



Course: Economics I

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1. MANUFACTURERS BEHAVIOR AND DECISION MAKING

The company (person or people who control it) behaves to maximize its profit. Selects the alternative which carries the highest total revenue, while the lowest total cost.

1.1 Assumptions of the theory of the company

The company appears in two markets:

- a) The goods and services market,
- b) The market of production factors.

The company must decide what and how much will be produced (production volume) which determines the price, combination and amount of factors of production. The main objective of the company is to maximize profit; maximize the surplus of total revenues over total costs.

The firm behavior affects the whole complex of economic and non-economic factors affecting the level of costs and revenues. Among these may be mentioned the following:

- prices of factors of production,
- technology,
- competition ,
- price of manufactured goods,
- the length of time (very short, short, long, very long period),
- a number of specific factors.

2. PRODUCTION AND COSTS

2.1 Production analysis in a short period

The amount of costs is influenced by the quantity and price of the used input. Therefore, we start by selecting input.

The volume of the production is the result of a combination of factors of production we have used, so we can write:

$$Q = f(F_1, F_2, \dots, F_n)$$

Production function specifies the maximum volume of production company may produce, at a given technology, and given the factors of production in a certain period.

Production function can be expressed: verbally, graphically, by equation or table.

Production is efficient when:

- quantity reduction of certain PF will lead to a reduction in the volume of production,
- technology is constant,
- manufacturer knows and accepts technology and prices of PF.

Thus defined production function has the following properties:

- expresses the fact that the output can be produced by various combinations of inputs,
- shows the technological limitations of production, it is based on the level of technology,
- does not assume unnecessary and inefficient production processes, which results from an emphasis on maximum output in its definition.

The basic characteristics of the production function **in the long run** are:

- inputs substitution,
- inputs economies of scale.

Total, average and marginal physical product

It is evident that the *production volume varies with changes in the quantity of the input.*

The total volume of production made is called total physical product (TPP). Total product (TP) represents the volume of production, which is made by a certain amount of the PF).

$$\text{TPP} = Q$$

Furthermore, we are interested in average physical product (APP) representing the average labor productivity and is used as an indicator of efficiency, ie. *the volume of production per unit as input, respectively. production factor.*

$$\mathbf{APP = TPP / F = Q / L}$$

For further analysis is important marginal physical product (MPP), which expresses the increase in the volume of total output produced by the last consumed unit of PF (assuming constant amount of other inputs), ie. *the change in volume of production made by changing the amount of input of the unit, that is:*

$$\mathbf{MPP = \Delta TPP / \Delta F = \Delta Q / \Delta L}$$

The graph shows relationships between variables:

- initially marginal physical product is increasing - to the point A on the curve MPP.

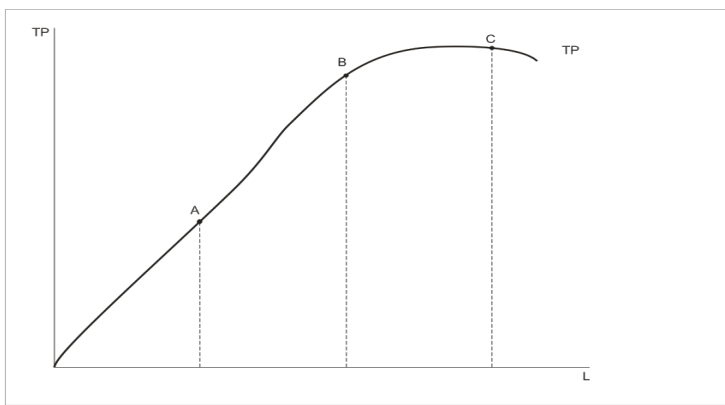
This means that the total physical product grows faster than the quantity used input.

- In the second section, the marginal physical product is decreasing, but is positive - from point A to point C on the curve MPP.

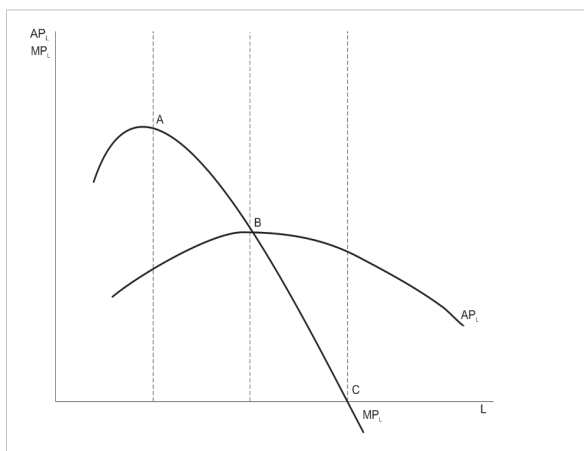
This means that the TPP is growing more slowly than the amount if used input.

