



SOLUTIONS TO HOMEWORK SET #1

1.

(a) FALSE

Some consumers may have a strong preference for Coke or Pepsi, but a large number of them view Coke and Pepsi as close demand substitutes. Consequently, if the price of Coke rises, many consumers will switch to Pepsi. Therefore they are in the same market.

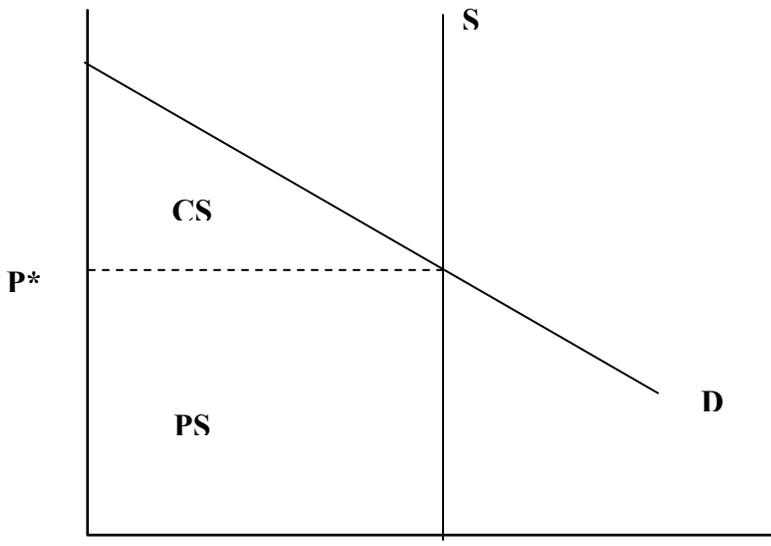
(b) TRUE

The burden of a tax falls mostly on buyers when demand is inelastic, and mostly on suppliers when demand is elastic (see page 316 in P&R). In the short run, many consumers have few options but to purchase gasoline – short-run demand is relatively inelastic. In the long run, however, people can purchase a more fuel-efficient car or modify their lifestyle in other ways so that they use less gasoline. Thus, short-run demand is likely to be more inelastic and hence more of the tax burden will fall on consumers in the short run than in the long run.

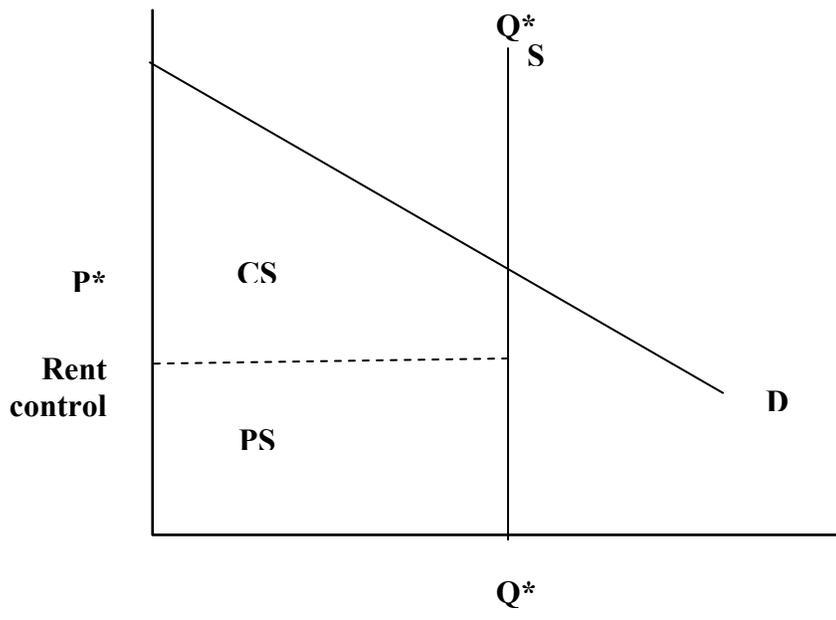
We would have accepted UNCERTAIN if the answer clearly stated that the tax may lead to some consumers no longer driving, and the remaining consumers may have demands that are substantially less elastic than the group as a whole.

