



# THE COSTS OF PRODUCTION PART I

It is one of the greatest economic errors to put any limitation on production ... We have not the power to produce more than there is the potential to consume.

– Louis D. Brandeis



# The Supply Process

- In the supply process, people first offer their factors of production to the market.
- Firms transform the factors into goods that consumers want.
- **Production** is the transformation of factors into goods.



# The Role of the Firm

- The **firm** is an economic institution that transforms factors of production into consumer goods. It:
  - Organizes factors of production.
  - Produces and sells goods and services.



# Firms Maximize Profit

- **Profit** = total revenue – total cost
- Economists and accountants measure profit differently.
  - Accountants focus on explicit costs and revenues.
  - Economists focus on both explicit and implicit costs and revenue.



# The Production Process

- The production process can be divided into the **long run** and the **short run**.
- The terms long run and short run do not necessarily refer to specific periods of time.
- They refer to the flexibility the firm has in changing the level of output.

# The Long Run and the Short Run



- A **long run** decision is a decision in which the firm can choose among all possible production techniques.
  - In the long run, all inputs are variable.
- A **short run** decision is one in which the firm is constrained in regard to what production decision it can make.
  - In the short run, some inputs are fixed.



# The Production Function

- It takes factors of production to produce a good or service – no matter what the good is.
  - **Factors of production** are the resource inputs – land, labor, capital and entrepreneurship – used to produce goods and services.

