

CHAPTER 2 – THE BASICS OF SUPPLY AND DEMAND

Key Concepts and Topics

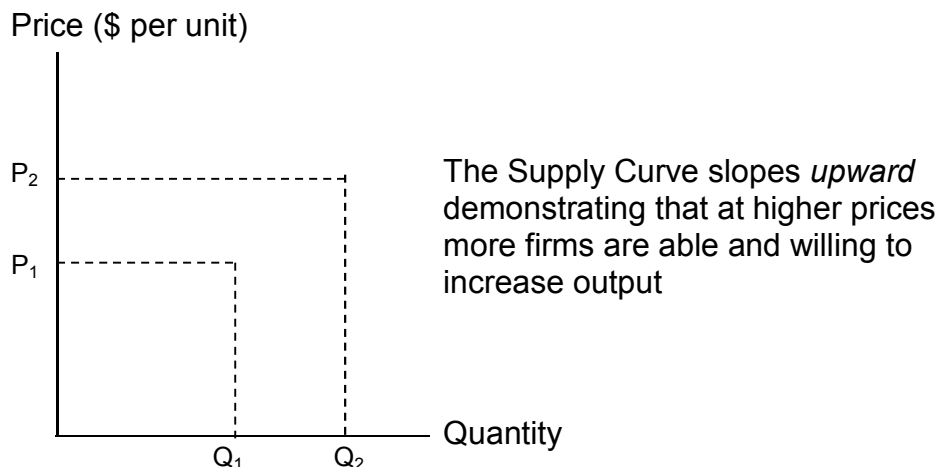
- Supply and Demand
- The Market Mechanism
- Changes in Market Equilibrium
- Elasticities of Supply and Demand
- Understanding and Predicting the Effects of Changing Market Conditions
- Effects of Government Intervention – Price Controls

Supply and Demand

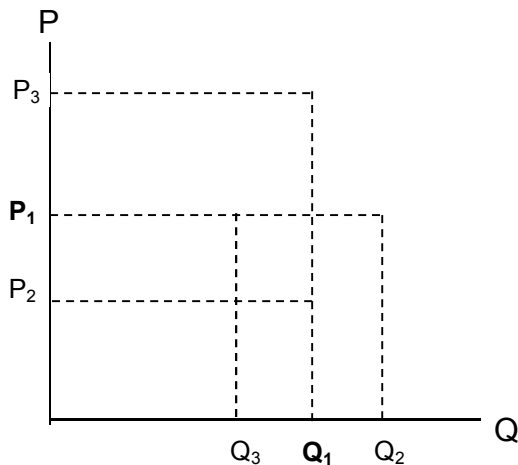
- Why and how prices change
 - How world economic conditions affect market price and production
- What happens when the government intervenes in a competitive market
 - The impact of price controls, minimum wages, price supports, and production incentives on the economy
 - How taxes, subsidies, tariffs and import quotas affect consumers and producers

The Supply Curve

- The relationship between the *quantity* of a good that producers are willing to sell and the *price* of the good, holding other supply-determining factors (e.g., wages, interest charges, raw material costs, etc.) constant, $Q_S = Q_S(P)$



- When the supply-determining factors change, say, lower (higher) production costs, the entire supply curve shifts to the right (left). Therefore, greater (lesser) quantity supplied at the same price, or same quantity supplied at a lower (higher) price

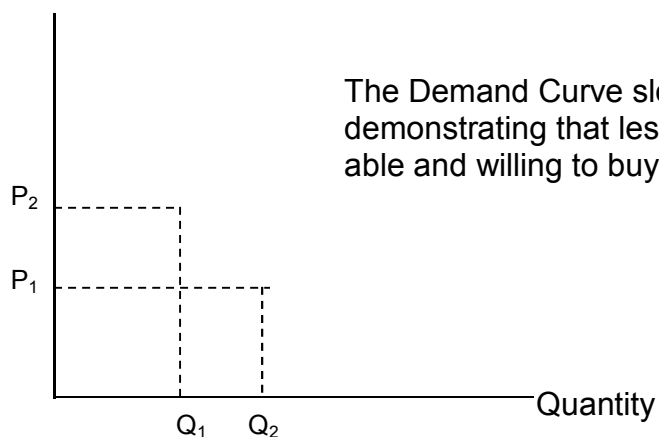


- Change in Q_S caused by
 - Price change – *movement* along the supply curve
 - Changes in supply-determining factors – *shift* of the supply curve

