

Production Function

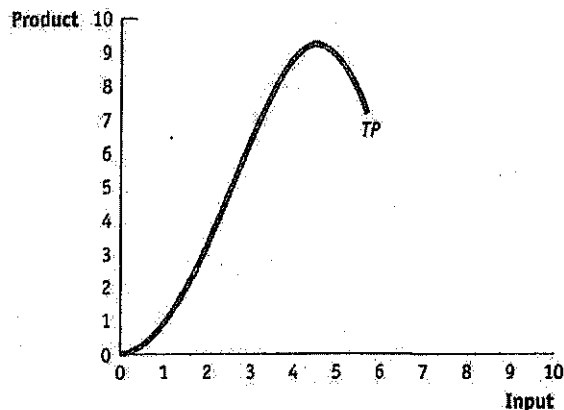
A production function illustrates the way in which fixed and variable inputs are combined to produce output.

A fixed input is an input whose quantity cannot be easily changed for a period of time. Typical fixed inputs are land and capital.

A variable input is an input whose quantity can be easily changed at any time. Typical variable inputs are labor and raw materials.

A production function graph illustrates the level of output (total product) produced using different levels of the variable input. Fixed input(s) are held constant along a production function.

The marginal product of an input is the additional output produced by using one more unit of that input.



The marginal product equals the change in output resulting from a change in a variable input.

$$MP_L = \Delta TP / \Delta L$$

The marginal product is also the slope of the total product curve.

When more of a variable input (such as labor) is added to a fixed input (such as capital), the marginal product of the variable input eventually declines. This is shown on the graph as a decrease in the slope of the total product curve from left to right. This is referred to as the "principle of diminishing returns" to that input.

The average product of an input is the output produced *per unit* of the input used. Average product equals the total product divided by the units of input used.

$$AP_L = TP / L$$

The short run is a period of time too short to change the fixed input(s). The long run is a period of time long enough to vary all inputs.

In the long run, firms can increase the level of fixed inputs. An increase in fixed inputs will shift the production function upward.