ECO101A: Introduction to Economics

Tutorial 4: Solution

1. **Suspose 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. Then:

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

   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. **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 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. **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 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?**

   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. In Exercise 4 in Chapter 2 (page 62), 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 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 $Q_S = \frac{2}{3}P$.

To find the equation for demand, we need to find a linear function $Q_D = a + bP$ so 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, substitute for b and one point, e.g., (15, 10), into the linear function to solve for the constant, a:

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

Therefore, $Q_D = 40 - 2P$.

Similarly, 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:

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

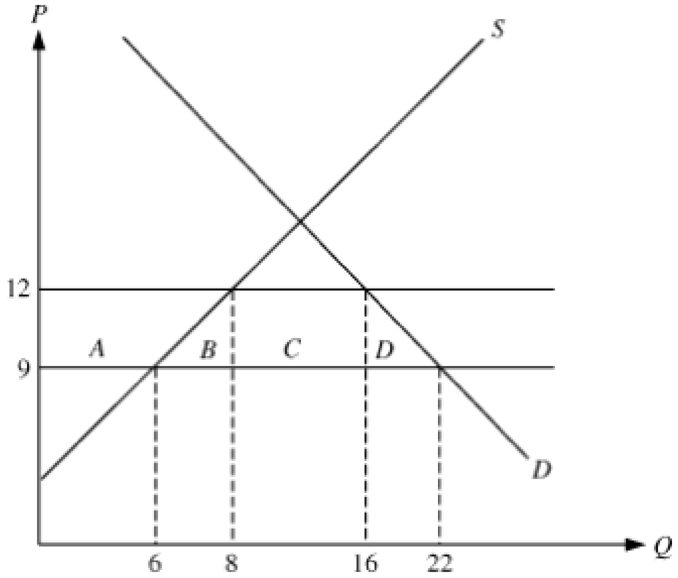
Therefore, $Q_S = \left(\frac{2}{3}\right)P$.

b. Confirm that if there were no restrictions on trade, the United States would import 16 million pounds.

If there were no trade restrictions, the world price of $9.00 would prevail in the United States. From the table, we see that at $9.00 domestic supply would be 6 million pounds. Similarly, domestic demand would be 22 million pounds. Imports provide the difference between domestic demand and domestic supply, so imports would be 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 U.S. supply is 8 million pounds, so imports are 8 million pounds (16 – 8). The government will collect $3(8) = $24 million, which is area C in the diagram below. To find deadweight loss, we must determine the changes in consumer and producer surpluses. Consumers lose area $A + B + C + D$ because they pay the higher price of $12 and purchase fewer pounds of the fiber. U.S. producers gain area A because of the higher price and the greater quantity they sell. So the deadweight loss is the loss in consumer surplus minus the gain in producer surplus and the tariff revenue. Therefore, DWL = $B + D$ = $0.5(12 - 9)(8 - 6) + 0.5(12 - 9)(22 - 16)$ = $12 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 the figure above, which is the reduction in consumer surplus. This equals

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

The gain to domestic producers (increase in producer surplus) is equal to area A, which is

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