



Econ 201: Introduction to Economic Analysis

September 28 Lecture: Cost Curves

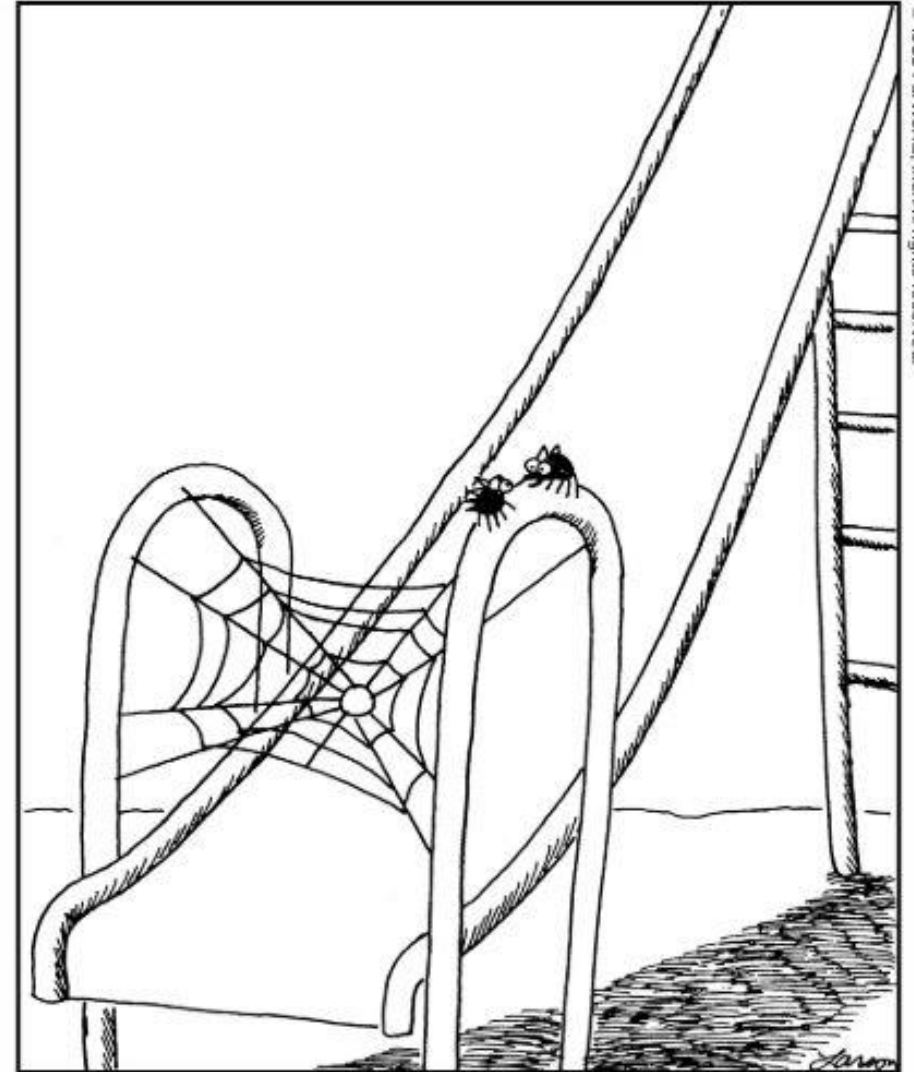


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Daily dose of The Far Side

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“If we pull this off, we’ll eat like kings.”

Preview of this class session

- Opportunity cost vs. accounting cost
- Sunk cost, fixed cost, and variable cost
- Short-run cost relationships
 - Total, average, and marginal cost
- Long-run costs
- Economies of scale and long-run average-cost curve





Basic Cost Concepts and Definitions



Economic cost vs. accounting cost

- **Accounting cost** appears on firm's financial statements
 - Includes only things for which the firm pays right now
- “**Economic cost**” is **opportunity cost**
 - What is forgone by doing something?
- Examples of opportunity cost without accounting cost
 - Leisure: No payment, but forgo the income from working
 - Valuable building firm owns: No payments, but could rent out
 - Brilliant ideas: Could license patents rather than just using
- We will be always concerned with economic cost/opportunity cost



