

Short run: The period of time in which at least one factor of production is fixed. All production takes place in the short run.

Long run: The period of time in which all factors of production are variable, but the state of technology is fixed. All planning takes place in the long run.

The hypothesis of eventually diminishing marginal returns: As extra units of a variable factor are added to a given quantity of a fixed factor, the output from each additional unit of the variable factor will eventually diminish.

The hypothesis of eventually diminishing average returns: As extra units of a variable factor are added to a given quantity of a fixed factor, the output per unit of the variable factor will eventually diminish.

Economies of scale: Any falls in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output.

Diseconomies of scale: Any increases in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output.

Shut-down price: The level of price that enables a firm to cover its variable costs in the short run, where $P = AVC$, if the firm cannot cover variable costs, then it will shut down in the short run (and plan ahead in the long run).

Break-even price: The price at which a firm is able to make normal profit in the long run, where $P = ATC$, so the firm covers all of its costs, including the opportunity cost.

Profit maximizing output: The level of output where marginal cost is equal to marginal revenue ($MC = MR$).

Product and the law of diminishing returns (short run)

The law of diminishing returns causes production eventually to become inefficient as more of a variable factor is applied to fixed factors and so the rate of growth of total product begins to decrease and the output per unit of the variable factor, and from each extra unit of the variable factor, begins to fall. This is shown below.

Total product (TP) is the total output that a firm produces, using its fixed and variable factors in a given time period. Output in the short run can only be increased by applying more units of the variable factors to the fixed factors.

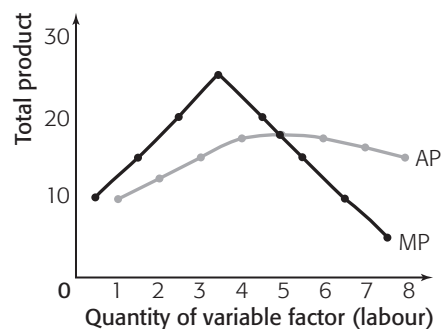
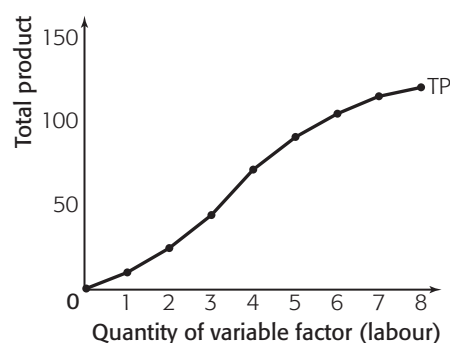
Average product (AP) is the output that is produced, on average, by each unit of the variable factor.

Marginal product (MP) is the extra output that is produced by using an extra unit of the variable factor.

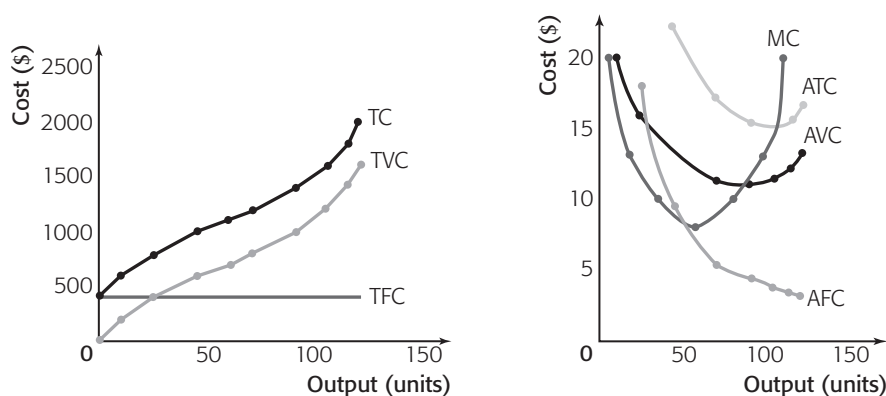
Costs – total (short run)

Total costs are the complete costs of producing output. We use three measures:

- Total fixed cost (TFC)** is the total cost of the fixed assets that a firm uses in a given time period. Since the number of fixed assets is, by definition, fixed, TFC is a constant amount. It is the same whether the firm produces one unit or one hundred units.
- Total variable cost (TVC)** is the total cost of the variable assets that a firm uses in a given time period. TVC increases as the firm uses more of the variable factor.



3. **Total cost (TC)** is the total cost of all the fixed and variable factors used to produce a certain output. It is equal to TFC plus TVC.