Growth of TPP curve therefore slows down.

- Theoretically it is possible to consider a possibility of the existence of the third section - point C on the curve MPP when the marginal physical product is negative and total physical product is decreasing.



Graph n. 1 – Total product



Graph n. 2 – Average and marginal product

2.2 Costs in the short run

Determining the magnitude of the costs

Total cost has two components:

Variable costs (VC) with the growth in production volume are growing (can be measured with a production capacity linearly or nonlinearly). In our case, is thus a the cost of the variable input.

Fixed costs (FC) are costs that do not change with the volume of production. The company must pay them, even if the output is zero. These include maintenance of buildings and equipment.

In our case, the fixed costs of production factors, which we consider to be constant.

Fixed costs can not usually be measured in short periods of time. They are the amortization of the building, and interest on mortgage loanswages management, rent, cost of heating and lighting of buildings.

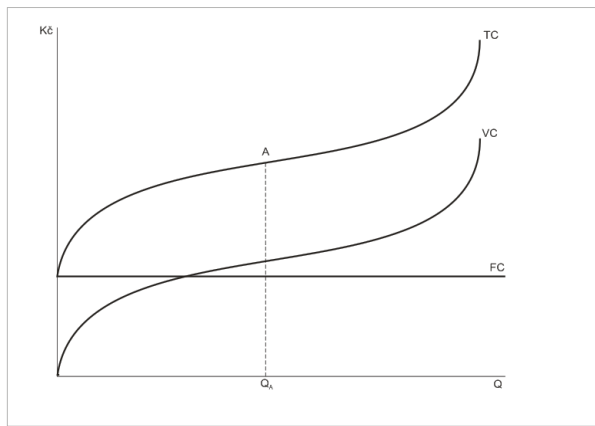
TC curve can be divided into two parts. Total costs are rising slower than the volume of production, but later on the contrary, faster.

Now we compare the graph of total, average and marginal product with a graph of the total cost.

Notice the curve VC: we find that section, where the production volume grows faster than the costs corresponds to the TPP curve to the point A.

In the next part are revenues from variable input declining: production volume grows more slowly than quantity of work, or variable costs growing faster than production volume.

Conclusions about the shape of the curve VC are valid for total costs. Fixed costs while affecting the specific amount of TC (or position of the curve TC), but not the shape of the curve TC.



Graph n. 3: Total costs

Comparison of curves TC and TTP confirms to us that we can derive the costs curve from the production function. This was mentioned earlier - we know that the costs are depending on the input quantities and prices. Input amount is then given by the production function (input price in this chapter we consider a given).

To compare the TC and TPP curves it is necessary to say that the cost curve does not include section from the point C. The production in this section is irrational, the same volume of output can be produced at a lower cost.

Average and marginal costs

As with physical product, we distinguish average (unit) and marginal costs.

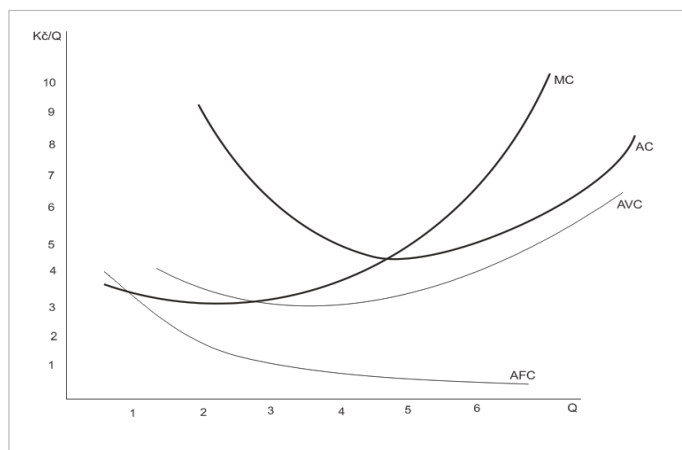
Average costs (AC) are the cost per unit of production.

Therefore: **$AC = TC / Q$**

Average cost curve has a similar shape to a letter U. Initially, with the increase of production volume the average costs are falling down. From a certain production volume average costs are rising.

How to explain this? Average costs could be split on the average fixed cost (AFC) and average variable cost (AVC).