Sunk cost, fixed cost, and variable cost

- **Sunk cost** cannot be recovered, even in the long run
 - Reed tuition for semester, once refund deadline passes
 - Something you have bought that could not be re-sold
- **Fixed cost** can *only* be varied/recovered in the long run
 - Reed's student apartments are fixed in short run, but could be sold off in long run, so not sunk
 - Chemistry labs?
- **Variable cost** can be varied in the short run
 - Firm can usually lay off workers with minimal notice and cost
 - Not true in other countries, where workers are entitled to notice and/or compensation
 - Not true for tenured faculty



Costs in the Short Run



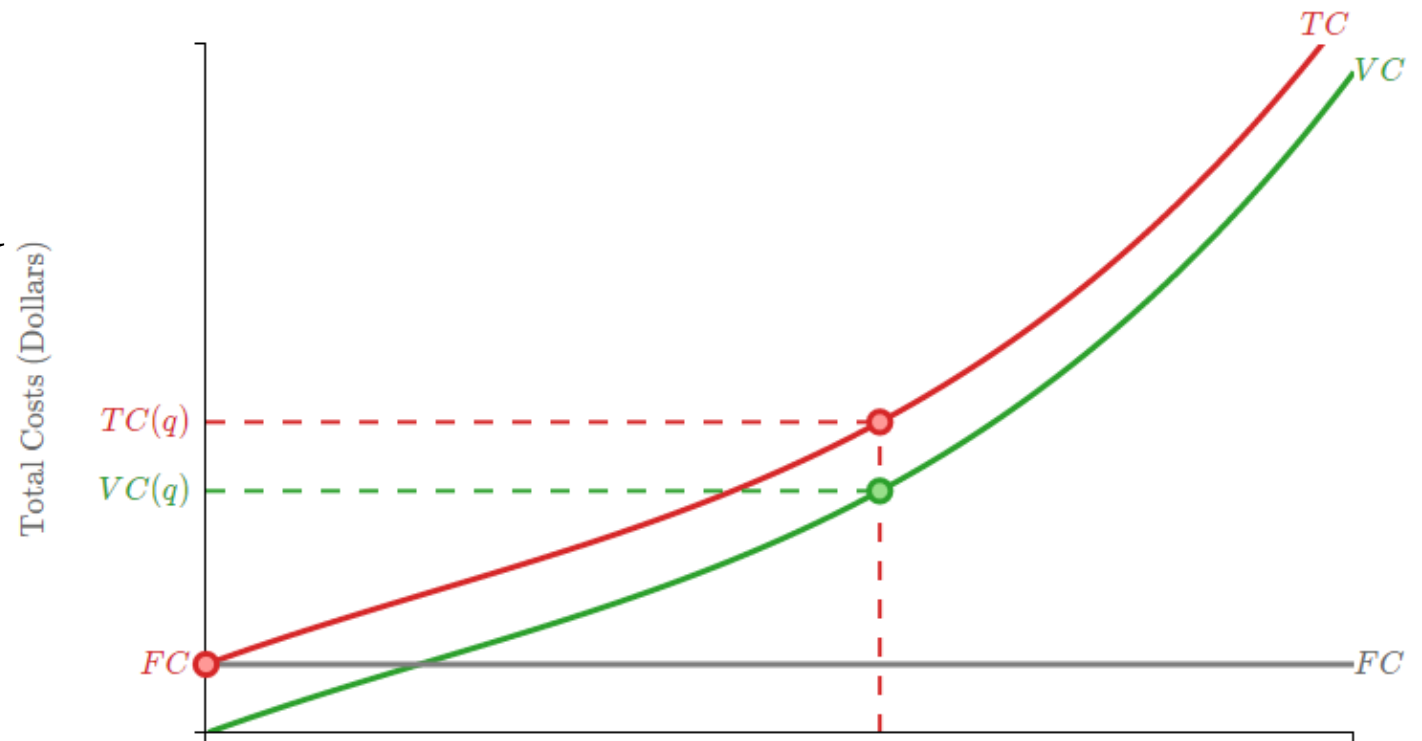
Costs in simple two-factor model

- Labor is variable factor, so labor costs are **variable costs**
 - $VC = W \times L$
- Capital is fixed factor in short run, so capital costs are **fixed costs**
 - Components of capital cost could be sunk or merely fixed
 - Depends on whether they can vary in long run
 - $FC = R \times K$
- **Total cost** = $TC = FC + VC = (R \times K) + (W \times L)$



