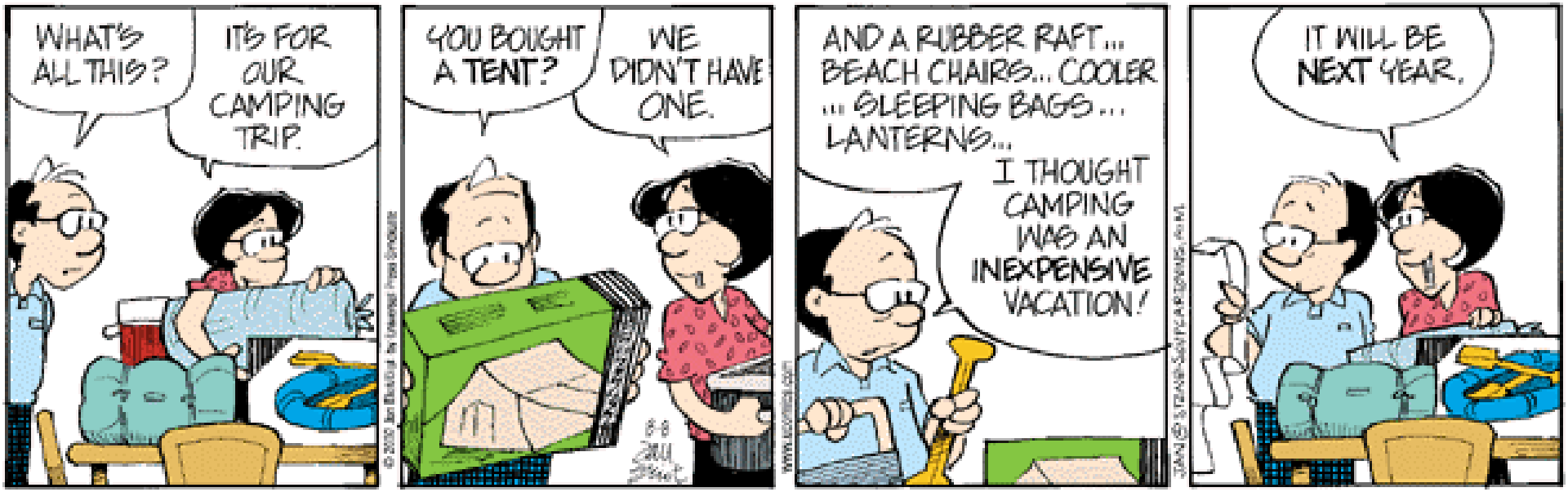
Ch 8 –Business Costs and Production



ECON 1B

CSUS

Business Decision-Making

- Consider a fast food restaurant
- Lots of information needed. Lots of decisions!
- Labor:
  - Workers
  - Shifts
  - Wages
- Capital
  - Fryers
  - Milkshake machines
  - Cash registers
- Other inputs
  - Food supplies
  - Napkins

Calculating Profit and Loss

- Total Revenue (TR)
  - The amount a firm receives from the sale of goods and services
- Total Cost (TC)
  - The amount a firm spends in order to produce those goods and services

Profit (or loss) = TR – TC

  - Profits occur when TR > TC
  - Losses occur when TR < TC

Explicit and Implicit Costs

- Explicit costs
  - Tangible expenses. Bills that the owner has to pay.
  - Wages, insurance, food ingredients
- Implicit costs
  - Opportunity costs of doing business
  - Opportunity cost of capital
    - Bought a franchise for a large sum of money. How could the money have been invested otherwise?
  - Opportunity cost of owner's time above salary paid
    - How much could the owner get paid elsewhere?

Examples of Explicit and Implicit Costs

Explicit Costs	Implicit Costs
The electricity bill	Labor of owner who works for the company but does not draw a salary
Advertising in the newspaper	The capital invested in the business
Employee wages	The use of the owner's car, computer, or other personal equipment to conduct business

Profits

- Accounting Profit
  - Does not take into account implicit costs of doing business

Accounting Profit = Revenues – Explicit Costs

- Economic Profit
  - Considers "All Costs" = (Explicit Costs + Implicit Costs)

Economic Profit = Revenues – All Costs

Accounting and Economic Profits

Item	Cost Type	Amount ($)
Revenues		$8,000
Workers' Wages	Explicit	$4,000
Insurance and Rent	Explicit	$2,500
Food Ingredients	Explicit	$1,000
Accounting Profits	→	**$8,000 - $7,500 = $500**
Opportunity Cost of Owner's Time	Implicit	$300
Opportunity Cost of Owner's Capital	Implicit	$400
Economic Profits	→	**$8,000 - $8,200 = -$200**

Practice What You Know—1

- Which of the following is an example of an implicit cost?