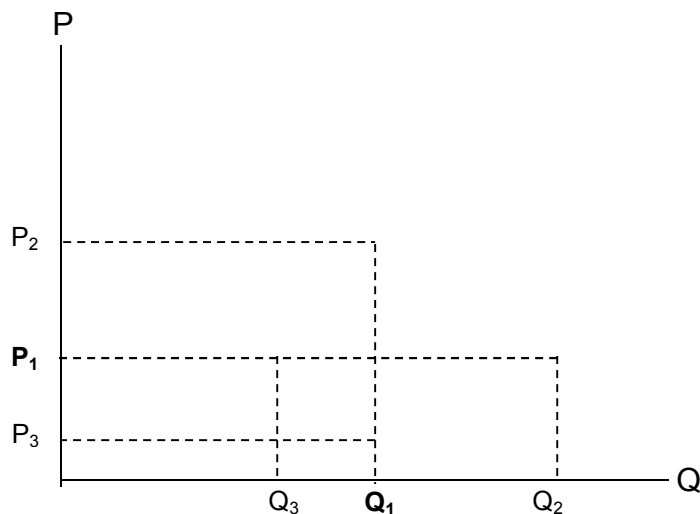
The Demand Curve

- The relationship between the *quantity* of a good that consumers are willing to buy and the *price* of the good, holding other demand-determining factors (e.g., incomes, tastes, weather, prices of substitute and complementary goods, etc.) constant, $Q_D = Q_D(P)$

Price (\$ per unit)



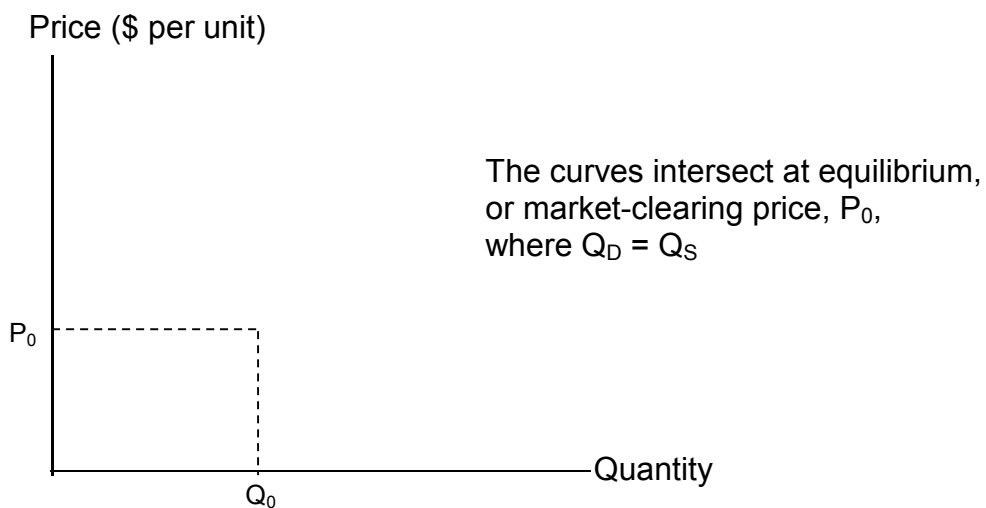
- When the demand-determining factors change, say, consumer incomes increase (decrease), the entire demand curve shifts to the right (left). Hence, greater (lesser) quantity demanded at the same price, or same quantity demanded at a higher (lower) price.



- Change in Q_D caused by
 - Price change – *movement* along the demand curve
 - Changes in demand-determining factors – *shift* of the demand curve

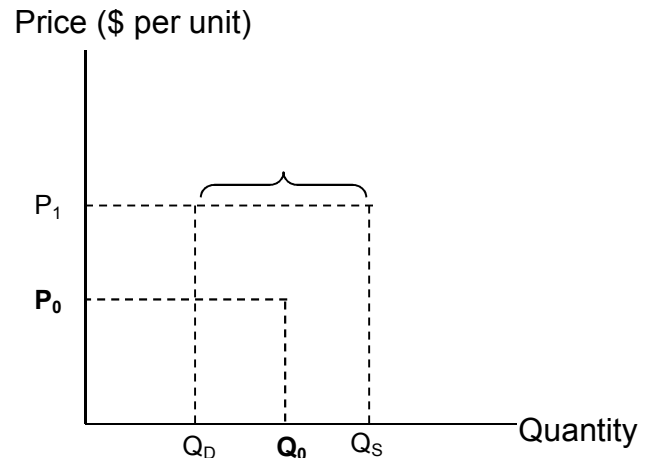
The Market Mechanism

- The tendency in a free market for price to change until the market clears, i.e., $Q_D = Q_S$ at the market-clearing (equilibrium) price