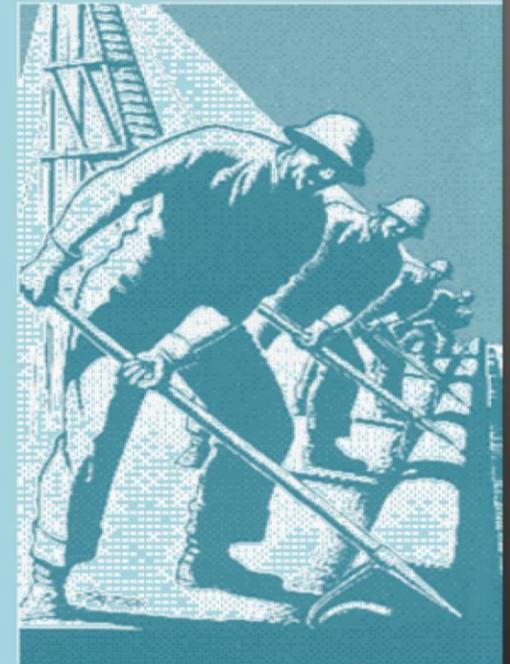
# Factors of Production



Land



Capital



Labor

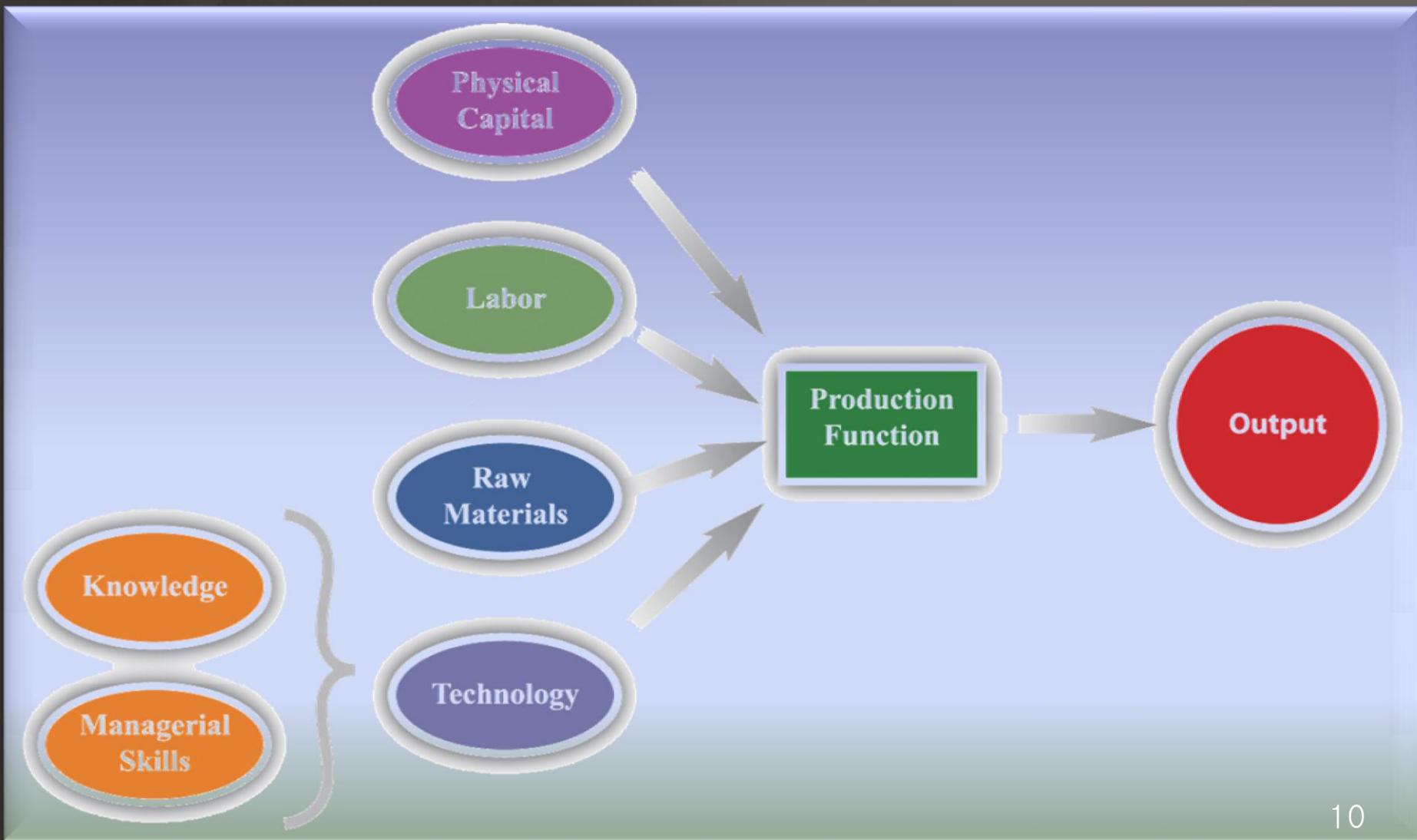


# The Production Function

The **production function** is a relationship that expresses the maximum quantity of a good that can be produced from different combinations of factor inputs.



# The Production Function





# Varying Input Levels

The purpose of a production function is to tell us just how much output we can produce with varying amounts of input.



# Productivity

- The productivity of any factor of production depends on the amount of other resources available to it.
- **Productivity** is defined as output per unit of input ... for example, output per labor hour or output per acre of land.



# Table: A Production Function Example

Capital Input (equipment)	Labor Input (hours)									
	0	1	2	3	4	5	6	7	8	
0	0	0	0	0	0	0	0	0	0	0
1	0	15	34	44	48	50	51	51	47	
2	0	20	46	64	72	78	81	82	80	
3	0	21	50	73	83	92	99	103	103	



# Efficiency

- The production function represents maximum efficiency.
- **Efficiency** is the maximum output of a good from the resources used in producing it.



# Inefficiency

- There is an opportunity cost to inefficiency. When production is inefficient, society either:
  - gets fewer goods than it should, or
  - gives up too many other goods & services in order to get the good.



# Short Run Constraints

- When there are fixed inputs, we're dealing with a short run production condition.
- The **short run** is the period in which the quantity (and quality) of some inputs cannot be changed.



# Short Run Example

For example, what you pay for electricity is a fixed cost in the short run. In the long run you have several options – perhaps building a solar-powered factory. But in the short run, your electricity costs are fixed, unchangeable.

