

BASICS OF BUSINESS ECONOMY -

OUTCOME 3 – LECTURE – PRODUCTION AND COSTS

Definition of production and functions of production

- Production is a process of combining production factors with the goal of creating the products intended for the satisfaction of human needs .

Production process

- In production process companies convert inputs (L, L, C) to outputs (products and services).
- Inputs are factors of production .
- Relationship between inputs and outputs is described by production function .

Production function

The **production function** specifies the maximum output that can be produced with a given quantity of inputs.

It is defined for a given state of engineering and technical knowledge.

The goal of the manufacturer is to achieve maximum output from a given amount of input

- Key element: production techniques -
Production techniques show how producers combine inputs to obtain output

E.g. based on the use of technology and human labor, we distinguish between labor - intensive and capital -intensive production

- Only a certain amount of output can always be obtained with the given technology and available inputs

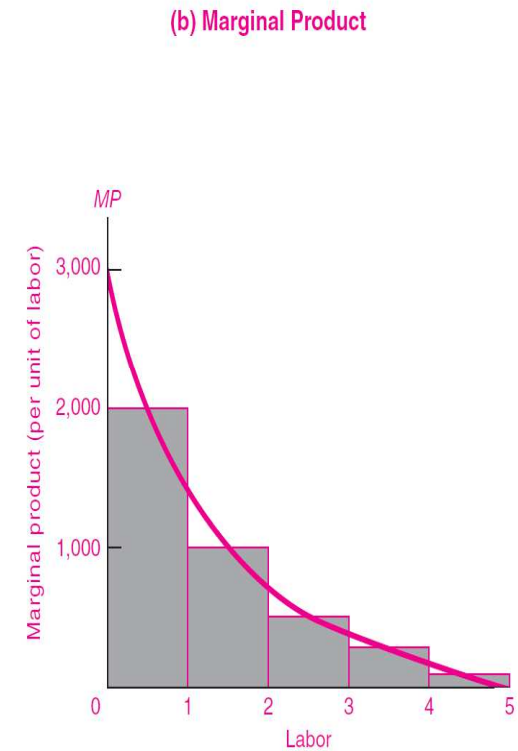
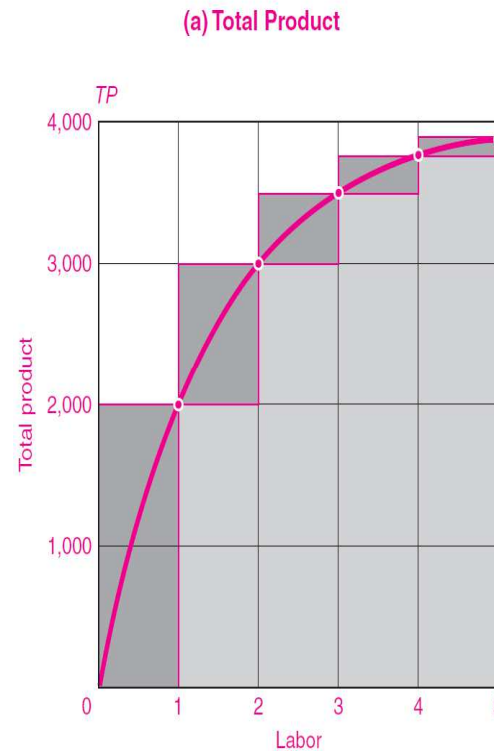


- The production function shows the relationship between the maximum output (output) and production inputs. In it, production inputs are an independent variable and output is a dependent one.
- Production function $Q = f(L, C, L)$
- where is Q = quantity of output , L quantity of labor , K = quantity of capital and L = quantity of land i.e. natural resources .

- Starting with a firm's production function, we can calculate three important production concepts:
- Total product (TP = total product): the total amount of output produced expressed in physical units (numbers of sneakers, computers, bushels of wheat etc)
- Average product (AP = average product): ratio of total product divided by quantity of input (TP/Q)
- Marginal product (MP = marginal product): marginal product of an input is the extra output produced by 1 additional unit of that input while other inputs are held constant ($\Delta TP/\Delta Q$)

Total, marginal and average product

(1) Units of labor input	(2) Total product	(3) Marginal product	(4) Average product
0	0		
1	2,000	2,000	2,000
2	3,000	1,000	1,500
3	3,500	500	1,167
4	3,800	300	950
5	3,900	100	780



definitions

Total product - total quantity produced (eg number of sneakers, number of cars, etc.)