  A. wages paid to employees

  B. cost of food delivery

  C. the opportunity cost of the owner's time

  D. monthly insurance premiums

How Much Should a Firm Produce?

- Two main ideas:
  - Describe the factors that determine output
  - How do firms use inputs to maximize production?

- Concepts:
  - Output—the product that the firm creates
  - Factors of production (inputs)—Resources used in the production process

Production

- Input
  - Resources used in the production process. Also called factors of production.
  - Labor (L), Capital (K), and sometimes materials (M)
- Output
  - The product that the firm creates

Production Function

- Production function
  - The relationship between inputs and outputs
  - To create output, the owner needs to decide how many inputs to employ
- Mathematically:

$$\mathbf{Q = \mathit{f}\,(K, L)}$$

  - "Quantity of output is a function of capital input and labor input"

Production

- Marginal product
  - Change in output divided by the change in input
  - Marginal Product of Labor (MPL)
  - Marginal Product of Capital (MPK)
- Mathematically:

$$MPL = \frac{\Delta Q}{\Delta L} \qquad MPK = \frac{\Delta Q}{\Delta K}$$

Number of Workers	Total Output (Number of Meals Served per Hour)	Marginal Product of Labor
0	0	
		5
1	5	
		10
2	15	
		15
3	30	
		12
4	42	
		10
5	52	
		8
6	60	
		5
7	65	
		2
8	67	
		-4
9	63	
		-8
10	55	

Diminishing Marginal Product

- Diminishing marginal product
  - Successive increases in an input eventually cause output to increase at a slower rate
  - <u>Assuming capital (K) is fixed</u>, we *eventually* get to a point where a new worker (L) adds less output than the previous worker
  - Example:
    - Laborer #3 increases output by 15
    - Laborer #4 increases output by 12
    - Laborer #5 increases output by 10

Why Does This Happen?

- Think about the fixed amount of capital
  - "Too many cooks in the kitchen"
  - Extra workers will eventually have less work to do, won't be able to add as much to the overall output
  - *Not* because new workers are less skilled
- With a very large amount of L
  - New workers could actually interfere with existing workers and slow them down
  - This means negative marginal product!

Practice What You Know—2

- Total output with seven workers is Q = 70. Total output with eight workers is Q = 82. What is the marginal product of the eighth worker?

A. 12

B. 10

C. 82

D. 8

Practice What You Know—3

- Where does diminishing marginal product begin?
  A. Worker 2
  B. Worker 3
  C. Worker 4
  D. Worker 5

Workers	Total Product
0	0
1	3
2	8
3	10
4	11
5	9
6	6

Costs in the Short Run

- Variable Costs (VC)
  - Costs that are directly related with the rate of output
  - ***Worker wages***, food ingredients
- Fixed Costs (FC)
  - Costs that do not vary with output
  - Costs that exist even if output is zero
  - Building rent, insurance
- Total Costs (TC)
  - The sum of variable and fixed costs

Costs in the Short Run

- Average Total Cost (ATC)
  - Total cost divided by the number of units produced
  - “cost per unit”
- Analogously,
  - Average Variable Cost (AVC)
  - Average Fixed Cost (AFC)
- Marginal Cost (MC)
  - The increase in total cost that occurs from producing additional output
  - Change in total cost divided by change in output