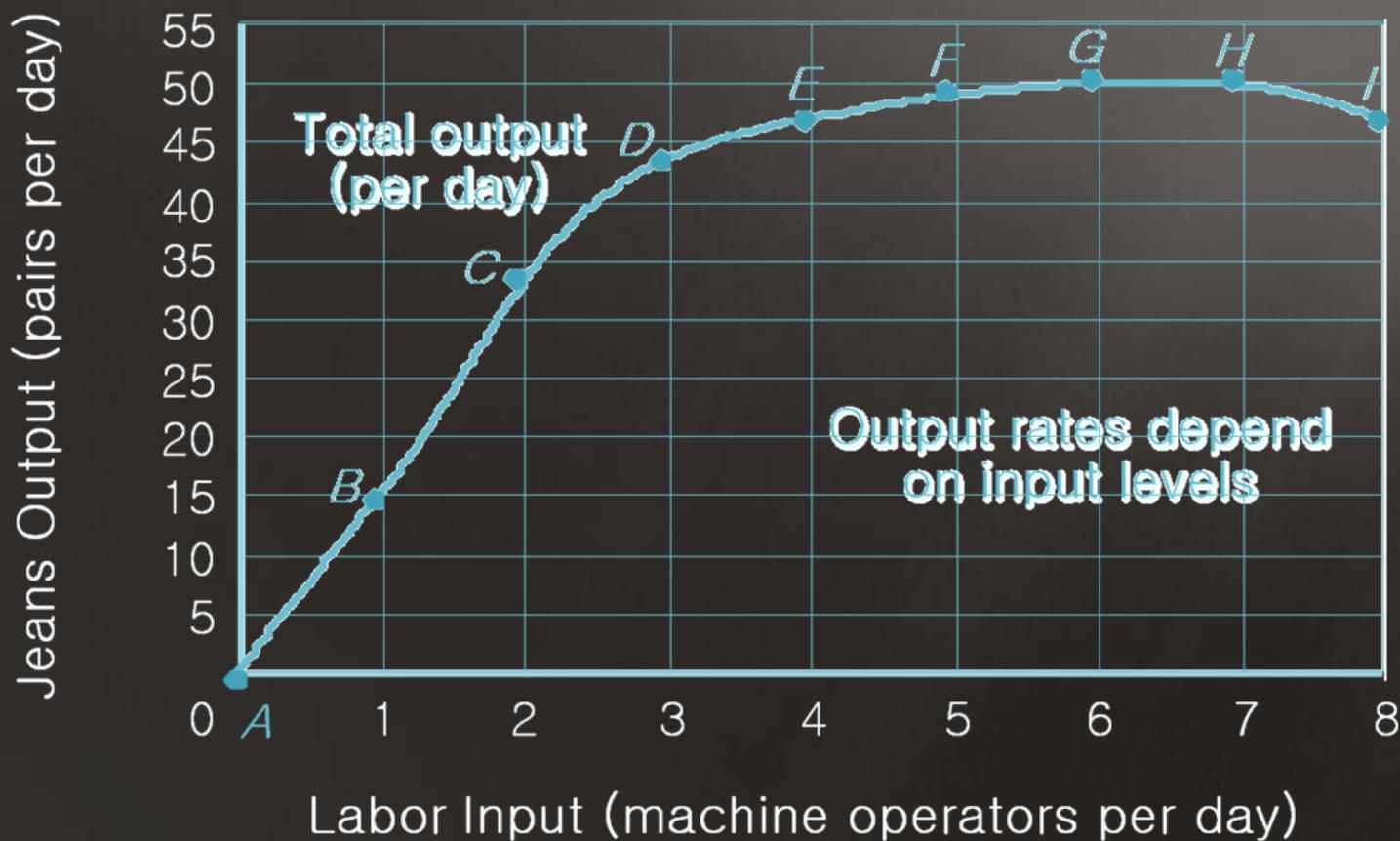


# Labor and Short Run Constraints

- Labor is the variable input that determines how much output we get from our fixed inputs (land and capital).
  - In general, as the amount of labor used increases, output also increases.



# Chart: Short Run Production Function





# Marginal Physical Productivity (MPP)

Marginal physical product (MPP) is the change in total output that results from the use of one additional unit of input.

$$\frac{\text{Marginal Physical Product}}{\text{(MPP)}} = \frac{\text{Change in total output}}{\text{Change in input quantity}}$$



# Labor and Marginal Productivity

- When the *MPP* of labor improves ( $MPP_L > 0$ ), then total output increases.
  - Improving the ratio of labor to other factors increases the *MPP* of labor.