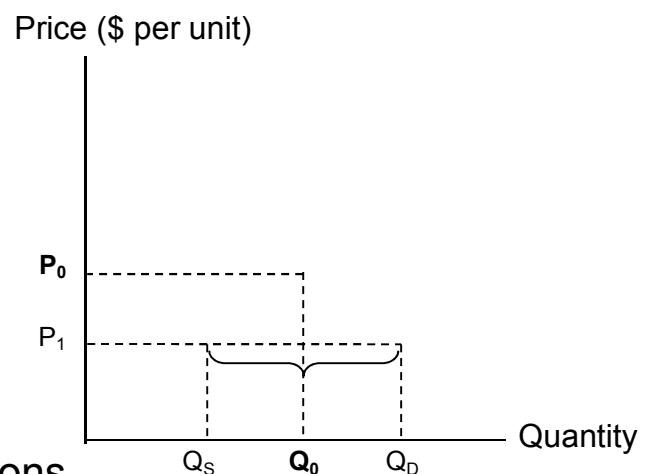
Market Surplus

- Market price $>$ equilibrium
 - $Q_S > Q_D$
 - Downward pressure on price, P_1 falls to P_0
 - Q_D increases and Q_S decreases
 - Market adjusts to equilibrium



Market Shortage

- Market price $<$ equilibrium
 - $Q_D > Q_S$
 - Upward pressure on price, P_1 rises to P_0
 - Q_D decreases and Q_S increases
 - Market adjusts to equilibrium

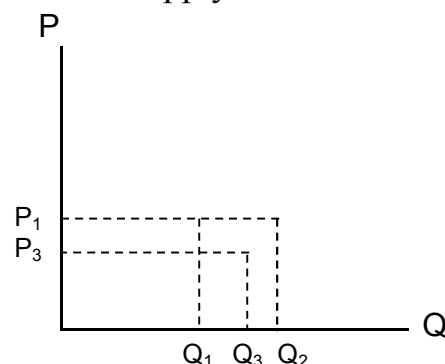


The Market Mechanism: Conclusions

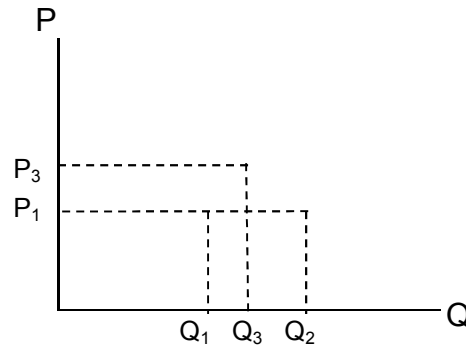
- S and D interact to determine the market-clearing price
- When not in equilibrium, the market will adjust to alleviate a shortage or surplus and return the market to equilibrium
- Markets must be *competitive* for the mechanism to be efficient

Changes In Market Equilibrium

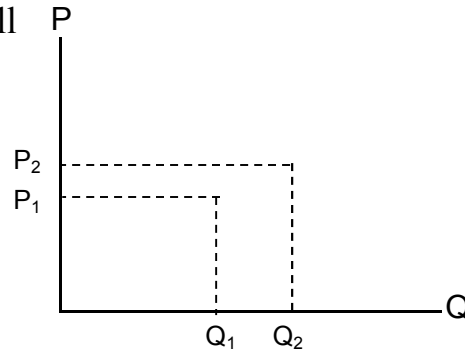
- Equilibrium changes in response to *shifts* in the supply and demand curves
- Raw material prices fall
 - S shifts to S'
 - Surplus at $P_1 = Q_2 - Q_1$
 - Market adjusts to equilibrium at P_3, Q_3



- Income Increases
 - D shifts to D'
 - Shortage at $P_1 = Q_2 - Q_1$
 - Market adjusts to equilibrium at P_3, Q_3