Cost Equations

$$TC = TVC + TFC$$

$$ATC = \frac{TC}{Q}$$

$$ATC = AVC + AFC$$

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

$$AVC = \frac{TVC}{Q}$$

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

Some Notes about the Equations

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

Set ΔQ = 1

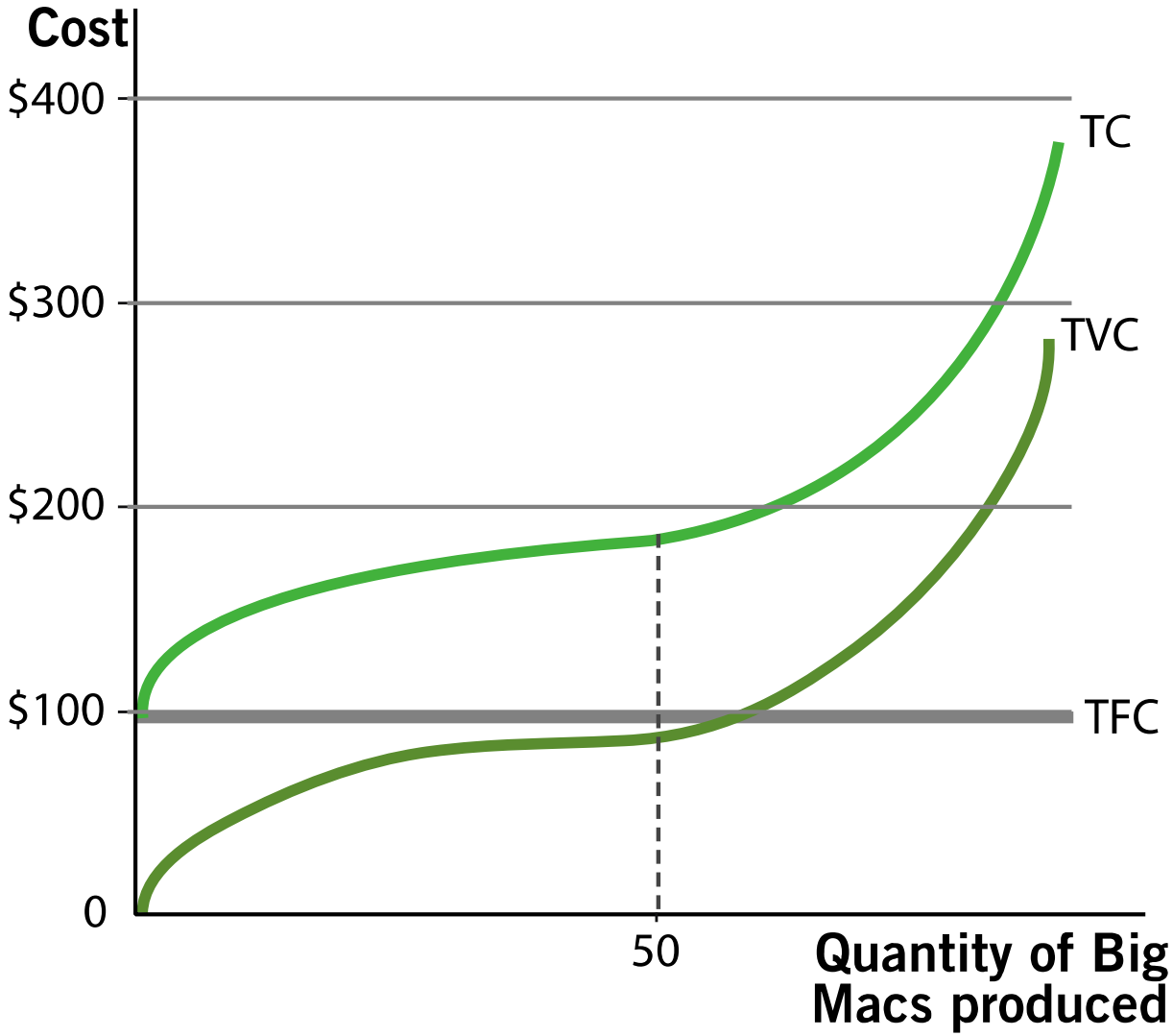
- MC
  - Easy if we can set the denominator equal to 1
  - Makes division and intuition simpler

- AFC
  - Will always decrease as we produce more output
  - Called "spreading overhead"
  - Why?