This applies : **$AC = AFC + AVC$**



Graph n. 4: Average and marginal costs

Mutual relations

SAC and AVC

- Min. AVC is to the left of min. SAC $SAC = AVC + APC$
- SAC grow only when growth AVC exceeds the decrease of AFC
- With the growth of Q there is a convergence SAC and AVC curves since AFC fall

MC and AC

- SMC curve intersects the AVC and SAC curves from below, in their minimum
- When $Q < Q_1$ SAC curve is above the curve SMC ($SAC > SMC$)
- When $Q = Q_1$ SMC curve intersects the curve at its minimum $SAC = SMC$
- When $Q > Q_3$ SAC curve lies below the curve of SMC ($SAC < SMC$)

This is so $MC = \Delta TC / \Delta Q$

Marginal costs are falling down and from a certain production quantity increases. This fact will be explained by the law of diminishing returns.

MC = AC min

Why?

If $MC < AC$, each additional unit production requires lower costs than previous manufactured unit. Average costs will drop, the average cost curve is downward curve.

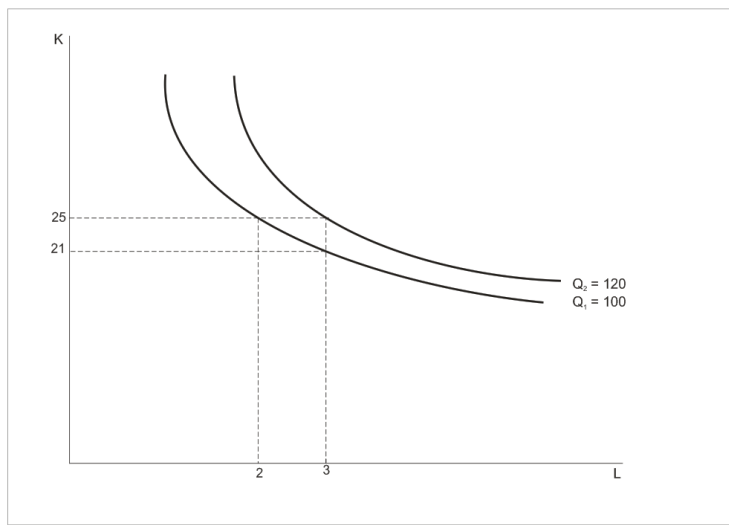
If $MC > AC$, extra production unit can be manufactured only with higher costs than the previous unit. Therefore, the average costs are rising, the average cost curve is rising curve.

Only when $MC = AC$, average costs are minimized. The same dependency applies to the average variable cost.

2.3 Production analysis in the long run

So far we have studied short term assuming one variable factor of production. Now, we discuss a long period (run) considering a production function with two variable inputs (labor and capital).

We call it the **isoquant**.



Graph n. 5: Isoquants map

Isoquant (sometimes called the indifference curve) represents a combination of factors of production, which use can produce the same volume of production.

Isoquants are an analogy of indifference curves, their basic characteristics only summarize:

- isoquant are declining since higher quantities of both factors of production can produce higher levels of production.
- isoquant are convex to the beginning. If the work is replaced by capital, increases due to the law of diminishing returns the marginal product of labor and declining marginal product of capital.

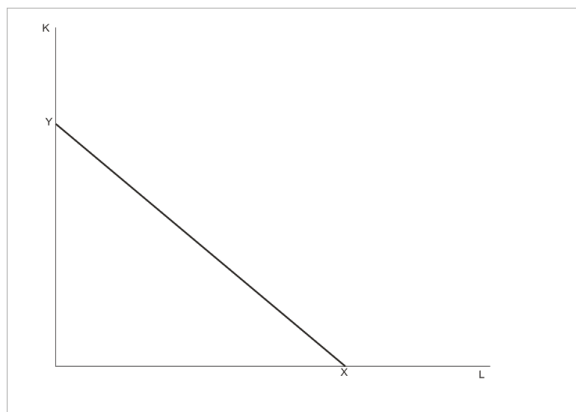
To be made the same volume of production, proportions in which factors of production are replaced must match the overturned ratio of their marginal products.

Therefore:

$\Delta K / \Delta L = MRPL / MPPK$ Marginal rate of technical substitution of capital for labor

Isocost $T_c = PL.L + PK.K$

$\Delta PL / PK$ and TC is reflected in the shift and spin of Isocost



Graph n. 6: Isocost (line of the same total costs)

- a) Change TC - shift Isocost with unchanged Direction
- b) Change in PL / PK - change of Isocost direction. Exception is the proportional change in the prices of both inputs.

This ratio is called the marginal rate of technical substitution of capital for labor (MRTS K, L).

Also in this case we use the analogy with indifference analysis: we replace the line budget by the line of the same total costs (**Isocost**).

