CHAPTER 9
THE ANALYSIS OF COMPETITIVE MARKETS

REVIEW QUESTIONS

1. What is meant by deadweight loss? Why does a price ceiling usually result in a deadweight loss?

Deadweight loss refers to the benefits lost to either consumers or producers when markets do not operate efficiently. The term deadweight denotes that these are benefits unavailable to any party. A price ceiling will tend to result in a deadweight loss because at any price below the market equilibrium price, quantity supplied will be below the market equilibrium quantity supplied, resulting in a loss of surplus to producers. Consumers will purchase less than the market equilibrium quantity, resulting in a loss of surplus to consumers. Consumers will also purchase less than the quantity they demand at the price set by the ceiling. The surplus lost by consumers and producers is not captured by either group, and surplus not captured by market participants is deadweight loss.

2. Suppose the supply curve for a good is completely inelastic. If the government imposed a price ceiling below the market-clearing level, would a deadweight loss result? Explain.

When the supply curve is completely inelastic, the imposition of an effective price ceiling transfers all loss in producer surplus to consumers. Consumer surplus increases by the difference between the market-clearing price and the price ceiling times the market-clearing quantity. Consumers capture all decreases in total revenue. Therefore, no deadweight loss occurs.

3. How can a price ceiling make consumers better off? Under what conditions might it make them worse off?

If the supply curve is perfectly inelastic a price ceiling will increase consumer surplus. If the demand curve is inelastic, price controls may result in a net loss of consumer surplus because consumers willing to pay a higher price are unable to purchase the price-controlled good or service. The loss of consumer surplus is greater than the transfer of producer surplus to consumers. If demand is elastic (and supply is relatively inelastic) consumers in the aggregate will enjoy an increase in consumer surplus.

4. Suppose the government regulates the price of a good to be no lower than some minimum level. Can such a minimum price make producers as a whole worse off? Explain.

Because a higher price increases revenue and decreases demand, some consumer surplus is transferred to producers but some producer revenue is lost because consumers purchase less. The problem with a price floor or minimum price is that it sends the wrong signal to producers. Thinking that more should be produced as the price goes up, producers incur extra cost to produce more than what consumers are willing to purchase at these higher prices. These extra costs can overwhelm gains captured in increased revenues. Thus, unless all producers decrease production, a minimum price can make producers as a whole worse off.

5. How are production limits used in practice to raise the prices of the following goods or services: (a) taxi rides, (b) drinks in a restaurant or bar, (c) wheat or corn?

Municipal authorities usually regulate the number of taxis through the issuance of licenses. When the number of taxis is less than it would be without regulation, those taxis in the market may charge a higher-than-competitive price.

State authorities usually regulate the number of liquor licenses. By requiring that any bar or restaurant that serves alcohol have a liquor license and then limiting the number of licenses available, the State limits entry by new bars and restaurants. This

limitation allows those establishments that have a license to charge a higher price for alcoholic beverages.

Federal authorities usually regulate the number of acres of wheat or corn in production by creating acreage limitation programs that give farmers financial incentives to leave some of their acreage idle. This reduces supply, driving up the price of wheat or corn.

6. Suppose the government wants to increase farmers' incomes. Why do price supports or acreage limitation programs cost society more than simply giving farmers money?

Price supports and acreage limitations cost society more than the dollar cost of these programs because the higher price that results in either case will reduce quantity demanded and hence consumer surplus, leading to a deadweight loss because the farmer is not able to capture the lost surplus. Giving the farmers money does not result in any deadweight loss, but is merely a redistribution of surplus from one group to the other.

7. Suppose the government wants to limit imports of a certain good. Is it preferable to use an import quota or a tariff? Why?

Changes in domestic consumer and producer surpluses are the same under import quotas and tariffs. There will be a loss in (domestic) total surplus in either case. However, with a tariff, the government can collect revenue equal to the tariff times the quantity of imports and these revenues can be redistributed in the domestic economy to offset the domestic deadweight loss by, for example, reducing taxes. Thus, there is less of a loss to the domestic society as a whole. With the import quota, foreign producers can capture the difference between the domestic and world price times the quantity of imports. Therefore, with an import quota, there is a loss to the domestic society as a whole. If the national government is trying to increase welfare, it should use a tariff.

8. The burden of a tax is shared by producers and consumers. Under what conditions will consumers pay most of the tax? Under what conditions will producers pay most of it? What determines the share of a subsidy that benefits consumers?

The burden of a tax and the benefits of a subsidy depend on the elasticities of demand and supply. If the ratio of the elasticity of demand to the elasticity of supply is small, the burden of the tax falls mainly on consumers. On the other hand, if the ratio of the elasticity of demand to the elasticity of supply is large, the burden of the tax falls mainly on producers. Similarly, the benefit of a subsidy accrues mostly to consumers (producers) if the ratio of the elasticity of demand to the elasticity of supply is small (large).

9. Why does a tax create a deadweight loss? What determines the size of this loss?

A tax creates deadweight loss by artificially increasing price above the free market level, thus reducing the equilibrium quantity. This reduction in demand reduces consumer as well as producer surplus. The size of the deadweight loss depends on the elasticities of supply and demand. As the elasticity of demand increases and the elasticity of supply decreases, i.e., as supply becomes more inelastic, the deadweight loss becomes larger.