Shape of TC, FC, and VC curves

- Quantity on horizontal axis; total cost (dollars) on vertical axis
- When $Q = 0$, $VC = 0$ and $TC = FC$
- VC eventually rises at increasing rate once enough labor is used that diminishing MP occurs
- TC (red) = FC (blue) + VC (green)



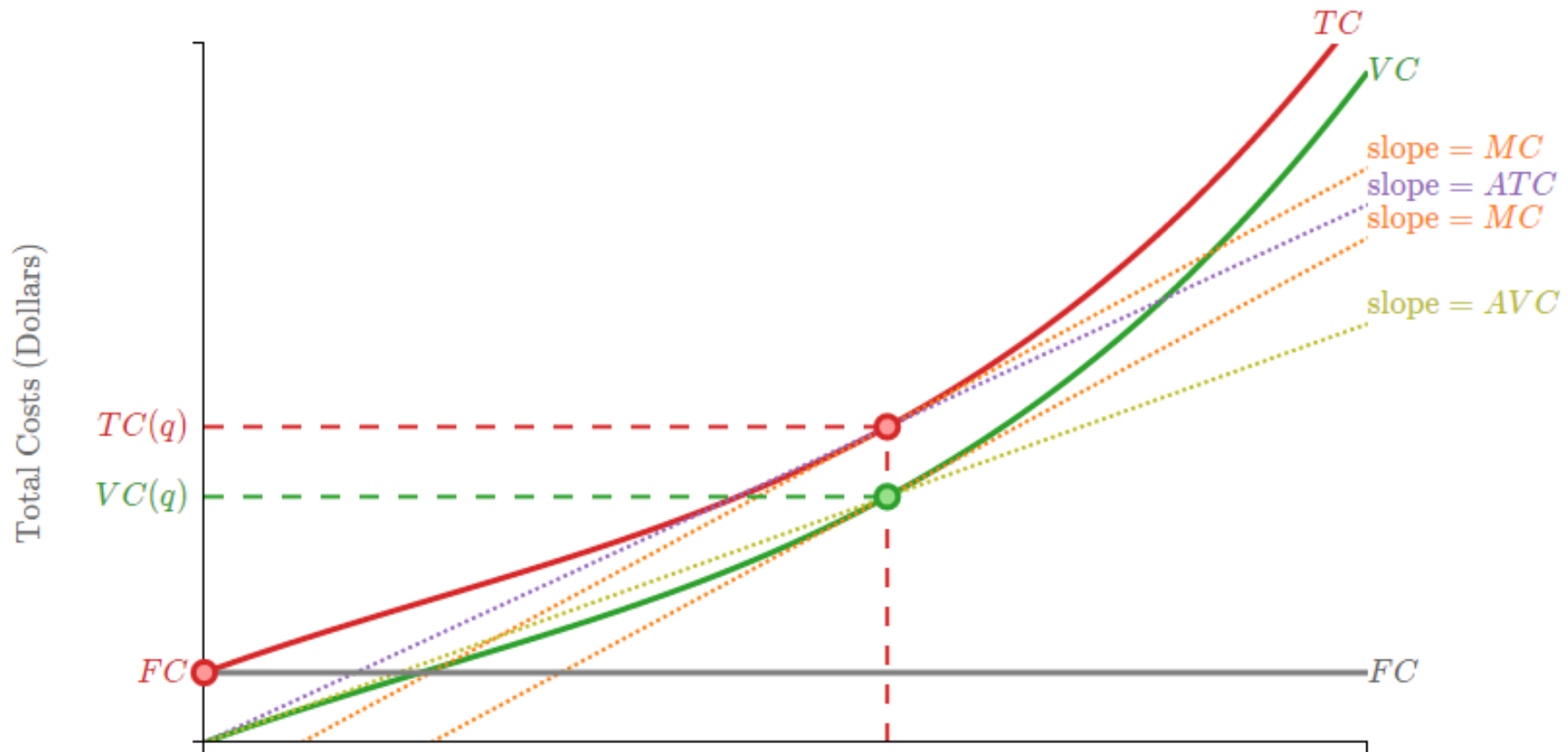


Average total, fixed, and variable cost

- **Average total cost** = $ATC = TC / Q$
 - Cost per unit of output (not labor input)
- **Average fixed cost** = $AFC = FC / Q$
 - Fixed cost per unit of output
 - Always falling as Q increases because FC does not increase with output
- **Average variable cost** = $AVC = VC / Q$
- **Marginal cost** = $\Delta TC / \Delta Q = \Delta VC / \Delta Q$
 - Marginal fixed cost is always zero



