ECON2103 Microeconomics

Chapter 9 Exercises

Solutions

1.

a. Equate supply and demand and solve for Q: $10 - Q = Q - 4$. Therefore $Q = 7$ thousand widgets.

Substitute Q into either the demand or the supply equation to obtain P.

$$P = 10 - 7 = \$3.00,$$

or

$$P = 7 - 4 = \$3.00.$$

b. With the imposition of a \$1.00 tax per unit, the price buyers pay is \$1 more than the price suppliers receive. Also, at the new equilibrium, the quantity bought must equal the quantity supplied. We can write these two conditions as

$$P_b - P_s = 1$$

$$Q_b = Q_s.$$

Let Q with no subscript stand for the common value of Q_b and Q_s. Then substitute the demand and supply equations for the two values of P:

$$(10 - Q) - (Q - 4) = 1$$

Therefore, $Q = 6.5$ thousand widgets. Plug this value into the demand equation, which is the equation for P_b, to find $P_b = 10 - 6.5 = \$3.50$. Also substitute $Q = 6.5$ into the supply equation to get $P_s = 6.5 - 4 = \$2.50$.

The tax raises the price in the market from \$3.00 (as found in part a) to \$3.50. Sellers, however, receive only \$2.50 after the tax is imposed. Therefore the tax is shared equally between buyers and sellers, each paying \$0.50.

c. Now the two conditions that must be satisfied are

$$P_s - P_b = 1$$

$$Q_b = Q_s.$$

As in part b, let Q stand for the common value of quantity. Substitute the supply and demand curves into the first condition, which yields

$$(Q - 4) - (10 - Q) = 1.$$

Therefore, $Q = 7.5$ thousand widgets. Using this quantity in the supply and demand equations, suppliers will receive $P_s = 7.5 - 4 = \$3.50$, and buyers will pay $P_b = 10 - 7.5 = \$2.50$. The total cost to the government is the subsidy per unit multiplied by the number of units. Thus the cost is (\$1)(7.5) = \$7.5 thousand, or \$7500.

2.

a. With a \$9 tariff, the price of the imported metal in the U.S. market would be \$18; the \$9 tariff plus the world price of \$9. The \$18 price, however, is above the domestic equilibrium price. To determine the domestic equilibrium price, equate domestic supply and domestic demand:

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

Because the domestic price of \$15 is less than the world price plus the tariff, \$18, there will be no imports. The equilibrium quantity is found by substituting the price of \$15 into either the demand or supply equation. Using demand,

$$Q^D = 40 - (2)(15) = 10 \text{ million ounces.}$$

b. With the voluntary restraint agreement, the difference between domestic supply and domestic demand would be limited to 8 million ounces, that is, $Q^D - Q^S = 8$. 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 U.S. domestic price of \$12, $Q^D = 16$ and $Q^S = 8$; the difference of 8 million ounces will be supplied by imports.

3.

a. The example gives equations for the total market demand for sugar in the U.S. and the supply of U.S. producers:

$$Q_D = 31.20 - 0.27P$$

$$Q_S = -8.95 + 0.99P.$$

The difference between the domestic quantities demanded and supplied, $Q_D - Q_S$, is the amount of imported sugar that is restricted by the quota. If the quota is increased to 10 billion pounds, then $Q_D - Q_S = 10$ and we can solve for P:

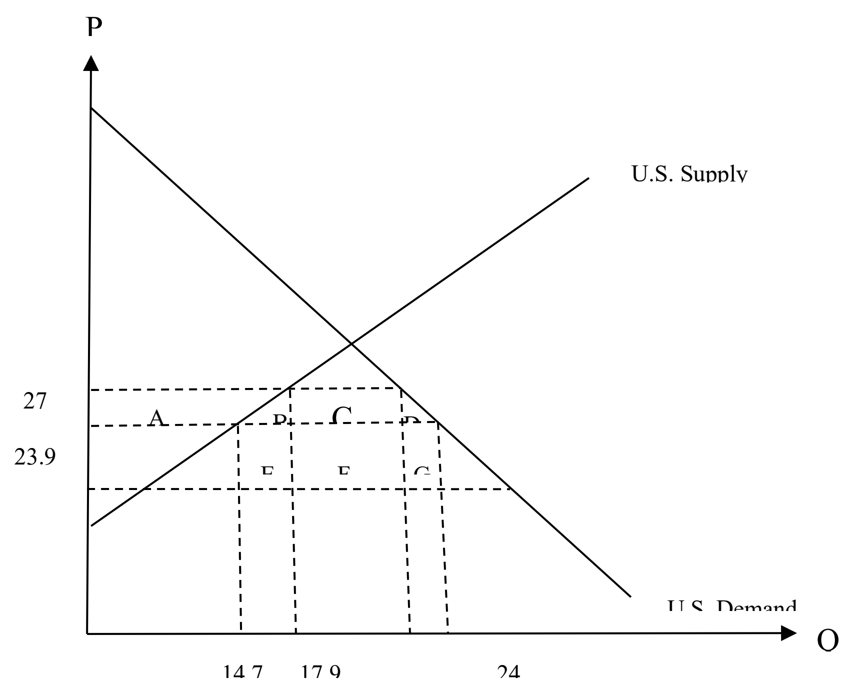
$$(31.20 - 0.27P) - (-8.95 + 0.99P) = 10$$

$$37.68 - 0.85P = 10$$

$$P = 23.9 \text{ cents per pound.}$$

At a price of 23.9 cents per pound, $Q_S = -8.95 + 0.99(23.9) = 14.7$ billion pounds, and $Q_D = Q_S + 10 = 14.7 + 10 = 24.7$ billion pounds.

b.



