

Theory of the Firm in Perfect Competition



Two Critical Decisions; Long Run
vs Short Run; Widget Production



The Firm's Problem

- Maximize profit:
- Given available technology: $Q(K,L)$
- Given prices of inputs: w and r
- Given price of final good Q



Two Critical Decisions

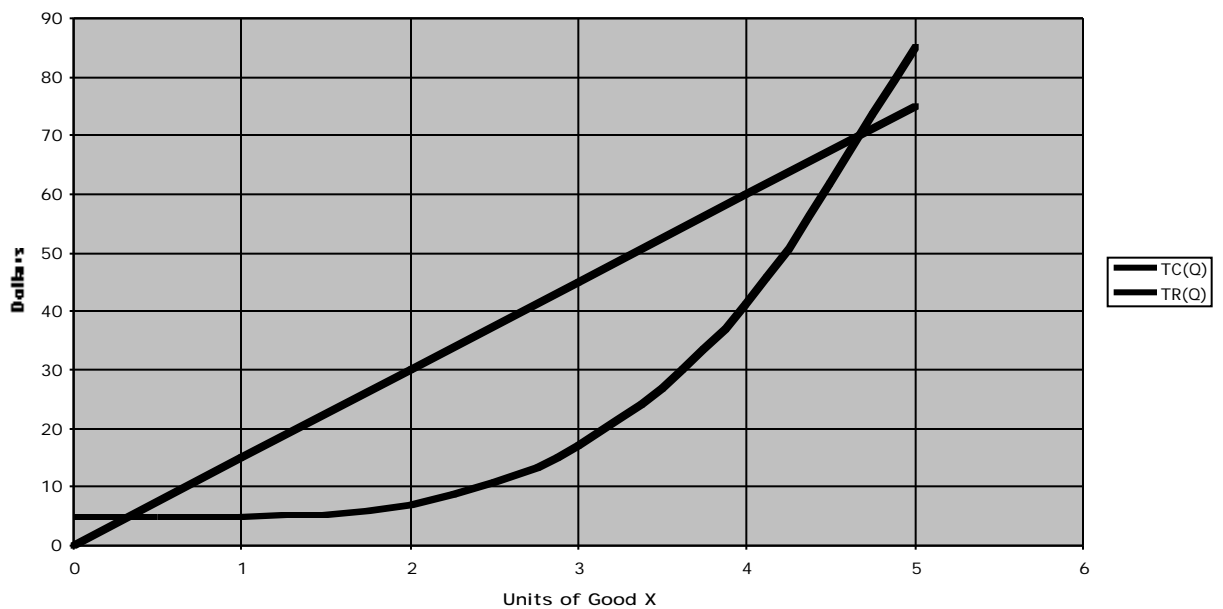
■ How to produce?

- List technically efficient methods
- Choose the lowest cost method: L^*, K^*
- $TC(Q) = wL^* + rK^*$

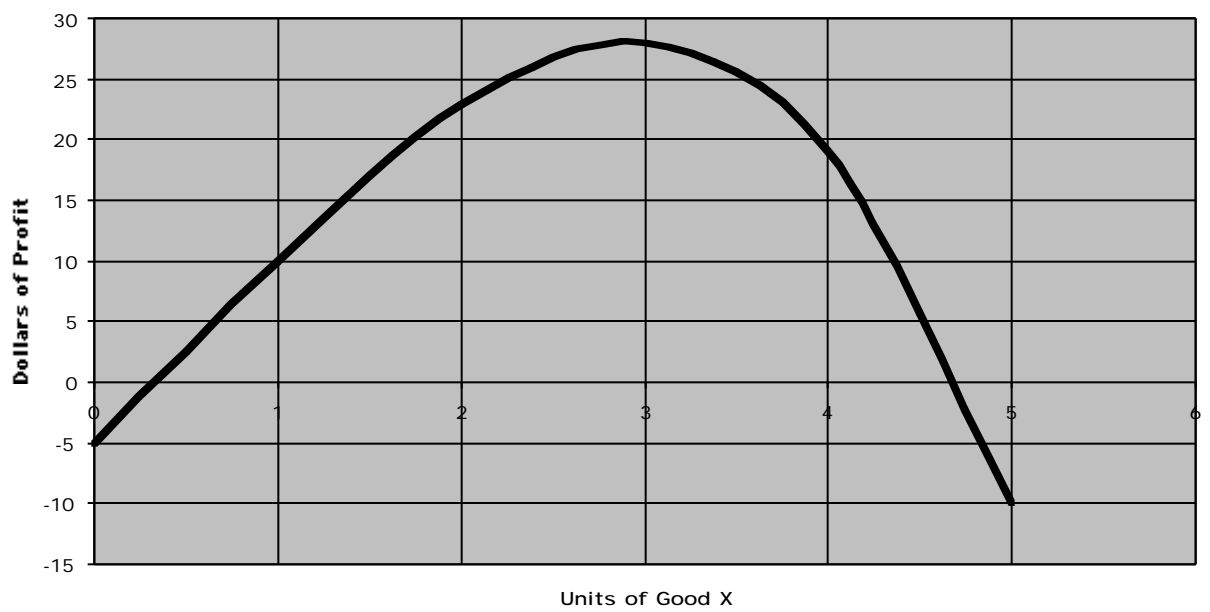
■ How much to produce?

