

4. The rent control agency of New York City has found that aggregate demand is $Q_D = 100 - 5P$. Quantity is measured in tens of thousands of apartments. Price, the average monthly rental rate, is measured in hundreds of dollars. The agency also noted that the increase in Q at lower P results from more three-person families coming into the city from Long Island and demanding apartments. The city's board of realtors acknowledges that this is a good demand estimate and has shown that supply is $Q_S = 50 + 5P$.

- a. If both the agency and the board are right about demand and supply, what is the free market price? What is the change in city population if the agency sets a maximum average monthly rental of \$100, and all those who cannot find an apartment leave the city?**

To find the free market price for apartments, set supply equal to demand:

$$100 - 5P = 50 + 5P, \text{ or } P = \$500,$$

since price is measured in hundreds of dollars. Substituting the equilibrium price into either the demand or supply equation to determine the equilibrium quantity:

$$Q_D = 100 - (5)(5) = 75$$

and

$$Q_S = 50 + (5)(5) = 75.$$

We find that at the rental rate of \$500, 750,000 apartments are rented.

If the rent control agency sets the rental rate at \$100, the quantity supplied would then be 550,000 ($Q_S = 50 + (5)(1) = 55$), a decrease of 200,000 apartments from the free market equilibrium. (Assuming three people per family per apartment, this would imply a loss of 600,000 people.) At the \$100 rental rate, the demand for apartments is 950,000 units, and the resulting shortage is 400,000 units (950,000-550,000). The city population will only fall by 600,000 which is represented by the drop in the number of apartments from 750,000 to 550,000, or 200,000 apartments with 3 people each. These are the only people that were originally in the City to begin with.

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

$$\text{Demand: } P = 10 - Q$$

$$\text{Supply: } P = Q - 4$$

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.

- 6. A vegetable fiber is traded in a highly competitive world market, and the world price is \$9 per pound. Unlimited quantities are available for import into the United States at this price. The U.S. domestic supply and demand for various price levels are shown below.**

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 questions 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 $Q_S=2/3P$.**

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 \$9 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 \$9.00 tariff, the U.S. price will be \$15 (the domestic equilibrium price), and there will be no imports. Because there are no imports, there is no revenue. The deadweight loss is equal to

$$(0.5)(16 \text{ million pounds})(\$6.00) = \$48 \text{ million,}$$

where 16 is the difference at a price of \$9 between 22 demanded and 6 supplied, and \$6 is the difference between \$15 and \$9.

- 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.f, which is

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

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

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

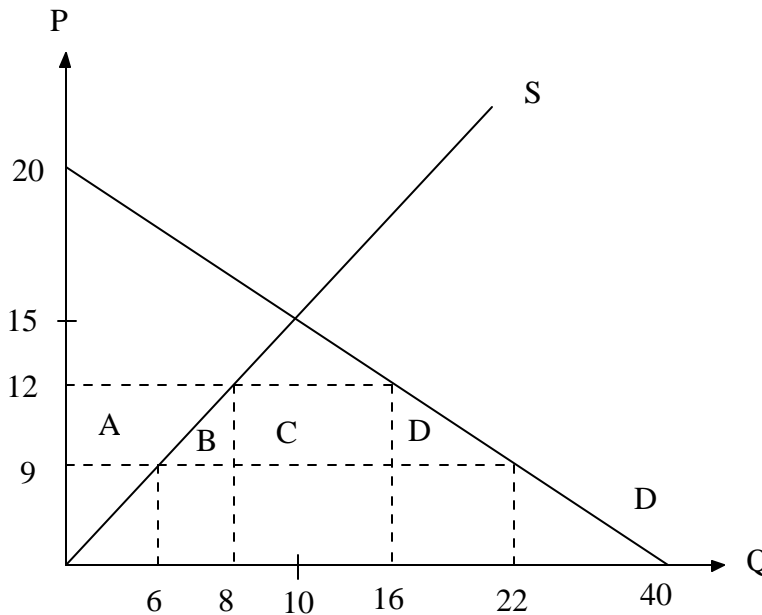


Figure 9.6.d

- 9. 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 was \$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 was \$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. Consumers gain area $A - B = 57 - 3.6 = \$53.4$ billion in the figure below. Producers lose the area $-A - C = -57 - 9 = \$66.0$ billion. Deadweight loss is equal to the area $C + B$, which is equal to \$12.6 billion.

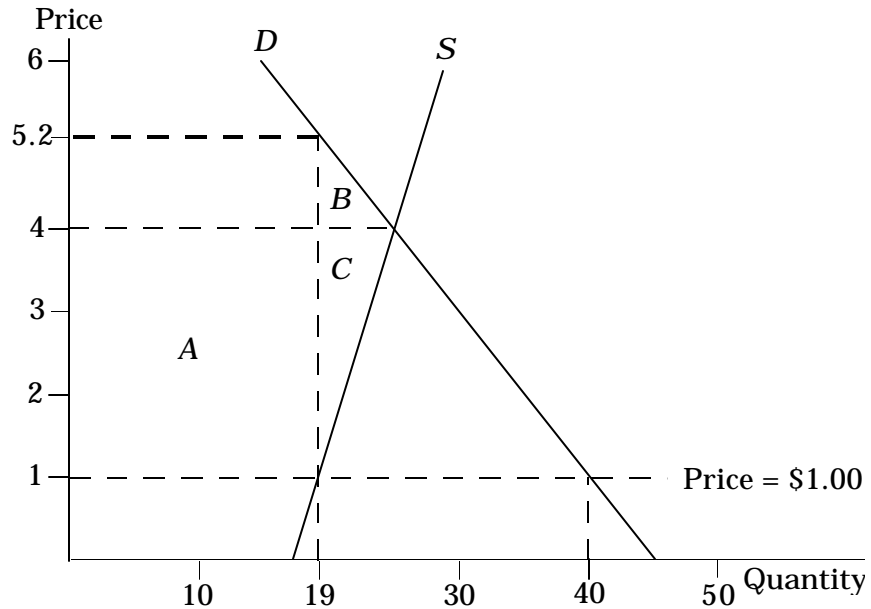


Figure 9.9