### MICROECONOMICS

#### 4. THEORY OF SUPPLY

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#### **Objectives of the Presentation:**

- define the product offerer / provider (company/enterprise)
- explain the basic foundations of the theory of the company
- define the types and kinds of costs and revenues of a company and their relationships
- define the profit of a company



#### **Presentation Outline**

- **1.** Theoretical definition of the company
- 2. General aspects of production
- **3.** Costs and production in the short run
- 4. Costs and production in the long run
- **5.** Revenue and profit of the company



- We are talking about the supply side of the market in the final production markets - the bidders/offerer (the word producer has a slightly different meaning).
- The basic element of the supply side of the market.
- For the purposes of microeconomics we will call the bidder a company.
- For the existence of a company, i.e. for the bidding side of the final output market (the main entity on the supply side), we analyse three main parameters:
  - costs;
  - revenue;
  - the choice of technology.

- Company:
  - economic entity;
  - specialization on production (transformation of resources production inputs - into products), i.e. on:
    - production (final product product);
    - provision (providinig) of services (final product service);
  - sells products or services on final output markets;
  - objective: profit maximisation (mostly).

- There are four basic factors on the basis of which we define the scope of the company (i.e. the analysis of the three parameters mentioned above):
  - a) time horizon;
  - **b)** economic constraints;
  - c) market constraints;
  - d) technological constraints.



- Ad a) Time horizon factor:
  - essential factor for defining and developing corporate costs;
  - four main time periods of the company (the length of each period is not fixed):
    - short period: only labour is a variable factor of production (other factors do not change during the short period of the company);
    - long period: all factors of production are variable (the company manages to change all factors of production);
    - very short period: no factor of production is changed in time;
    - very long period: all factors of production are variable, and very substantially so (e.g. change in output, new know-how, investment, new technology).

- Ad b) Economic constraints:
  - reflects the fact that company production is struggling:
    - a cost requirement (the company has always costs);
    - the existence of competitive pressures (in terms of the costs necessary to beat competitors);
  - it is therefore a cost constraint.



- Ad c) Market constraint:
  - the fact that the firm's decision on the volume of output is influenced by the consumer (the size of demand for the product) - note that competitive pressures belong above;
  - so it is a constraint caused only on the demand side.



- Ad d) Technological constraints:
  - the product is produced by efficient use of factors of production (factors of production are scarce);
  - main inputs: natural resources, labour, capital goods;
  - choice of combination of factors of production = choice of technology;
  - it is therefore the availability of production processes, which are determined by the maturity and technological level of the industry.

- Factors determining the formation of a firm:
  - economies of scale: the company realizes economies of scale because production costs usually decrease as the volume of production increases (the link between variable and fixed costs);
  - financing: the life of the company (creation of production, development, response to change, investment including innovation) requires a certain amount of finance (often very significant) that only the company can accumulate (a private individual would not be able to do so);
  - management: a sequence of managerial activities (planning, organising, deciding and controlling) is necessary for all the activities taking place in the company.

#### 2. General Aspects of Production

- Problem to be solved: transformation of inputs (factors of production) into outputs (final production).
- Factors of production are limited.
- Production depends on consumer demand, which is unlimited (but production is not unlimited because factors of production are limited plus there are other factors such as competition, government intervention, global problems, climate problems, etc.).
- There are two basic aspects to this transformation:
  - production functions;
  - marginal product.

#### 2. General Aspects of Production

- Production function:
  - illustrates the process of production (transforming inputs into outputs):
  - expresses a relationship:
    - maximum (desired) quantity of production;
    - to the production of the required inputs;
    - under given technological conditions;
  - describes the functional relationship between the quantity of products X and the production inputs of land (A), labour (L), capital (K) and technology (t):

$$Qx = f(A,L,K,t);$$

- also referred to as total product (TP) synonym;
- it is the total amount of output produced in physical units.

#### 2. General Aspects of Production

- Marginal product:
  - represents the ratio of the increase in the total level of output (total product) by adding one unit of input;
  - the marginal product function is initially increasing but decreasing from a certain point - the law of diminishing (decreasing) returns (increasing the quantity of the variable factor of production from a certain point causes the fact that the increments of additional product start to decrease gradually);
  - total product (production function) grows more and more slowly as the marginal productivity of the additional factors of production falls;
  - this relationship (function) can be expressed:

 $\mathsf{MP} = \Delta \mathsf{TP} / \Delta \mathsf{F}.$ 

 So we have a functional dependence described by a production function:

Qx = f(A,L,K,t).

• However, if we are talking about a short period, then:

Qx = f(L).