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

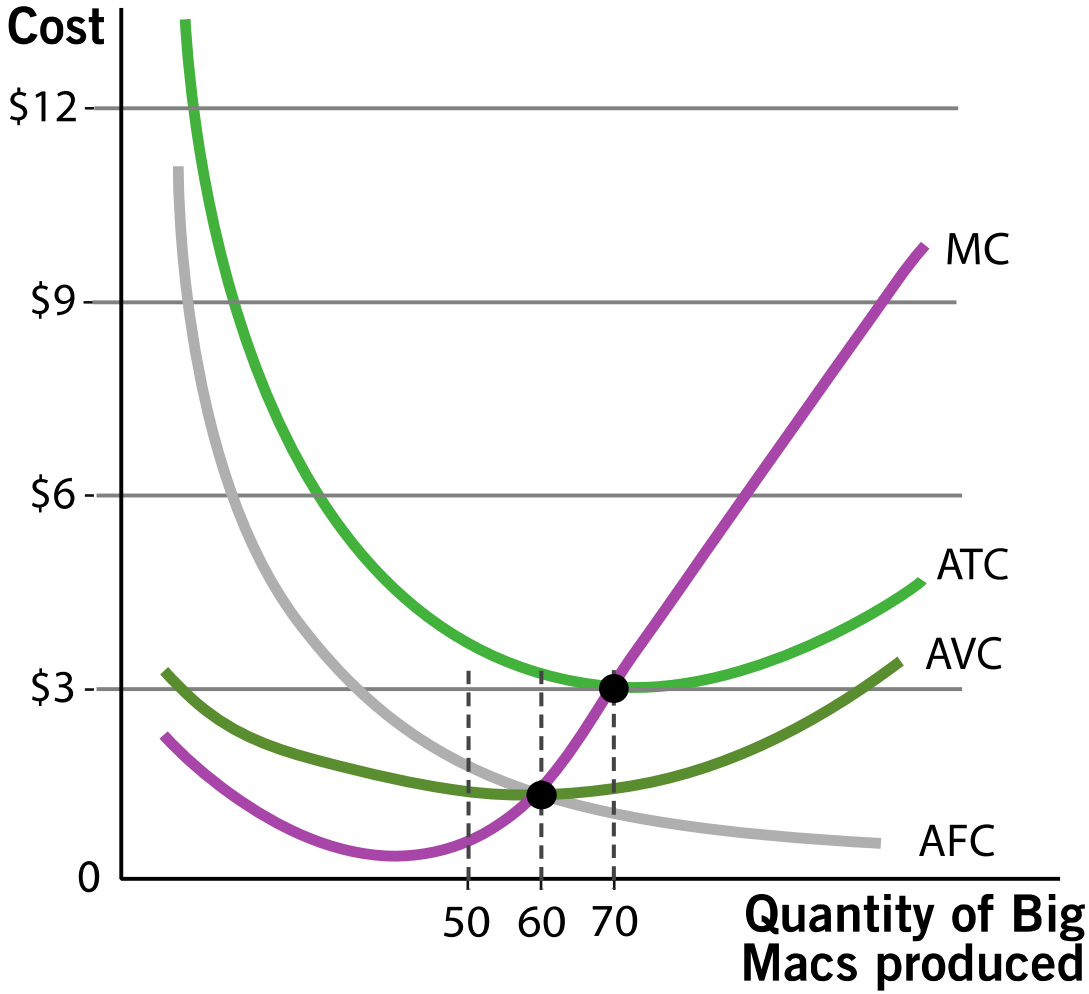
Q	TVC	TFC	TC TVC + TFC	AVC TVC ÷ Q	AFC TFC ÷ Q	ATC TC ÷ Q or AVC + AFC	MC Δ TVC ÷ ΔQ
0	$0.00	$100.00	$100.00				
10	30.00	100.00	130.00	$3.00	$10.00	$13.00	$3.00
20	50.00	100.00	150.00	2.50	5.00	7.50	2.00
30	65.00	100.00	165.00	2.17	3.33	5.50	1.50
40	77.00	100.00	177.00	1.93	2.50	4.43	1.20
50	87.00	100.00	187.00	1.74	2.00	3.74	**1.00**
60	100.00	100.00	200.00	**1.67**	1.67	3.34	1.30
70	120.00	100.00	220.00	1.71	1.43	**3.14**	2.00
80	160.00	100.00	260.00	2.00	1.25	3.25	4.00
90	220.00	100.00	320.00	2.44	1.11	3.55	6.00
100	300.00	100.00	400.00	3.00	**1.00**	4.00	8.00