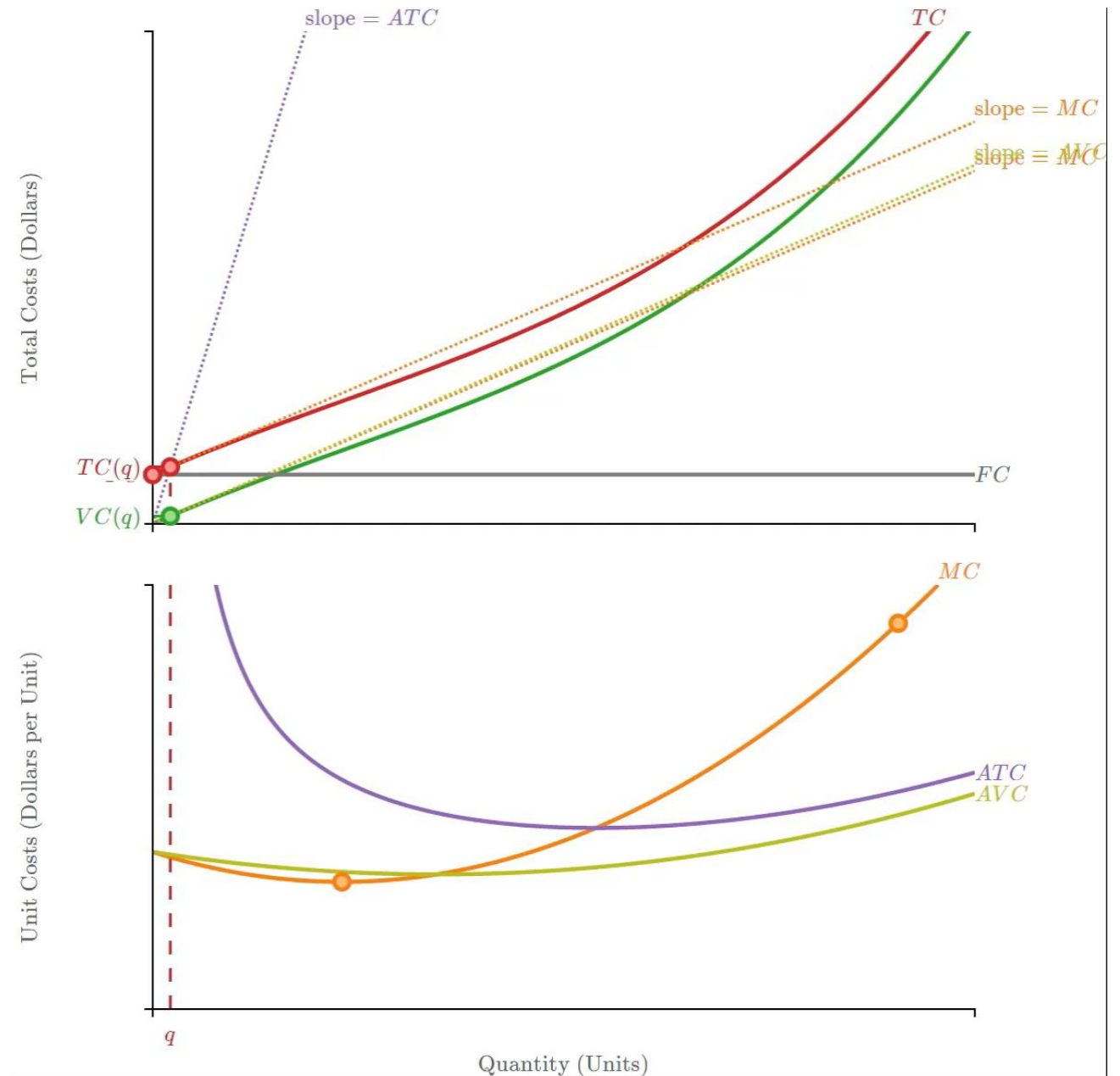
Average and marginal cost on TC graph



- ATC or AVC is slope of line connecting point to origin (purple & green)
- Marginal cost is slope of tangent line to TC or VC (orange)

