

Group: YSU Economics & Supply Chain

## ECONOMICS TOPIC 5

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## TOPIC 5: PRODUCTION AND COSTS

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## 0 SHORT-RUN VS LONG-RUN



The **short run** is the time period over which *at least one* factor of production is **fixed**.

### Fixed Factors

Factors that cannot be changed in the short run e.g., capital, buildings



The **long run** is the time period in which *all* factors of production can be changed (all factors become **variable**).

### Variable factors

Factors that can be changed in the short run e.g., labour and raw materials



5 Different firms and different industries will have different short and long-run periods.

## 1.1 THE LAW OF DIMINISHING (MARGINAL) RETURNS

Production in the short run is subject to *diminishing returns*.

**Example:** A farm with one fixed factor (land) and one variable factor (labour).



Since the land is fixed in supply, output per period of time can be increased only by increasing the number of workers employed.



With more and more workers, the land cannot go on yielding more and more output indefinitely. After a point the additions to output from each extra worker will begin to diminish or reduce.

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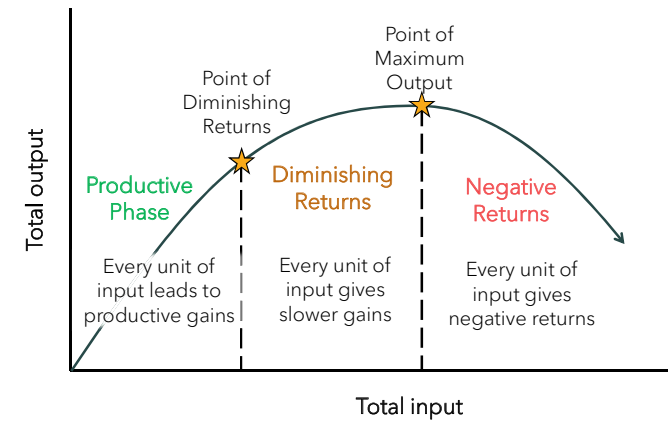
## 1.1 THE LAW OF DIMINISHING (MARGINAL) RETURNS



**Law of diminishing (marginal) returns**  
After some optimal level of capacity is reached, adding additional variable factor of production will result in smaller increases in output. It applies in the short run, as the fixed factors become overloaded.

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## 1.1 THE LAW OF DIMINISHING (MARGINAL) RETURNS



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## 1.2 TOTAL, AVERAGE AND MARGINAL PRODUCTS

How the law of diminishing returns affects total output or total physical product?

### Total physical product (TPP)

the amount of output produced over a given time period from a given quantity of inputs.

The relationship between inputs and outputs is shown in a **production function**:

$$TPP = f(K, L)$$

where  $K$  = capital and  $L$  = labour. This states that TPP over a given period of time is a function of (i.e. depends on) the quantity of capital and labour employed.

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## 1.2 TOTAL, AVERAGE AND MARGINAL PRODUCTS

### Average physical product (APP)

is equal to total physical product (TPP) per unit of a variable factor. So, if  $Q_v$  is the quantity of the variable factor:

$$APP = \frac{TPP}{Q_v}$$

### Marginal physical product (MPP)

is the extra output produced by employing one extra unit of the variable factor, when the input of other factors is held constant, i.e.:

$$MPP = \frac{\Delta TPP}{\Delta Q_v}$$

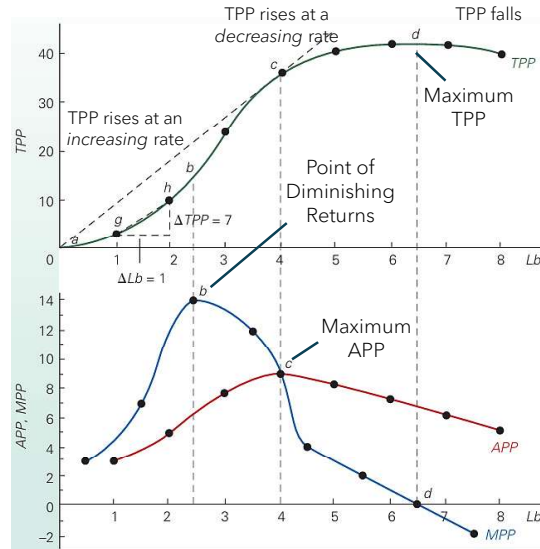
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## 1.2 TPP, APP AND MPP

Wheat annual production from a farm (tonnes)

	Number of workers (Lb)	TPP	APP (=TPP/Lb)	MPP (=ΔTPP/ΔLb)
a	0	0		
	1	3		3
	2	10		7
b	3	24		14
c	4	36		12
	5	40		4
	6	42		2
d	7	42		0
	8	40		-2

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## 1.2 TPP, APP AND MPP: SUMMARY

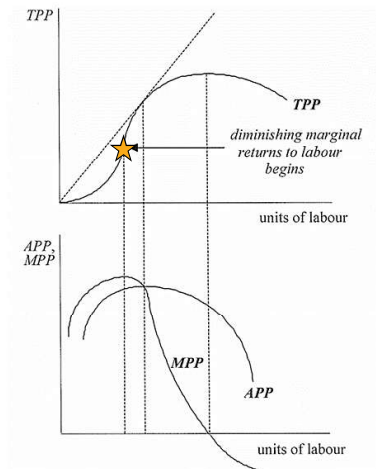
Short-run production curves relationship summary:

- The law of diminishing returns means that MPP will eventually decrease. When it does, TPP will start to rise at a decreasing rate. When MPP becomes negative, TPP will start to fall.

