Lecture 15-16

- Production function
  - Technology
  - Inputs
- Isoquants
- Cost function
- Iso-cost line
- Producer theory
Production

- Production is a process where firms turn inputs (factors of production) into outputs (products)
- Production function: $Q = F(K,L)$
  
  Describe what is technically feasible when the firm operates efficiently, that is, when the firm uses inputs as effectively as possible (no wastes)
- Basic assumptions:
  Free disposal, etc.
Isoquants

• **Definition:**
  An isoquant is a curve that shows all the possible combinations of inputs that yield the same output.
  (Similar to an indifference curve, except that each isoquant is associated with a specific level of output that represents cardinal ranking)

• **Shape:**
  Convex as an indifference curve
  The law of diminishing returns states that as the use of an input increases (with other inputs fixed), a point will eventually be reached at which the resulting additions to output decrease

• **Isoquant map:** (similar to an indifference map)
  A set of isoquants, each of which shows the maximum output that can be achieved for any set of inputs (another way to describe production)
Measuring Costs

- **What’s included in costs?**
  - Accounting cost:
    Retrospective, monetary transactions, keep tract of assets and liabilities to evaluate past financial performance
  - Economic cost:
    - Forward-looking, include implicit non-monetary transactions
    - Opportunity cost that associated with opportunities that are foregone by not putting the firm's resources to their highest value use

- **Types of costs: (SC vs. VC)**
  - Sunk costs: an expenditure once made cannot be recovered
  - Variable costs: an expenditure varies with output
Isocost Line

- **Definition:**
  An isocost line includes all possible combinations of labor and capital that can be purchased for a given total cost.

- **Expression:**
  - \( C = wL + rK \)
  - Slope is \( \frac{dK}{dL} = -\frac{w}{r} \)

- **Dual problem:**
  - Choosing inputs to minimize the cost of producing a given level of output
  - Maximizing the level of output at a given cost
  - Condition: isocost line is tangent to isoquant
    \( \text{MRTS} = -\frac{dK}{dL} = \frac{MP_L}{MP_K} = \frac{w}{r} \)
**Producer Theory**

- **Cost Minimization:**
  \[
  \text{Min } C = wL + rK \ (w = 1, r = 2) \\
  \text{s.t. } L^{1/2}K^{1/2} = Q = 100
  \]
  – Calculate:
    - \(L^*\) and \(K^*\)
    - \(C^*\) at \((L^*, K^*)\)
  – Check: \(\frac{MP_L}{MP_K} = \frac{w}{r}\)

- **Output Maximization:**
  \[
  \text{Max } Q = L^{1/2}K^{1/2} \\
  \text{s.t. } wL + rK = C^*
  \]
  – Calculate: \(L^*, K^*, Q^*\) at \((L^*, K^*)\)
SR and LR Costs

- Cost in the short-run: (K is fixed)
  - Total cost (TC): TC = FC + VC (FC vs. SC)
  - Marginal cost (MC): MC = dTC/dQ = dVC/dQ
  - Average cost (AC):
    - ATC = TC/Q = AFC + AVC
    - AFC = FC/Q
    - AVC = VC/Q
- Determinants:
  - MC = dVC/dQ = wdL/dQ = w/MPL
  - AVC = wL/Q = w/AP_L
- Shape of the cost curves:
  Table 7.1 and Figure 7.1
- Cost in the long-run: (Both K and L change)