(in the short run, only one of the inputs - labour - is variable)

• So we have a functional dependence for the marginal product:

 $MP = \Delta TP / \Delta F.$ 

- But if we are talking about the short run, then:
  - only human power is the variable under investigation (MP =  $\Delta TP/\Delta L$ );
- We also use the average product (AP), which represents the average amount of output per unit of the factor of production (the average yield of each additional unit of the factor of production - how much the total product increases on average each time one unit of the factor of production is added):

AP = TP/F.

• So we have a functional dependence for the marginal product:



- We know the production function and the marginal product for the firm's short run.
- Another important aspect is cost.
- The company makes payments for the factors of production it uses to produce the output, and thus the company incurs costs.
- Thus, costs are the payments for the factors of production it needs to produce.
- By definition, we are talking about production for sale on the market.
- The financial amount of costs depends on many factors.

- The price of the cost is determined primarily by their:
  - market price;
  - the quantity used for production;
  - quality;
  - availability;
  - choice of technology (choice of combination of production factors).

- There is a structured taxonomy of cost division.
- The basic division of costs:
  - variable cost (VC):
    - are directly dependent on the quantity of production (related to the production itself);
    - in particular the cost of hiring labour (plus raw materials and supplies);
  - fixed cost (FC) overhead:
    - need to be paid permanently, no matter how much output the company produces (even if the company is not currently producing);
    - mainly capital costs (plus e.g. building rent, advance payments);
  - total (TC, total cost) the sum of the two types of costs listed above, which we denote:

#### TC = VC + FC.

• The relationship TC = VC + FC can be broken down as follows:

TC = r.Kfix + w.L.

- where:
  - r is the price of capital (interest rate);
  - K is the factor of production in the form of capital (quantity of capital used);
  - w is the price of labour (wage rate);
  - L is the factor of production in the form of human labour power (quantity of labour power used).
- Note: sometimes factor of production are categorised as costs according to their nature (e.g. land is usually characterised under fixed costs, energy under specific contractual relationships).

Relationship TC = VC + FC: graphical representation.



Q (Quantity of output)

- Fixed costs represent a line parallel to the x-axis, (this line is at the monetary level of these fixed costs).
- Variable costs represent an increasing curve.
- Total costs represent the sum of VC and FC (the TC curve logically follows the shape of the variable costs).

• Relationship TC = VC + FC: graphical representation.



- All three types of costs have a unit form:
  - average variable cost (AVC);
  - average fixed cost (AFC);
  - average (total) cost (AC) this is the amount of specific costs per unit of output (Q) - how much one unit of output costs on average (average amount of costs per unit of output):

$$AC = AVC + AFC.$$

AC shows the opposite reality compared to AP (average product).

- Another type of costs Marginal costs:
  - we denote MC;
  - additional or incremental costs;
  - this is the increment in total cost that is required to expand production by one unit (not to be confused with AC, which is an average value, not incremental);
  - it is the increment in total cost caused by an increase in production by one unit of production
  - MC shows the opposite reality compared to MP;MC therefore expresses the relationship:

$$MC = TC2 - TC1 = \Delta TC / \Delta Q.$$

• The increase in total cost caused by an increase of one unit of output.

- If marginal cost is falling, then it is true that the production of each additional unit of output requires a cost lower than the production of the previous unit average cost is falling (certainly higher than MC).
- If marginal cost is increasing, then it is true that it is only possible to produce an additional unit of output at a higher cost than producing the previous unit - average costs are rising now or soon (it may still be higher than MC, but not for long).
- Marginal cost (MC) strongly influences the development of average cost (AC).
- Equality of MC and AC corresponds to the volume of final output that can be produced with the minimum average cost firm's production efficiency.

 Relationship of MC to average costs (AC, AVC and AFC): graphical representation.



- Relationship between short-term and long-term average costs:
  - AC cost curves are short-run average cost curves, so they are valid in the short run;
  - because of the firm's investment in the long run and the change in the involvement of factors of production, the level of final output that can be produced at the lowest average cost changes and the long-run average cost curve LRAC (the so-called envelope curve) is emerging.

Relationship between short-term and long-term average costs: graphical representation:



- Relationship between short-term and long-term average costs:
  - The shape of the short-run average cost curves (AC1 AC4) is the result of the law of diminishing marginal product (rising marginal costs), which holds in the short run.
  - In the long run, the shape of the long-run average cost curve is more elongated. The curve wraps around the short-run curves from below.
    Its shape is a consequence of economies and costs of scale.

- In the long run, all factors of production change (for the purposes of Microeconomics, we will consider only labour and capital as variable - a simpler graphical representation).
- The variability of these two factors of production can be represented by the so-called isoquant.
- Isoquant:
  - an isoproduct declining curve that represents all combinations of factors of production that can be used to produce the same quantity of output;
  - expresses the relationship between two factors of production, labour and capital.