The Total Cost Curve



(a) Total Costs

Cost Curves



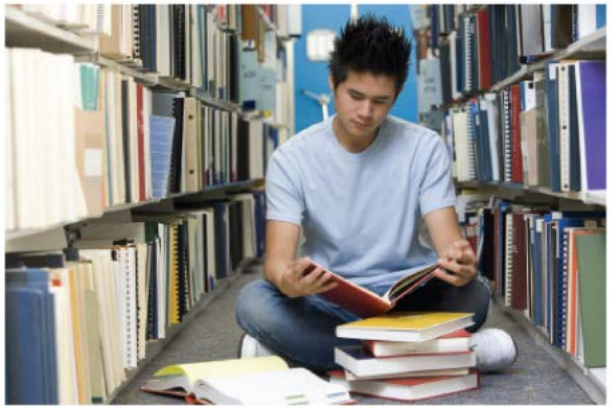
(b) Average and Marginal Costs

Margin and Average Relationship

- How do we know if the average cost will increase or decrease when we produce more?
  - We need to compare the current average to the marginal cost of producing another unit
- Key phrase to remember:
  - "The average *follows* the margin"
- If the margin is above the average
  - The average will increase
- If the margin is below the average
  - The average will decrease

Margin and Average Relationship

- Think about two examples:
  - Class GPA
  - Sports statistics
- Suppose the class average grade on the economics exam is 85%
  - Smarty McGenius joins the class, gets 100% on the exam
    - The class average rises
  - Lazy NoStudyson joins the class, gets 34% on the exam
    - The class average falls



Margin and Average Relationship

- Suppose Lebron James has a scoring *average* of 30 points per game
  - If he has a game in which he scores 45 points
    - His average increases
  - If he has a game in which he scores 12 points
    - His average decreases
- Once again:
  - The average follows the margin

Why U-Shaped Cost Curves?

- Why are the short run cost curves, including the ATC, AVC, and MC, U-shaped?
  - Diminishing marginal product!
- Explanation?
  - Assume all labor is paid the same wage
  - Eventually, inputs become less productive at the margin. (lower productivity)
  - This implies that output costs will start to rise

Practice What You Know—4

- The MC, ATC, and AVC curves are

A. vertical.
B. horizontal.
C. hill-shaped.
D. U-shaped.

Long Run Costs

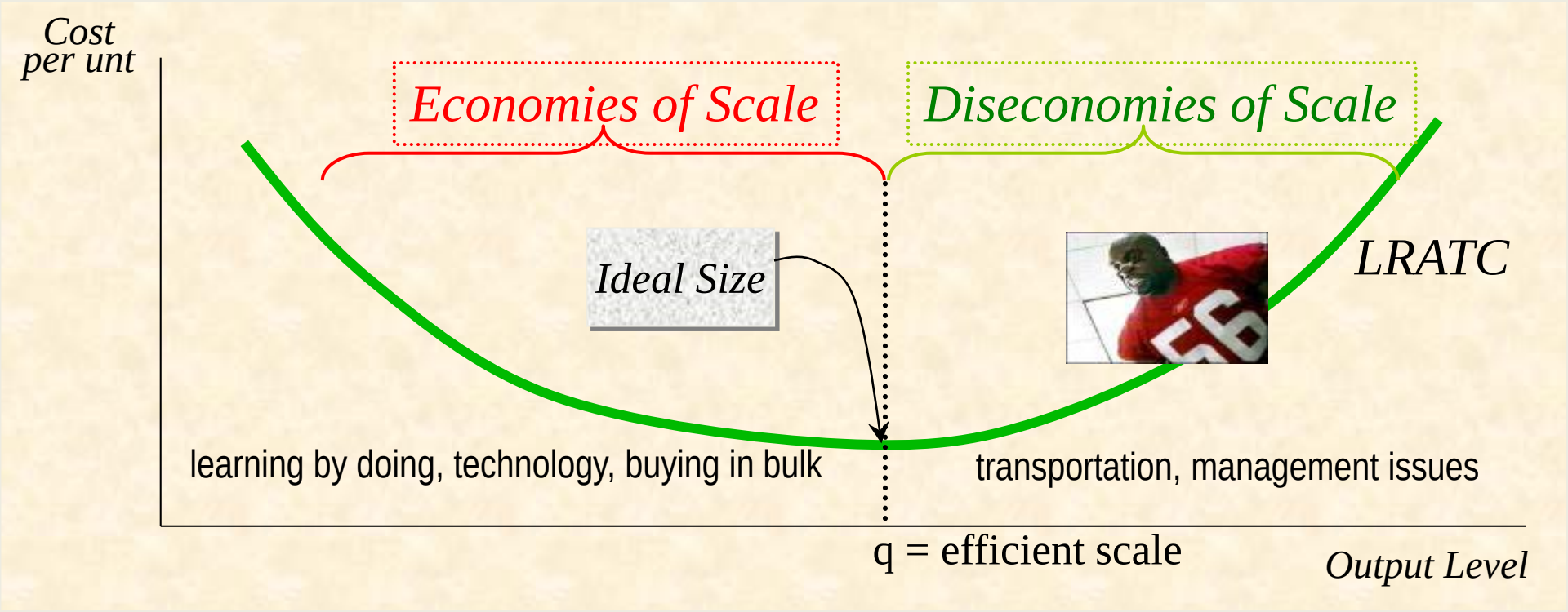
- Scale
  - Size of the production process
- Efficient scale
  - The level of output in which ATC is minimized
- Free to Vary Capital
  - In the long run, we can adjust our capital accordingly.