EXERCISES

1. In 1996, the U.S. Congress raised the minimum wage from \$4.25 per hour to \$5.15 per hour. Some people suggested that a government subsidy could help employers finance the higher wage. This exercise examines the economics of a minimum wage and wage subsidies. Suppose the supply of low-skilled labor is given by $L^S = 10w$, where L^S is the quantity of low-skilled labor (in millions of persons employed each year) and w is the wage rate (in dollars per hour). The demand for labor is given by $L^D = 80 - 10w$.

a. **What will the free market wage rate and employment level be? Suppose the government sets a minimum wage of $5 per hour. How many people would then be employed?**

In a free-market equilibrium, $L^S = L^D$. Solving yields w = $4 and $L^S = L^D = 40$. If the minimum wage is $5, then $L^S = 50$ and $L^D = 30$. The number of people employed will be given by the labor demand, so employers will hire 30 million workers.
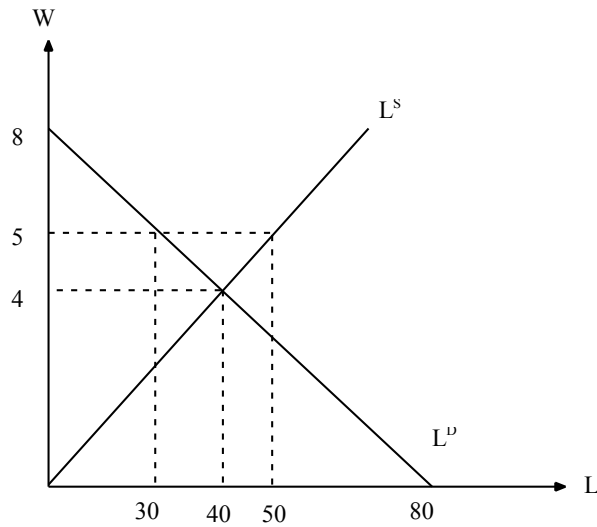

Figure 9.1.a

b. **Suppose that instead of a minimum wage, the government pays a subsidy of $1 per hour for each employee. What will the total level of employment be now? What will the equilibrium wage rate be?**

Let w denote the wage received by the employee. Then the employer receiving the $1 subsidy per worker hour only pays w-1 for each worker hour. As shown in Figure 9.1.b, the labor demand curve shifts to:

$$L^D = 80 - 10\,(w\text{-}1) = 90 - 10w,$$

where w represents the wage received by the employee.

The new equilibrium will be given by the intersection of the old supply curve with the new demand curve, and therefore, $90\text{-}10_w** = 10_w**$, or $w** = \$4.5$ per hour and $L** = 10(4.5) = 45$ million persons employed. The real cost to the employer is $3.5 per hour.

Figure 9.1.b
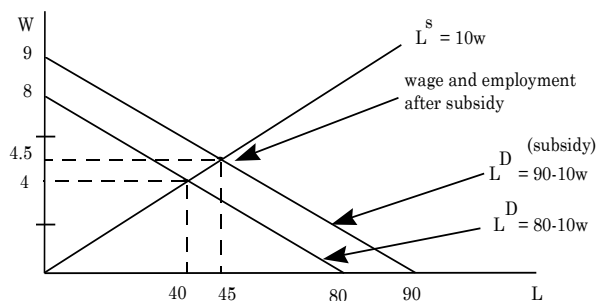
2. Suppose the market for widgets can be described by the following equations:

Demand: P = 10 - Q   **Supply: P = Q - 4**

where P is the price in dollars per unit and Q is the quantity in thousands of units.

a. **What is the equilibrium price and quantity?**

To find the equilibrium price and quantity, equate supply and demand and solve for Q_{EQ}:

$$10 - Q = Q - 4, \text{ or } Q_{EQ} = 7.$$

Substitute Q_{EQ} into either the demand equation or the supply equation to obtain P_{EQ}.

$$P_{EQ} = 10 - 7 = 3,$$

or

$$P_{EQ} = 7 - 4 = 3.$$

b. **Suppose the government imposes a tax of $1 per unit to reduce widget consumption and raise government revenues. What will the new equilibrium quantity be? What price will the buyer pay? What amount per unit will the seller receive?**

With the imposition of a $1.00 tax per unit, the demand curve for widgets shifts inward. At each price, the consumer wishes to buy less. Algebraically, the new demand function is:

$$P = 9 - Q.$$

The new equilibrium quantity is found in the same way as in (2a):

$$9 - Q = Q - 4, \text{ or } Q^* = 6.5.$$

To determine the price the buyer pays, P_B^*, substitute Q^* into the demand equation:

$$P_B^* = 10 - 6.5 = \$3.50.$$

To determine the price the seller receives, P_S^*, substitute Q^* into the supply equation:

$$P_S^* = 6.5 - 4 = \$2.50.$$

c.   **Suppose the government has a change of heart about the importance of widgets to the happiness of the American public. The tax is removed and a subsidy of $1 per unit is granted to widget producers. What will the equilibrium quantity be? What price will the buyer pay? What amount per unit (including the subsidy) will the seller receive? What will be the total cost to the government?**

The original supply curve for widgets was $P = Q - 4$. With a subsidy of $1.00 to widget producers, the supply curve for widgets shifts outward. Remember that the supply curve for a firm is its marginal cost curve. With a subsidy, the marginal cost curve shifts down by the amount of the subsidy. The new supply function is:

$$P = Q - 5.$$

To obtain the new equilibrium quantity, set the new supply curve equal to the demand curve:

$$Q - 5 = 10 - Q, \text{ or } Q = 7.5.$$

The buyer pays $P = \$2.50$, and the seller receives that price plus the subsidy, i.e., $3.50. With quantity of 7,500 and a subsidy of $1.00, the total cost of the subsidy to the government will be $7,500.

3. Japanese rice producers have extremely high production costs, in part due to the high opportunity cost of land and to their inability to take advantage of economies of large-scale production. Analyze two policies intended to maintain Japanese rice production: (1) a per-pound subsidy to farmers for each pound of rice produced, or (2) a per-pound tariff on imported rice. Illustrate with supply-and-demand diagrams the equilibrium price and quantity, domestic rice production, government revenue or deficit, and deadweight loss from each policy. Which policy is the Japanese government likely to prefer? Which policy are Japanese farmers likely to prefer?

Figure 9.3.a shows the gains and losses from a per-pound subsidy with domestic supply, S, and domestic demand, D. P_S is the subsidized price, P_B is the price paid by the buyers, and P_{EQ} is the equilibrium price without the subsidy, assuming no imports. With the subsidy, buyers demand Q_1. Farmers gain amounts equivalent to areas A and B. This is the increase in producer surplus. Consumers gain areas C and F. This is the increase in consumer surplus. Deadweight loss is equal to the area E. The government pays a subsidy equal to areas $A + B + C + F + E$.