Average and marginal cost curves

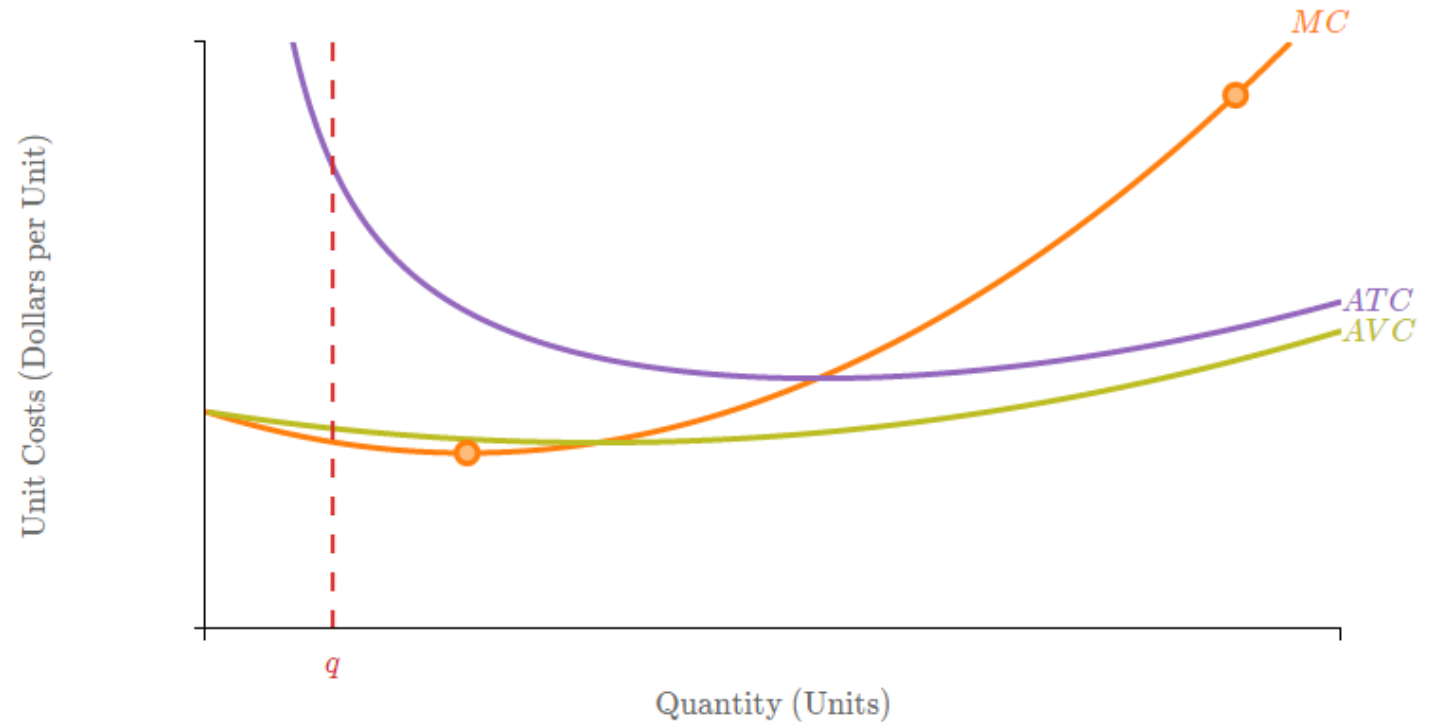
Average total cost, average variable cost, and marginal cost curves are derived by seeing how the slopes of line to origin and tangent line change when Q changes





