



# THE COSTS OF PRODUCTION PART II

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



# Preview of Cost Concepts

- **Total cost** – the dollars you give up by being in business and operating at your current rate
- **Fixed cost** – the dollars you give up by being in business, even if you produce nothing
- **Variable cost** – the dollars you give up to produce at your current rate, over and above your fixed cost
- **Marginal cost** – the dollars you give up to add one to your rate of production
- **Average cost** – total cost divided by output rate



# Preview of Cost Concepts

- Costs are generally divided into fixed costs, variable costs and marginal costs.
- $TC = FC + VC$
- $MC = \text{change in } TC$
- $AFC = FC/Q$
- $AVC = VC/Q$
- $ATC = AFC + AVC$



# Marginal Cost (MC)

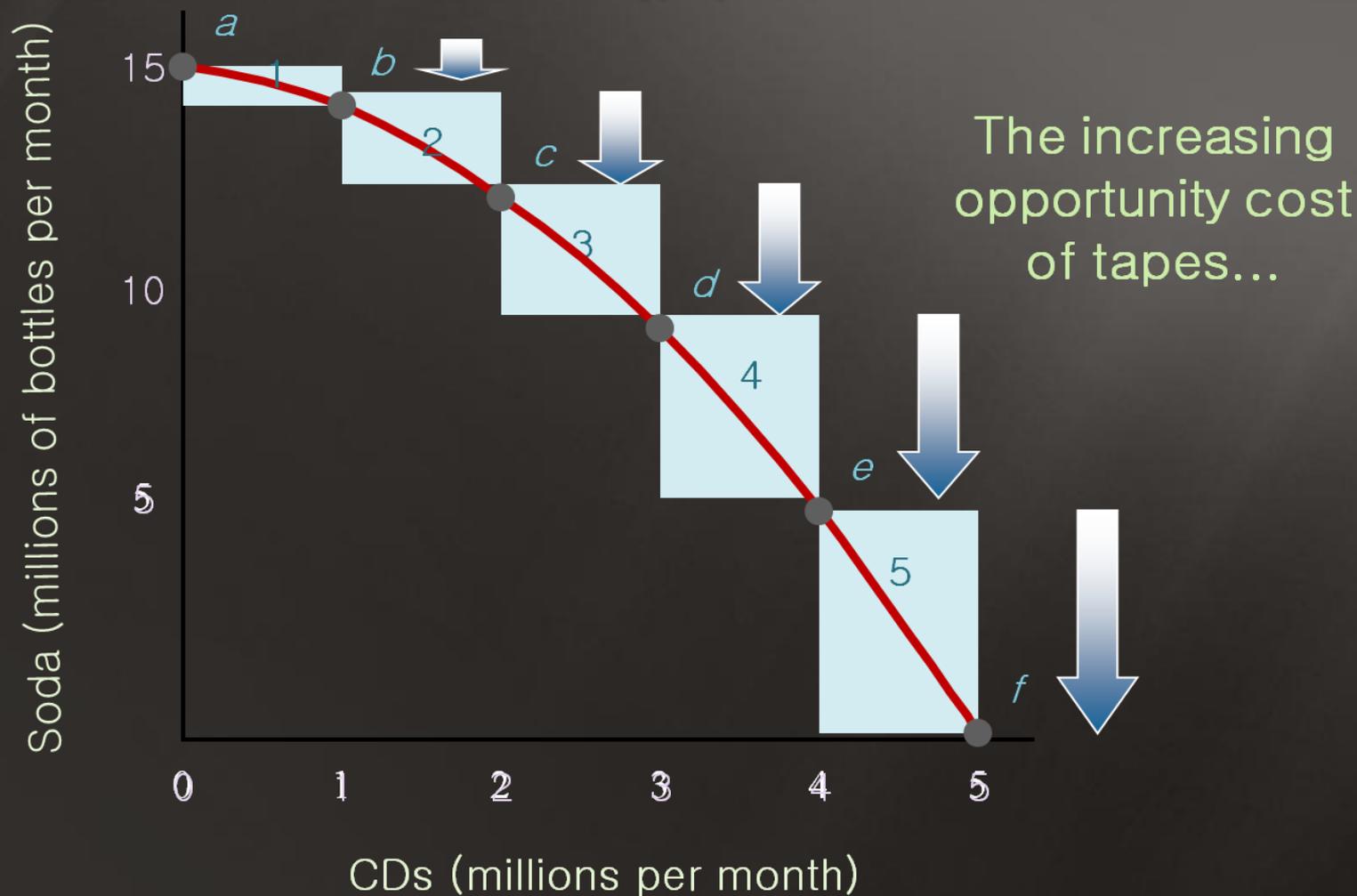
**Marginal cost** is the increase in total costs associated with a one unit increase in production ... How much more will your total costs be if you produce one more widget?

