point α_E, the model gets into two partial consumer optimums α_M and α_N which do not together enable to efficiently use all production inputs, the point β is below the production-possibility frontier PPF. At the point β, the marginal rate of product transformation MRPT is lower than the marginal rate of substitution in exchange MRS_E since the imperfectly competitive producer of the goods A compensates its marginal costs with marginal revenue MR_{A2} while the perfectly competitive producer of the product *B* compensates its marginal costs with the price P_{B2}.

The allocation of consumed quantities of the goods *A* and *B* between the consumer *M* and *N* is not consumptively efficient as a result of the monopoly present on the market since the points α_M and α_N do not lie on the contract curve CC. The consumers realize lower total utility from the same budget, the monopoly deprives them of a part of their consumer surplus.

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