- If:

MPP > APP, then APP is increasing  
MPP < APP, then APP is decreasing  
MPP = APP, then APP is at its maximum.  
MPP = 0, then TPP is at its maximum.

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## 2 COSTS IN THE SHORT RUN

The relationship between costs and factor inputs depends on:

- ★ Factor productivity: Higher productivity implies lower production costs



The greater the productivity, the smaller amount of labour and capital is needed to produce a given level of output.

- ★ Factor prices: Higher prices imply higher production costs

- Fixed costs: costs that do not vary with the level of output produced, eg capital
- Variable costs: costs that vary with the level of output produced, eg raw materials.

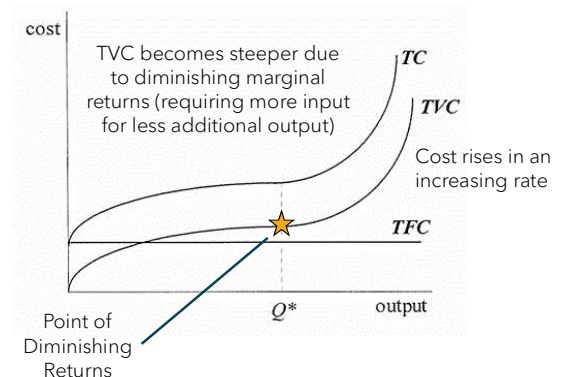
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## 2.1 TOTAL, AVERAGE AND MARGINAL COST

The relationship between TC, TFC and TVC

Total cost is the sum of total fixed costs (TFC) and total variable costs (TVC), ie:

$$TC = TFC + TVC$$



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## 2.1 TOTAL, AVERAGE AND MARGINAL COST

Average total cost (AC) is equal to total cost divided by the number of units of output produced.

$$AC = TC / Q = AFC + AVC$$

Average fixed cost (AFC) is equal to total fixed cost divided by the number of units of output produced.

$$AFC = TFC / Q$$

Average variable cost (AVC) is equal to total variable cost divided by the number of units of output produced.

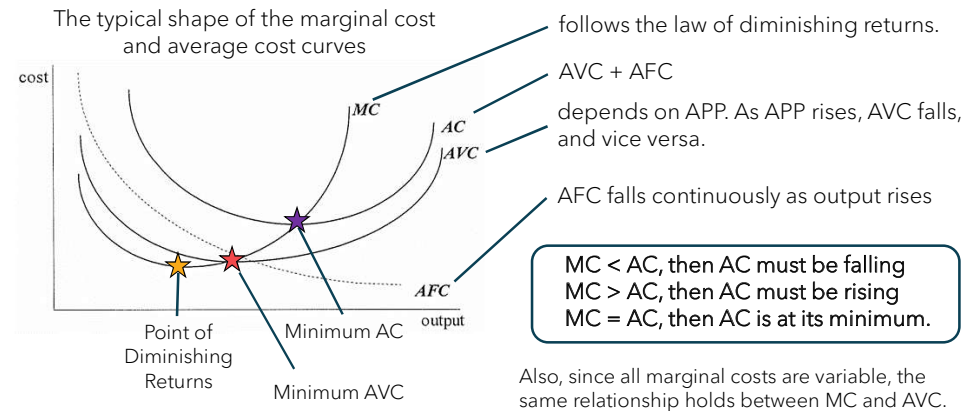
$$AVC = TVC / Q$$

Marginal cost (MC) is the increase in total cost from producing one extra unit of output.

$$MC = \Delta TC / \Delta Q$$

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## 2.1 AVERAGE AND MARGINAL COSTS



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## 3 PRODUCTION IN THE LONG RUN

In the long run, all factors are **variable**. Firms will therefore need to make decision about the:

### Scale of production

The size of a firm's productive capacity, or the size of operation adopted.

Changing the scale of production refers to changing *all* factor inputs by the same %

### Location of production

In the long run, a firm can choose the location of production.

The location affect the cost of production due to its availability, suitability and cost of the factors of production.