$$\text{Marginal Cost} = \frac{\text{Change in total cost}}{\text{Change in output}}$$

$$MC = \frac{\Delta TC}{\Delta Q}$$

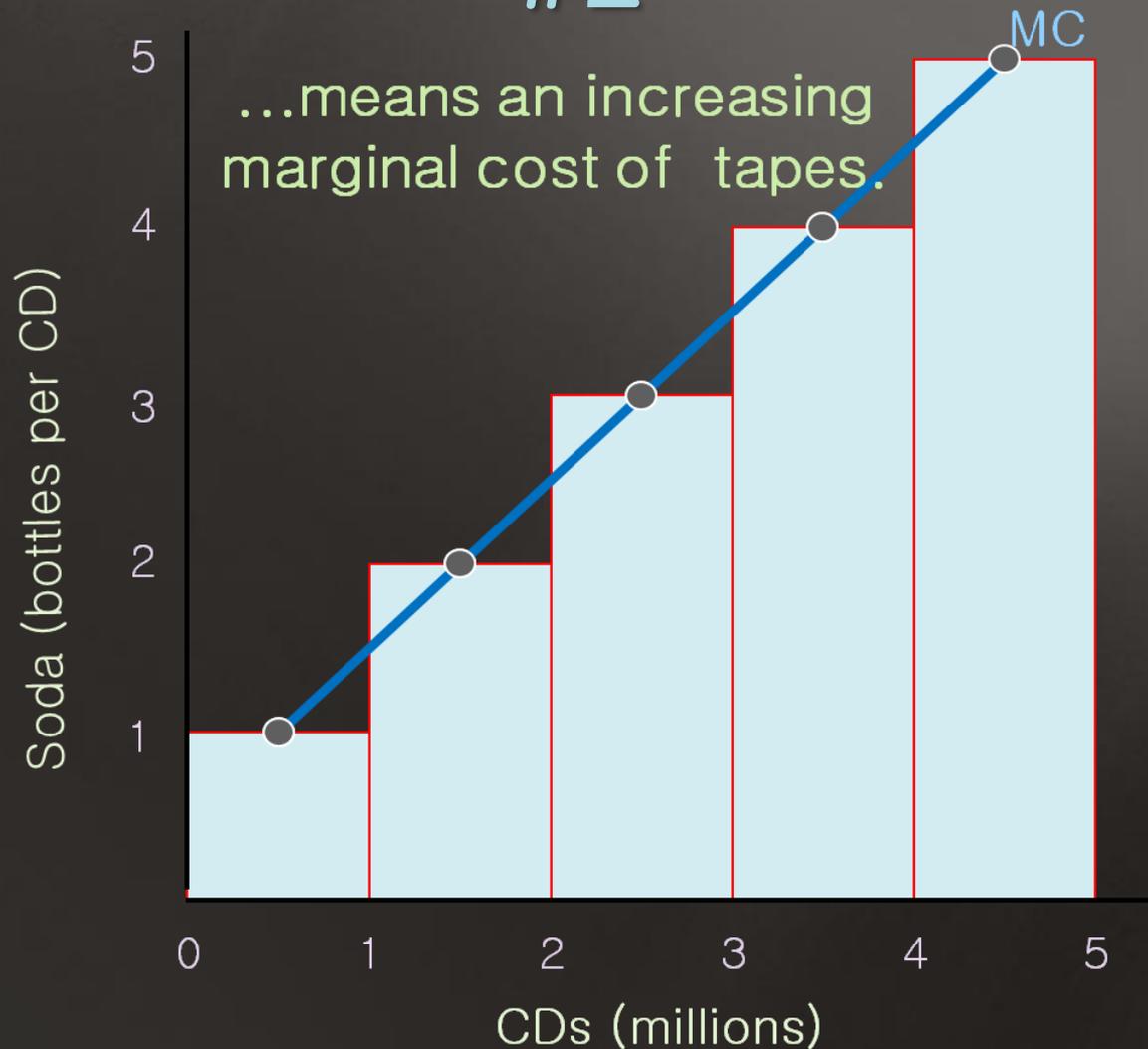


# Chart: Opportunity Cost and Marginal Cost #1



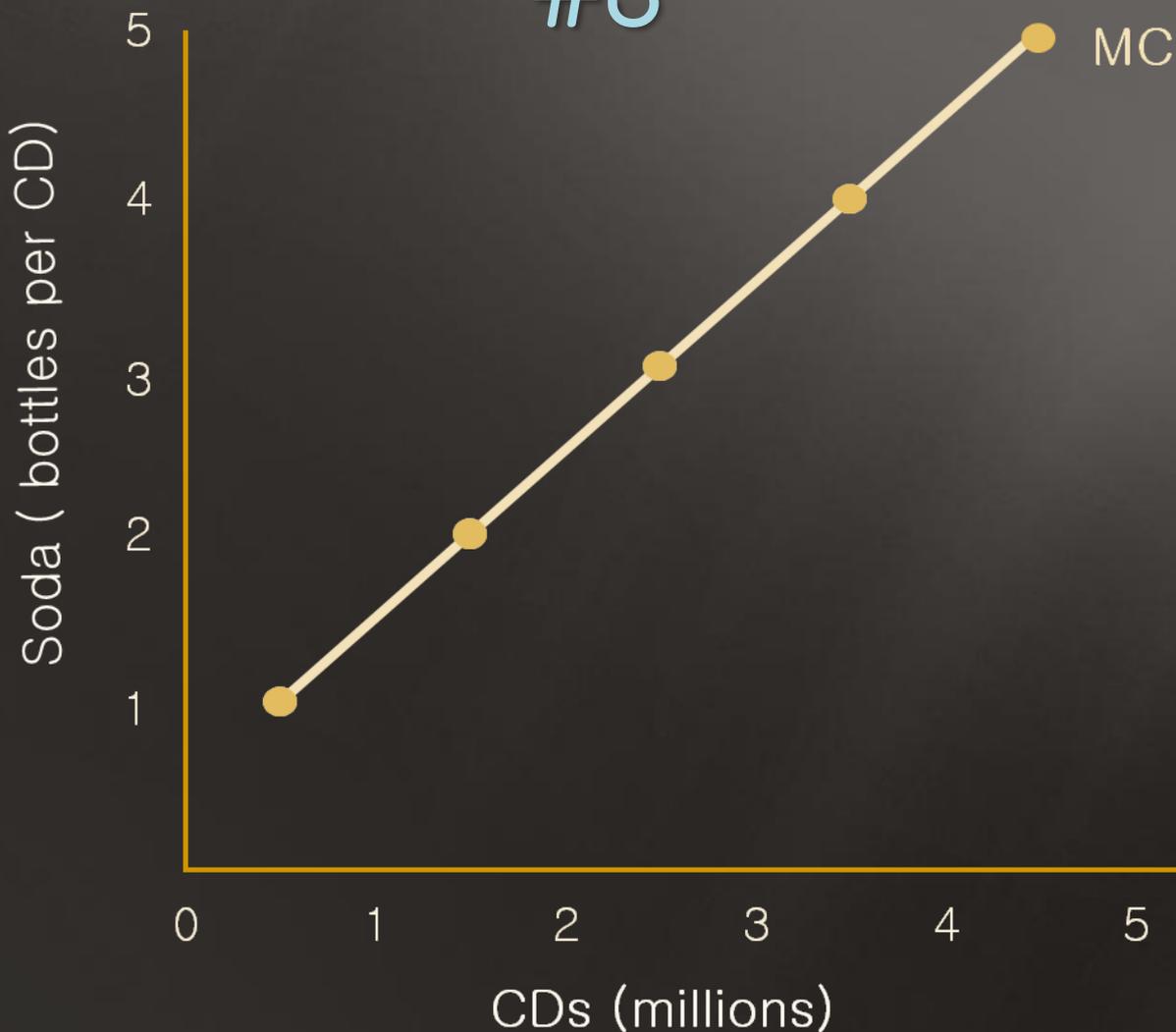


