Contents

Technology and Production Function

The Short and the Long Run
Firms use inputs to produce goods and services (output).

Inputs or production factors are labor, capital (also intermediate) goods, and natural resources (land).

To simplify we consider only labor (L) and capital (K).

A production technique is a combination of L and K that yields output Q (in physical units).

Production techniques

With 1 sewing machine (K=1) and 1 worker (L=1) we can repair seven pairs of socks per hour (Q=7). So \((L, K, Q) = (1, 1, 7)\) would be a production technique.

The different production techniques which are available for a firm (or civilisation) conforms its technology.

When a new production technique appears or disappears, we experience technological change.

- If the new technique allows to produce more efficiently, → technological progress.
- If the new technique allows to produce more efficiently, → technological regress.
The Production function summarizes the technology of a firm or country. Shows for every combination of L,K the corresponding output Q.

It assumes that the technology is constant. Thus, changes in technology (progress or regress) change the production function.

The perfect substitutes production function

The technology for producing cheese (H) uses two inputs: cow milk (C) or goat milk (G). With 10 liter of either milk one can produce 1 kg. of cheese. A production function could be \( H = \frac{(G + C)}{10} \). Different techniques from this production function are (20, 10, 3) or (15, 15, 3) or (7, 34, 4.1), etc. . . A technological progress could imply this new production function: \( H = \frac{(G + C)}{5} \).

Total, Average and Marginal Products

- Total product: Output produced by a number of inputs over a period of time
- Average product: Output produced per unit of input
- Marginal product: the addition to output of one extra unit of inputs.
The Short and Long Run

- Short run: period where producers face the problem that some of their factors are fixed.
- Long run: period where all factor inputs are variable.
- In the long run, producers can vary the amount of land or capital. In the short run usually, capital is given.
- Short and long run can not be given a standard length: it depends on sector or firm.

The Short and Long Run
Short Run: Diminishing Returns

- In the short run, one factor, capital is fixed.
- If we want to expand production, we need to contract more from the only variable input. (table 46.1)
- By the law of diminishing returns, each extra worker adds less and less to the total output.
The Short and Long Run
Long Run: Returns to Scale

- In the long run, all factors are variable
- If we want to expand production we can, for example, double the inputs used.
  - If the final production doubles: constant returns to scale
  - If the final production more than doubles: increasing returns to scale
  - If the final production less than doubles: decreasing returns to scale.
- Economic meaning: A firm with increasing returns is a firm prone to grow. A firm with decreasing returns to scale is a firm with a growth-cap.

The Short and Long Run
Long Run: Returns to Scale

- If we are producing Q with inputs L and K.
- We multiply L and K by factor $\lambda$.
  - If with $\lambda L$ and $\lambda K$ produce $\lambda Q$ then constant returns to scale.
  - If with $\lambda L$ and $\lambda K$ produce more than $\lambda Q$ then increasing returns to scale.
  - If with $\lambda L$ and $\lambda K$ produce less than $\lambda Q$ then decreasing returns to scale.