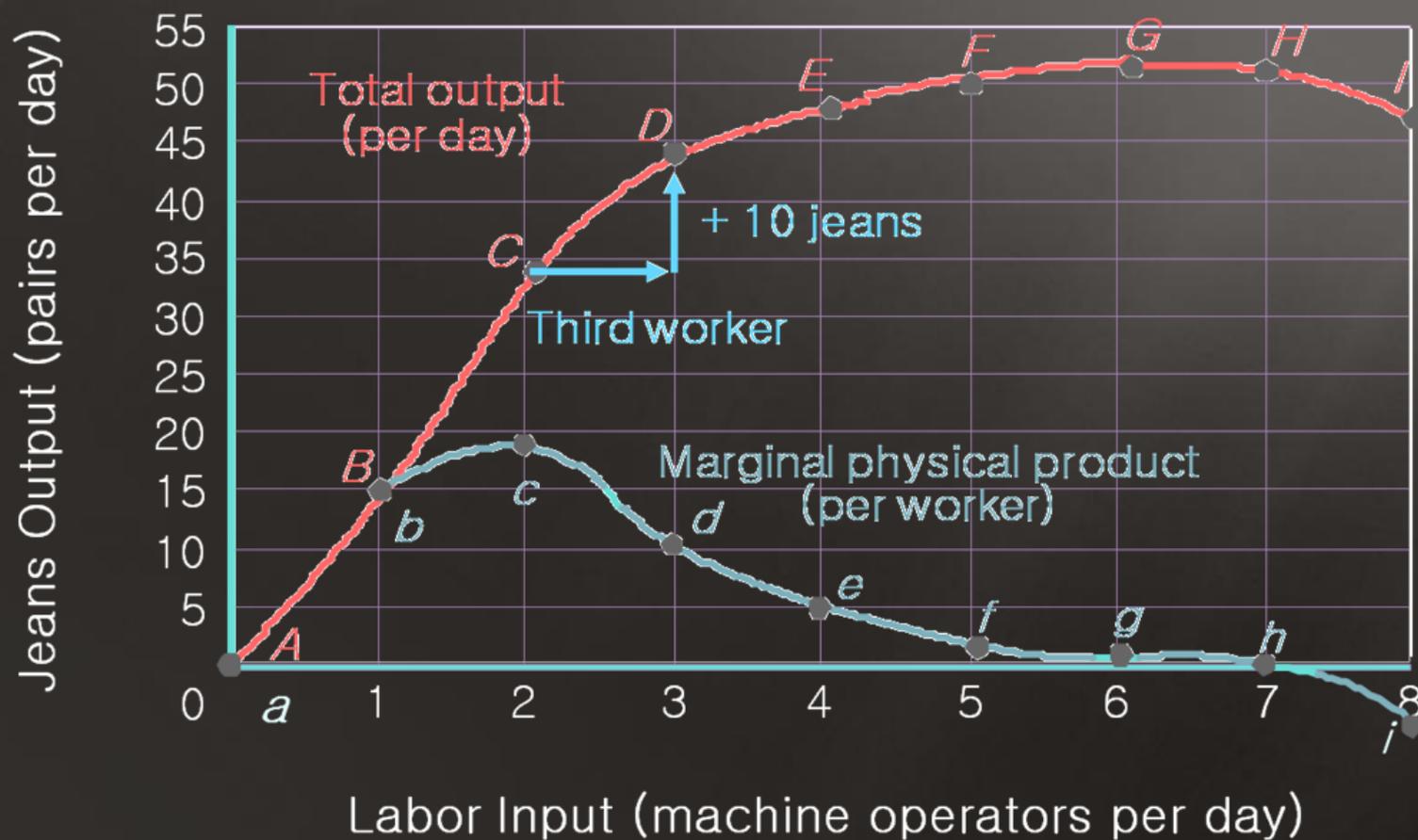


# Table: Marginal Physical Product (MPP)

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>
Number of workers	0	1	2	3	4	5	6	7	8
Total Output	0	15	34	44	48	50	51	51	47
MPP	—	15	19	10	4	2	1	0	-0.4



