Chapter 2

The Basics of Supply and Demand
Introduction

- What are supply and demand?
- What is the market mechanism?
- What are the effects of changes in market equilibrium?
- What are elasticities of supply and demand?
- What are the effects of government intervention – price controls?
Supply and Demand

- The Supply Curve
  - The relationship between the quantity of a good that producers are willing to sell and the price of the good
  - Measures quantity on the x-axis and price on the y-axis

\[ Q_s = Q_s(P) \]
The supply curve slopes upward, demonstrating that at higher prices firms will increase output.
The Supply Curve

- Other Variables Affecting Supply
  - Costs of Production
    - Labor
    - Capital
    - Raw Materials
  - Lower costs of production allow a firm to produce more at each price and vice versa
The Supply Curve

- Change in Quantity Supplied
  - Movement along the curve caused by a change in price

- Change in Supply
  - Shift of the curve caused by a change in something other than the price of the good
    - Change in costs of production
Change in Supply

- The cost of raw materials falls
  - Produced $Q_1$ at $P_1$ and $Q_0$ at $P_2$
  - Now produce $Q_2$ at $P_1$ and $Q_1$ at $P_2$
  - Supply curve shifts right to $S'$

![Diagram showing supply shift from $S$ to $S'$ with points $Q_0$, $Q_1$, and $Q_2$ at prices $P_1$ and $P_2$.]
Supply and Demand

- The Demand Curve
  - The relationship between the quantity of a good that consumers are willing to buy and the price of the good
  - Measures quantity on the x-axis and price on the y-axis

\[ Q_D = Q_D(P) \]
The demand curve slopes downward, demonstrating that consumers are willing to buy more at a lower price as the product becomes relatively cheaper.
The Demand Curve

- Other Variables Affecting Demand
  - Income
    - Increases in income allow consumers to purchase more at all prices
  - Consumer Tastes
  - Price of Related Goods
    - Substitutes
    - Complements
The Demand Curve

- Changes in quantity demanded
  - Movements along the demand curve caused by a change in price

- Changes in demand
  - A shift of the entire demand curve caused by something other than price
    - Income
    - Preferences
Change in Demand

- Income Increases
  - Purchased $Q_0$, at $P_2$ and $Q_1$ at $P_1$
  - Now purchased $Q_1$ at $P_2$ and $Q_2$ at $P_1$
  - Same for all prices
  - Demand curve shifts right
The Market Mechanism

- The market mechanism is the tendency in a free market for price to change until the market clears.
- Markets clear when quantity demanded equals quantity supplied at the prevailing price.
- Market clearing price – price at which markets clear.
The curves intersect at equilibrium, or market-clearing, price. Quantity demanded equals quantity supplied at $P_0$. 

The Market Mechanism
The Market Mechanism

- In equilibrium
  - There is no shortage or excess demand
  - There is no surplus or excess supply
  - Quantity supplied equals quantity demanded
  - Anyone who wants to buy at the current price can and all producers who want to sell at that price can
1. At $P_1$, price is above the market clearing price.
2. $Q_s > Q_D$
3. Price falls to the market-clearing price.
4. Market adjusts to equilibrium.
The Market Mechanism

1. At $P_2$, price is below the market clearing price
2. $Q_D > Q_S$
3. Price rises to the market-clearing price
4. Market adjusts to equilibrium

At $P_2$, the price is below the market clearing price. The quantity demanded ($Q_D$) is greater than the quantity supplied ($Q_S$). As a result, there is a shortage, indicating that the price is too low. The market adjusts to reach equilibrium at $P_3$, where $Q_S = Q_D$, and the price clears the market.
The Market Mechanism

- Supply and demand interact to determine the market-clearing price.
- When not in equilibrium, the market will adjust to alleviate a shortage or surplus and return the market to equilibrium.
- Markets must be competitive for the mechanism to be efficient.
Changes in Market Equilibrium

- Equilibrium prices are determined by the relative level of supply and demand.
- Changes in supply and/or demand will cause change in the equilibrium price and/or quantity in a free market.
Changes in Market Equilibrium

- Raw material prices fall
  - S shifts to S’
  - Surplus at P₁ between Q₁, Q₂
  - Price adjusts to equilibrium at P₃, Q₃
Changes in Market Equilibrium

- Income Increases
  - Demand increases to $D'$
  - Shortage at $P_1$ of $Q_1$ to $Q_2$
  - Equilibrium at $P_3$ and $Q_3$
Changes in Market Equilibrium

- Income increases and raw material prices fall
  - Quantity increases
  - If the increase in D is greater than the increase in S price also increases
Shifts in Supply and Demand

When supply and demand change simultaneously, the impact on the equilibrium price and quantity is determined by:

1. The relative size and direction of the change
2. The shape of the supply and demand models
The Price of a College Education

- The real price of a college education rose 55 percent from 1970 to 2002
- Increases in costs of modern classrooms and wages increased costs of production – decrease in supply
- Due to a larger percentage of high school graduates attending college, demand increased
New equilibrium was reached at $4,573 and a quantity of 12.3 million students.
The Long-Run Behavior of Natural Resource Prices

- Consumption of copper has increased about a hundredfold from 1880 through 2002
- The long term real price for copper has remained relatively constant
- Increased demand as world economy grew
- Decreased production costs increased supply
Resource Market Equilibrium

Long-Run Path of Price and Consumption
Price Elasticity of Demand

- Measures the sensitivity of quantity demanded to price changes
  - It measures the percentage change in the quantity demanded of a good that results from a one percent change in price

\[
E_P^D = \frac{\% \Delta Q_D}{\% \Delta P}
\]
Price Elasticity of Demand

- The percentage change in a variable is the absolute change in the variable divided by the original level of the variable.
- Therefore, elasticity can also be written as:

\[
E_p^D = \frac{\Delta Q/Q}{\Delta P/P} = \frac{P}{Q} \frac{\Delta Q}{\Delta P}
\]
Price Elasticity of Demand

- Usually a negative number
  - As price increases, quantity decreases
  - As price decreases, quantity increases
- When $|E_P| > 1$, the good is price elastic
  - $|\%\Delta Q| > |\%\Delta P|$
- When $|E_P| < 1$, the good is price inelastic
  - $|\%\Delta Q| < |\% \Delta P|$
Price Elasticity of Demand

- The primary determinant of price elasticity of demand is the availability of substitutes
  - Many substitutes, demand is price elastic
    - Can easily move to another good with price increases
  - Few substitutes, demand is price inelastic
Price Elasticity of Demand

- Given a linear demand curve
  - Elasticity depends on slope and on the values of P and Q
  - The top portion of demand curve is elastic
    - Price is high and quantity small
  - The bottom portion of demand curve is inelastic
    - Price is low and quantity high
Price Elasticity of Demand

Demand Curve
\[ Q = 8 - 2P \]

Elastic
\[ E_p = -\infty \]

Inelastic
\[ E_p = 0 \]
Price Elasticity of Demand

\[ E_p = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P} \]

Demand Curve
\[ Q = 8 - 2P \]

Elastic
\[ E_p = -1 \]

Inelastic
\[ E_p = 0 \]
Price Elasticity of Demand

- The steeper the demand curve, the more inelastic the demand for the good becomes.
- The flatter the demand curve, the more elastic the demand for the good becomes.
- Two extreme cases of demand curves:
  - Completely inelastic demand – vertical
  - Infinitely elastic demand – horizontal
Infinitely Elastic Demand

\[ E_P = \infty \]
Completely Inelastic Demand

\[ E_P = 0 \]
Other Demand Elasticities

- Income Elasticity of Demand
  - Measures how much quantity demanded changes with a change in income

\[ E_I = \frac{\Delta Q/Q}{\Delta I/I} = \frac{I}{Q} \frac{\Delta Q}{\Delta I} \]
Other Demand Elasticities

- Cross-Price Elasticity of Demand
  - Measures the percentage change in the quantity demanded of one good that results from a one percent change in the price of another good

\[
E_{Q_bP_m} = \frac{\Delta Q_b}{Q_b} / \frac{\Delta P_m}{P_m} = \frac{P_m}{Q_b} \frac{\Delta Q_b}{\Delta P_m}
\]
Other Demand Elasticities

- **Complements: Cars and Tires**
  - Cross-price elasticity of demand is negative
  - Price of cars increases, quantity demanded of tires decreases

- **Substitutes: Butter and Margarine**
  - Cross-price elasticity of demand is positive
  - Price of butter increases, quantity of margarine demanded increases
Price Elasticity of Supply

- Measures the sensitivity of quantity supplied given a change in price
  - Measures the percentage change in quantity supplied resulting from a 1 percent change in price

\[ E_P^S = \frac{\% \Delta Q^S}{\% \Delta P} \]
Point vs. Arc Elasticities

- **Point elasticity of demand**
  - Price elasticity of demand at a particular point on the demand curve

- **Arc elasticity of demand**
  - Price elasticity of demand calculated over a range of prices

\[
E^D_P = \left( \frac{\Delta Q}{\Delta P} \right) \left( \frac{\bar{P}}{\bar{Q}} \right)
\]
Elasticity: An Application

- During the 1980’s and 1990’s, the market for wheat went through changes that had great implications for American farmers and US agricultural policy.
- Using the supply and demand curves for wheat, we can analyze what occurred in this market.
Elasticity: An Application