(c) TRUE

Because supply is completely price inelastic, the supply curve is represented by a vertical line. Therefore, rent control will shift surplus from the producer to the consumer, but the sum of surplus will remain constant. *Comment:* There will be a shortage of apartments. Yet the people who had an apartment before rent control remain the same people who have an apartment with rent control. See graphs:



**No Rent Control
(Free Market)**



Rent Controls:
Total surplus has not changed, as Q^* has not changed; CS has increased and PS has decreased; no DWL

2.

a. First we set $Q_s = Q_d$. Then we solve for the equilibrium price.

$$Q_s = Q_d \Leftrightarrow 600P = 7500 - 2400P \Leftrightarrow P = 2.5$$

$$P^* = \$2,500/\text{HDTV}$$

$$Q^* = 1,500 \text{ HDTVs}$$

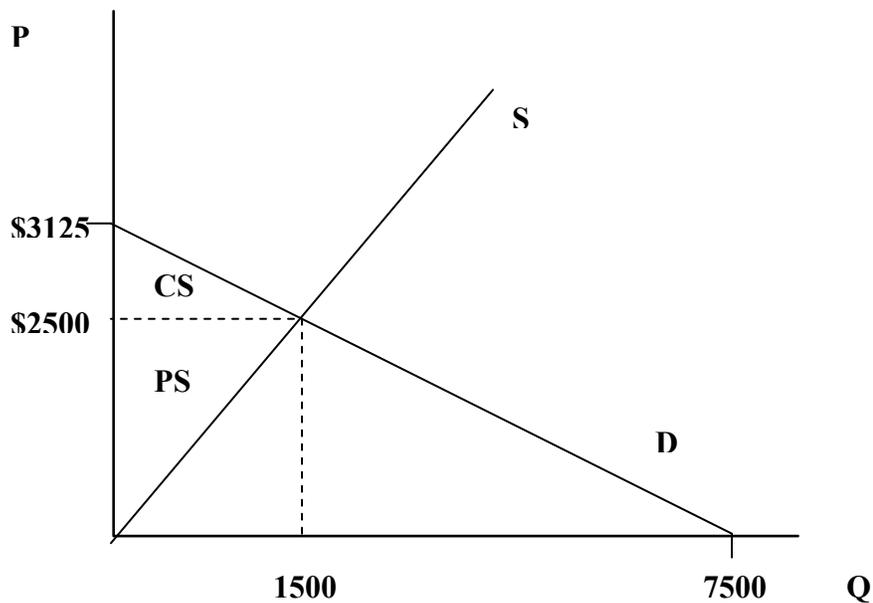
b. Price elasticity of supply:

$$E_s = \frac{\Delta Q_s / Q_s}{\Delta P / P} = (\text{slope in } Q_s \text{ equation}) * (P^*/Q^*) = 600 * (2.5/1,500) = 1$$

Price Elasticity of demand:

$$E_d = \frac{\Delta Q_d / Q_d}{\Delta P / P} = (\text{slope in } Q_d \text{ equation}) * (P^*/Q^*) = -2400 * (2.5/1,500) \\ = -4$$

c. Consumer surplus and producer surplus are labeled in the graph below.



$$\begin{aligned} \text{Consumer surplus (CS)} &= \frac{1}{2} * (\$3125 - P^*) * (Q^* - 0) \\ &= \frac{1}{2} * (\$3125 - \$2500) * (1500 - 0) \\ &= \$468,750 \end{aligned}$$

$$\begin{aligned}
 \text{Producer surplus (PS)} &= \frac{1}{2} * (P^* - 0) * (Q^* - 0) \\
 &= \frac{1}{2} * (\$2500 - 0) * (1500 - 0) \\
 &= \mathbf{\$1,875,000}
 \end{aligned}$$

- d. With a government HDTV subsidy of \$300, the equilibrium price that consumers pay is different than the equilibrium price that suppliers receive. This relationship can be expressed as follows:

$$P_S = P_D + 0.3$$

To determine the new equilibrium, we need to substitute for P_S in the supply equation and set supply equal to demand to get:

$$7,500 - 2,400P_D = 600(P_D + 0.3)$$

$$3,000P_D = 7,320 \quad \text{or} \quad P_D = 2.44; \text{ so}$$

$$\mathbf{P_D = \$2,440 \text{ (the price paid by consumers)}}$$

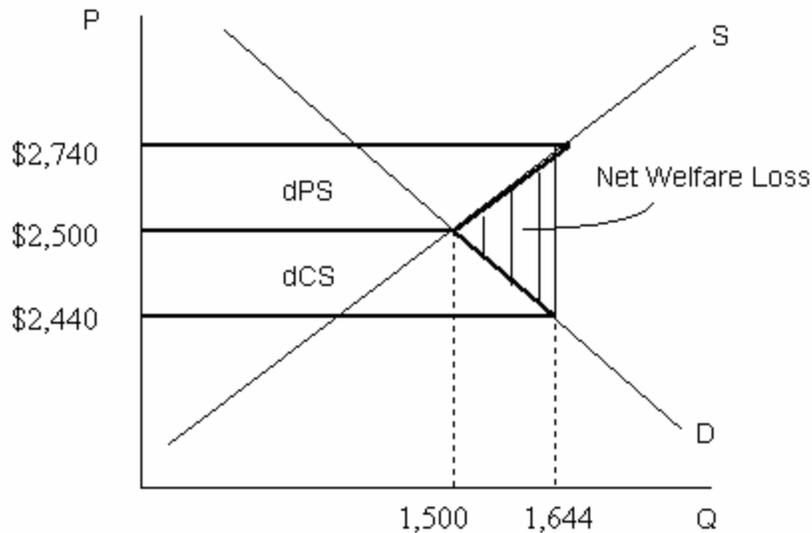
$$\mathbf{P_S = \$2,740 \text{ (= } P_D + \$300, \text{ the price collected by producers)}}$$

Plug P_D into the demand equation to determine equilibrium quantity:

$$Q^* = 7,500 - 2,400(2.44)$$

$$\mathbf{Q^* = 1,644 \text{ HDTVs}}$$

- e. There is a net welfare loss. Although both consumers and producers benefit from the subsidy (i.e., increased surplus), this benefit is more than offset by the cost to the government. These changes are represented in the graph below:



We can calculate the change in consumer and producer surplus, and government expense under the subsidy, as follows:

$$\begin{aligned} \Delta CS &= (\$2,500 - \$2,440) * 1,500 + 0.5*(1,644 - 1,500)*(\$2,500 - \$2,440) \\ \Delta CS &= \$94,320 \end{aligned}$$

$$\begin{aligned} \Delta PS &= (\$2,740 - \$2,500) * 1,500 + 0.5*(1,644 - 1,500)*(\$2,740 - \$2,500) \\ \Delta PS &= \$377,280 \end{aligned}$$

$$\text{Gov't Expense} = \$300 * 1,644 \text{ HDTVs} = \$493,200$$

$$\begin{aligned} \text{Net Welfare Effect} &= \Delta CS + \Delta PS - \text{Gov't Expense} \\ &= \$94,320 + \$377,280 - \$493,200 = -\$21,600 \end{aligned}$$

Alternate (much shorter) solution to e:

The main solution presented above shows how to calculate changes in producer surplus, consumer surplus, and government revenue. But one need not calculate all of these quantities to find the magnitude of net welfare loss. Remember: the size of the total surplus is determined by the extent to which trade occurs between higher valuation buyers and lower cost suppliers. In this case, the net welfare loss (i.e. dead-weight loss) is the lost surplus due to some *low* valuation buyers with high cost suppliers (there are too many trades) ... Exactly the highlighted triangle in the picture:

$$\begin{aligned} \Delta \text{Total Surplus} &= -\frac{1}{2} * (\$2,740 - \$2,440) * (1,644 - 1,500) \\ &= -\$21,600 \end{aligned}$$

3.

- a. We know the equilibrium price and quantity, along with the demand and supply elasticities, so we can use our formula for elasticities given linear demand and supply curves. Recall the notation that demand takes form: $Q_d = a - bP$ and supply takes form $Q_s = c + dP$.

Demand: Elasticity equation allows us to solve for b.

$$\begin{aligned}E_d &= -b (P^* / Q^*) \\-4.0 &= -b (\$15 / 5) \\b &= 4/3\end{aligned}$$