- Income Increases & raw material prices fall
 - Quantity increases
 - If increase in D > increase in S, price also increases



Shifts in Supply and Demand

- When S and D change simultaneously, the impact on the equilibrium price and quantity is determined by:
 - The relative *size* and *direction* of the change
 - The *shape* of the supply and demand models

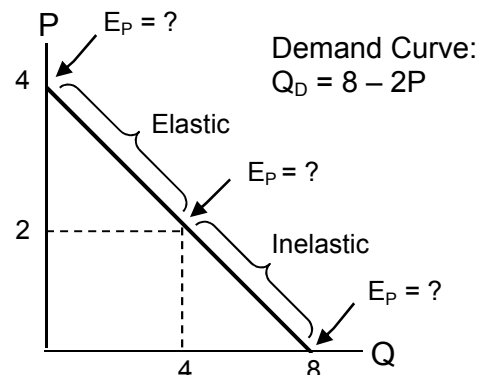
Price Elasticity of Demand (E_p^D)

- Measures the percentage change in the quantity demanded of a good resulting from a one-percent change in price

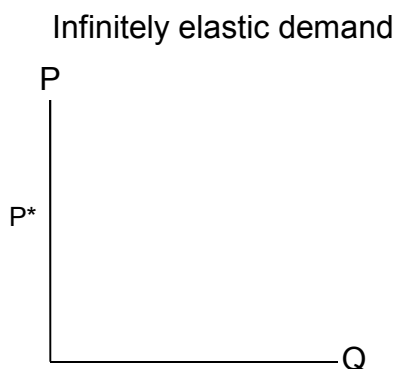
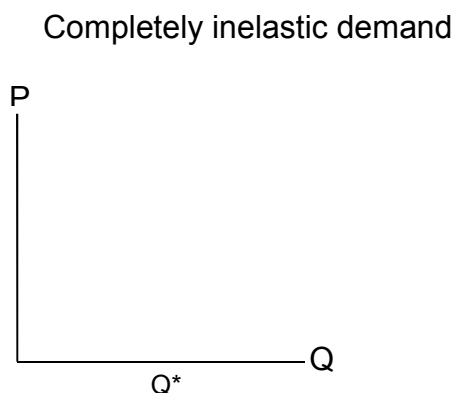
$$E_p^D = \frac{\% \Delta Q_D}{\% \Delta P} = \frac{\Delta Q_D / Q_D}{\Delta P / P} = \frac{P}{Q_D} * \frac{\Delta Q_D}{\Delta P} < 0$$

- $|E_p^D| > 1$, the good is price *elastic*
- $|E_p^D| < 1$, the good is price *inelastic*
- E_p^D of a good depends on the availability of *substitute* goods
- E_p^D must be measured at a particular point on the demand curve because E_p^D changes along the demand curve

- Given a linear demand curve
 - E_P^D depends on the slope and the values of P and Q
 - The top portion of Q_D is elastic (*why?*)
 - The bottom portion of Q_D is inelastic (*why?*)



- For a linear demand curve: $Q_D = a - bP$, where $-b = \Delta Q / \Delta P = 1/\text{slope of the demand curve}$ (*why? And what happens to E_P^D when the slope is steep?*)
- Two extreme cases of demand curves
 - Completely inelastic demand
 - Infinitely elastic demand



Other Demand Elasticities

- Income Elasticity of Demand measures the percentage change in the quantity demanded of a good resulting from a one-percent change in income

$$E_I^D = \frac{\Delta Q_D / Q_D}{\Delta I / I} = \frac{I}{Q_D} * \frac{\Delta Q_D}{\Delta I}$$

- Cross-Price Elasticity of Demand measures the percentage change in quantity demanded of good A resulting from a one-percent change in the price of good B

$$E_{QaPb} = \frac{\Delta Q_a / Q_a}{\Delta P_b / P_b} = \frac{P_b}{Q_a} * \frac{\Delta Q_a}{\Delta P_b}$$

- $E_{QaPb} < 0$ for *complementary* goods, e.g., cars and tires (*why?*)
- $E_{QaPb} > 0$ for *substitute* goods, e.g., butter and margarine (*why?*)

Price Elasticity of Supply (E_p^S)