# Chart: Opportunity Cost and Marginal Cost #2





# Chart: Opportunity Cost and Marginal Cost #3





# MPP and MC

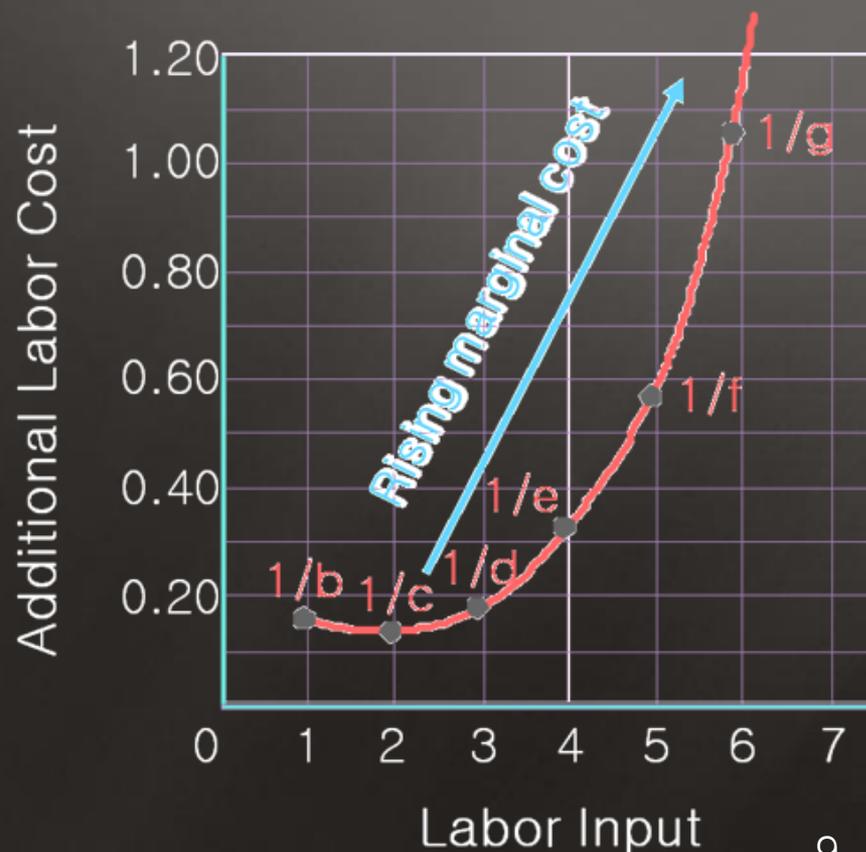
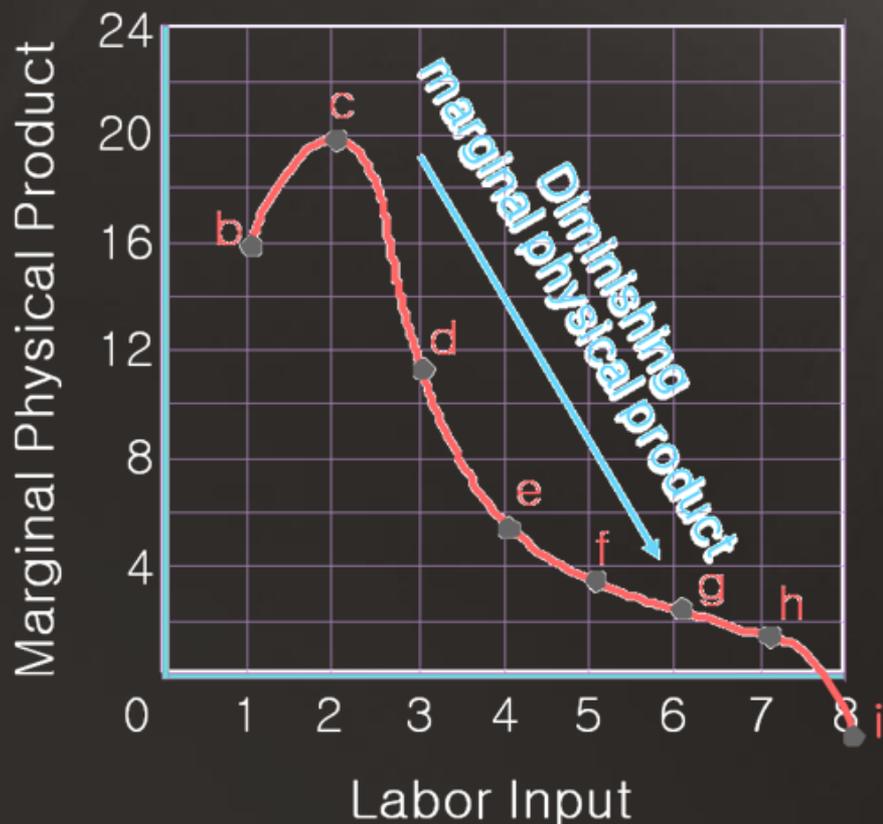
Think about each of the following statements carefully and make certain you understand WHY each is true!