Isoquant map



- Multiple curves can be plotted on the graph, which together are called the isoquant map.
- Each isoquant in the graph above represents a larger volume of production:

 The ratio in which a company is able to substitute labour for capital in its production process (without changing the volume of output produced) is the marginal rate of technical substitution of capital for labour (MRTSLK)
- it indicates the slope of the isoquant.

MRTS = MPL/MPK

- Depending on the fact that this measure changes as a function of distance from point 0, the slope of the isoquant changes.
- But this is not the end of the story for determining the optimal production factors combination...

- In order to determine the optimal combination of production factors, it is necessary to determine the so-called isocost (CL) or isocost line.
- This represents a line of equal total costs and is given by the ratio of factor prices.
- To determine the firm's cost optimum in the long run, the equality of the slope of the isoquant and the isocost line (see previous figure) is essential, i.e.:

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MRTS = MPL/MPK = PL/PK.
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- The optimal combination of factors of production (optimal production) can be considered to be a situation where the last unit of money spent on each factor of production yields the same increase in output.
- Graphically, this can be thought of as the point of contact between the isoquant and the isocost, or the isoquant touching the highest available isocost.
- In the figure, the cost optimum is marked by point E.
- At this point, the marginal rate of technical substitution is equal to the ratio of factor prices.

- Combinations of factors of production (isoquants) that lie above the isoquant are unavailable to the firm (the firm does not have sufficient finance for these combinations of factors of production).
- All other factor combinations (isoquants) below the isocost are costaffordable, but yield lower output.



- The last cost typology:
  - explicit: all costs actually incurred in the execution of production that are recorded in the accounts;
  - implicit: are opportunity costs that the firm does not actually pay for, but which are nevertheless kept visible - foregone revenues from the use of scarce resources (in the firm's particular way and not in an alternative way) - all costs associated with the use of production factors for which the firm does not actually pay (alternative use of factors owned by the entrepreneur).

- Company income:
  - important indicators;
  - it become even more important in relation to costs;
  - the firm receives income from the sales of its production;
  - all cash receipts = sales;
  - to calculate the different types of income it is necessary to know:
    - price per unit of production (P);
    - the quantity of products sold (Q).

- All the cash income that a firm realizes is referred to as total revenue (TR).
- Their calculation is given by a simple relationship:

TR = P. Q.

 Average revenue (AR) is the monetary amount attributable to a unit of output sold:

$$AR = TR/Q$$
 (i.e.  $AR = P$ ).

 Since TR = P. Q; AR = TR/Q; therefore P.Q/Q. It follows that average income is equal to the price of output (more precisely, the price per unit of output):

**AR = P.** 

- In the case of a constant price, the graphical representation of income is a straight line that is horizontal and just at its level (of the price).
- If the price decreases as the quantity of units sold increases, the graphical representation of income is a downward sloping curve expressing the relationship between price and the volume of output sold.

- And again the marginal variable, i.e. marginal revenue (MR).
- Marginal revenue is an incremental quantity that represents the additional income (the increase in total income) caused by a unit change in the quantity of output produced (sold):

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

- The graphical representation of MR depends on the variability of the price level (on the type of competition), so there are two possible shapes of the marginal revenue curve:
  - the price is constant (it does not change as output increases) the MR curve is a line parallel to the x-axis and identical to the line of average income lying at the price level.
  - price is volatile (the producer is able to influence it) the MR curve is a downward sloping curve that is twice as steep as the AR curve.

- Production means the relationship between income and costs.
- Each specific size of production corresponds to a specific level of total revenue (TR) and total cost (TC).
- The difference between TR and TC can mean:
  - the amount of profit (in the case of a positive result);
  - a loss (in the case of a negative result .



- Company profit:
  - a positive relationship between total revenue and total costs;
  - (π, profit);
  - expressed by the equation:
    - $\pi = \text{TR-TC}$  (where  $\pi > 0$ , otherwise we are talking about a loss).



Company profit in a perfectly competitive environment: a graphical representation.



Company profit in a perfectly competitive environment: a graphical representation.





- Profit typology (corresponds to the division of costs):
  - a) accounting profit;
  - b) net economic profit.
- The division of profits corresponds to the typology of costs (specifically the division into explicit and implicit costs).
- In general, when determining profit, it is important to know whether I am an economist or an accountant.
- We always consider total income.

- Ad a) Accounting profit:
  - This view looks at profit as the difference between total income (TR) and the real costs associated with the realisation of production that are recorded in the accounts (explicit costs).
  - Thus, this view of profit does not take into account opportunity costs (which the firm does not actually pay, yet keeps in mind).
- Ad b) Economic profit:
  - This is a more comprehensive view of the nature of profit (it takes into account the higher level of total costs).
  - This profit-making approach subtracts all costs from total income (TR), i.e. not only costs recorded in the accounts (explicit), but also opportunity costs that the firm does not actually pay, yet keeps visible foregone revenue from the use of scarce resources (implicit).

#### Thank You for Your Attention