Figure 9.3.b shows the gains and losses from a per-pound tariff. P_W is the world price, and P_{EQ} is the equilibrium price. With the tariff, assumed to be equal to $P_{EQ} - P_W$, buyers demand Q_T, farmers supply Q_D, and $Q_T - Q_D$ is imported. Farmers gain a surplus equivalent to area A. Consumers lose areas A, B, C; this is the decrease in consumer surplus. Deadweight loss is equal to the areas B and C.
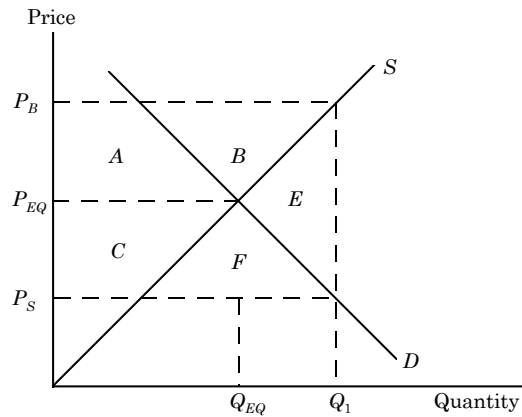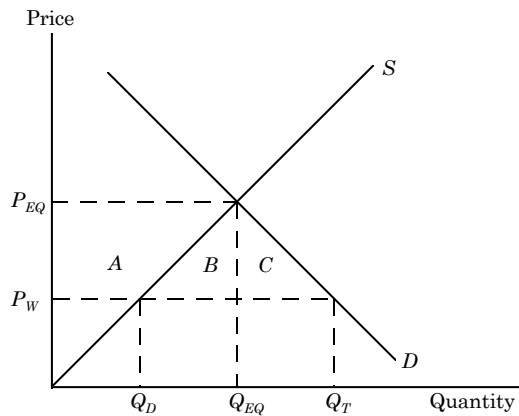
Price

Figure 9.3.a

Price

Figure 9.3.b

Without more information regarding the size of the subsidy and the tariff, and the specific equations for supply and demand, it seems sensible to assume that the Japanese government would avoid paying subsidies by choosing a tariff, but the rice farmers would prefer the subsidy.

4. In 1983, the Reagan Administration introduced a new agricultural program called the Payment-in-Kind Program. To see how the program worked, let's consider the wheat market.

a.   **Suppose the demand function is $Q^D = 28 - 2P$ and the supply function is $Q^S = 4 + 4P$, where P is the price of wheat in dollars per bushel and Q is the quantity in billions of bushels. Find the free-market equilibrium price and quantity.**

Equating demand and supply, $Q^D = Q^S$,

$$28 - 2P = 4 + 4P, \text{ or } P = 4.$$

To determine the equilibrium quantity, substitute $P = 4$ into either the supply equation or the demand equation:

$$Q^S = 4 + 4(4) = 20$$

and

$$Q^D = 28 - 2(4) = 20.$$

b. **Now suppose the government wants to lower the supply of wheat by 25 percent from the free-market equilibrium by paying farmers to withdraw land from production. However, the payment is made in wheat rather than in dollars--hence the name of the program. The wheat comes from the government's vast reserves that resulted from previous price-support programs. The amount of wheat paid is equal to the amount that could have been harvested on the land withdrawn from production. Farmers are free to sell this wheat on the market. How much is now produced by farmers? How much is indirectly supplied to the market by the government? What is the new market price? How much do the farmers gain? Do consumers gain or lose?**

Because the free market supply by farmers is 20 billion bushels, the 25 percent reduction required by the new Payment-In-Kind (PIK) Program would imply that the farmers now produce 15 billion bushels. To encourage farmers to withdraw their land from cultivation, the government must give them 5 billion bushels, which they sell on the market.

Because the total supply to the market is still 20 billion bushels, the market price does not change; it remains at $4 per bushel. The farmers gain $20 billion, equal to ($4)(5 billion bushels), from the PIK Program, because they incur no costs in supplying the wheat (which they received from the government) to the market. The PIK program does not affect consumers in the wheat market, because they purchase the same amount at the same price as they did in the free market case.

c. **Had the government not given the wheat back to the farmers, it would have stored or destroyed it. Do taxpayers gain from the program? What potential problems does the program create?**

Taxpayers gain because the government is not required to store the wheat. Although everyone seems to gain from the PIK program, it can only last while there are government wheat reserves. The PIK program assumes that the land removed from production may be restored to production when stockpiles are exhausted. If this cannot be done, consumers may eventually pay more for wheat-based products.

5. About 100 million pounds of jelly beans are consumed in the United States each year, and the price has been about 50 cents per pound. However, jelly bean producers feel that their incomes are too low, and they have convinced the government that price supports are in order. The government will therefore buy up as many jelly beans as necessary to keep the price at $1 per pound. However, government economists are worried about the impact of this program, because they have no estimates of the elasticities of jelly bean demand or supply.

a. **Could this program cost the government *more* than $50 million per year? Under what conditions? Could it cost *less* than $50 million per year? Under what conditions? Illustrate with a diagram.**

If the quantities demanded and supplied are very responsive to price changes, then a government program that doubles the price of jelly beans could easily cost more than $50 million. In this case, the change in price will cause a large change in quantity supplied, and a large change in quantity demanded. In Figure 9.5.a.i, the cost of the program is $(Q_S - Q_D) * \$1$. Given $Q_S - Q_D$ is larger than 50 million, then the government will pay more than 50 million dollars. If instead supply and demand were relatively price inelastic, then the change in price would result in very small changes in quantity

supplied and quantity demanded and (Q_S-Q_D) would be less than $50 million, as illustrated in figure 9.5.a.ii.

b.   **Could this program cost consumers (in terms of lost consumer surplus)** *more* **than $50 million per year?   Under what conditions?   Could it cost consumers** *less* **than $50 million per year?   Under what conditions?   Again, use a diagram to illustrate.**