# Chart: Marginal Physical Product (MPP)



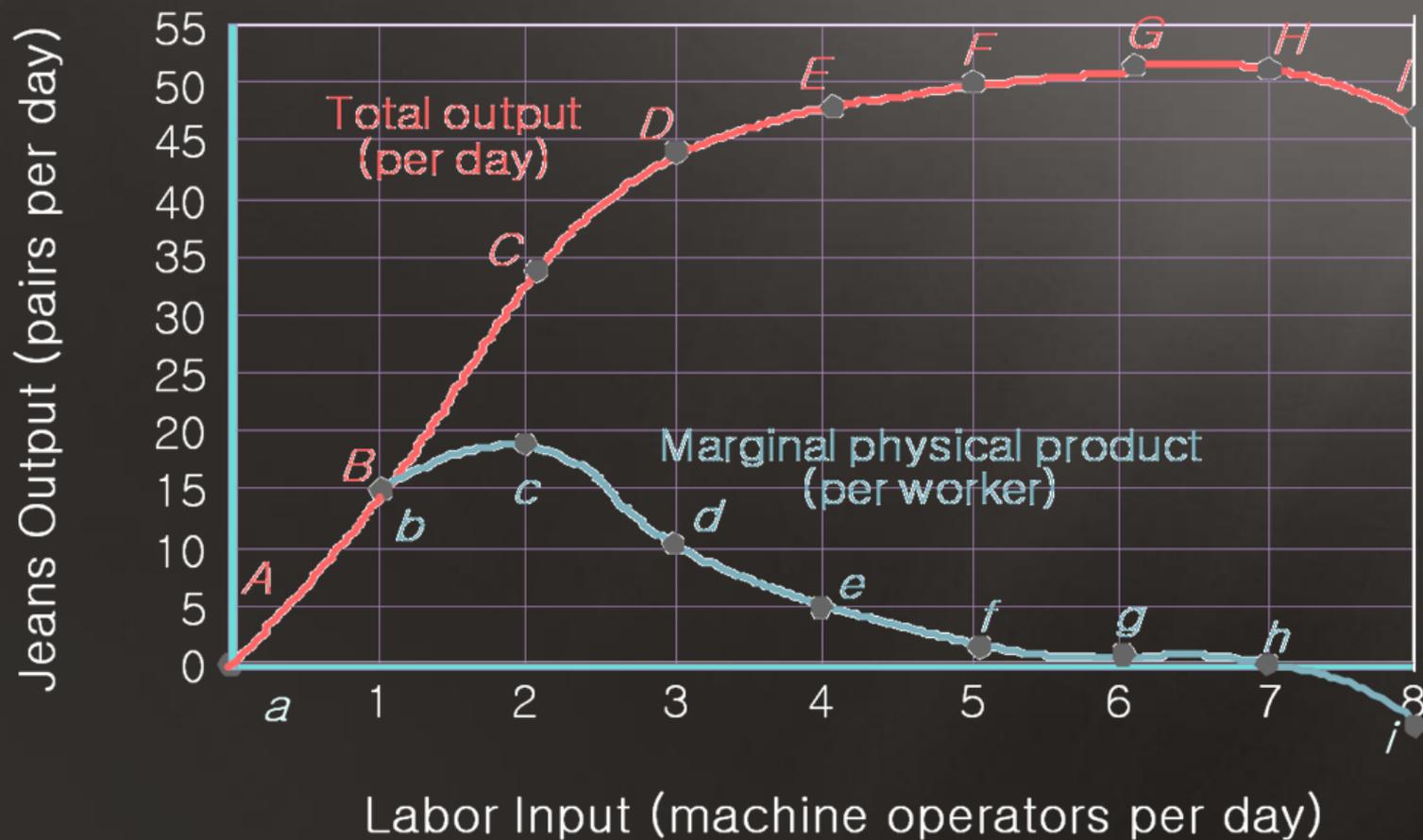


# Diminishing Marginal Returns

- At some point, the ratio of labor to other factors decreases.
- As more labor is hired, each unit of labor has less capital and land to work with.
- Output begins to rise more and more slowly as more workers are hired.