- Whenever MPP is increasing, the marginal cost of producing a good must be falling.
- If marginal physical product declines, marginal cost increases.



# Chart: Falling MPP Implies Rising Marginal Cost

DIMINISHING marginal productivity implies ... RISING marginal cost.





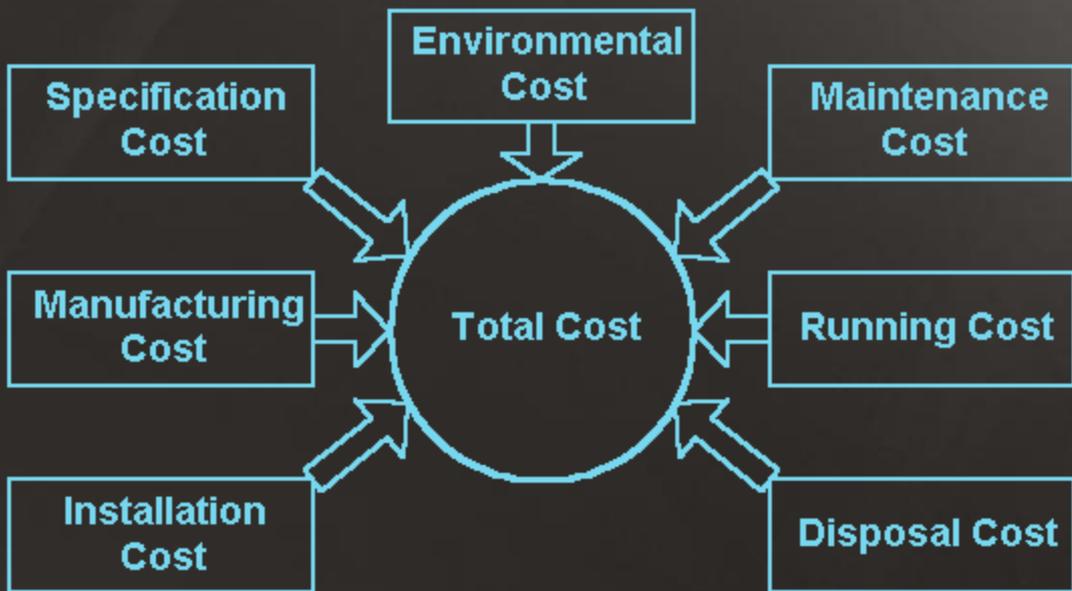
# Dollar Costs

The **dollar costs** of production are directly related to the underlying production function.



# Total Cost (TC)

The cost components of a window



Total cost is the market value of all resources used to produce a good or service. Total cost includes fixed costs and variable costs.



# Fixed Costs (FC)

**Fixed costs** are the costs of production that do not change when the rate of output is altered, such as the cost of plants and equipment.

The mortgage payment for your plant is the same no matter how much or how little you produce in it.



# Variable Costs (VC)

**Variable costs** are the costs of production that change when the rate of output is altered, such as labor and material costs.