- Supply: \( Q_S = 1900 + 24P \)
- Demand: \( Q_D = 3550 - 266P \)
  (unit is $ and million bushel)
Elasticity: An Application

\[ Q_S = Q_D \]
\[ 1800 + 240P = 3550 - 266P \]
\[ 506P = 1750 \]
\[ P = $3.46 \text{ per bushel} \]

\[ Q = 1800 + (240)(3.46) = 2630 \text{ million bushels} \]
Elasticity: An Application

- We can find the elasticities of demand and supply at these points

\[ E_D^P = \frac{P}{Q} \frac{\Delta Q_D}{\Delta P} = \frac{3.46}{2,630} (-266) = -0.35 \]

\[ E_S^P = \frac{P}{Q} \frac{\Delta Q_S}{\Delta P} = \frac{3.46}{2,630} (240) = 0.32 \]
Elasticity: An Application

Assume the price of wheat is $4.00/bushel due to decrease in supply

\[ Q_D = 3,550 - (266)(4.00) \]
\[ = 2,486 \]

\[ Q_P^D = \frac{4.00}{2,486}(-266) = -0.43 \]
Short-Run Versus Long-Run Elasticity

- Price elasticity varies with the amount of time consumers have to respond to a price
- Short-run demand and supply curves often look very different from their long-run counterparts
Short-Run Versus Long-Run Elasticity

- Demand
  - In general, demand is much more price elastic in the long run
    - Consumers take time to adjust consumption habits
    - Demand might be linked to another good that changes slowly
    - More substitutes are usually available in the long run
Gasoline: Short-Run and Long-Run Demand Curves

- People cannot easily adjust consumption in the short run.
- In the long run, people tend to drive smaller and more fuel efficient cars.
Short-Run Versus Long-Run Elasticity

- Demand and Durability
  - For some durable goods, demand is more elastic in the short run
  - If goods are durable, then when price increases, consumers choose to hold on to the good instead of replacing it
  - But in long run, older durable goods will have to be replaced
Initially, people may put off immediate car purchase.

In the long run, older cars must be replaced.
Short-Run Versus Long-Run Elasticity

- Income elasticity also varies with the amount of time consumers have to respond to an income change
  - For most goods and services, income elasticity is larger in the long run
  - When income changes, it takes time to adjust spending
Short-Run Versus Long-Run Elasticity

- Income elasticity of durable goods
  - Income elasticity is less in the long run than in the short run
    - Increases in income mean consumers will want to hold more cars
    - Once older cars are replaced, purchases will only be to replace old cars
    - Less purchases from income increase in long run than in short run
## Demand for Gasoline

### Number of Years Allowed to Pass Following a Price or Income Change

<table>
<thead>
<tr>
<th>Elasticity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5</th>
<th>10</th>
<th>20</th>
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<tbody>
<tr>
<td>Price</td>
<td>-0.11</td>
<td>-0.22</td>
<td>-0.32</td>
<td>-0.49</td>
<td>-0.82</td>
<td>-1.17</td>
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<tr>
<td>Income</td>
<td>0.07</td>
<td>0.13</td>
<td>0.20</td>
<td>0.32</td>
<td>0.54</td>
<td>0.78</td>
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## Demand for Automobiles

<table>
<thead>
<tr>
<th>Elasticity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>-1.20</td>
<td>-0.93</td>
<td>-0.75</td>
<td>-0.55</td>
<td>-0.42</td>
<td>-0.40</td>
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<td>Income</td>
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<td>2.33</td>
<td>1.88</td>
<td>1.38</td>
<td>1.02</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Effects of Price Controls

- Markets are rarely free of government intervention
  - Imposed taxes and granted subsidies
  - Price controls
- Price controls usually hold the price above or below the equilibrium price
  - Excess demand – shortage
  - Excess supply – surplus
Effects of Price Controls

- Price is regulated to be no higher than $P_{max}$
- Quantity supplied falls and quantity demanded increases
- A shortage results

![Graph showing supply and demand with a shortage](image)

- Price: $P_0$
- Supply: $S$
- Demand: $D$
- Quantity: $Q_S$, $Q_0$, $Q_D$
Effects of Price Controls

- Excess demand sometimes takes the form of queues
  - Lines at gas stations during 1974 shortage
- Sometimes get curtailments and supply rationing
  - Natural gas shortage of the mid ’70’s
- Producers typically lose, but some consumers gain. Some consumers lose.
Price Controls and Natural Gas Shortages

- In 1954, the federal government began regulating the wellhead price of natural gas.
- Price regulation was a major component of US energy policy in the 1960s and 1970s, and it continued to influence the natural gas markets in the 1980s.