- Profit = Total Revenue - Total Costs
- Total Revenue = PQ
- Total Costs = $TC(Q)$

Total Revenue-Total Cost



Profit





Profit Maximization Rule

Marginal Revenue = Marginal Cost

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



Some Basic Vocabulary

- **Explicit costs vs Implicit costs**
 - Explicit costs require an outlay of money by firm; Implicit costs do not.
- **Economic Profit vs Accounting profit**
 - Economists include opportunity costs in calculating economic profit; Accountants do not.
- **Long run vs short run**
 - In long run both K and L are variable. In short run, K is fixed Only L is variable.



Short Run Production

- Widget manufacturing
 - Variable Input -- Labor (Staples)
 - Fixed Inputs -- Table, Stapler
- Production Table
 - Total Product -- total number of widgets
 - Average Product -- total number of widgets divided by total number of workers
 - Marginal Product -- change in number of widgets following addition of worker



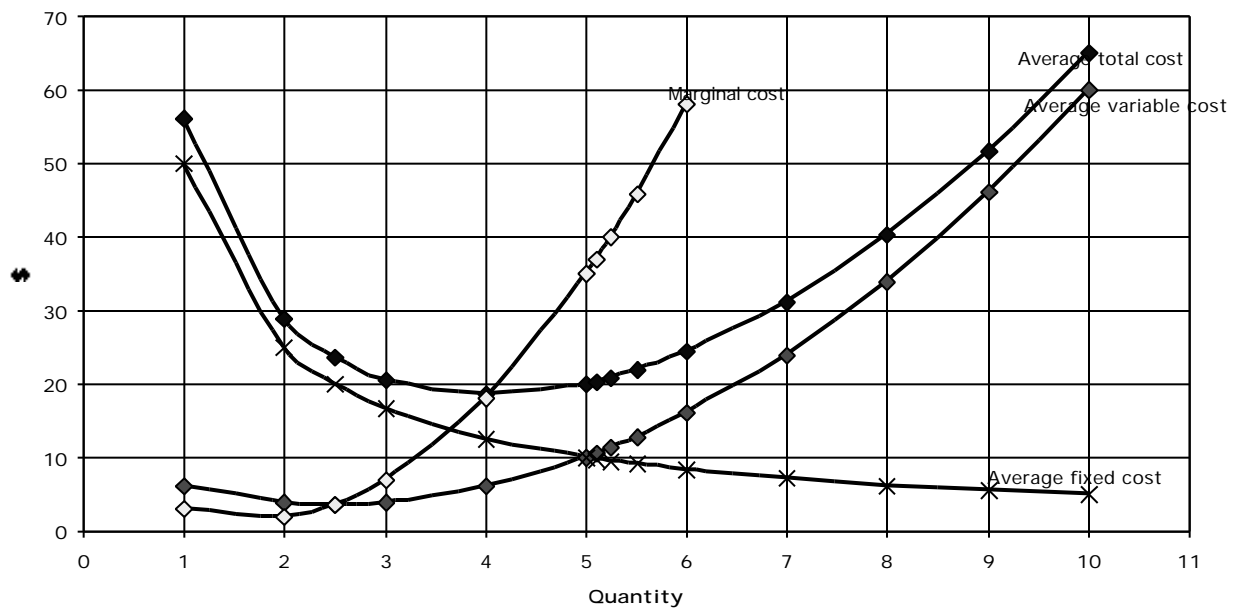
Discussion

- What happens to marginal product as number of workers increases?
- What happens to total costs as number of workers increases?
- What happens to cost per unit produced as output increases?

Short Run Costs

- Fixed vs variable costs
- $ATC = \text{Total Cost} / \text{Output}$
- $AVC = \text{Total Variable Cost} / \text{Output}$
- $AFC = \text{Total Fixed Cost} / \text{Output}$
- $MC = \Delta TC / \Delta Q$
 - Change in Total Cost associated with last unit produced

Typical Short Run Cost Curves





Marginal Cost

- Marginal cost is inversely related to marginal product.
- Because of the law of diminishing marginal returns (diminishing marginal productivity), short run marginal cost slopes up. Why is that important?
- Marginal cost will intersect AC at minimum of AC.