If you want to produce more, you must buy more raw materials and pay more workers.



# Understanding Total Cost

Think about each of the following statements carefully and make certain you understand WHY each is true!

- How fast TC rises depends on VC only.
- TC is equal to the FC when output is zero.
- There is no way to avoid FC in the short-run.



# Table: Total Cost (TC)

| Rate of Output | Fixed Cost | Variable Cost | Total Cost (FC + VC) |
|----------------|------------|---------------|----------------------|
| 0              | \$120      | \$ 0          | \$120                |
| 10             | 120        | 85            | 205                  |
| 15             | 120        | 125           | 245                  |
| 20             | 120        | 150           | 270                  |
| 30             | 120        | 240           | 360                  |
| 40             | 120        | 350           | 470                  |
| 50             | 120        | 550           | 670                  |
| 51             | 120        | 633           | 753                  |

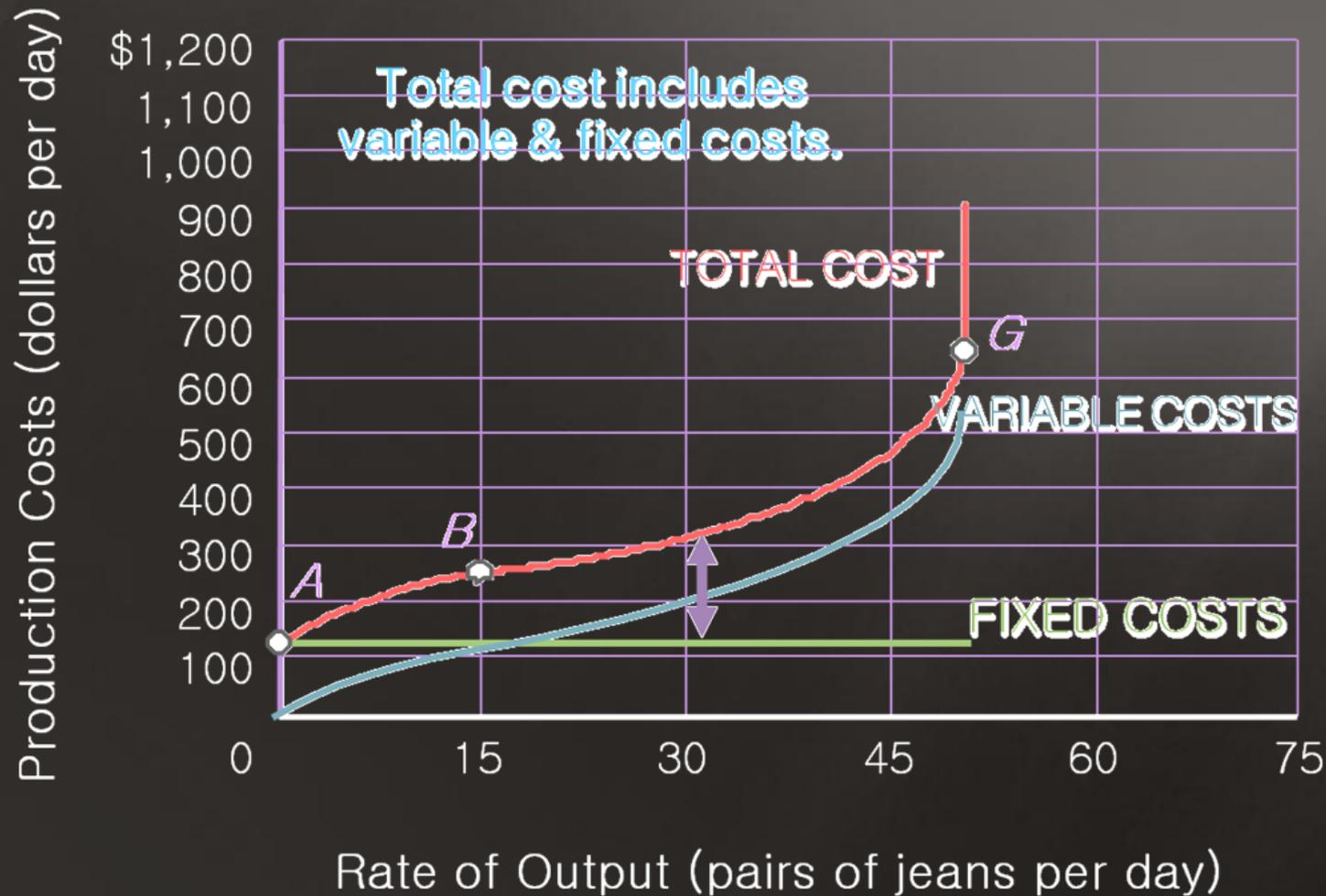


# Table: Total Cost of Production

| RESOURCE INPUT     | X | UNIT PRICE    | = | TOTAL COST |
|--------------------|---|---------------|---|------------|
| 1 factory          |   | \$100 per day |   | \$100      |
| 1 sewing machine   |   | 20 per day    |   | 20         |
| 1 operator         |   | 80 per day    |   | 80         |
| 1.5 bolts of denim |   | 30 per bolt   |   | <u>45</u>  |
| Total cost         |   |               |   | \$245      |