The gain in consumer surplus is $A + B + C + D$. The loss to domestic producers is area A. The areas in billions of cents (that is, tens of millions of dollars) are:

$A = (14.7)(27 - 23.9) + (0.5)(17.9 - 14.7)(27 - 23.9) = 50.53$

$B = (0.5)(17.9 - 14.7)(27 - 23.9) = 4.96$

$C = (24 - 17.9)(27 - 23.9) = 18.91$

$D = (0.5)(24.7 - 24)(27 - 23.9) = 1.09$

Thus, consumer surplus increases by 75.49, or \$754.9 million, while domestic producer surplus decreases by 50.53, or \$505.3 million.

c. Domestic deadweight loss decreases by the difference between the increase in consumer surplus and the decrease in producer surplus, which is \$754.9 – 505.3 = \$249.6 million.

When the quota was 6.1 billion pounds, the profit earned by foreign producers was the difference between the domestic price and the world price (27 – 17) times the 6.1 billion units sold, for a total of 61.0, or \$610 million. When the quota is increased to 10 billion pounds, domestic price falls to 23.9 cents per pound, and profit earned by foreigners is (23.9 – 17)(10) = 69.0, or \$690 million. Profit earned by foreigners therefore increases by \$80 million. On the diagram above, this is area $(E + F + G) - (C + F) = E + G - C$. The deadweight loss of the quota, including foreign producer surplus, decreases by area $B + D + E + G$. Area $E = 22.08$ and $G = 4.83$, so the decrease in deadweight loss = 4.96 + 1.09 + 22.08 + 4.83 = 32.96, or \$329.6 million.

4. 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 without the tariff:

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

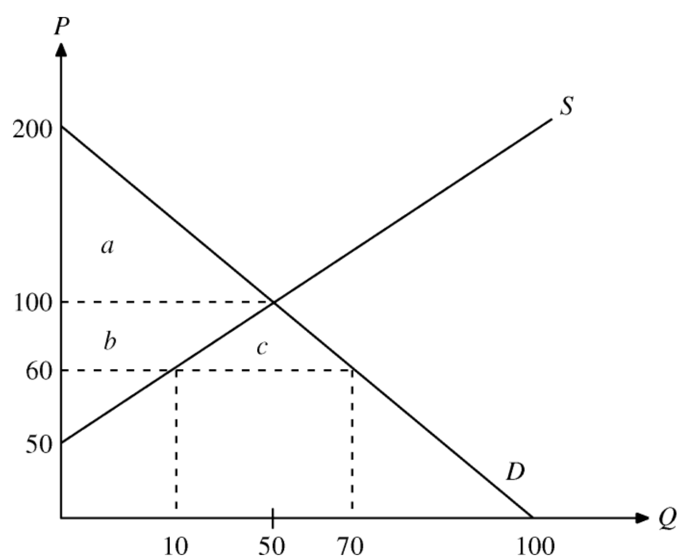
Thus the equilibrium quantity is 50 million pounds. Substituting Q_{EQ} of 50 into either the supply or demand equation to determine price, we find:

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

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 the figure below, consumer surplus before the imposition of the tariff is equal to area $a + b + c$, or (0.5)(70)(200 − 60) = 4900 million cents, or \$49 million. After the tariff, the price rises to \$1.00 and consumer surplus falls to area a, or (0.5)(50)(200 – 100) = \$25 million, a loss of \$24 million. Producer surplus increases by area b, or (10)(100 – 60) + (0.5)(50 – 10)(100 – 60) = \$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 \$24 – 12 = \$12 million (area c).



5.

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

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

We know the values of the elasticity, P, and Q, which means we can solve for the slope, which is $-b$ in the above formula for the demand curve.

$$-0.4 = \left(\frac{5.00}{16}\right)(-b)$$

$$b = 0.4\left(\frac{16}{5.00}\right) = 1.28.$$

To find the constant a, substitute for Q, P, and b in the demand curve formula: $16 = a - 1.28(5.00)$. Solving yields $a = 22.4$. The equation for demand is therefore $Q = 22.4 - 1.28P$. To find the supply curve, recall the formula for the elasticity of supply and follow the same method as above:

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

$$0.5 = \left(\frac{5.00}{16}\right)(d)$$

$$d = 0.5\left(\frac{16}{5.00}\right) = 1.6$$

To find the constant c, substitute for Q, P, and d in the supply formula, which yields $16 = c + 1.6(5.00)$. Therefore $c = 8$, and the equation for the supply curve is $Q = 8 + 1.6P$.

b. The tax drives a wedge between supply and demand. At the new equilibrium, the price buyers pay, P_b, will be \$1.00 higher than the price sellers receive, P_s. Also, the quantity buyers demand at P_b must equal the quantity supplied at price P_s. These two conditions are:

$$P_b - P_s = 1.00 \quad \text{and} \quad 22.4 - 1.28P_b = 8 + 1.6\,P_s.$$

Solving these simultaneously, $P_s = \$4.56$ and $P_b = \$5.56$. The new quantity will be $Q = 22.4 - 1.28(5.56) = 15.3$ billion packs. So the price consumers pay will increase from \$5.00 to \$5.56 (a 56-cent increase) and consumption will fall from 16 to 15.3 billion packs per year (a drop of 700 million packs per year).

c. Consumers pay \$5.56 – 5.00 = \$0.56 and producers pay the remaining \$5.00 – 4.56 = \$0.44 per pack. We could also find these amounts using the pass-through formula. The fraction of the tax paid by consumers is $E_S/(E_S - E_D) = 0.5/[0.5 - (-0.4)] = 0.5/0.9 = 0.56$. Therefore, consumers will pay 56% of the \$1.00 tax, which is 56 cents, and suppliers will pay the remaining 44 cents.