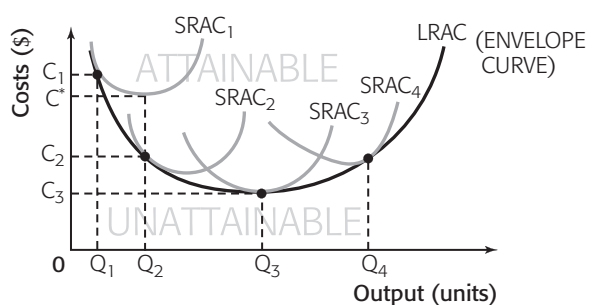


Costs – average and marginal (short run)

- Average costs** are costs per unit of output. We use three measures.
 - Average fixed cost (AFC)**
AFC is the fixed cost per unit of output. As TFC is a constant, **AFC always falls as output increases.**
 - Average variable cost (AVC)**
AVC is the variable cost per unit of output. AVC tends to fall as output increases and then to start to rise again as the output continues to increase. This is explained by the hypothesis of eventually diminishing average returns.
 - Average total cost (ATC)**
ATC is the total cost per unit of output. It is equal to AFC plus AVC. As with AVC, ATC tends to fall as output increases and then to start to rise again as the output continues to increase.
- Marginal cost (MC)** is the increase in total cost of producing an extra unit of output. MC tends to fall as output increases and then to start to rise again as the output continues to increase. This is explained by the hypothesis of eventually diminishing marginal returns.

Costs (long run) and economies and diseconomies of scale

When planning in the long run, an entrepreneur is free to adjust the quantity of all of the factors of production that are used and is only restrained by the current level of technology. This means that in the long run, we look at what happens to costs when **all of the factors of production are increased** in order to increase output. In theory, the long-run average cost curve (LRAC) is an 'envelope' curve, i.e. it envelops an infinite number of short-run average cost (SRAC) curves.



When long-run unit costs are falling as output increases, we say that the firm is experiencing **increasing returns to scale**. This means that a given percentage increase in all factors of production will lead to a greater percentage increase in output, thus reducing long-run average costs.

When long-run average costs are constant as output increases, we say that the firm is experiencing **constant returns to scale**. This means that a given percentage increase in all factors of production will lead to the same percentage increase in output, thus leaving long-run average costs the same.

When long-run average costs are rising as output increases, we say that the firm is experiencing **decreasing returns to scale**. This means that a given percentage increase in all factors of production will lead to a smaller percentage increase in output, thus increasing long-run average costs.

Why do long-run costs increase or decrease as output increases? There are two factors to be considered.

1. **Economies of scale** – these are any falls in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output. Economies of scale lead to the firm experiencing increasing returns to scale. The main economies of scale that may benefit a firm as it increases the scale of its output are **specialization, division of labour, bulk buying, financial economies** and **transport economies**.
2. **Diseconomies of scale** – these are any increases in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output. Diseconomies of scale lead to the firm experiencing decreasing returns to scale. The main diseconomies of scale are **control and communication problems, alienation and loss of identity**.

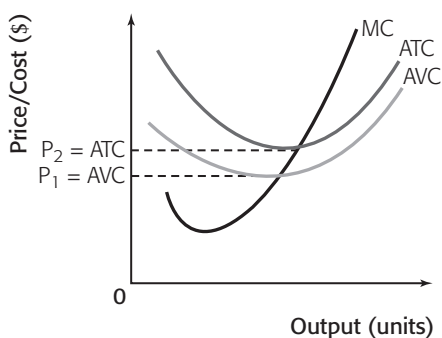
All of the above economies and diseconomies of scale relate to the unit cost decreases or increases that might be encountered by a single firm. They are known as **internal economies and diseconomies of scale**. There are other economies and diseconomies that come about when the size of the whole industry increases and this has an effect on the unit costs of individual firms. They are known as **external economies and diseconomies of scale**.

Economist's definition of profit, shut-down price, break-even price and profit maximization

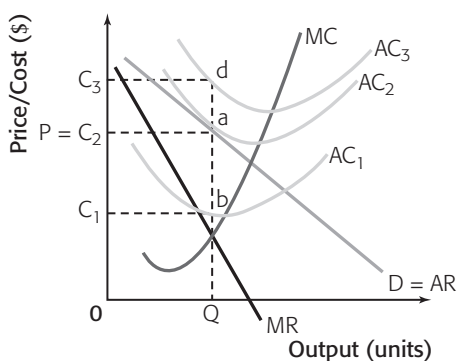
Normal profit: Total revenue = total cost (fixed cost, variable cost **and opportunity cost**). The opportunity cost is the amount of profit that the owner of the firm expects to make. If the owner does, then he/she is happy.

Abnormal profit: Total revenue > total cost (fixed cost, variable cost **and opportunity cost**). The owner is making more than his/her expected profit and so is very happy.

Losses: Total revenue < total cost (fixed cost, variable cost, **and opportunity cost**). The owner is making less than his/her expected profit and so, if the losses continue in the long run, the owner will shut down the firm and move to his/her next best occupation.



The shut-down price is $P_1 = AVC$. If the firm receives a price below this, then the firm will shut down in the short run and try to plan for a profit in the long run. The break-even price is $P_2 = ATC$. If the firm receives a price below this in the long run, then the firm will shut down for good. If the firm receives the break-even price, then the firm will be happy, since it is making normal profit.



Profit is maximized where $MC = MR$. If the cost curve is at AC_1 , then the firm is making abnormal profits of C_1C_2ab (a-b per unit). If the cost curve is at AC_2 , then the firm is making normal profits. If the cost curve is at AC_3 , then the firm is making losses of C_2C_3da (d-a per unit).