

Production

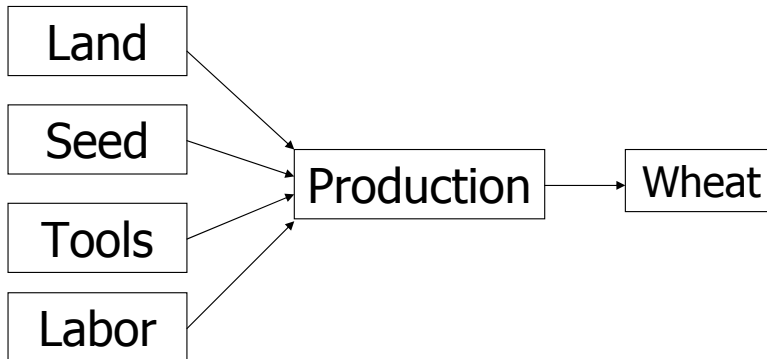


**“Nothing comes from nothing.
Nothing ever could.”**

(from the movie “Sound of Music”)

**Production is a way to transform
some resources into another form.**

Factors of Production (example)



- For example, we combine/use land, seed, tools and labor to produce wheat. Land, seed, tools and labor are called factors of production. Wheat is called the output.

Factors of Production

- ❖ **Land** — is all the natural resources used to produce goods and services.
- ❖ **Labor** — is the time and effort that people devote to producing goods and services.
 - ❖ **Labor supply = labor x labor man-hour**
- ❖ **Capital** — is all the equipment, buildings, tools and other manufactured goods used to produce other goods and services.
- ❖ **Entrepreneurship**— is a special type of human resource that organizes the other three factors of production, makes business decisions and bears business risk.

•In economics, we abstract from the many type of factor inputs and classify them as land, labor, capital and entrepreneurship.

Production Factors



- ❖ **Fixed factor** – input whose employment remains constant when output changes.
- ❖ **Variable factor** – input whose employment increases (drops) as output increases (drops).

Differences between short run, intermediate run & long run

- ❖ **For production period, we have short run, intermediate run & long run.**
- ❖ **In short run, all factors are fixed.**
- ❖ **In intermediate run, all factors are variable.**
- ❖ **In long run, all factors are variable. Also, the number of producers in market can be changed.**
 - ❖ **Profit attract new producer.**
 - ❖ **Loss will force producer out.**

- To see that how a typical production is done and the factors that may affect the production, we will conduct many experiments/games of production as explained below.

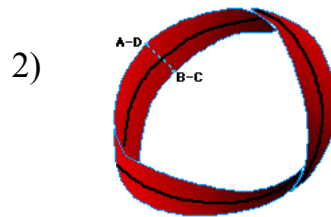
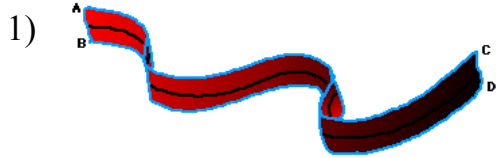
Moebius Strip



- ❖ **We will produce Moebius Strips.**
- ❖ **Start with a long rectangle (ABCD) made of paper, then give the rectangle a half twist. Join the ends so that A is matched with D and B is matched with C.**

- Today, we will produce the Moebius Strip. Here is how we may produce a moebius strip. (Show Figure 1)

Moebius Strip



From: <http://www.scidiv.bcc.ctc.edu/Math/Mobius.html>

- Demonstration by teacher using the toothpick to pick up glue. Also, pick two students to do demonstration.