Points on the line of the same total costs XY show all combinations of available production factors regarded to the given total costs. Point on the x-axis represents the situation where the company spent costs only on the work, the point on the y-axis situation where only capital is purchased.

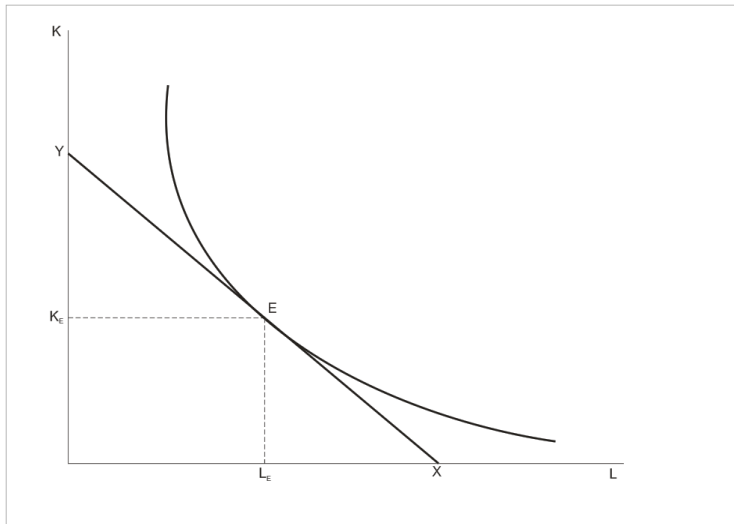
- **isoquant** therefore express all the combination of use of production factors bringing the same volume of production.

The optimal combination of inputs so called Cost optimum of the firm, we can find in the point where the line of the same total cost touches the isoquant.

The knowledge we have obtained from the indifference analysis can help us to understand that the ratio in which the total cost of factors of production is given by the ratio of prices of production factors.

Therefore:

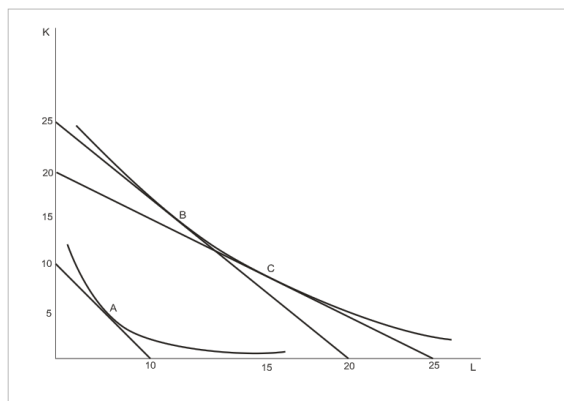
$$PL / PK = MPP L / MPP K \quad \text{or} \quad K / L = PL / PK$$



Graph n. 7: Cost optimum

The effect of changes in input prices on cost optimum

Change in input prices is reflected in the change of the position and slope of the line of the same total cost.



Graph n. 8: The effect of changes in input prices on cost optimum

2.4 Costs in the long run

Derivation of the cost curve in the long run

Various lines of the same total costs are confronted with different isoquant. Each isoquant represents a certain volume of production.

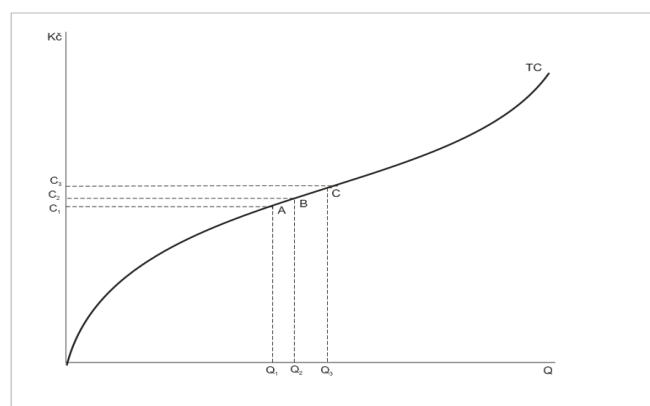
The purpose is to find out which isoquant will meet the total costs line.

Thus we find the cost corresponding to each level of production volume.

If we know the cost corresponding to each level of production volume, we can construct a curve costs.

The curve of the total costs in the long term has a similar shape as in the short term. But in a short period, its shape is determined by the revenues from the variable production factor, in the long run is determined by the returns to scale. When proportionally equal increments labor and capital costs, there may occur three different trends in the development of revenues:

- constant returns to scale - TC curve will have a growing line shape,
- increasing returns to scale - TC curve will rise with Q grow at a slower pace,
- decreasing returns to scale - TC curve will grow faster than output.