- Measures the quantity supplied of a good resulting from a one-percent change in price

$$E_p^S = \frac{\% \Delta Q_S}{\% \Delta P} = \frac{\Delta Q_S / Q_S}{\Delta P / P} = \frac{P}{Q_S} * \frac{\Delta Q_S}{\Delta P}$$

- $E_p^S > 1$, the good is price *elastic*, and vice versa

Point vs Arc Elasticities

- Point elasticity of demand – E_p^D at a particular point on the demand curve
- Arc elasticity of demand – E_p^D calculated over a range of prices

$$E_p^D = \frac{\Delta Q_D}{\Delta P} * \frac{\bar{P}}{\bar{Q}}$$

When to use arc elasticity of demand?

Elasticity: An Application

- Using the supply and demand curves for wheat, we can analyze what occurred in this market

– $Q_S = 1800 + 240P$ and $Q_D = 3550 - 266P$

At equilibrium:

$$\begin{aligned} & \underline{\hspace{10em}} \\ & \underline{\hspace{10em}} \\ & \underline{\hspace{10em}} \\ & P = \$3.46 \text{ per bushel} \end{aligned}$$

Substituting P into Q_S ,

$Q = \underline{\hspace{10em}} = 2630 \text{ million bushels}$

- Find the elasticities of demand and supply at these points

$$E_p^D = \frac{P}{Q_D} * \frac{\Delta Q_D}{\Delta P} = \frac{?}{?} * (?) = -0.35$$

$$E_p^S = \frac{P}{Q_S} * \frac{\Delta Q_S}{\Delta P} = \frac{?}{?} * (?) = 0.32$$

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

$Q_D = \underline{\hspace{10em}} = 2486 \text{ million bushels}$

$$E_p^D = \frac{P}{Q_D} * \frac{\Delta Q_D}{\Delta P} = \frac{?}{?} * (?) = -0.43$$

- If the supply and demand for wheat were:
 - $Q_S = 1439 + 267P$ and $Q_D = 2809 - 226P$

At equilibrium, _____

$P = \$2.78$ per bushel

Substituting P into Q_D ,

$Q = \underline{\hspace{2cm}} = 2181$ million bushels

Understanding and Predicting the Effects of Changing Market Conditions

- How to “fit” linear demand and supply to market data
 - Given equilibrium price (P^*) and quantity (Q^*), and the price elasticities of supply (E_S) and demand (E_D), we can calculate the curves that fit the information and then calculate changes in the market

- Let's begin with the equations for supply, demand and elasticity:

- Demand: $Q_D = a - bP$
- Supply: $Q_S = c + dP$
- Elasticity: $(P/Q)(\Delta Q/\Delta P)$

First, find numbers for a , b , c , and d

- The slope of $Q_D = \Delta Q/\Delta P = -b$
- The slope of $Q_S = \Delta Q/\Delta P = d$
- Substituting $-b$ and d into elasticity

$$E_D = -b(P^*/Q^*)$$

$$E_S = d(P^*/Q^*)$$

- Given $P^* = \$0.75$, $Q^* = 7.5$ units, $E_S = 1.6$ and $E_D = -0.8$, solve for d and c from supply, and b and a from demand

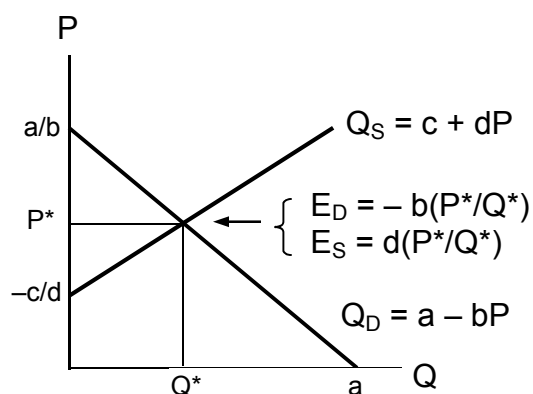
$$E_S = d(P^*/Q^*)$$

$$E_D = -b(P^*/Q^*)$$

$$Q_S = c + dP$$

$$Q_D = a - bP$$

- $Q_S = -4.5 + 16P$ and $Q_D = 13.5 - 8P$
- Setting $Q_S = Q_D$ to find P^*



- Substituting P into Q_S to find Q^*

- Demand could also depend upon other variable such as income
- Demand would then be written as: $Q_D = a - bP + fI$
- Given $I = 1.0$; $P^* = 0.75$; $Q^* = 7.5$; $b = 8$; and Income elasticity: $E_I = 1.3$
- Using the elasticity of income formula, we can solve for f