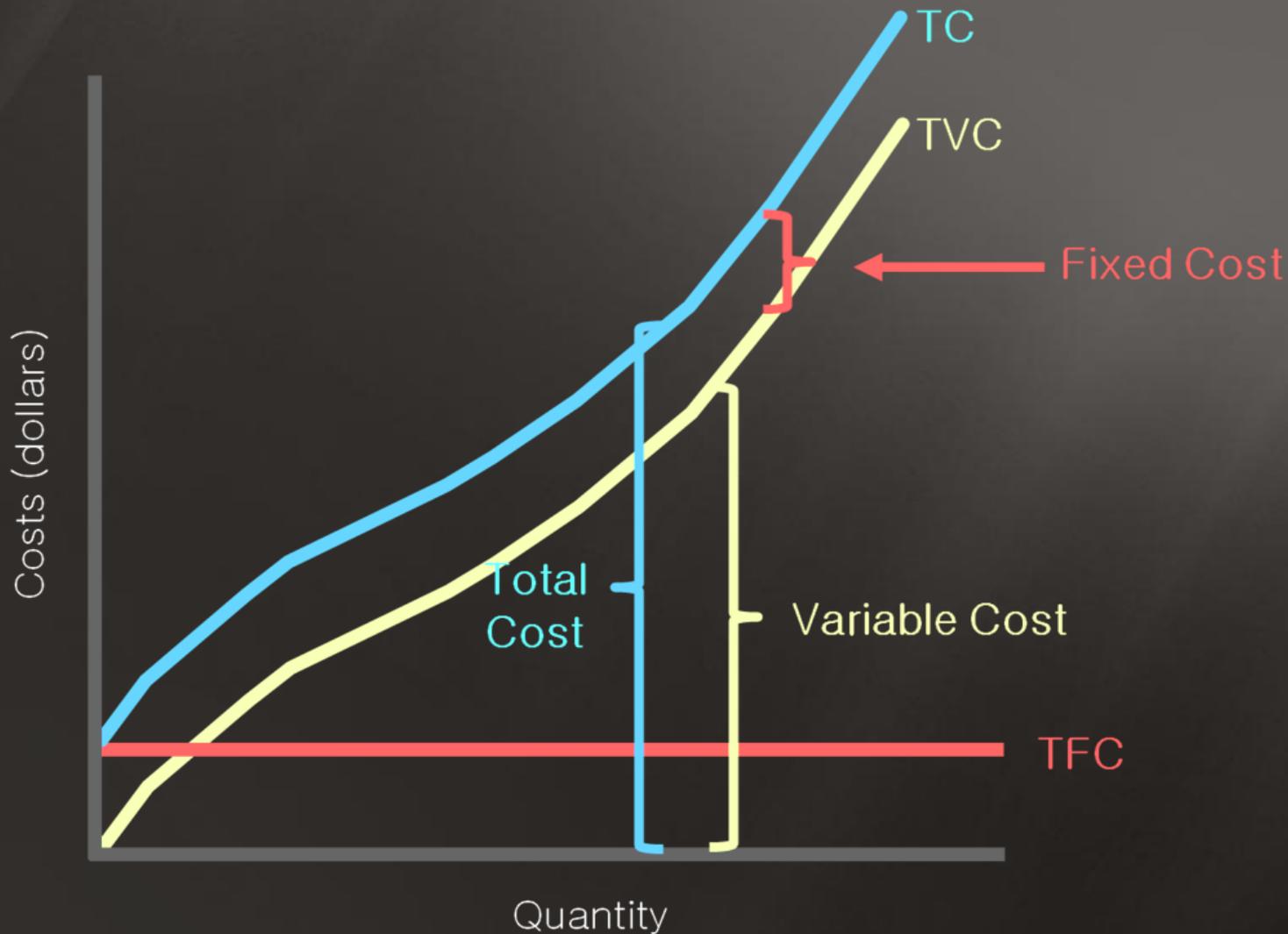


# Chart: The Cost of Jeans Production





# Chart: Combining TVC with TFC to Get TC





# Average Costs (AC)

One of the most common costs is average, or per-unit, cost.

There are several kinds of average costs.



# Average Total Cost (ATC)

**Average total cost** is the total cost divided by the quantity produced in a given time period.

$$\text{Average total cost} = \frac{\text{Total cost}}{\text{Total output}} \quad \text{ATC} = \frac{\text{TC}}{\text{Q}}$$



# Average Fixed Cost (AFC)

**Average fixed cost** is the total fixed cost divided by the quantity produced in a given time period.

$$\text{Average fixed cost} = \frac{\text{Total fixed cost}}{\text{Total output}}$$

$$\text{AFC} = \frac{\text{TFC}}{Q}$$



# Average Variable Cost (AVC)

**Average variable cost** is the total variable cost divided by the quantity produced in a given time period.

$$\text{Average variable cost} = \frac{\text{Total variable cost}}{\text{Total output}} \quad \text{AVC} = \frac{\text{TVC}}{Q}$$



# ATC from Another Angle

Average total cost is the sum of average fixed costs and average variable costs.

