ECON2103 Microeconomics

Chapter 2 Exercises

Solutions

1.

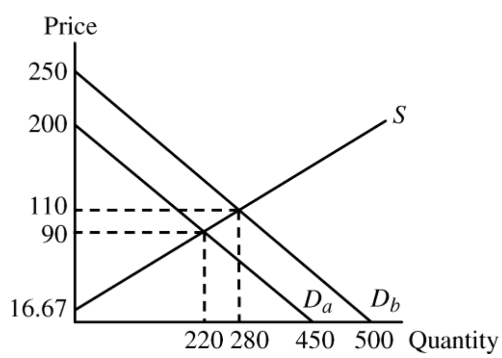
a. Given $I = 25$, the demand curve becomes $Q = 300 - 2P + 4(25)$, or $Q = 400 - 2P$. Set demand equal to supply and solve for P and then Q:

$$400 - 2P = 3P - 50$$
$$P = 90$$
$$Q = 400 - 2(90) = 220.$$

b. Given $I = 50$, the demand curve becomes $Q = 300 - 2P + 4(50)$, or $Q = 500 - 2P$. Setting demand equal to supply, solve for P and then Q:

$$500 - 2P = 3P - 50$$
$$P = 110$$
$$Q = 500 - 2(110) = 280.$$

c. It is easier to draw the demand and supply curves if you first solve for the inverse demand and supply functions, i.e., solve the functions for P. Demand in part a is $P = 200 - 0.5Q$ and supply is $P = 16.67 + 0.333Q$. These are shown on the graph as D_a and S. Equilibrium price and quantity are found at the intersection of these demand and supply curves. When the income level increases in part b, the demand curve shifts up and to the right. Inverse demand is $P = 250 - 0.5Q$ and is labeled D_b. The intersection of the new demand curve and original supply curve is the new equilibrium point.



2.

a.

$$E_D = \frac{\frac{\Delta Q_D}{Q_D}}{\frac{\Delta P}{P}} = \frac{P}{Q_D}\frac{\Delta Q_D}{\Delta P}.$$

With each price increase of \$20, the quantity demanded decreases by 2 million. Therefore,

$$\left(\frac{\Delta Q_D}{\Delta P}\right) = \frac{-2}{20} = -0.1.$$

At $P = 80$, quantity demanded is 20 million and thus

$$E_D = \left(\frac{80}{20}\right)(-0.1) = -0.40.$$

Similarly, at $P = 100$, quantity demanded equals 18 million and

$$E_D = \left(\frac{100}{18}\right)(-0.1) = -0.56.$$

b. Calculate the price elasticity of supply when the price is \$80 and when the price is \$100.

$$E_S = \frac{\frac{\Delta Q_S}{Q_S}}{\frac{\Delta P}{P}} = \frac{P}{Q_S}\frac{\Delta Q_S}{\Delta P}.$$

With each price increase of \$20, quantity supplied increases by 2 million. Therefore,

$$\left(\frac{\Delta Q_S}{\Delta P}\right) = \frac{2}{20} = 0.1.$$

At $P = 80$, quantity supplied is 16 million and

$$E_S = \left(\frac{80}{16}\right)(0.1) = 0.5.$$

Similarly, at $P = 100$, quantity supplied equals 18 million and

$$E_S\left(\frac{100}{18}\right)(0.1) = 0.56.$$

c. The equilibrium price is the price at which the quantity supplied equals the quantity demanded. Using the table, the equilibrium price is $P^* = \$100$ and the equilibrium quantity is $Q^* = 18$ million.

d. With a price ceiling of \$80, price cannot be above \$80, so the market cannot reach its equilibrium price of \$100. At \$80, consumers would like to buy 20 million, but producers will supply only 16 million. This will result in a shortage of 4 million units.

3.

a. The equation for demand is of the form $Q = a - bP$. First find the slope, which is $\frac{\Delta Q}{\Delta P} = \frac{-6}{3} = -2 = -b$. You can figure this out by noticing that every time price increases by 3, quantity demanded falls by 6 million pounds. Demand is now $Q = a - 2P$. To find a, plug in any of the price and quantity demanded points from the table. For example: $Q = 34 = a - 2(3)$ so that $a = 40$ and demand is therefore $Q = 40 - 2P$.

The equation for supply is of the form $Q = c + dP$. First find the slope, which is $\frac{\Delta Q}{\Delta P} = \frac{2}{3} = d$. You can figure this out by noticing that every time price increases by 3, quantity supplied increases by 2 million pounds. Supply is now $Q = c + \frac{2}{3}P$. To find c, plug in any of the price and quantity supplied points from the table. For example: $Q = 2 = c + \frac{2}{3}(3)$ so that $c = 0$ and supply is $Q = \frac{2}{3}P$.

b. Elasticity of demand at $P = 9$ is $\frac{P}{Q}\frac{\Delta Q}{\Delta P} = \frac{9}{22}(-2) = \frac{-18}{22} = -0.82$.

Elasticity of demand at $P = 12$ is $\frac{P}{Q}\frac{\Delta Q}{\Delta P} = \frac{12}{16}(-2) = \frac{-24}{16} = -1.5$.

c. Elasticity of supply at $P = 9$ is $\frac{P}{Q}\frac{\Delta Q}{\Delta P} = \frac{9}{6}\left(\frac{2}{3}\right) = \frac{18}{18} = 1.0$.