Relationship between average and marginal

- Marginal $<$ average \rightarrow average curve is falling
 - Additional unit costs less than average previous unit
 - Adding it into the total lowers average
- Marginal $>$ average \rightarrow average curve is rising
- Marginal = average at flat point of average
 - **MC cuts ATC, AVC at minimum points**





Marginal cost and marginal product

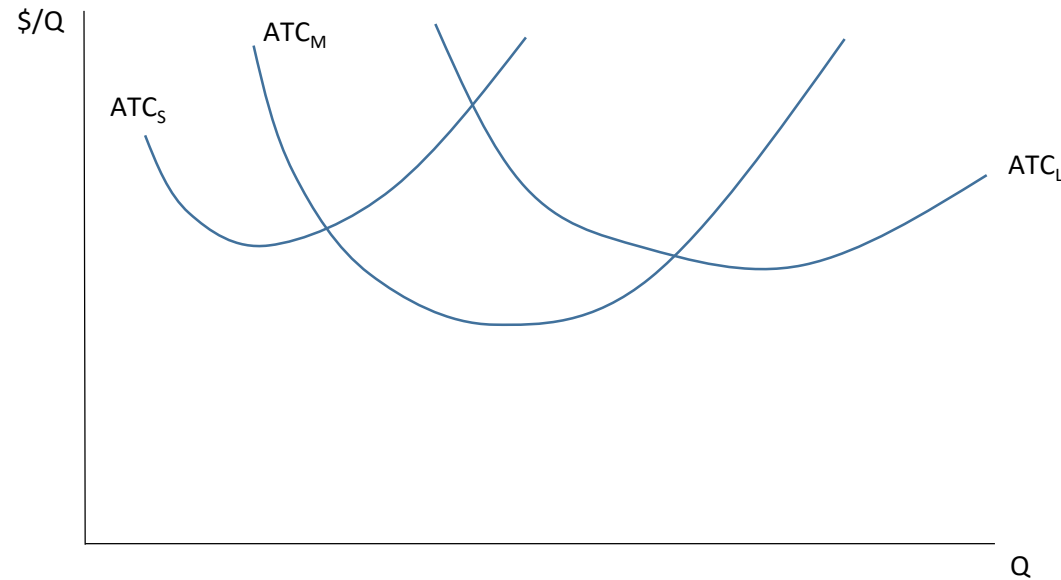
- Assume that labor is only variable input
- Adding one more unit of labor gives MP_L units of output and costs W
- Each of those MP_L units of output costs W / MP_L
 - If wage = \$15 and marginal hour produces 10 units, each (on average) costs \$1.50, which is marginal cost
- So $MC = W / MP_L$ and MC is rising (in Q) when MP_L is falling (in L)
- Since MP_L falls (perhaps after some initial rise) because of diminishing marginal returns, **MC must eventually rise**