Demand equation, $Q_d = a - bP$, allows us to solve for a:

$$\begin{aligned}5 &= a - (4/3)*\$15 \\a &= 25\end{aligned}$$

So our demand curve (with Q expressed in millions) is:

$$Q_d = 25 - (4/3)P$$

Supply: Same steps for supply, using now $Q_s = c + dP$ in the second step

$$\begin{aligned}E_s &= d (P^* / Q^*) \\2.0 &= d (\$15 / 5) \\d &= 2/3\end{aligned}$$

$$\begin{aligned}5 &= c + (2/3)*\$15 \\c &= -5\end{aligned}$$

$$Q_s = -5 + (2/3)P$$

- b. A \$3 tax will change the price that consumers pay, the price that producers receive, and the equilibrium quantity. The price that consumers pay (P_d) is different than the price that producers receive (P_s): $P_d = P_s + T$, where T is the amount of the tax. Using our demand and supply curves found in part a, our new demand and supply curves are:

$$\begin{aligned}Q_d &= 25 - (4/3)P_d \\Q_s &= -5 + (2/3)P_s\end{aligned}$$

We can then substitute into our demand curve:

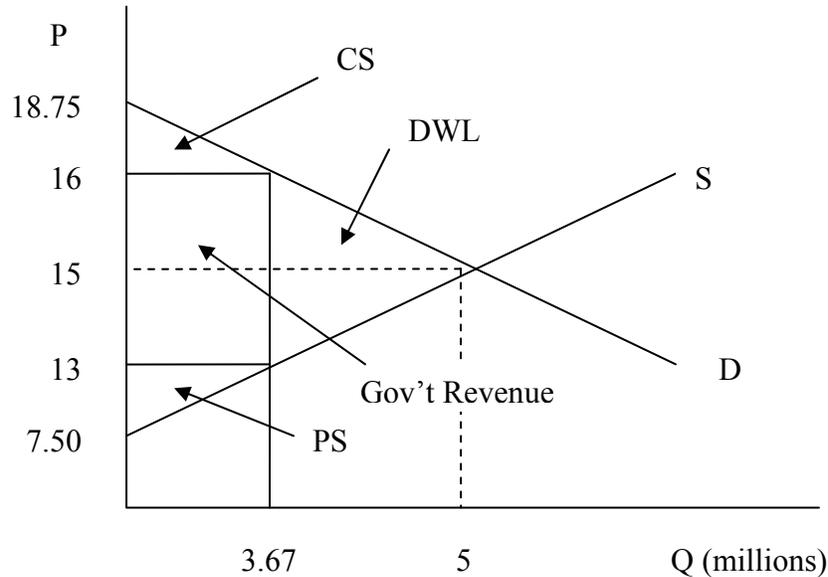
$Q_d = 25 - (4/3)*(P_s + T)$ and set this equal to $Q_s = -5 + (2/3)P_s$ to find the new equilibrium prices and quantity:

$$25 - (4/3)*(P_s + 3) = -5 + (2/3)P_s$$

$$26 = 2 P_s$$

$$P_s = \$13 \text{ and } P_d = P_s + T = 13 + 3 = \$16$$

Plugging back into either our new supply or demand curve (using the appropriate price), our new quantity is $Q_s = -5 + (2/3)P_s = 3.67$ million footballs.



$$\text{Gov't Revenue} = \text{Tax} * \text{Quantity} = \$3 * 3.67 \text{ million} = \mathbf{\$11 \text{ million}}$$

$$\Delta \text{CS} = (\$15 - \$16) * 3.67 \text{ m} + \frac{1}{2} * (\$15 - \$16) * (5 \text{ m} - 3.67 \text{ m})$$

$$= \mathbf{-\$4.33 \text{ million}}$$

$$\Delta \text{PS} = (\$13 - \$15) * 3.67 \text{ m} + \frac{1}{2} * (\$13 - \$15) * (5 \text{ m} - 3.67 \text{ m})$$

$$= \mathbf{-\$8.67 \text{ million}}$$

4. $\ln Q^{\text{cars}} = 5 - 2.4 \ln P^{\text{cars}} - 1.2 \ln P^{\text{gasoline}} + 0.5 \ln (\text{GDP per capita})$
- The elasticity of demand of cars with respect to the price of cars is the coefficient of the price of cars: $E_{\text{cars}} = \mathbf{-2.4}$
 - The elasticity with respect to the price of gasoline is the coefficient of the price of gasoline: $E_{\text{gasoline}} = \mathbf{-1.2}$
 - The elasticity with respect to GDP per capita is its coefficient: $E_{\text{GDP per capita}} = \mathbf{0.5}$
 - Do not let the excess data distract you from what is asked! In log-linear demand curves, elasticity is always the same, regardless of where you are on the demand curve. Therefore, for the given information, elasticity of demand with respect to GDP per capita is still $E_{\text{GDP per capita}} = \mathbf{0.5}$.