When the demand curve is perfectly inelastic, the loss in consumer surplus is $50 million, equal to ($0.5)(100 million pounds). This represents the highest possible loss in consumer surplus.   If the demand curve has any elasticity at all, the loss in consumer surplus would be less then $50 million. In Figure 9.5.b, the loss in consumer surplus is area A plus area B if the demand curve is D and only area A if the demand curve is D'.
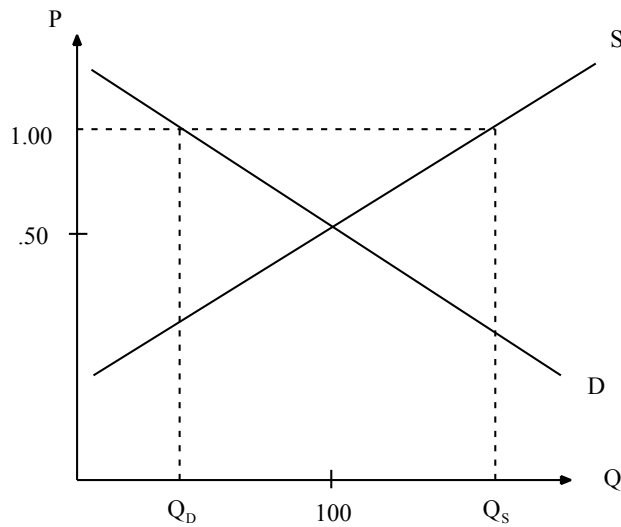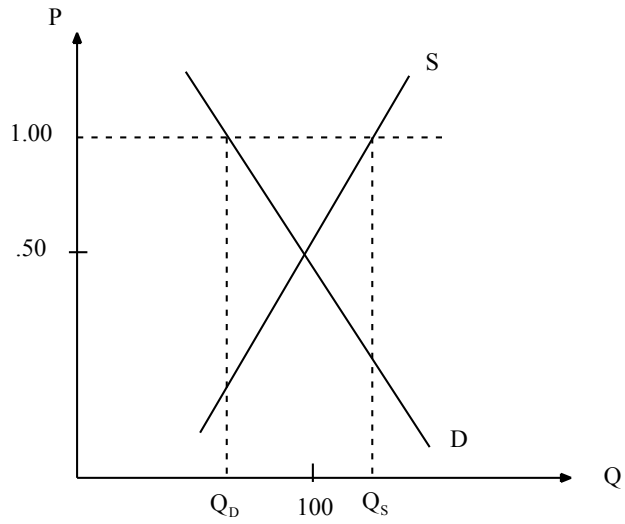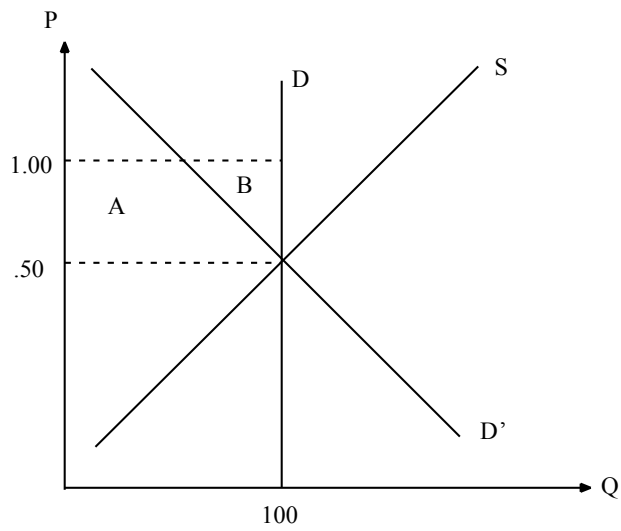

Figure 9.5.a.i

Figure 9.5.a.ii

Figure 9.5.b

6. In Exercise 4 of Chapter 2, we examined a vegetable fiber traded in a competitive world market and imported into the United States at a world price of $9 per pound. U.S. domestic supply and demand for various price levels are shown in the following table.

Price	U.S. Supply (million pounds)	U.S. Demand (million pounds)
3	2	34
6	4	28
9	6	22
12	8	16
15	10	10
18	12	4

Answer the following about the U.S. market:

a. **Confirm that the demand curve is given by $Q_D = 40 - 2P$, and that the supply curve is given by $Q_S = \dfrac{2}{3}P$.**

To find the equation for demand, we need to find a linear function $Q_D = a + bP$ such that the line it represents passes through two of the points in the table such as (15,10) and (12,16). First, the slope, b, is equal to the "rise" divided by the "run,"

$$\frac{\Delta Q}{\Delta P} = \frac{10 - 16}{15 - 12} = -2 = b.$$

Second, we substitute for b and one point, e.g., (15, 10), into our linear function to solve for the constant, a:

$$10 = a - 2(15), \text{ or } a = 40.$$

Therefore, $Q_D = 40 - 2P$.

Similarly, we may solve for the supply equation $Q_S = c + dP$ passing through two points such as (6,4) and (3,2). The slope, d, is

$$\frac{\Delta Q}{\Delta P} = \frac{4 - 2}{6 - 3} = \frac{2}{3}..$$

Solving for c:

$$4 = c + \left(\frac{2}{3}\right)(6), \text{ or } c = 0.$$

Therefore, $Q_S = \left(\frac{2}{3}\right)P$.

b. **Confirm that if there were no restrictions on trade, the U.S. would import 16 million pounds.**

If there are no trade restrictions, the world price of $9.00 will prevail in the U.S. From the table, we see that at $9.00 domestic supply will be 6 million pounds. Similarly, domestic demand will be 22 million pounds. Imports will provide the difference between domestic demand and domestic supply: 22 - 6 = 16 million pounds.

c.   **If the United States imposes a tariff of $3 per pound, what will be the U.S. price and level of imports? How much revenue will the government earn from the tariff? How large is the deadweight loss?**

With a $3.00 tariff, the U.S. price will be $12 (the world price plus the tariff). At this price, demand is 16 million pounds and supply is 8 million pounds, so imports are 8 million pounds (16-8). The government will collect $3*8=$24 million. The deadweight loss is equal to

$$0.5(12\text{-}9)(8\text{-}6)+0.5(12\text{-}9)(22\text{-}16)=\$12 \text{ million.}$$

d.   **If the United States has no tariff but imposes an import quota of 8 million pounds, what will be the U.S. domestic price? What is the cost of this quota for U.S. consumers of the fiber? What is the gain for U.S. producers?**