- The total product curve shows how total product responds as the amount of labor applied is increased. The total product starts at zero for zero labor and then increases as additional units of labor are applied, reaching a maximum of 3900 units when 5 units of labor are used.
- Marginal product - an additional product produced by one additional unit of labor (while other inputs, ie machinery and land are fixed). The marginal product of labor starts at 2000 for the first unit of labor and then falls to only 100 units for the fifth unit.
- Average product - on average how many workers are needed to produce a certain amount of product. Calculated as total output divided by total units of input. (i.e. table shows the average product of labor as 2000 units per worker with one worker, 1500 units per worker with two workers, and so forth).

Short run and long run

- In addition to inputs (labor, capital, and land), production takes time.
- Short run - a period in which companies can adjust production by changing variables such as labor and materials (you can hire additional workers and buy raw materials) but cannot change fixed factors (eg capital - build a new hall or rent an office floor)
- Long run - a period that is sufficient for all factors, including capital, to adjust

The law of diminishing returns

- Basic law in economics
- Under the law of diminishing returns, a firm will get less and less extra output when it adds additional units of an input while holding other inputs fixed.
- It is valid for the short run in which we believe that we can increase production only by adding additional units of work (in the short term we cannot build a new production plant or buy new production machines so quickly)
- The marginal product of each unit of input declines as that input increases — each additional worker contributes less and less to production

- An example of a car wash

Returns to scale

- What would happen to production if land, labor, and capital increased in the same proportions?
- In this case, we are interested in the so-called returns to scale
- **Constant returns to scale** - change of all inputs leads to proportional change of production (eg If you double labor, land or capital, you will double production - hairdressing); long-run average total cost does not vary with the level of output
- **Increasing returns to scale (economies of scale)** - an increase in all inputs by 10% leads to an increase in production of more than 10% - e.g. Introduction of conveyor belt in car production and specialization of work; long-run average total cost falls as the quantity of output increases
- **Decreasing returns to scale (diseconomies of scale)** - an increase in input leads to a smaller increase in production - e.g. Production of monoculture in agriculture - if you increase the number of tractors, pesticides and insecticides and workers, the country will give less; long-run average total cost rises as the quantity of output increases

What might cause economies or diseconomies of scale?

- Economies of scale often arise because higher production levels allow *specialization* among workers, which permits each worker to become better at a specific task. For instance, if Ford hires a large number of workers and produces a large number of cars, it can reduce costs using modern assembly-line production.
- Diseconomies of scale can arise because of *coordination problems* that are inherent in any large organization. The more cars Ford produces, the more stretched the management team becomes, and the less effective the managers become at keeping costs down.

An example of economies of scale



- Apple is more efficient in the production of mobile phones than we would be if we did it in a garage, for example
- Why?
 - Cheaper labor (products in China)
 - Better negotiating terms (with suppliers, banks and investors)
 - Better equipment
 - Specialized workforce (marketing, administration, production)

Example of diseconomies of scale



IBM 'To Cut 111,000 Jobs' In Biggest-Ever Round Of Corporate Layoffs

Matthew Broersma, January 26, 2015, 11:25 am

- Relationships between people can get worse in large companies (problem of poor management)
- Communication between departments becomes more difficult the bigger the company (more hierarchical levels)
- Coordination - It is becoming increasingly difficult to coordinate the large number of tasks that need to be done
- Control - the geographical expansion of companies reduces control

Revenue and costs

definitions

- Total revenue = the amount the company receives to sell its product or service
- Total cost = market value of inputs used by the enterprise in production
- Profit = Total Revenue - Total Cost



Breakdown of company costs

(1) Output (cups of coffee per hour)	(2) Total Cost	(3) Fixed Cost	(4) Variable Cost	(5) Average Fixed Cost	(6) Average Variable Cost	(7) Average Total Cost	(8) Marginal Cost
0	\$3.00	\$3.00	\$0.00	—	—	—	
1	3.30	3.00	0.30	\$3.00	\$0.30	\$3.30	\$0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90
5	6.50	3.00	3.50	0.60	0.70	1.30	1.10
6	7.80	3.00	4.80	0.50	0.80	1.30	1.30
7	9.30	3.00	6.30	0.43	0.90	1.33	1.50
8	11.00	3.00	8.00	0.38	1.00	1.38	1.70
9	12.90	3.00	9.90	0.33	1.10	1.43	1.90
10	15.00	3.00	12.00	0.30	1.20	1.50	2.10