# Chart: Diminishing Marginal Returns



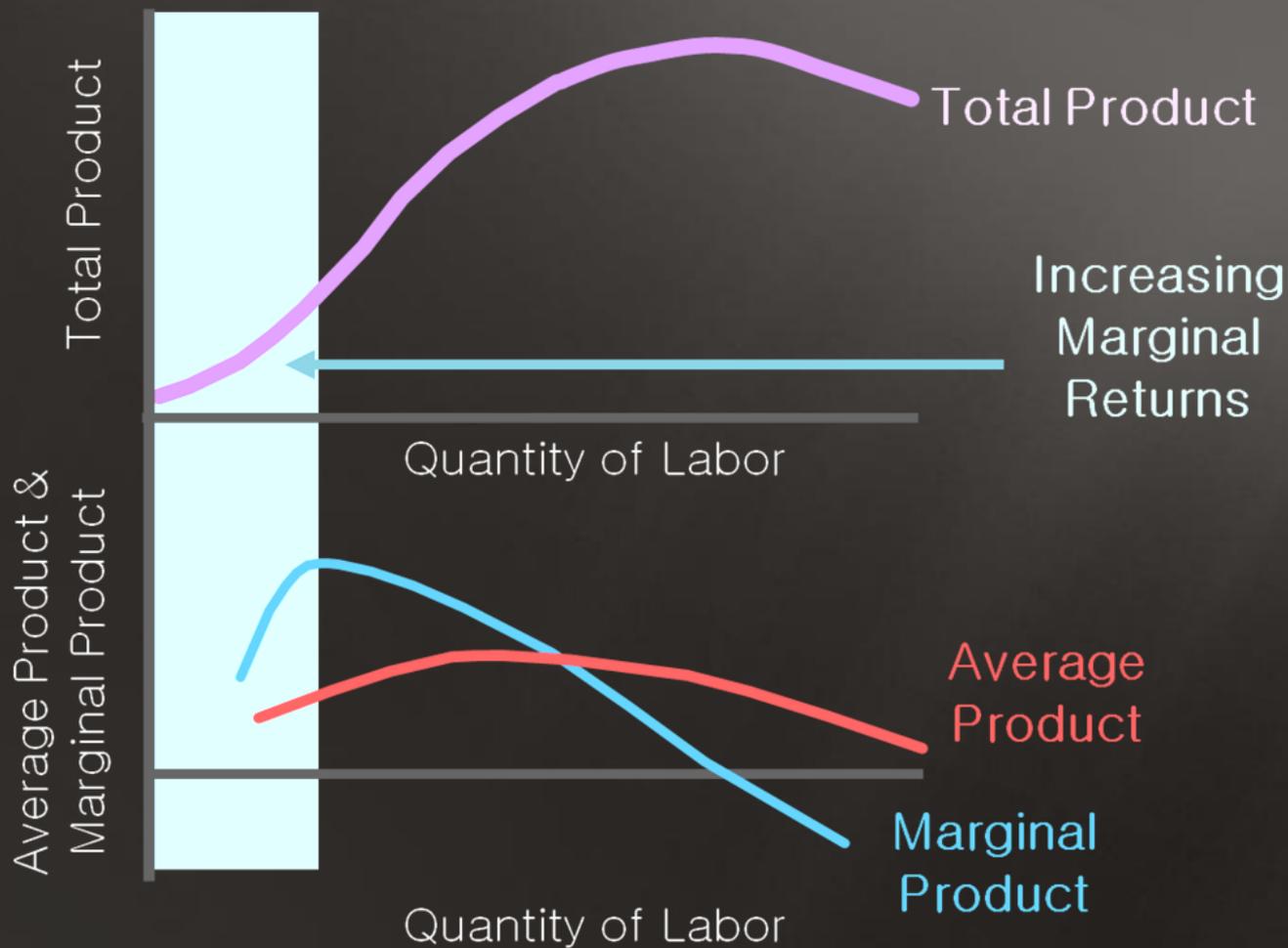


# Diminishing Marginal Returns

Look again at the table on slide 22. At first, hiring each additional worker results in a large increase in output. Then the increases begin to get smaller. Finally, output actually decreases with the addition of the 9<sup>th</sup> worker. That's an example of diminishing marginal returns: with each additional input marginal returns begin to diminish.