With an import quota of 8 million pounds, the domestic price will be $12. At $12, the difference between domestic demand and domestic supply is 8 million pounds, i.e., 16 million pounds minus 8 million pounds. Note you can also find the equilibrium price by setting demand equal to supply plus the quota so that

$$40 - 2P = \frac{2}{3}P + 8.$$

The cost of the quota to consumers is equal to area A+B+C+D in Figure 9.6.d, which is

$$(12 \text{ - } 9)(16) + (0.5)(12 \text{ - } 9)(22 \text{ - } 16) = \$57 \text{ million.}$$

The gain to domestic producers is equal to area A in Figure 9.6.d, which is

$$(12 \text{ - } 9)(6) + (0.5)(8 \text{ - } 6)(12 \text{ - } 9) = \$21 \text{ million.}$$

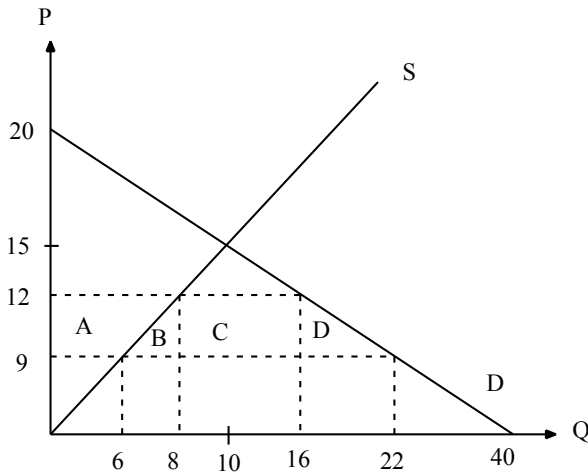
Figure 9.6.d

7.7. **The United States currently imports all of its coffee. The annual demand for coffee by U.S. consumers is given by the demand curve Q = 250 – 10P, where Q is quantity (in millions of pounds) and P is the market price per pound of coffee.   World producers can harvest and ship coffee to US distributors at a constant marginal (= average) cost of $8 per pound. U.S. distributors can in turn distribute coffee for a constant $2 per pound. The U.S. coffee market is competitive. Congress is considering imposing a tariff on coffee imports of $2 per pound.**

a. **If there is no tariff, how much do consumers pay for a pound of coffee? What is the quantity demanded?**

If there is no tariff then consumers will pay $10 per pound of coffee, which is found by adding the $8 that it costs to import the coffee plus the $2 that is costs to distribute the coffee in the U.S., per pound. In a competitive market, price is equal to marginal cost. If the price is $10, then demand is 150 million pounds.

b.b. **If the tariff is imposed, how much will consumers pay for a pound of coffee? What is the quantity demanded?**

Now we must add $2 per pound to marginal cost, so price will be $12 per pound and demand is Q=250-10(12)=130 million pounds.

c.b. **Calculate the lost consumer surplus.**

The lost consumer surplus is (12-10)(130)+0.5(12-10)(150-130)=$280 million.

d.d. **Calculate the tax revenue collected by the government.**

The tax revenue is equal to the tax of $2 per pound times the number of pounds imported, which is 130 million pounds. Tax revenue is therefore $260 million.

e.e. **Does the tariff result in a net gain or a net loss to society as a whole?**

There is a net loss to society because the gain ($260 million) is less than the loss ($280 million).

8. **A particular metal is traded in a highly competitive world market at a world price of $9 per ounce. Unlimited quantities are available for import into the United States at this price. The supply of this metal from domestic U.S. mines and mills can be represented by the equation Q^S = 2/3P, where Q^S is U.S. output in million ounces and P is the domestic price. The demand for the metal in the United States is Q^D = 40 - 2P, where Q^D is the domestic demand in million ounces.**

In recent years, the U.S. industry has been protected by a tariff of $9 per ounce. Under pressure from other foreign governments, the United States plans to reduce this tariff to zero. Threatened by this change, the U.S. industry is seeking a Voluntary Restraint Agreement that would limit imports into the United States to 8 million ounces per year.

a. **Under the $9 tariff, what was the U.S. domestic price of the metal?**

With a $9 tariff, the price of the imported metal on U.S. markets would be $18, the tariff plus the world price of $9. To determine the domestic equilibrium price, equate domestic supply and domestic demand:

$$\frac{2}{3}P = 40 \text{ - } 2P, \text{ or } P = \$15.$$

The equilibrium quantity is found by substituting a price of $15 into either the demand or supply equations:

$$Q^D = 40 - (2)(15) = 10$$

and

$$Q^S = \left(\frac{2}{3}\right)(15) = 10.$$

The equilibrium quantity is 10 million ounces. Because the domestic price of $15 is less than the world price plus the tariff, $18, there will be no imports.

b.   If the United States eliminates the tariff and the Voluntary Restraint Agreement is approved, what will be the U.S. domestic price of the metal?

With the Voluntary Restraint Agreement, the difference between domestic supply and domestic demand would be limited to 8 million ounces, i.e. Q^D - Q^S = 8. To determine the domestic price of the metal, set Q^D - Q^S = 8 and solve for P:

$$(40 - 2P) - \frac{2}{3}P = 8, \text{ or } P = \$12.$$

At a price of $12, Q^D = 16 and Q^S = 8; the difference of 8 million ounces will be supplied by imports.

9. Among the tax proposals regularly considered by Congress is an additional tax on distilled liquors. The tax would not apply to beer. The price elasticity of supply of liquor is 4.0, and the price elasticity of demand is -0.2. The cross-elasticity of demand for beer with respect to the price of liquor is 0.1.

a.   If the new tax is imposed, who will bear the greater burden, liquor suppliers or liquor consumers? Why?

Section 9.6 in the text provides a formula for the "pass-through" fraction, i.e., the fraction of the tax borne by the consumer. This fraction is $\dfrac{E_S}{E_S - E_D}$, where E_S is the own-price elasticity of supply and E_D is the own-price elasticity of demand. Substituting for E_S and E_D, the pass-through fraction is

$$\frac{4}{4 - (-0.2)} = \frac{4}{4.2} \approx 0.95.$$

Therefore, 95 percent of the tax is passed through to the consumers because supply is relatively elastic and demand is relatively inelastic.

b.   Assuming that beer supply is infinitely elastic, how will the new tax affect the beer market?