$$E_I = (I/Q)(\Delta Q/\Delta I)$$

- Substituting f into Q_D to find a ,

- $Q_D = 3.75 - 8P + 9.75I$

An Application: Declining Demand and the Behavior of Copper Prices

- Given $Q_D = 13.5 - 8P$ and $Q_S = -4.5 + 16P$, we can calculate by how much prices will fall with future declines in demand
- Assume that demand will fall by 20%
 - What is the resulting decrease in price?
 - Demand curve will shift to left by 20%
- We want to consider 80% of the past demand

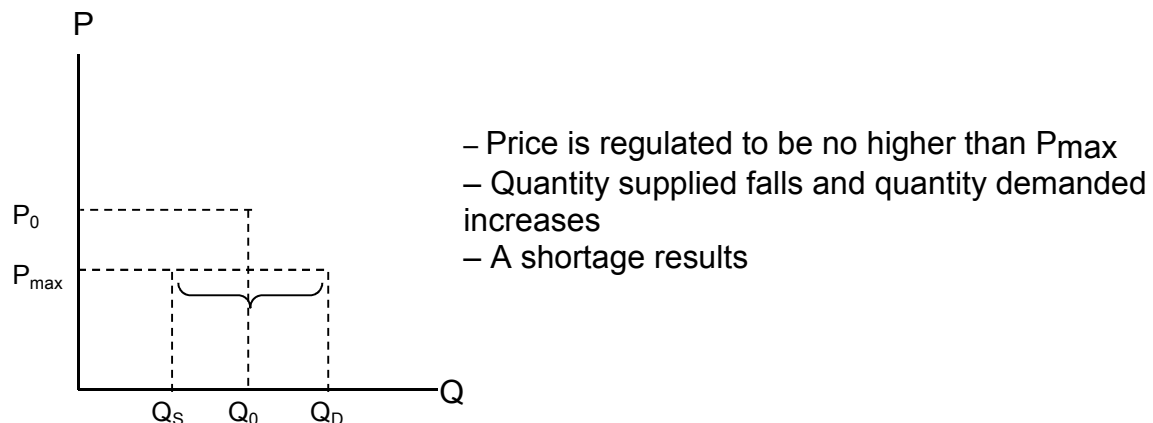
$$Q'_D = \frac{80}{100} (13.5 - 8P)$$

$$Q'_D = 10.8 - 6.4P$$
- Setting $Q_S = Q'_D$,

$$P = \$0.683 \text{ per pound}$$
- A decline in demand of 20% will lead to a drop in price about 9%

Effects of Government Intervention – 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



- Shortage 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 and some consumers lose

Quick Quiz

1. Are the following statements true or false? Explain your answer.
 - a. The elasticity of demand is the same as the slope of the demand curve.
 - b. The cross price elasticity will always be positive.
 - c. The supply of apartments is more inelastic in the short run than the long run.
2. Suppose the demand curve for a product is given by $Q_D = 300 - 2P + 4I$, where I is average income measured in thousands of dollars. The supply curve is $Q_S = 3P - 50$.
 - a. If $I = 25$, find the market-clearing price and quantity for the product.
 - b. If $I = 50$, find the market-clearing price and quantity for the product.
 - c. Draw a graph to illustrate your answers.
3. Using the data given below:
Free market price of natural gas $P_G = \$6.40$ per mcf (thousand cubic feet)
 $Q_{GS} = Q_{GD}$ at $Q^* = 23$ tcf (trillion cubic feet)
Market price of oil, $P_O = \$50$ per barrel
Price elasticity of supply for natural gas $= 0.2$
Cross-price elasticity of supply for natural gas w.r.t. the price of oil $= 0.1$
Price elasticity of demand for natural gas $= -0.5$
Cross-price elasticity of demand for natural gas w.r.t. the price of oil $= 1.5$
 - a. Find the supply and demand curves for natural gas.
 - b. What would happen when the gas price is regulated at \$4.50 per mcf?
 - c. Suppose that the market for natural gas had not been regulated. If the price of oil had increased from \$50 to \$100, what would have happened to the free market price of natural gas?