### Production techniques

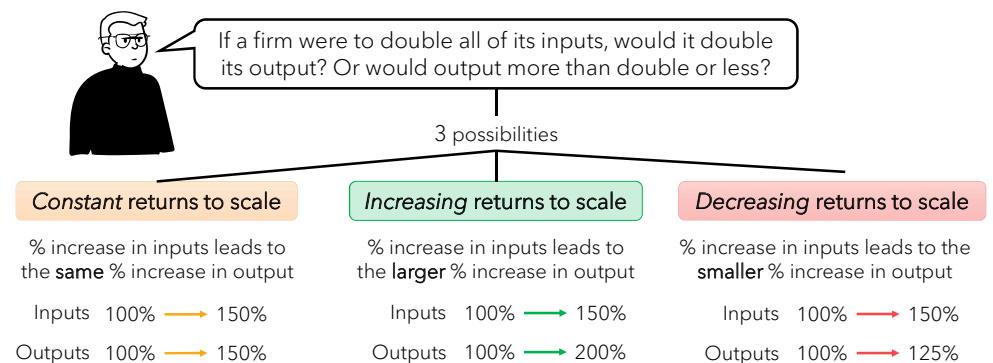
A profit-maximizing firm will aim to *minimise the* costs of production.

The optimum combination of factors a firm can produce at the lowest possible cost are determined.

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## 3.1 SCALE OF PRODUCTION

Changing the scale of production = changing *all* factor inputs by the same %



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### 3.1 SCALE OF PRODUCTION: ECONOMIES OF SCALE

An increase in output quantity *reduces* the long-run average cost of production.

If all factor costs are constant, then **increasing returns of to scale** results in economies of scale.

It occurs from operational efficiencies and various sources, including:

- ★ **Purchasing**                      Buying inputs in bulk for volume discounts leads to lower average costs.
- ★ **Managerial**                      Improving management structure and hiring better skilled or more experienced managers.
- ★ **Technological advancement**                      Improving production efficiency and productivity

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### 3.2 LOCATION

In the long run, a firm can choose the location of production. The choice of location reflects:

- the availability, suitability, and cost of **factor inputs**
- **transport costs** – distance to both market and raw materials is appropriate.

**Example:** It is more profitable to locate car factories in countries that have access to cheaper inputs and are more centrally located in their largest markets.

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### 3.1 SCALE OF PRODUCTION: DISECONOMIES OF SCALE

An increase in output quantity *increases* the long-run average cost of production.

They may arise from:

- ★ **Managerial problems**                      less efficiency
- ★ **Poor motivation of the workforce**                      poor-quality output
- ★ **Problems in one area holding up all production**                      Part of production-line disruption can leads to great disruption

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### 3.3 THE OPTIMUM COMBINATION OF FACTORS

In the long run, the profit-maximising firm can choose any mix of factors to minimise the costs of producing a given level output

**The simple two-factor case**

With only two factors, capital ( $K$ ) and labour ( $L$ ), the *cost-minimising combination* is where:

$$\frac{MPP_K}{P_K} = \frac{MPP_L}{P_L} = \dots = \frac{MPP_N}{P_N}$$

marginal physical product of factor  $i$  / price of factor  $i$

**The multifactor case**

In the case of  $N > 2$  factors, the two-factor result generalise to:

This ensures that the extra output produced by the last dollar spent on each factor is equal and that it is impossible to reorganize the factors to reduce costs.

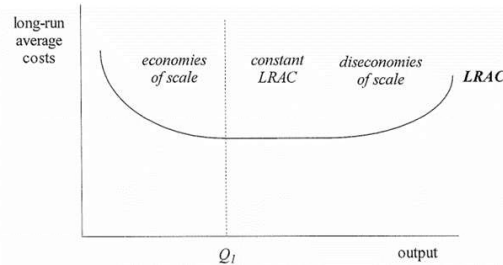
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## 4.1 COSTS IN THE LONG RUN: LONG-RUN AVERAGE COSTS

The **long-run average cost curve (LRAC)** shows how average costs vary with output, assuming that all factors can be varied and that costs are minimised. LRAC typically:

- **decrease** up to a certain level of output due to **economies of scale**
- **increase** beyond a certain level of output due to **diseconomies of scale**.

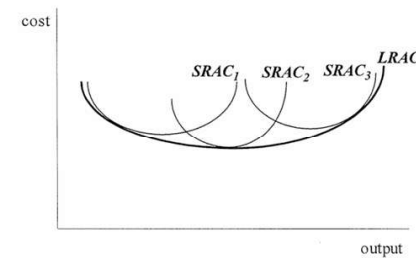
In between, there may be a range of output levels, over which they are fairly constant. So, the LRAC curve is often a U-shaped or a saucer-shaped curve.



**minimum efficient scale (MES)**, ie the output level beyond which no further economies of scale can be achieved.

## 4.2 RELATIONSHIP BETWEEN LONG-RUN AND SHORT-RUN AVERAGE COST CURVES

The relationship between long-run and short-run average cost curves



The LRAC curve is typically an *envelope curve* lying below the corresponding short-run average cost curves, which are *tangential* to it.

This is because in the long run, the quantities of all input factors can be varied and hence optimised, whereas in the short run, some are fixed (e.g., capital) and so cannot be re-optimised.