With an increase in the price of liquor (from the large pass-through of the liquor tax), some consumers will substitute away from liquor to beer, shifting the demand curve for beer outward. With an infinitely elastic supply for beer (a perfectly flat supply curve), there will be no change in the equilibrium price of beer.

10. In Example 9.1, we calculated the gains and losses from price controls on natural gas and found that there was a deadweight loss of $1.4 billion. This calculation was based on a price of oil of $8 per barrel. If the price of oil were $12 per barrel, what would the free market price of gas be? How large a deadweight loss would result if the maximum allowable price of natural gas were $1.00 per thousand cubic feet?

From Example 9.1, we know that the supply and demand curves for natural gas in the 1970s can be approximated as follows:

$$Q_S = 14 + 2P_G + 0.25P_O$$

and

$$Q_D = -5P_G + 3.75P_O,$$

where P_G is the price of gas and P_O is the price of oil.

With the price of oil at $12 per barrel, these curves become,

$$Q_S = 17 + 2P_G$$

and

$$Q_D = 45 - 5P_G.$$

Setting quantity demanded equal to quantity supplied,

$$17 + 2P_G = 45 - 5P_G, \text{ or } P_G = \$4.$$

At this price, the equilibrium quantity is 25 thousand cubic feet (Tcf).

If a ceiling of $1 is imposed, producers would supply 19 Tcf and consumers would demand 40 Tcf. The deadweight loss is the area below the demand curve and above the supply curve, between the quantities of 19 and 25 Tcf. This can be computed as

$$0.5(5.2-4)(25-19)+0.5(4-1)(25-19)=\$12.6 \text{ billion.}$$

11. Example 9.5 describes the effects of the sugar quota. In 2001, imports were limited to 3 billion pounds, which pushed the domestic price to 21.5 cents per pound. Suppose imports were expanded to 6.5 billion pounds.

a. What would be the new U.S. domestic price?

We are given the equations for the total market demand for sugar in the U.S. and the supply of U.S. producers:

$$Q_D = 26.53 - .285P$$

$$Q_S = -8.70 + 1.214P.$$

The difference between the quantity demanded and supplied, Q_D-Q_S, is the amount of sugar imported that is restricted by the quota. If the quota is increased from 3 billion pounds to 6.5 billion pounds, then we will have $Q_D - Q_S = 6.5$ and we can solve for P:

$$(26.53-.285P)-(-8.70+1.214P)=6.5$$

$$35.23-1.499P=6.5$$

$$P=19.2 \text{ cents per pound.}$$

At a price of 19.2 cents per pound $Q_S = -8.70 + (1.214)(19.2) = 14.6$ billion pounds and $Q_D = Q_S + 6.5 = 21.1$ billion pounds.

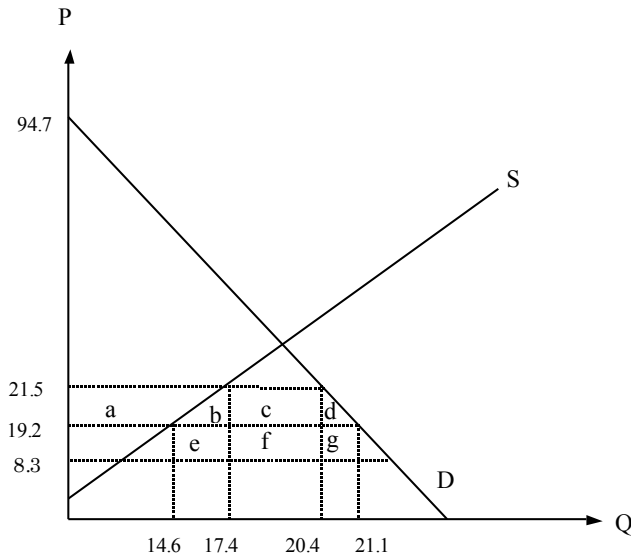**b.   How much would consumers gain and domestic producers lose?**

Figure 9.11.b

The gain in consumer surplus is area a+b+c+d in Figure 9.11.b. The loss to domestic producers is equal to area a.

Numerically:

a = (21.5-19.2)(14.6)+(17.4-14.6)(21.5-19.2)(.5)=36.8

b = (17.4-14.6)(21.5-19.2)(.5)=3.22

c = (21.5-19.2)(20.4-17.4)=6.9

d = (21.5-19.2)(21.1-20.5)(.5)=0.69.

These numbers are in billions of cents or tens of millions of dollars.

Thus, consumer surplus increases by $476.1 million, while domestic producer surplus decreases by $368 million.

c.   What would be the effect on deadweight loss and foreign producers?

When the quota was 3 billion pounds, the profit earned by foreign producers is the difference between the domestic price and the world price (21.5-8.3) times the 3 billion units sold, for a total of 39.6, or $396 million. When the quota is increased to 6.5 billion pounds, domestic price will fall to 19.2 cents per pound and profit earned by foreigners will be (19.2-8.3)*6.5=70.85, or $708.5 million. Profit earned by foreigners therefore increased by $312.5 million. On the graph above, this is area (e+f+g)-(c+f)=e+g-c. The deadweight loss of the quota decreases by area b+e+d+g, which is equal to $420.6 million.

12. The domestic supply and demand curves for hula beans are as follows:

 Supply: P = 50 + Q   Demand: P = 200 - 2Q

where P is the price in cents per pound and Q is the quantity in millions of pounds. The U.S. is a small producer in the world hula bean market, where the current price (which will not be affected by anything we do) is 60 cents per pound. Congress is considering a tariff of 40 cents per pound. Find the domestic price of hula beans that will result if the tariff is imposed. Also compute the dollar gain or loss to domestic consumers, domestic producers, and government revenue from the tariff.

To analyze the influence of a tariff on the domestic hula bean market, start by solving for domestic equilibrium price and quantity. First, equate supply and demand to determine equilibrium quantity:

$$50 + Q = 200 - 2Q, \text{ or } Q_{EQ} = 50.$$

Thus, the equilibrium quantity is 50 million pounds. Substituting Q_{EQ} equals 50 into either the supply or demand equation to determine price, we find:

$$P_S = 50 + 50 = 100 \text{ and } P_D = 200 - (2)(50) = 100.$$

The equilibrium price P is \$1 (100 cents). However, the world market price is 60 cents. At this price, the domestic quantity supplied is $60 = 50 - Q_S$, or $Q_S = 10$, and similarly, domestic demand at the world price is $60 = 200 - 2Q_D$, or $Q_D = 70$. Imports are equal to the difference between domestic demand and supply, or 60 million pounds. If Congress imposes a tariff of 40 cents, the effective price of imports increases to \$1. At \$1, domestic producers satisfy domestic demand and imports fall to zero.