Long Run Costs

- Economies of scale
  - ATC *falls* when production expands
  - Larger firm more efficient than a smaller firm
- Diseconomies of scale
  - ATC *rises* when production expands
  - Very large firm has to deal with additional management, coordination, logistics expenses
- Constant returns to scale
  - ATC *doesn't change* when production expands
  - Olive Garden builds another restaurant. Requires same K and L as previous restaurants. Output similar.

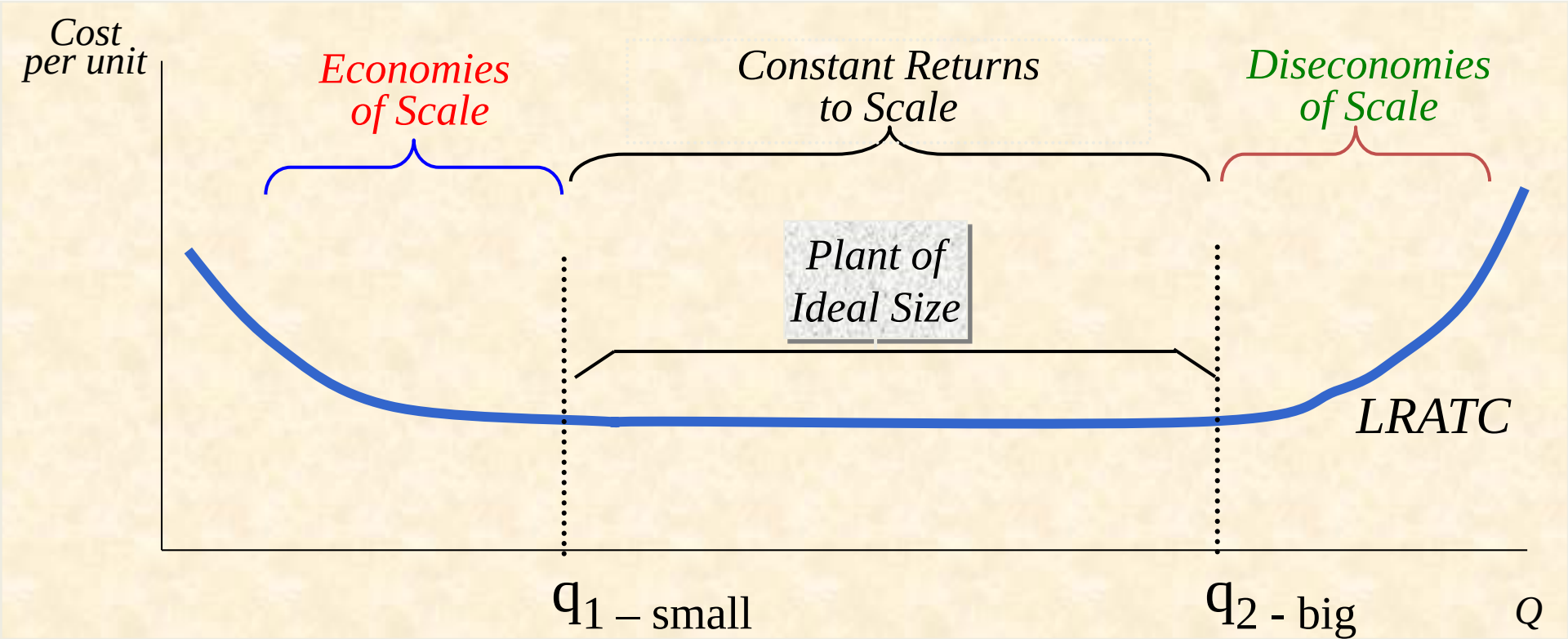
Different Types of Long Run ATC

- A firm's long-run curves are a reflection of scale and the cost of providing additional output (sometimes this falls, other times it rises) – this has *nothing* to do with Diminishing marginal product.