$$ATC = AFC + AVC$$

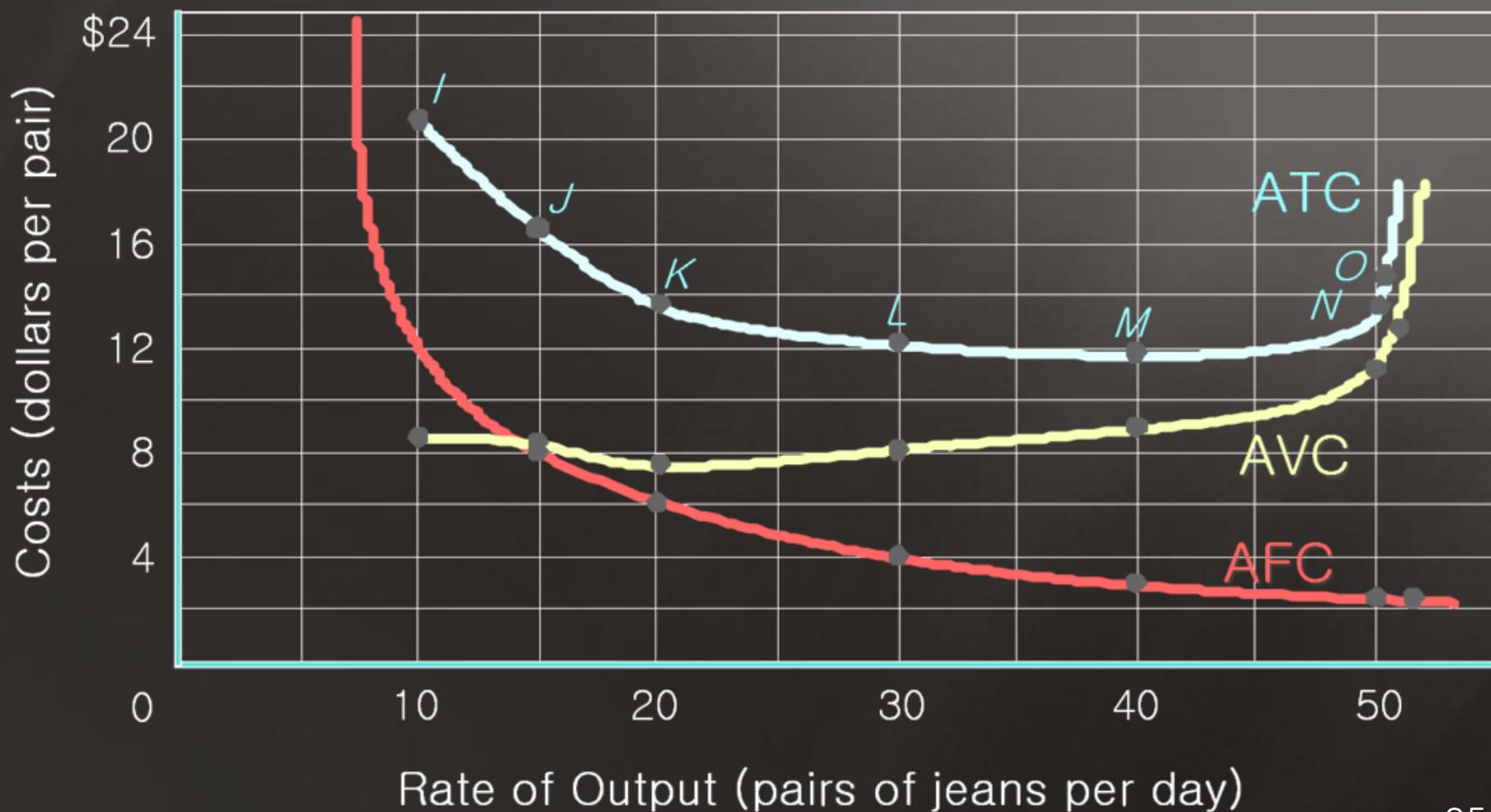


# Table: Average Costs

| Rate of Output | TC    | AFC     | AVC     | ATC<br>(AFC + AVC) |
|----------------|-------|---------|---------|--------------------|
| 0              | \$120 | --      | --      | --                 |
| 10             | 205   | \$12.00 | \$ 8.50 | \$20.50            |
| 15             | 245   | 8.00    | 8.33    | 16.33              |
| 20             | 270   | 6.00    | 7.50    | 13.50              |
| 30             | 360   | 4.00    | 8.00    | 12.00              |
| 40             | 470   | 3.00    | 8.75    | 11.75              |
| 50             | 670   | 2.40    | 11.00   | 13.40              |
| 51             | 753   | 2.35    | 12.41   | 14.76              |



# Chart: Average Costs





# Falling AFC

- As the rate of output increases, AFC decreases as the fixed cost is spread over more output (economies of scale).
- Any increase in output lowers average fixed cost.



# Rising AVC

- AVC will eventually rise as the rate of output increases.
- AVC rises because of diminishing returns in the production process.



# U-Shaped ATC

The initial decrease in AFC 

and the later increase in AVC 

gives the ATC curve its characteristic U shape. 



# Minimum Average Cost

- The bottom of the U-shaped ATC curve represents the minimum ATC.
- It identifies the lowest possible opportunity costs to produce the product.
- Profits aren't necessarily maximized where ATC are minimized. In other words, the point at which your costs are lowest isn't necessarily the point at which you make the most money.