Costs in the Long Run



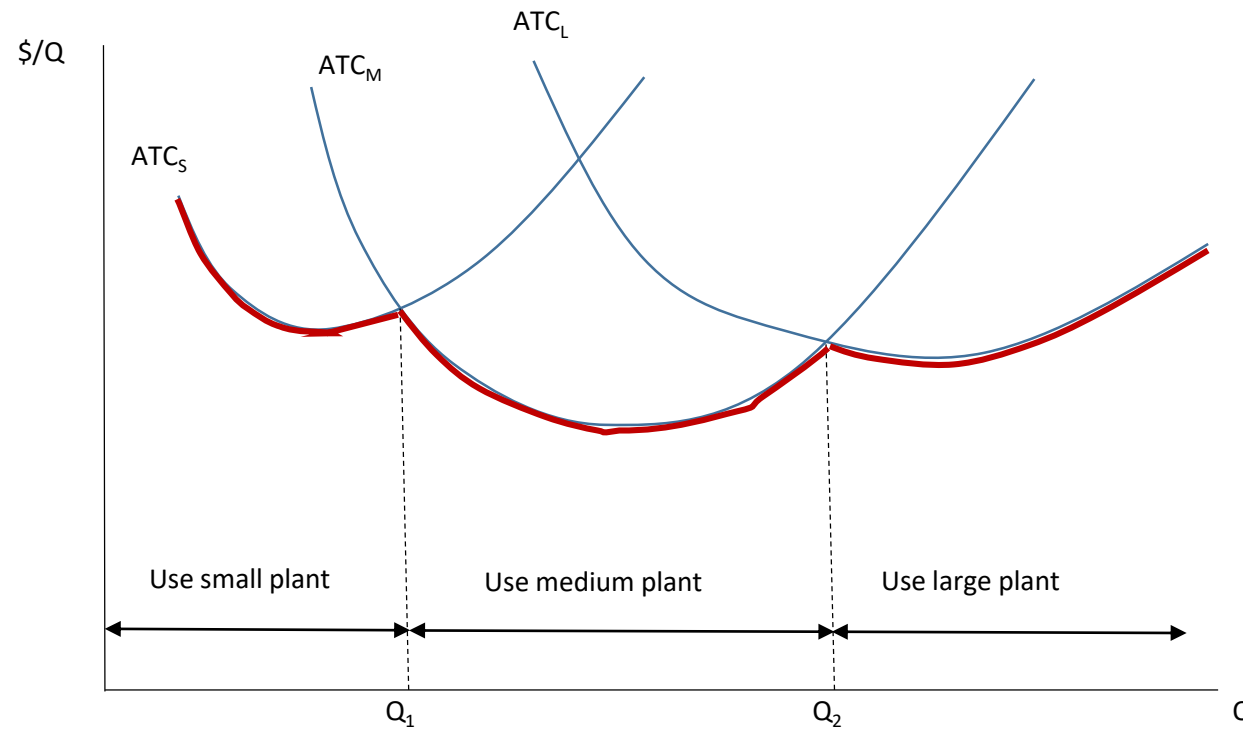
Nature of long-run average costs



- Choice of amount of capital
 - Short-run ATC is different for each level of K
 - Small Q usually more efficient with small plant; large Q better with large plant
- Diagram shows ATC curves for small, medium, and large plants
 - Each is optimal for some ranges of production