Example:
Conrad's coffee
shop

Definitions of costs

- Total cost (TC) consists of total fixed and total variable cost

$$TC = TFC + TVC$$

- Fixed cost (TFC) - Conrad's total cost can be divided into two types. Some costs, called fixed costs, do not vary with the quantity of output produced. They are incurred even if the firm produces nothing at all. Conrad's fixed costs include any rent he pays because this cost is the same regardless of how much coffee he produces. Similarly, if Conrad needs to hire a full-time bookkeeper to pay bills, regardless of the quantity of coffee produced, the bookkeeper's salary is a fixed cost.
- Variable cost (TVC) - change as the firm alters the quantity of output produced. Conrad's variable costs include the cost of coffee beans, milk, sugar, and paper cups: The more cups of coffee Conrad makes, the more of these items he needs to buy. Similarly, if Conrad has to hire more workers to make more cups of coffee, the salaries of these workers are variable costs.
- Note: There is also a mixed cost (for example, a telephone bill - the fixed part is a subscription, variable is what you spend outside the agreed subscription –e.g. roaming costs etc.)

Average and marginal cost

- As the owner of his firm, Conrad has to decide how much to produce. One issue he will want to consider when making this decision is how the level of production affects his firm's costs. Conrad might ask his production supervisor the following two questions about the cost of producing coffee:

1. How much does it cost to make the typical cup of coffee?

- To calculate a typical cup of coffee, we divide the company's costs by the amount of product it produces - average total cost - $ATC = TC / Q$

2. How much does it cost to increase production of coffee by 1 cup?

To calculate how the total cost increases when a company increases its production by 1 unit of product, we calculate the marginal cost $MC = \Delta TC / \Delta Q$

Average cost - definition

- Total cost divided by the quantity of output is called average total cost.
- Because total cost is the sum of fixed and variable costs, average total cost can be expressed as the sum of average fixed cost and average variable cost.
- Average fixed cost is the fixed cost divided by the quantity of output, and average variable cost is the variable cost divided by the quantity of output.
- Average costs are important for calculating the unit cost of a product and / or service, price calculation, profitability of a product or group of products, production plant ...

Average cost

- Average total cost
 - $ATC = \text{average total cost}$
 - They are also called unit costs
 - Total cost divided by the level of production of the enterprise (TC / Q)
- Average fixed cost
 - $AFC = \text{average fixed cost}$
 - Fixed cost divided by the company's production level (TFC / Q)
 - As the fixed cost is constant, the average fixed cost decreases with increasing level of production – spreading the overhead
- Average variable cost
 - $AVC = \text{average variable cost}$
 - Variable cost divided by the level of production of the company (TVC / Q)

Marginal cost

- MC = marginal cost
- the increase in total cost that arises from an extra unit of production
- $MC = \Delta TC / \Delta Q$
- It provides information on how much it will cost a company to increase the level of production for one extra unit of production

What is the effective amount of production?

(1) Output (cups of coffee per hour)	(2) Total Cost	(3) Fixed Cost	(4) Variable Cost	(5) Average Fixed Cost	(6) Average Variable Cost	(7) Average Total Cost	(8) Marginal Cost
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1	3.30	3.00	0.30	\$3.00	\$0.30	\$3.30	\$0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90
5	6.50	3.00	3.50	0.60	0.70	1.30	1.10
6	7.80	3.00	4.80	0.50	0.80	1.30	1.30
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- Marginal cost increases with the quantity of product produced (decreasing marginal product)
- As production grows - the marginal product of the extra worker is large and the marginal cost of an extra cup of coffee is small
- This is up to the level of 5 or 6 cups of coffee - at that point the average total cost is the lowest (\$ 1.3 per cup) and is equal to the marginal cost
- We say it is an efficient amount of production
- When the marginal cost is less than the average total cost = the average total cost decreases and vice versa