# Marginal Cost (MC)

Remember that marginal cost refers to the *change in total costs* associated with *one more unit of output*.

$$\text{Marginal Cost} = \frac{\text{Change in total cost}}{\text{Change in output}}$$

$$\text{MC} = \frac{\Delta\text{TC}}{\Delta\text{Q}}$$

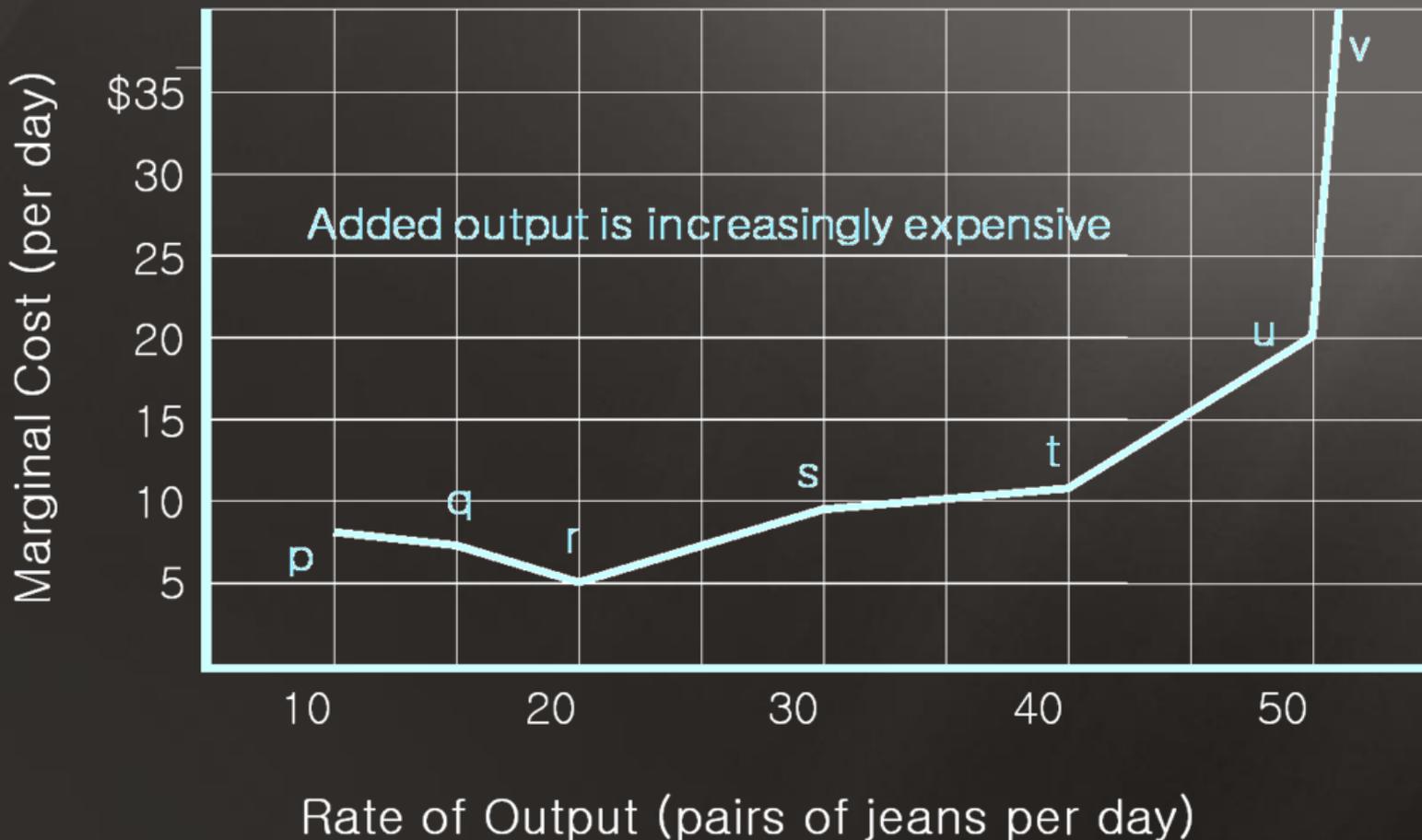


# Table: Marginal Cost (MC)

|   | Rate of Output | Total Cost | $\frac{\Delta TC}{\Delta Q} = MC$ |
|---|----------------|------------|-----------------------------------|
|   | 0              | \$120      | --                                |
| p | 10             | 205        | $\$85/10 = \$8.5$                 |
| q | 15             | 245        | $\$40/5 = \$8.0$                  |
| r | 20             | 270        | $\$25/5 = \$5.0$                  |
| s | 30             | 360        | $\$90/10 = \$9.0$                 |
| t | 40             | 470        | $\$110/10 = \$11$                 |
| u | 50             | 670        | $\$200/10 = \$20$                 |
| v | 51             | 753        | $\$83/1 = \$83$                   |



# Chart: Marginal Cost (MC)





# Diminishing Returns and MC

Diminishing returns in production cause MC to increase as the rate of output is expanded.



# Continued in *The Costs of Production Part III*