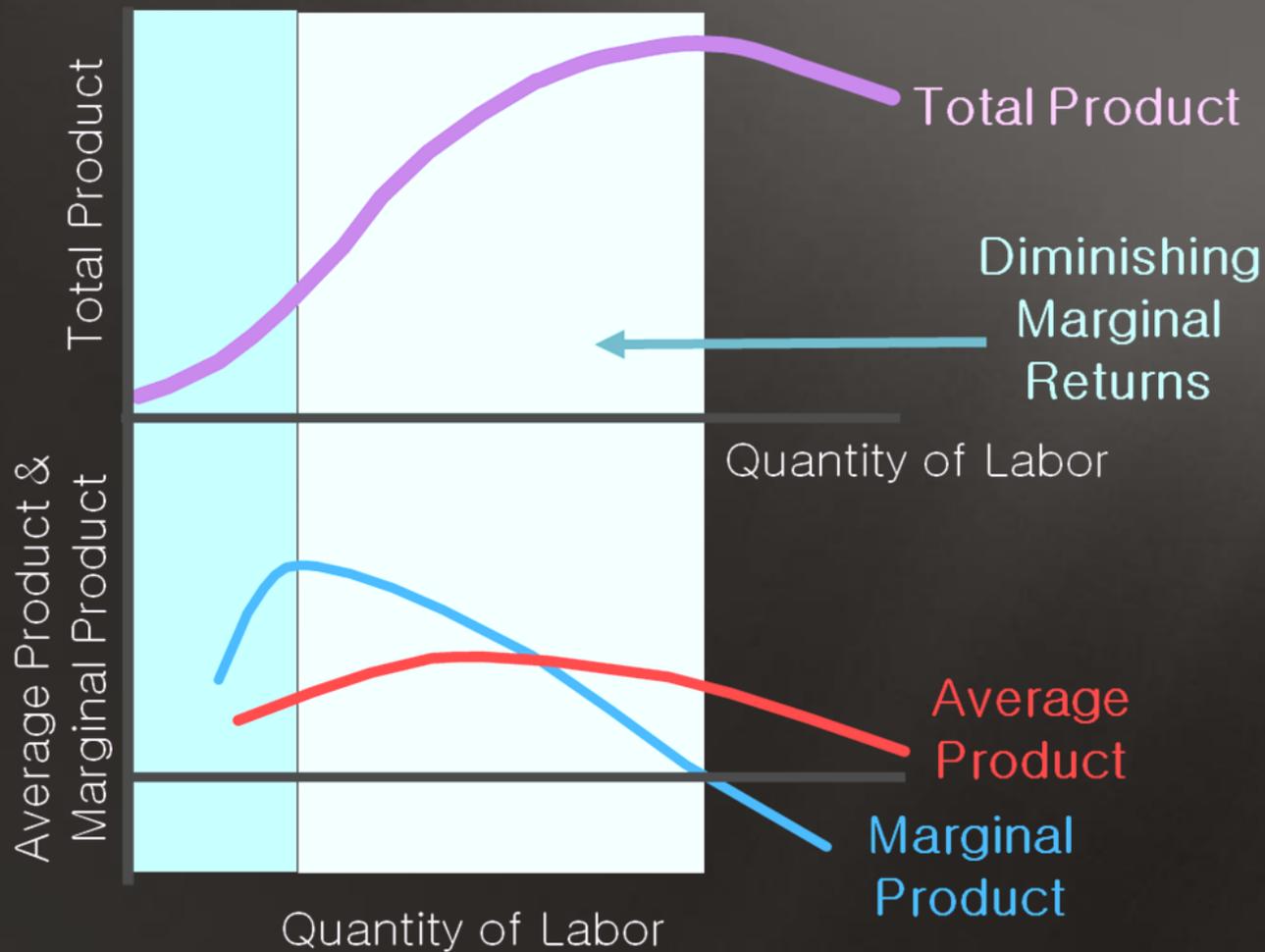


# Chart: Marginal Returns #1



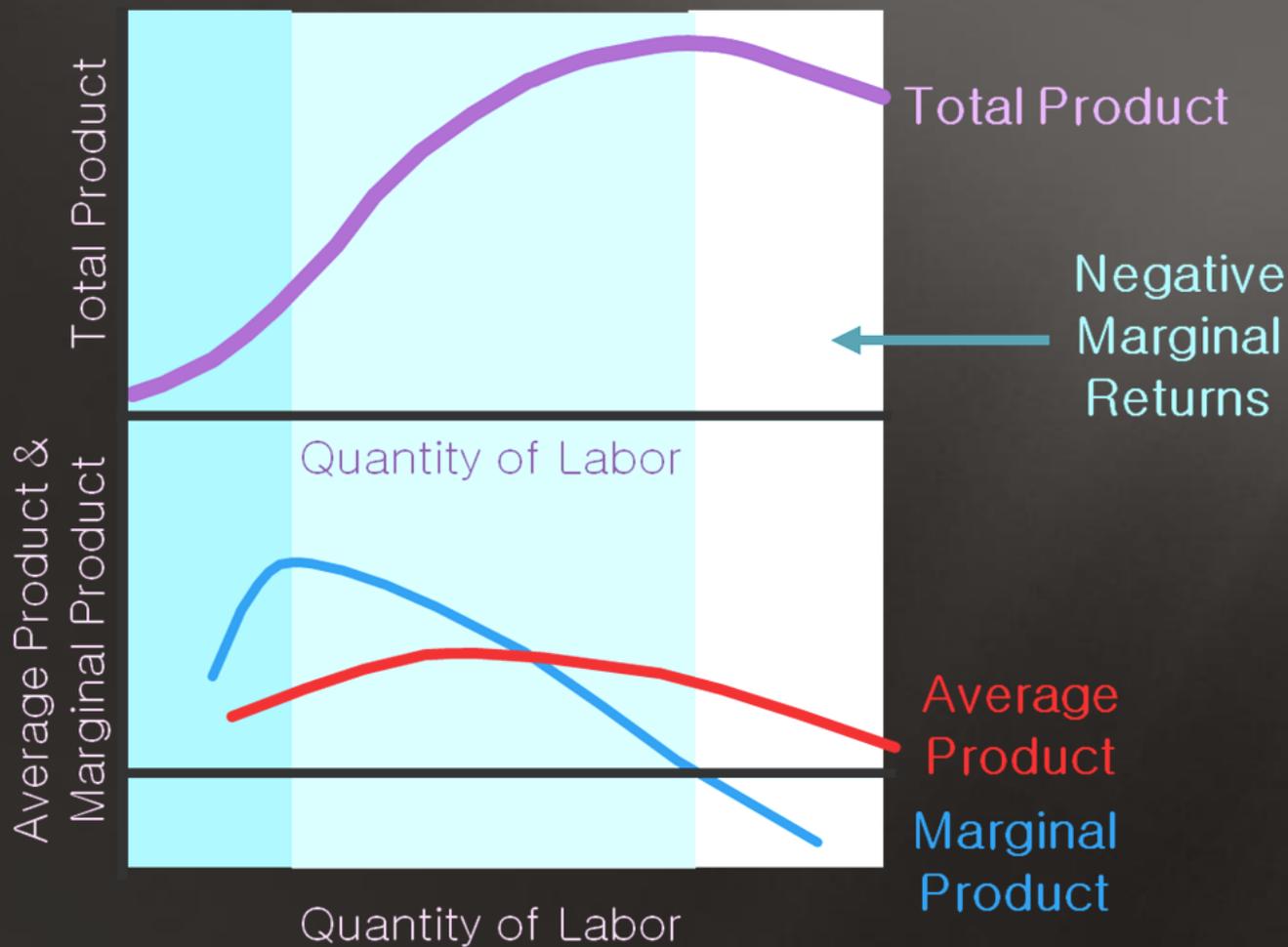


# Chart: Marginal Returns #2





# Chart: Marginal Returns #3





# Law of Diminishing Returns

According to the **law of diminishing returns**, the MPP of a variable input declines as more of it is employed with a given quantity of other (fixed) inputs. You can add more workers but there's only so much they can do if you cannot also add available space or electricity.