As shown in Figure 9.12, consumer surplus before the imposition of the tariff is equal to area a+b+c, or (0.5)(200 - 60)(70) = 4,900 million cents or \$49 million. After the tariff, the price rises to \$1.00 and consumer surplus falls to area a, or

(0.5)(200 - 100)(50) = \$25 million, a loss of \$24 million. Producer surplus will increase by area b, or (100-60)(10)+(.5)(100-60)(50-10)=\$12 million.

Finally, because domestic production is equal to domestic demand at \$1, no hula beans are imported and the government receives no revenue. The difference between the loss of consumer surplus and the increase in producer surplus is deadweight loss, which in this case is equal to \$12 million. See Figure 9.12.
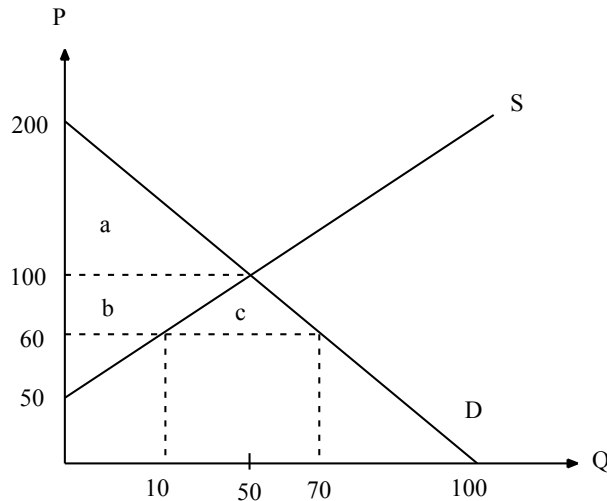
Figure 9.12

13.   Currently, the social security payroll tax in the United States is evenly divided between employers and employees. Employers must pay the government a tax of 6.2 percent of the wages they pay, and employees must pay 6.2 percent of the wages they receive. Suppose the tax was changed so that employers paid the full 12.4 percent and employees paid nothing. Would employees then be better off?

If the labor market is competitive, that is, both employers and employees take the wage as given, then shifting an equal tax amount from the employee to the employer will have no effect on the amount of labor employed and on the wage kept by the employee after taxes. The equilibrium amount of labor employed is determined by the total amount of tax paid by both employees and employers. This is represented by the difference between the wage paid by the employer and the wage received by the employee. As long as the total tax doesn't change, the same amount of labor is employed and the wages paid by the employer and received by the employee (after tax) will not change. Hence, employees would be no better or worse off if the employers paid the full amount of the social security tax.

14. You know that if a tax is imposed on a particular product, the burden of the tax is shared by producers and consumers. You also know that the demand for automobiles is characterized by a stock adjustment process. Suppose a special 20 percent sales tax is suddenly imposed on automobiles. Will the share of the tax paid by consumers rise, fall, or stay the same over time? Explain briefly. Repeat for a 50-cents-per-gallon gasoline tax.

For products with demand characterized by a stock adjustment process, the short-run demand curve is more elastic than the long-run demand curve because consumers can delay their purchases of these goods in the short run. For example, when price rises, consumers may continue using the older version of the product, which they currently own. However, in the long run, a new product will be purchased. Thus, the long-run demand curve is more inelastic than the short-run one.

Consider the effect of imposing a 20 percent sales tax on automobiles in the short and long run. To analyze the influence of the tax, we can shift the demand curves because consumers are forced to pay a higher price. Notice that this tax is an ad valorem tax. The demand curve does not shift parallel to the old one, but pivots to reflect the higher tax paid per unit at higher prices.

The burden of the tax shifts from producers to consumers as we move from the short run (Figure 9.15.a) to the long run (Figure 9.15.b).   In these figures, P_O is the

consumer's price, P_S is the producer's price, and P_O - P_S is the value of the tax. Intuitively, we may assume consumers have a more inelastic demand curve in the long run. They are less able to adjust their demand to price changes and must carry a larger burden of the tax. In both figures, the supply curve is the same in the long and short run. If the supply curve is more elastic in the long run, then even more of the tax burden is shifted to consumers.

Unlike the automobile market, the gasoline demand curve is not characterized by a stock adjustment effect. The long-run demand curve will be more elastic than the short-run one, because in the long run substitutes (e.g., gasohol or propane) will become available for gasoline. We may analyze the effect of the tax on gasoline in the same manner as the tax on automobiles. However, the gasoline tax is a per unit or specific tax, so the demand curves exhibit a parallel shift.

In Figures 9.15.c and 9.15.d, the tax burden shifts from consumers to producers as we move from the short to the long run. Now the elasticity of demand increases from the short run to the long run (the usual case), resulting in less gasoline consumption. Also, if the supply curve is more elastic in the long run, some of the burden would again be shifted back to consumers. Note that we have drawn demand curve shifts in both cases, assuming the consumers pay the tax. The same results may be obtained by shifting the supply curve, assuming the firms pay the tax.
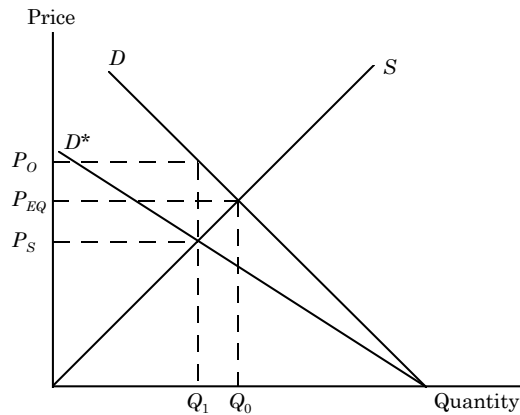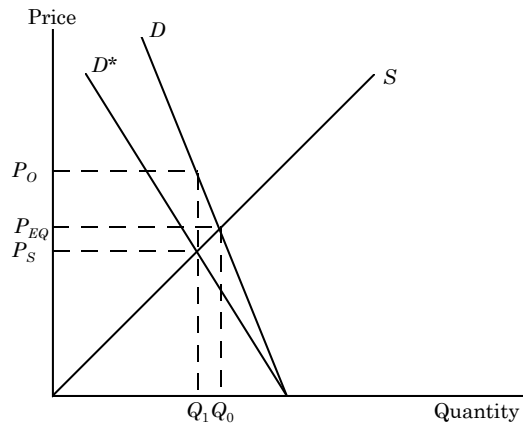