Graph n. 9: Total costs curve in the long run

3. COMPANY REVENUES

Total, average and marginal revenue

In evaluating its position in the market the company is based on their income, which constantly measured against the costs. All cash income that the company gains from the sale of goods, the total revenue (TR).

$$TR = P \cdot Q$$

Development of income is affected by the market in which the company moves.

Average revenue (AR) income per unit of production, or:

$$AR = TR / Q = P$$

$$AR \cdot Q / Q \quad AR = P$$

The average income is therefore the price of production. The curve of average income then expresses the relationship between price and volume of produce as well as the demand curve. It follows that the curve of average revenue always coincides with the demand curve for production companies.

Marginal revenue (MR) is the change in total revenue caused by a change quantity produced by one unit.

Marginal revenue of the company is equal to the product price ($MR = P$). Marginal revenue curve is therefore a perfectly competitive market with identical demand curve, which the firm could be expected.

$$MR = \Delta TR / \Delta Q$$

$$MR = AR$$

4. NET PROFIT

We already know that the profit (π) is the difference between total revenue and total costs.

Thus we can write:

$$\pi = TR - TC$$

If we are interested in profit per unit of output we find it as the difference between average incomes and average costs, because

$$\pi / Q = TR / Q - TC / Q \text{ and hence: } \pi / Q = AR - AC$$

The total profit, we can express as follows:

$$\pi = (AR - AC) \cdot Q$$

In terms of cost concept is distinguished:

- **Accounting** (implicit))
- **Economic** (explicit).

$$\text{Net economic profit} = TR - \text{explicit costs} - \text{implicit costs}$$

In contrast, the accounting profit is the difference between total revenue and explicit costs:

$$\text{Accounting profit} = TR - \text{explicit costs}$$

Net economic profit can therefore be alternatively expressed as follows:

$$\text{Net economic profit} = \text{accounting profit} - \text{implicit costs}$$

The optimal level of firm's output (firms balance)

For profit-maximizing firms deciding on the optimal production volume (or. In imperfect competition on the price) are crucial marginal revenue and marginal costs, respectively. Their relationship. Why?

As already mentioned several times, the gain is the difference between total revenue and total costs. Furthermore, we know that the total revenues and total costs are increasing production volume increase.

What happens if **MR > MC**? When increasing the production volume of the unit will increase total revenue over total costs and thus increase profits. This means that the profit can be increased by increasing the volume of production. The volume of production is less than optimal.

If **MR < MC**, increasing production by one unit causes a greater increase than the total cost of revenues and profit therefore falls. Decrease in production volume causes higher decrease in total costs than total revenue and profit increases. In this case it is not therefore profit the maximum volume of production is higher than optimal.

Only when **MR = MC**, profit can be maximized because the change in volume production can not increase profit. The production volume for which this equality holds, then it is optimal, the company is the optimum.

The company is in optimum if the following applies: $MR = MC$.

List of tasks for students:

1. Draw indifference curves for the following consumer situation (pair of goods) and explain:
 - a) "I like beer, and I do not care what brand it is.
 - b) "I do eat bread, but only with a butter Otherwise I do not eat bread at all.
 - c) "If you give 3 or more cubes of sugar to the coffe it will be for me unacceptable.
2. Consumer spends on the purchase of goods X and Y together 200 monetary units. Utility function is defined as $U = X * Y$. Price the of good X is 10 - and the goods price Y is 4, -. What quantity of goods the will the consumer buy if he wants to maximize his benefit?
3. State always two kinds of goods whose demand manifests features:
 - a) high income elasticity,
 - b) low income elasticity,
 - c) high price elasticity,
 - d) low price elasticity.
4. Determine the marginal utility from the consumption of the tenth good X, if you know the total utility function: $TU = 24X - X^2$.
5. Determine the marginal utility from the consumption of the third unit of the good X, if the total utility function is given by the equation: $TU = 8X + 2X^2$.
6. We have the overall utility function of the form: $10X - X^2$. (X indicates the unit of goods consumed per week). Determine the equation of MU.
 - a) At what level of consumption will fall TU?
 - b) Derive and draw the curve MU and TU.
 - c) The price of X is 6 CZK. At which consumption goods X will maximize household utility.
7. Student gets an allowance CZK 300 per week. He spends his money on Kofola (X) and trdelník (Y). Price of trdelník is 50 CZK per piece and price of Kofola is 25 CZK per half liter.
 - a) Write the equation of the budgetary constraints of the student.
 - b) At steady state student drinks per week 5 liters Kofola. How much trdelník then buys?
 - c) Calculate the MRS equilibrium market basket and draw graphically.

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