# Profit

- A production function tells us how much a firm can produce but not how much it should produce.
- The most desirable rate of output is the one that maximizes total profit.
  - **Profit** is the difference between total revenue and total cost.

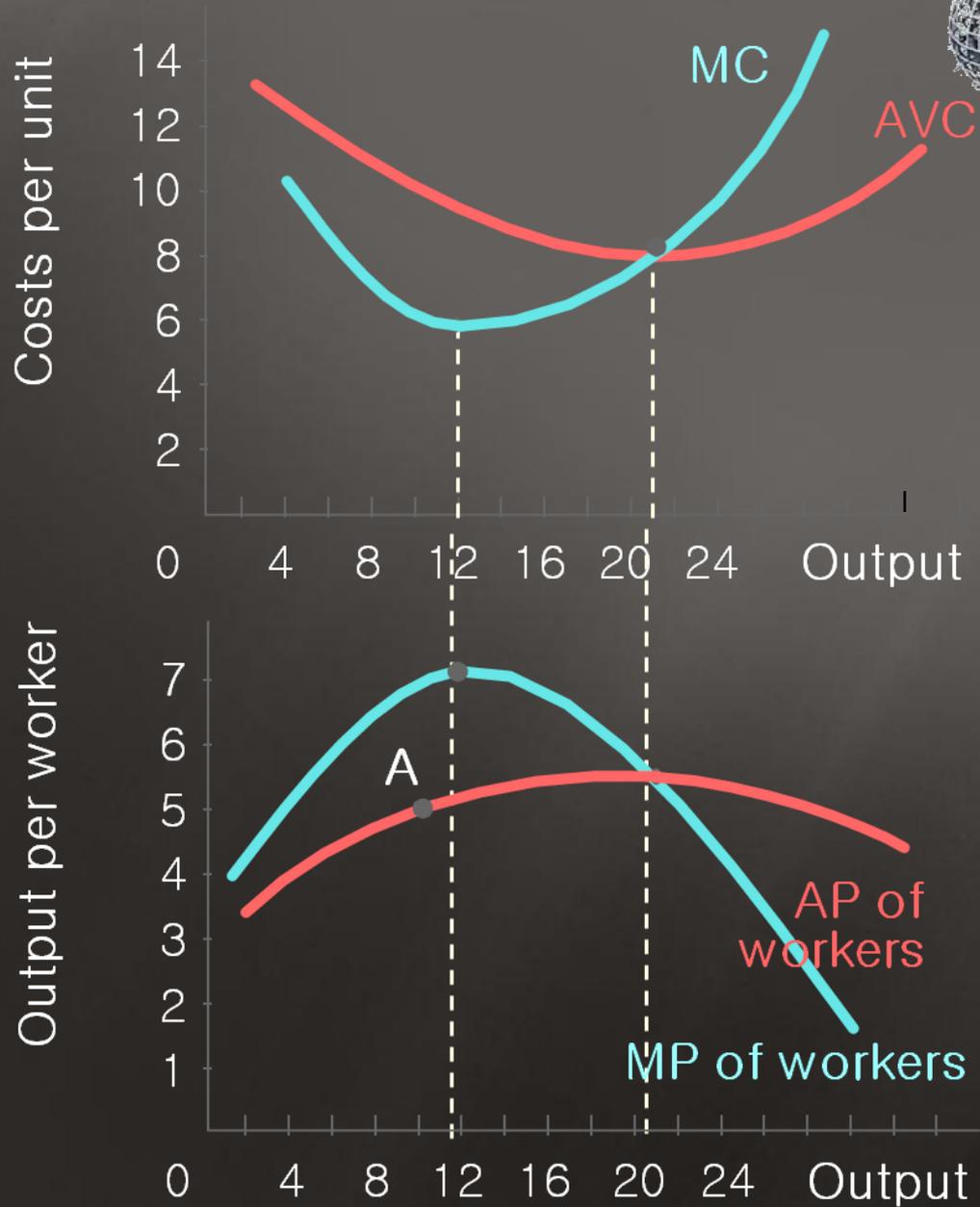


# Productivity and Costs Are Mirror Images

- The shapes of the cost curves are mirror-image reflections of the corresponding productivity curves.
- When one is increasing, the other is decreasing.
- When one is at a maximum, the other is at a minimum.



# Chart: The Relationship Between Productivity and Costs





Continued in  
*The Costs of Production Part II*

