Chapter 7

The Cost of Production
Topics to be Discussed

- Measuring **Cost**: Which Costs Matter?
- Cost in the Short Run
- Cost in the Long Run
- Long-Run Versus Short-Run Cost Curves
- Production with Two Outputs: Economies of Scope
Introduction

- Production technology (function) measures the relationship between inputs and output.
- Production technology, together with prices of factor inputs, determine the firm’s cost of production. (Managers need to ask themselves how much it costs to produce a given quantity of their product.)
- Given the production technology, managers must choose how to produce (choice of an input combination).
Introduction

- The optimal, cost minimizing, level of inputs *can be determined*

- A firm’s costs depend on the rate of output and we will show how these costs are likely to change over time

- The characteristics of the firm’s production technology can affect costs in the long run and short run
Measuring Cost: Which Costs Matter? (pp. 213 - 9)

- For a firm to minimize costs, we must clarify what is meant by costs and how to measure them
  - It is clear that if a firm has to rent equipment or buildings, the rent they pay is a cost
  - What if a firm owns its own equipment or building?
    - How are costs calculated here?
Measuring Cost: Which Costs Matter? (pp. 213 - 9)

- Accountants tend to take a retrospective view of firms’ costs, whereas economists tend to take a forward-looking view.
- Accounting Cost
  - Actual expenses plus depreciation charges for capital equipment
- Economic Cost
  - Cost to a firm of utilizing economic resources in production, including *opportunity cost*
Measuring Cost: Which Costs Matter? (pp. 213 - 9)

- Economic costs distinguish between costs the firm can control and those it cannot
  - Concept of opportunity cost plays an important role

- Opportunity cost
  - Cost associated with opportunities that are foregone when a firm’s resources are not put to their highest-value use
Opportunity Cost (pp. 213 - 9)

- An Example
  - A firm owns its own building and pays no rent for office space
  - Does this mean the cost of office space is zero?
  - The building could have been rented instead
  - Foregone rent is the opportunity cost of using the building for production and should be included in the economic costs of doing business
Opportunity Cost (pp. 213 - 9)

- A person starting their own business must take into account the opportunity cost of their time
  - Could have worked elsewhere making a competitive salary as well
  
  *A joke:* Economists regard holding a meeting costly, but accountants don’t.
Some costs vary with output, while some remain the same no matter the amount of output.

Total cost can be divided into:
1. Fixed Cost ($FC$)
   - Does not vary with the level of output
2. Variable Cost ($VC$)
   - Cost that varies as output varies
Fixed and Variable Costs (pp. 213 - 9)

● Total output is a function of variable inputs and fixed inputs
● Therefore, the total cost of production equals the fixed cost (the cost of the fixed inputs) plus the variable cost (the cost of the variable inputs), or…

\[ TC = FC + VC \]
Fixed and Variable Costs (pp. 213 - 9)

- Which costs are variable and which are fixed depends on the time horizon
- Short time horizon – most costs are fixed
- Long time horizon – many costs become variable
- In determining how changes in production will affect costs, must consider if fixed or variable costs are affected.
Fixed Cost Versus Sunk Cost (pp. 213 - 9)

- Fixed cost and sunk cost are often confused

- Fixed Cost
  - Cost paid by a firm that is in business regardless of the level of output

- Sunk Cost
  - Cost that has been incurred and cannot be recovered
Measuring Cost: Which Costs Matter? Ex. 7-2 (pp. 213 - 9)

- Personal Computers
  - Most costs are variable
  - Largest component: labor
- Software
  - Most costs are sunk
  - Initial cost of developing the software
Marginal and Average Cost (pp. 213 - 9)

- In completing a discussion of costs, must also distinguish between
  - Average Cost
  - Marginal Cost
- After definition of costs is complete, one can consider the analysis between short-run and long-run costs
Measuring Costs (pp. 213 - 9)

- Marginal Cost (MC):
  - The cost of expanding output by one unit
  - Fixed costs have no impact on marginal cost, so it can be written as:

\[ MC = \frac{\Delta VC}{\Delta q} = \frac{\Delta TC}{\Delta q} \]
Measuring Costs (pp. 213 - 9)

- **Average Total Cost (ATC)**
  - Cost per unit of output
  - Also equals average fixed cost (AFC) plus average variable cost (AVC)

\[
ATC = \frac{TC}{q} = AFC + AVC
\]

\[
ATC = \frac{TC}{q} = \frac{TFC}{q} + \frac{TVC}{q}
\]
Measuring Costs  (pp. 213 - 9)

- All the types of costs relevant to production have now been discussed.
- Can now discuss how they differ in the long and short run.
- Costs that are fixed in the short run may not be fixed in the long run.
- Typically in the long run, most if not all costs are variable.
### A Firm’s Short Run Costs

(pp. 220 - 5)

<table>
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<th>Rate of Output (Units per Year)</th>
<th>Fixed Cost (Dollars per Year)</th>
<th>Variable Cost (Dollars per Year)</th>
<th>Total Cost (Dollars per Year)</th>
<th>Marginal Cost (Dollars per Unit)</th>
<th>Average Fixed Cost (Dollars per Unit)</th>
<th>Average Variable Cost (Dollars per Unit)</th>
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Determinants of Short Run Costs (pp. 220 - 5)

- The rate at which these costs increase depends on the nature of the production process
  - The extent to which production involves diminishing returns to variable factors
- Diminishing returns to labor
  - When marginal product of labor is decreasing
Determinants of Short Run Costs (pp. 220 - 5)

- If marginal product of labor decreases significantly as more labor is hired
  - Costs of production increase rapidly
  - Greater and greater expenditures must be made to produce more output

- If marginal product of labor decreases only slightly as increase labor
  - Costs will not rise very fast when output is increased
Determinants of Short Run Costs – An Example (pp. 220 - 5)

- Assume the wage rate \((w)\) is fixed relative to the number of workers hired.
- Variable costs is the per unit cost of extra labor times the amount of extra labor: \(wL\)

\[
MC = \frac{\Delta VC}{\Delta q} = \frac{w\Delta L}{\Delta q}
\]
Determinants of Short Run Costs – An Example  (pp. 220 - 5)

- Remembering that

\[ \Delta MP_L = \frac{\Delta Q}{\Delta L} \]

- And rearranging

\[ \Delta L \text{ for a } 1 \text{ unit } \Delta Q = \frac{\Delta L}{\Delta Q} = \frac{1}{\Delta MP_L} \]
Determinants of Short Run Costs – An Example  

We can conclude:

\[ MC = \frac{w}{MP_L} \]

...and a low marginal product \((MP_L)\) leads to a high marginal cost \((MC)\) and vice versa.