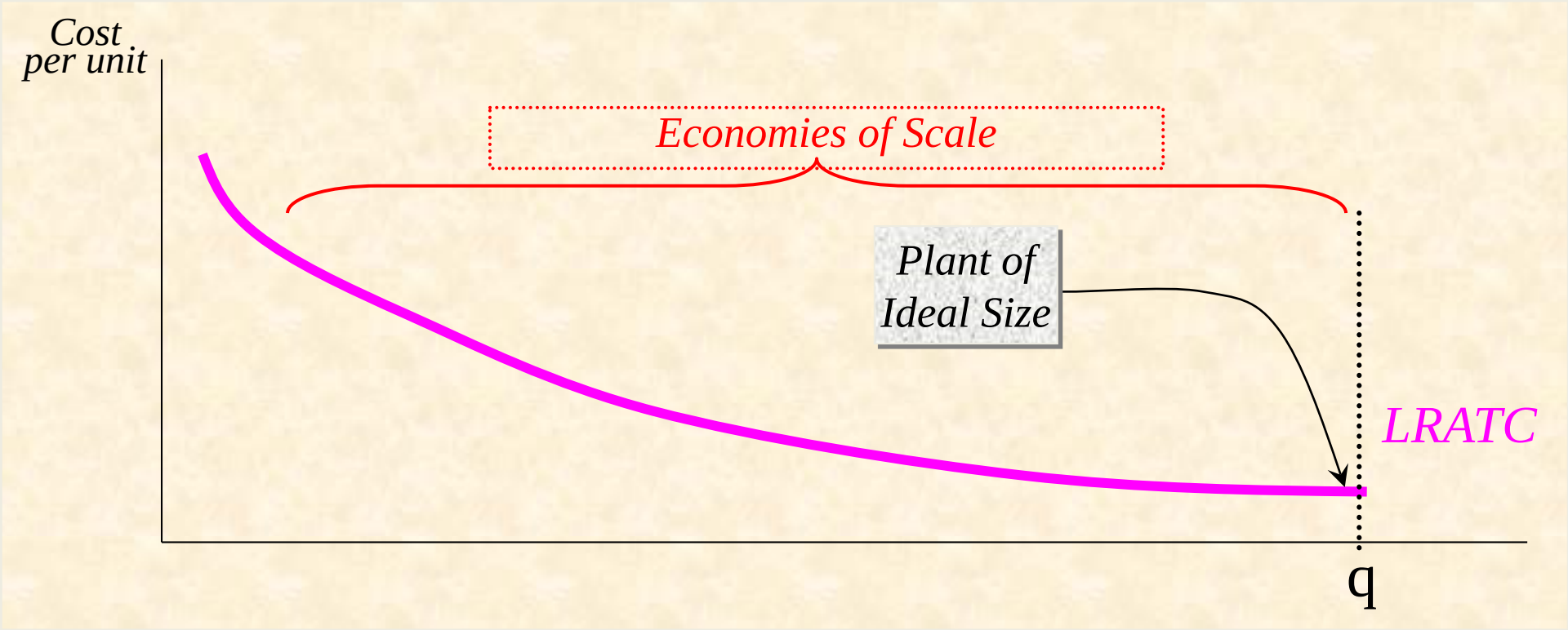
Different Types of *LRATC*

Constant Returns to Scale - suggests that the ideal plant size would be one of any size that delivers between q_1 and q_2. Increases in plant size from q_1 to any point below or including q_2 would result in neither a reduction nor an increase in the per unit costs of production due to scale.



Different Types of *LRATC*

Economies of scale can lead to monopoly…this both a GOOD and BAD thing.



SR and LR Cost Comparison

- The short run cost curve and the long run cost curve are both U-shaped. However, they are U-shaped for different reasons!
- SRATC
  - U-shaped because of diminishing marginal product
  - MPL falls, MC rises, and ATC follows MC
- LRAC
  - U-shaped because of economies and diseconomies of scale
  - Smaller firms can lower costs by growing, but if they get too big, costs can grow

Conclusion

- Costs are defined in a number of ways, but marginal cost plays the most crucial role in a firm’s cost structure.
- By observing what happens to marginal cost, you can understand changes in average cost and total cost. This is why economists place so much emphasis on marginal costs.