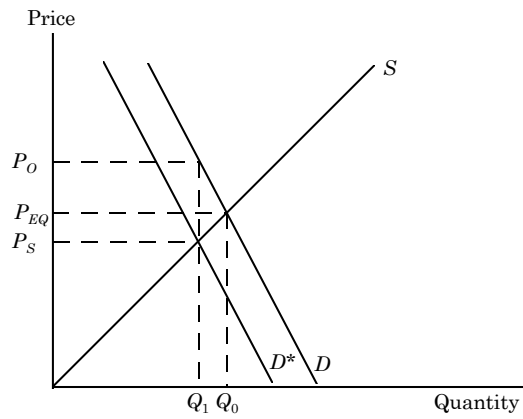Figure 9.14.a: Short Run
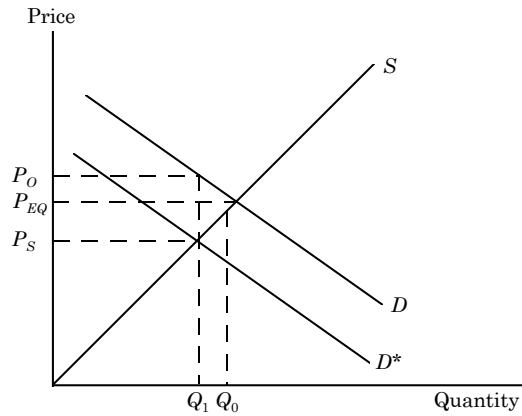
Figure 9.14.b: Long Run

Figure 9.14.c: Short Run

Figure 9.14.d: Long Run

15. In 1998, Americans smoked 23.5 billion packs of cigarettes. They paid an average retail price of $2 per pack.

a.   Given that the elasticity of supply is 0.5 and the elasticity of demand is -0.4, derive linear demand and supply curves for cigarettes.

Let the demand curve be of the general form Q=a+bP and the supply curve be of the general form Q=c+dP, where a, b, c, and d are the constants that you have to find from the information given above. To begin, recall the formula for the price elasticity of demand

$$E_P^D = \frac{P}{Q}\frac{\Delta Q}{\Delta P}.$$

You are given information about the value of the elasticity, P, and Q, which means that you can solve for the slope, which is b in the above formula for the demand curve.

$$-0.4 = \frac{2}{23.5}\frac{\Delta Q}{\Delta P}$$

$$\frac{\Delta Q}{\Delta P} = -0.4\left(\frac{23.5}{2}\right) = -4.7 = b.$$

To find the constant a, substitute for Q, P, and b into the above formula so that 23.5=a-4.7*2 and a=32.9. The equation for demand is therefore Q=32.9-4.7P. To find the supply curve, recall the formula for the elasticity of supply and follow the same method as above:

$$E_P^S = \frac{P}{Q}\frac{\Delta Q}{\Delta P}$$

$$0.5 = \frac{2}{23.5}\frac{\Delta Q}{\Delta P}$$

$$\frac{\Delta Q}{\Delta P} = 0.5\left(\frac{23.5}{2}\right) = 5.875 = d.$$

To find the constant c, substitute for Q, P, and d into the above formula so that 23.5=c+5.875*2 and c=11.75. The equation for supply is therefore Q=11.75+5.875P.

b.   In November 1998, after settling a lawsuit filed by 46 states, the three major tobacco companies raised the retail price of a pack of cigarettes by 45 cents. What is the new equilibrium price and quantity? How many fewer packs of cigarettes are sold?

The new price of cigarettes would be $2.45. Plugging $2.45 into the demand curve results in a quantity demanded of 21.39 billion packs, which represents a decrease of 2.11 billion packs of cigarettes. Note that you could also use the formula for elasticity to come up with the answer:

$$\varepsilon_p^D = \frac{\%\Delta Q}{\%\Delta P} = \frac{\%\Delta Q}{22.5\%} \Rightarrow \%\Delta Q = 9\%.$$

The new quantity demanded is then 23.5*.91=21.39 billion packs.

c.   Cigarettes are subject to a Federal tax, which was about 25 cents per pack in 1998. This tax will increase by 15 cents in 2002. What will this increase do to the market-clearing price and quantity?

The tax of 15 cents will shift the supply curve up by 15 cents. To find the new supply curve, first rewrite the equation for the supply curve as a function of Q instead of P:

$$Q_S = 11.75 + 5.875P \Rightarrow P = \frac{Q_S}{5.875} - \frac{11.75}{5.875}.$$

The new supply curve is now

$$P = \frac{Q_S}{5.875} - \frac{11.75}{5.875} + .15 = 0.17Q_S - 1.85.$$

To equate the new supply with the equation for demand, first rewrite demand as a function of Q instead of P:

$$Q_D = 32.9 - 4.7P \Rightarrow P = 7 - .21Q_D.$$

Now equate supply and demand and solve for the equilibrium quantity:
$$0.17Q - 1.85 = 7 - .21Q \Rightarrow Q = 23.29.$$
Plugging the equilibrium quantity into the equation for demand gives a market price of $2.11.

Note that we assume that part c is independent of part b. If we incorporate information from part b, the supply curve in part c is 60 cents (45+15) higher vertically than the supply curve from part a.

d.   How much of the Federal tax will consumers pay? What part will producers pay?

Since the price went up by 11 cents, consumers pay 11 of the 15 cents or 73% of the tax, and producers will pay the remaining 27% or 4 cents.

16.

서식 있음: 글머리 기호 및 번호 매기기