Factors for producing Moebius strip

- ❖ **Here, the toothpicks and glue are the capital (K).**
- ❖ **Students are labor (L).**
- ❖ **Production technology (A) will raise from toothpicks & glue to glue pen.**

- Let's divide the class into two groups and compete in the production of moebius strip. The production mimics a firm that has two production teams. We have only 30 seconds to produce as many moebius strips as we can.
- After evenly dividing the class into two groups, teacher should assign a number to each student.
- A student is chosen from each group to be a Quality Control (QC) and recorder of the other group. Teacher should post two Table 1 (one for group one's record and one for group two's) and a Table 2 on blackboard in advance. The classroom setting can be seen in Figure 2.
- Repeat with two toothpicks. Tell students that capital \uparrow .
- Repeat with a glue pen. Tell students that technology \uparrow .
- Let's revise the whole production process: For every production process, we have fixed factors, so it is a short run production. But for the whole production, all production factors are variable, so it is a long run production.
- Since we have 2 sets of data now, let's take the simple average and record it

Total product, average product & marginal product

- ❖ **Total product – the whole amount of output produced by all the factors employed.**
- ❖ **Average product of labor – the total output produced by labor in a given period of time, holding capital and technology constant.**
= TP / L

Total product, average product & marginal product

❖ **Marginal product of Labor – the change in output resulting from employing an additional unit of Labor.**

$$= \Delta TP_L / \Delta L$$

❖ **e.g. If we know the marginal output when labor unit being employed increase from 0 to 1, then $MP_{L=1} = [TP(L=1) - TP(L=0)] / [L=1 - L=0]$**

Δ = change

Total product, average product & marginal product

L	TP(L)	MP(L) =	AP(L) =
0	TP(0)		TP(0) / 0
1	TP(1)	TP(1) – TP(0) / 1	TP(1) / 1
2	TP(2)	TP(2) – TP(1) / 1	TP(2) / 2
3	TP(3)	TP(3) – TP(2) / 1	TP(3) / 3
4	TP(4)	TP(4) – TP(3) / 1	TP(4) / 4

- Let's use the figure in table 1 & 2 to demonstrate.
- Students can compare MP_L and AP_L .
- After they are done with the calculation, teacher can plot the TPC_L , APC_L and MPC_L for each round of games on three separate transparencies with graph paper printed on (Teacher should print the Diagram 1 on three blank transparencies in advance.) Use this opportunity as a demonstration of how to plot graphs.

From Table 2



We can observe 3 economics concept:

- 1. Law of diminishing marginal returns**
- 2. How Capital input change affects output**
- 3. How production technology change affects output**

Law of diminishing marginal returns



❖ Law of diminishing marginal returns

– as more variable factors are added to given quantity of fixed factors, holding technology constant, marginal product eventually drops.

- In our game, total production increase as labor input increase at the beginning (refer to Table 2). As more labor are added to given quantity of fixed factors, holding technology constant, marginal product eventually drops.

How Capital input change affect output

- ❖ **Increase capital input, producers can increase output even the level of variable inputs is unchanged.**

•Like we increase 2 pieces of toothpicks, total output increases at the beginning (refer to Table 2). After that, because of the Law of diminishing marginal returns, total output begins to drop.

How production technology change affects output

❖ With the increase in the level of production technology, producers can reduce the usage of inputs or the costs of production, but still have an increase in the level of outputs.

• Like we use glue pen instead of toothpicks, total production can be raised at the beginning (refer to Table 2). After that, it is affected by Law of diminishing marginal returns, total production growth begins to decrease.

Discussion



- ❖ **For any given technology and capital, how does the total product change with labor used?**

- ❖ **How does an increase in technology affect the output for any given labor input?**

Discussion



- ❖ **How does an increase in capital affect the output for any given labor input?**
- ❖ **The change in technology and the change in capital seem to have different effects on the total product. Can you suggest the reason(s) behind?**

•After class, demonstrate the magic of moebius strip by cutting the strip's width into half again and again.

Discussion



- ❖ **If you are the manager and you can employ only two labors, who should be chosen to produce the strips and why?**

- ❖ **How much are you willing to pay to increase the number of capital (i.e. the number of toothpicks in the game)?**

Discussion



- ❖ **How much are you willing to pay for raising the level of production technology (i.e. buying glue pen to replace toothpicks and glue)?**
- ❖ **How much are you willing to pay for employing an extra labor?**
- ❖ **In the game, did you practice division of labor? If yes, how and why?**