Elasticity of supply at $P = 12$ is $\frac{P}{Q}\frac{\Delta Q}{\Delta P} = \frac{12}{8}\left(\frac{2}{3}\right) = \frac{24}{24} = 1.0$.

d. With no restrictions on trade, the price in the United States will be the same as the world price, so $P = \$9$. At this price, the domestic supply is 6 million lbs., while the domestic demand is 22 million lbs. Imports make up the difference and are thus 22 – 6 = 16 million lbs.

4.

a. Before the drop in export demand, the market equilibrium price is found by setting total demand equal to domestic supply:

$$3244 - 283P = 1944 + 207P, \text{ or}$$

$$P = \$2.65.$$

Export demand is the difference between total demand and domestic demand: $Q = 3244 - 283P$ minus $Q_D = 1700 - 107P$. So export demand is originally $Q_e = 1544 - 176P$. After the 40% drop, export demand is only 60% of the original export demand. The new export demand is therefore, $Q'_e = 0.6Q_e = 0.6(1544 - 176P) = 926.4 - 105.6P$. Graphically, export demand has pivoted inward as illustrated in the figure below.

The new total demand becomes

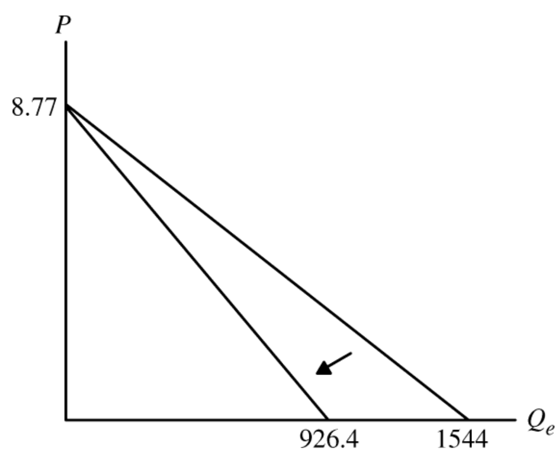
$$Q' = Q_D + Q'_e = (1700 - 107P) + (926.4 - 105.6P) = 2626.4 - 212.6P.$$

Equating total supply and the new total demand,

$$1944 + 207P = 2626.4 - 212.6P, \text{ or}$$

$$P = \$1.63,$$

which is a significant drop from the original market-clearing price of \$2.65 per bushel. At this price, the market-clearing quantity is about $Q = 2281$ million bushels. Total revenue has decreased from about \$6609 million to \$3718 million, so farmers have a lot to worry about.



b. With a price of \$3.50, the market is not in equilibrium. Quantity demanded and supplied are

$Q' = 2626.4 - 212.6(3.50) = 1882.3$, and

$Q_S = 1944 + 207(3.50) = 2668.5$.

Excess supply is therefore 2668.5 – 1882.3 = 786.2 million bushels. The government must purchase this amount to support a price of \$3.50, and will have to spend \$3.50(786.2 million) = \$2751.7 million.

5.

a. Let the demand curve be of the form $Q = a - bP$ and the supply curve be of the form $Q = c + dP$, where a, b, c, and d are positive constants. 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 demand elasticity is –0.4, $P = 5$, and $Q = 15.75$, which means we can solve for the slope, $-b$, which is $\Delta Q/\Delta P$ in the above formula.

$$-0.4 = \frac{5}{15.75}\frac{\Delta Q}{\Delta P}$$
$$\frac{\Delta Q}{\Delta P} = -0.4\left(\frac{15.75}{5}\right) = -1.26 = -b.$$

To find the constant a, substitute for Q, P, and b in the demand function to get $15.75 = a - 1.26(5)$, so $a = 22.05$. The equation for demand is therefore $Q = 22.05 - 1.26P$. To find the supply curve, recall the formula for the elasticity of supply and follow the same method as above:

$$E_P^S = \frac{P}{Q}\frac{\Delta Q}{\Delta P}$$
$$0.5 = \frac{5}{15.75}\frac{\Delta Q}{\Delta P}$$
$$\frac{\Delta Q}{\Delta P} = 0.5\left(\frac{15.75}{5}\right) = 1.575 = d.$$

To find the constant c, substitute for Q, P, and d in the supply function to get $15.75 = c + 1.575(5)$ and $c = 7.875$. The equation for supply is therefore $Q = 7.875 + 1.575P$.

b. In 1998, Americans smoked 23.5 billion packs cigarettes, and the retail price was about \$2.00 per pack. The decline in cigarette consumption from 1998 to 2010 was due in part to greater public awareness of the health hazards from smoking, but was also due in part to the increase in price. Suppose that the *entire decline* was due to the increase in price. What could you deduce from that about the price elasticity of demand?

Calculate the arc elasticity of demand since we have a range of prices rather than a single price. The arc elasticity formula is

$$E_P = \frac{\Delta Q}{\Delta P}\frac{\overline{P}}{\overline{Q}}$$

where $\overline{P}$ and $\overline{Q}$ are average price and quantity, respectively. The change in quantity was 15.75 –23.5 = –7.75, and the change in price was 5 – 2 = 3. The average price was (2 + 5)/2 = 3.50, and the average quantity was (23.5 + 15.75)/2 = 19.625. Therefore, the price elasticity of demand, assuming that the *entire decline* in quantity was due solely to the price increase, was

$$E_P = \frac{\Delta Q}{\Delta P}\frac{\overline{P}}{\overline{Q}} = \frac{-7.75}{3}\frac{3.50}{19.625} = -0.46.$$