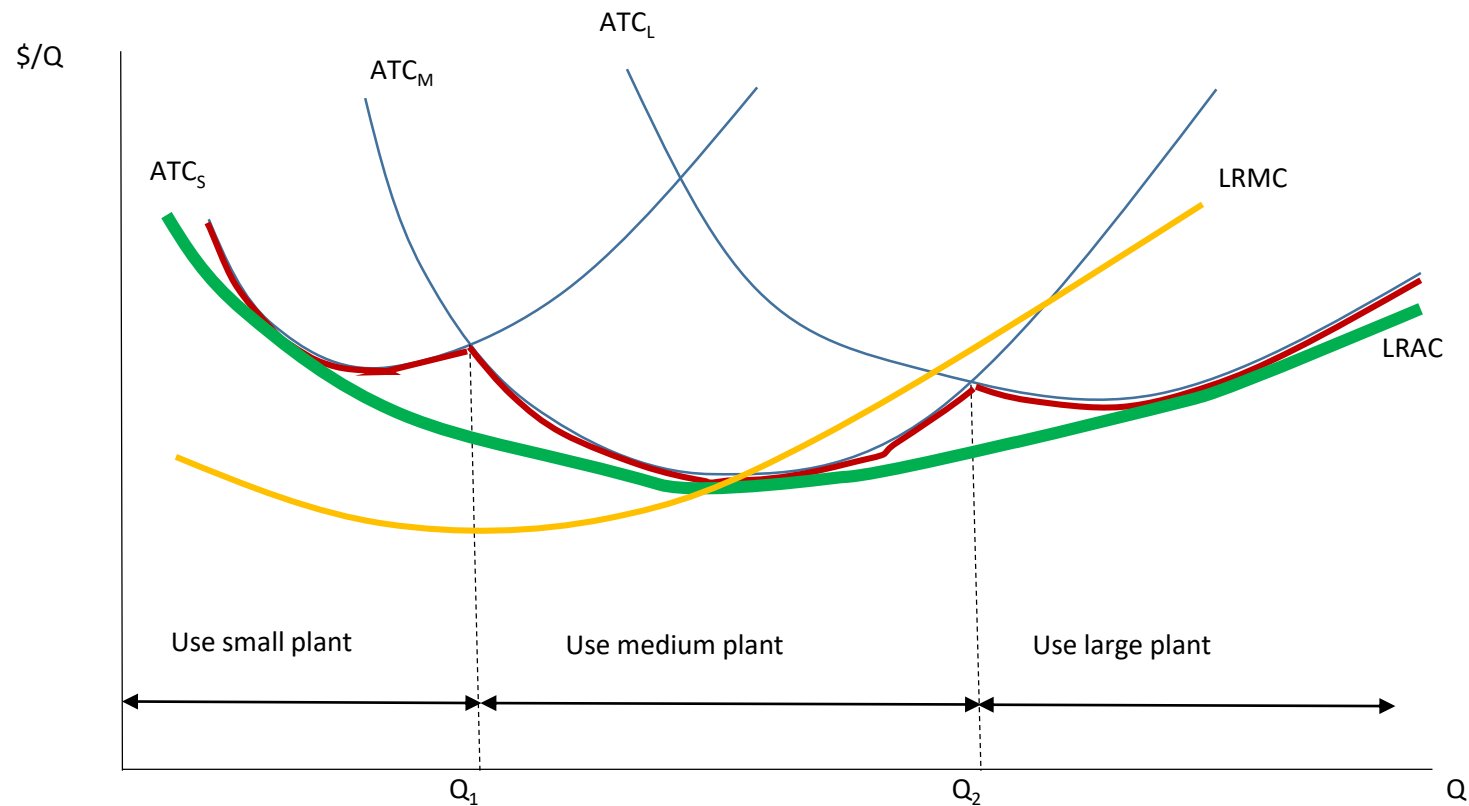
Long-run average costs: The envelope curve



- What's the lowest possible average cost for each level of output?
- Choose plant size that is the lowest for that Q
- With 3 choices of size, LRAC curve is **three-part envelope**



Long-run average and marginal cost curves



- With continuous choice of plant sizes, **LRAC becomes smooth envelope curve** tangent to all possible ATC curves
- **Long-run marginal cost** curve cuts minimum of LRAC



Economies and diseconomies of scale

- What happens when the firm expands?
 - More of all inputs leads to more output and more cost
 - Does average cost go up or down?
 - Is LRAC upward-sloping, downward-sloping, or flat at point?
- **Economies of scale:** LRAC slopes downward
 - Increasing output leads to lower average cost
- **Diseconomies of scale:** LRAC slopes upward
 - Increasing output leads to higher average cost
- We often draw LRAC as U-shaped
- **Efficient scale** is at minimum point of LRAC



Economies of scope

- For multi-product firms, does producing one good lead to lower average cost for producing another?
 - Gasoline and asphalt use different components of crude oil
 - Producing gasoline allows cheap production of asphalt as by-product
- **Economies of scope** occur when expanding the scope of the firm (range of products produced) lowers average cost
 - Universities: research, graduate education, undergraduate education
 - Supermarket: same selling infrastructure for produce, meat, etc.
 - Amazon?

Review

- Definitions of economic (opportunity) cost, sunk cost, fixed cost, and variable cost
- Relationships among total cost, average cost, and marginal cost in the short run
- Behavior of average and marginal cost in the long run





Daily diversion

A Challenge:

Take a common phrase and change one letter to make a new phrase that is meaningful. For example, I avoid the free samples at Costco under the principle of:

“Taste not, want not.”

Send me one that you come up with, or just add it to the conversation at the end of our conference.



What comes next?

- We have now laid the foundation for the analysis of firms' profit-maximizing decisions under perfect competition
- Next class looks at firm's supply in the short run; after that we consider long-run supply decisions under competition
- Case study on dairy farms continues for those sessions
- Exam on Monday, October 5