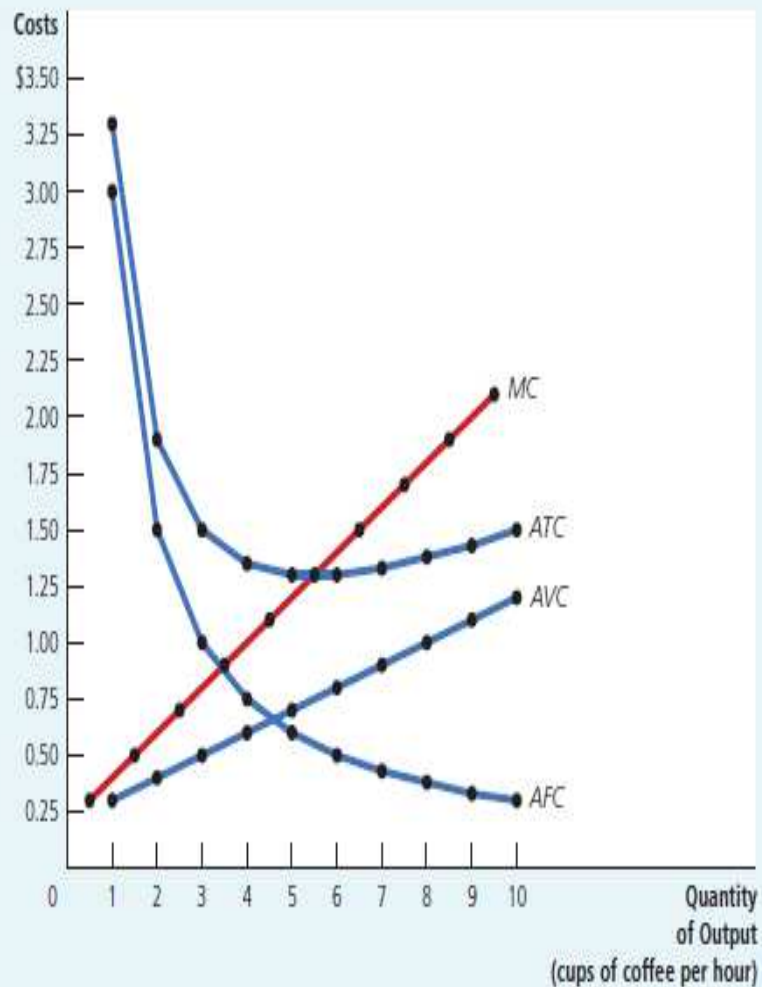


FIGURE 4

Conrad's Average-Cost and Marginal-Cost Curves

This figure shows the average total cost (ATC), average fixed cost (AFC), average variable cost (AVC), and marginal cost (MC) for Conrad's Coffee Shop. All of these curves are obtained by graphing the data in Table 2. These cost curves show three common features: (1) Marginal cost rises with the quantity of output. (2) The average-total-cost curve is U-shaped. (3) The marginal-cost curve crosses the average-total-cost curve at the minimum of average total cost.

- We will produce a quantity that minimizes the average total cost - where the MC curve intersects the ATC curve (U-shaped)
- In our case the effective amount is 5 or 6 cups of coffee
- If more or less is produced, ATC rises above the \$ 1.30 minimum

- Let's go back to the car wash and look at the costs... ..

Short run and long run

- In production, the concept of short run and long run does not coincide with short run and long run in accounting terms (fiscal year for a firm is 365 days, i.e. 1 year – that is short run; more than that is long run)
- The short run in production is characterized by the existence of fixed costs, while the long run is the one in which all costs are variable, ie there are no fixed costs
- The long run in production can be several weeks, but also several years

Cost and time

- The division of costs into fixed and variable is valid only in the short run, while in the long run all costs are variable
- Short run period is shorter in industries with a small amount of fixed inputs (e.g. service industry) or if they can be easily replaced
- The opposite is true in branches with a large amount of fixed inputs (shipyards, car industry)
- For many firms, the division of total costs between fixed and variable costs depends on the time horizon. Consider, for instance, a car manufacturer such as Ford Motor Company. Over a period of only a few months, Ford cannot adjust the number or sizes of its car factories. The only way it can produce additional cars is to hire more workers at the factories it already has. The cost of these factories is, therefore, a fixed cost in the short run. By contrast, over a period of several years, Ford can expand the size of its factories, build new factories, or close old ones. Thus, the cost of its factories is a variable cost in the long run.