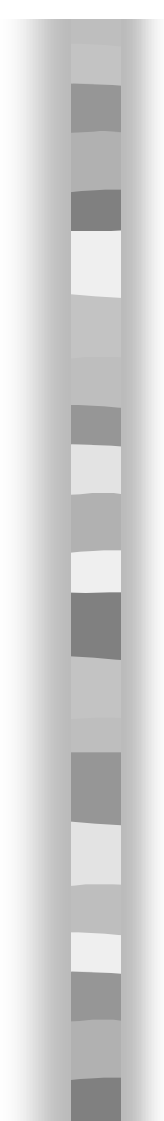


Long Run Production

- Plans Output (Q)
- Firm chooses K and L to produce Q at lowest possible cost
- Chooses among technically efficient technologies (combinations of K & L)

Technically Efficient Technologies:
 $Q=20$

Units of Labor	Units of Capital
3	1
2	2
1	3



Cost Minimizing Technology? $w=\$5$ and
 $r=\$10$

L	K	TC
3	1	\$25
2	2	\$30
1	3	\$35

Long Run Production

Q=20		Q=40		Q=60	
L	K	L	K	L	K
3	1	6	2	9	3
2	2	4	4	6	6
1	3	2	6	3	9



Long Run Total Costs

Output	Total Costs	Average Costs	K
20	25	12.5	1
40	50	12.5	2
60	75	12.5	4



Returns to Scale

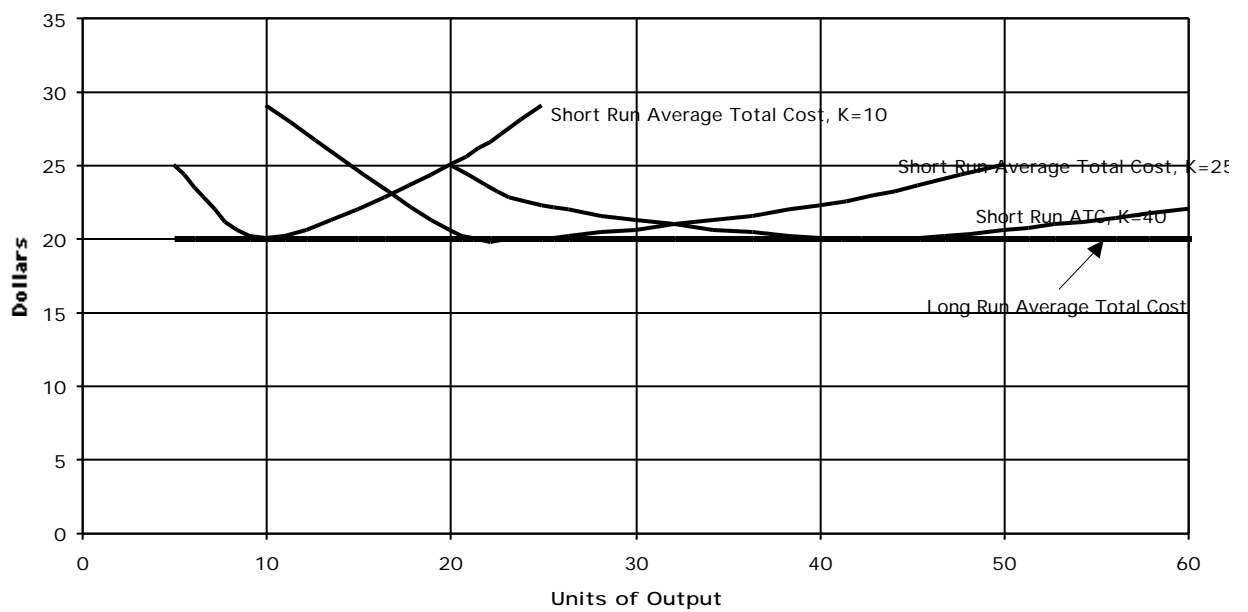
- **Increasing Returns to Scale**
 - As inputs double, output more than doubles
 - Average total costs are decreasing
- **Constant Returns to Scale**
 - As inputs double, output doubles
 - Average total costs are constant
- **Decreasing Returns to Scale**
 - As inputs double, output less than doubles
 - Average total costs are increasing



Relationship between Long Run and Short Run Costs

- Short run, K is fixed. Only L variable
- Suppose firm built factory with $K=2$, anticipating production of 40 units.
- If output is 20 instead, firm will have total costs of \$30 and SRATC of \$15. SRATC would be greater than LRATC.

Relationship between Long Run and Short Run Costs





Summary

- For economists, cost is opportunity cost. It includes the opportunity cost of capital invested in firm.
- In long run firm's choose K and L to produce planned output at lowest cost.
- Short run production is characterized by diminishing marginal returns.
- MC will intersect ATC at ATC's minimum.
- Minimums of SRATCs will be tangent to LRATC