PAI 723 **Professor David Popp**
Solutions to Problem Set #2 **Fall 2024**

1. For this problem, we simply use the elasticity formula:

$$\varepsilon = \frac{\%\Delta Q}{\%\Delta P}$$

We are given the percent change in price (10%) and the elasticity. Thus, we can calculate the change in quantity:

$$-0.4 = \frac{\%\Delta Q}{0.1}$$
$$\%\Delta Q = (-0.4)(0.1) = -0.04$$

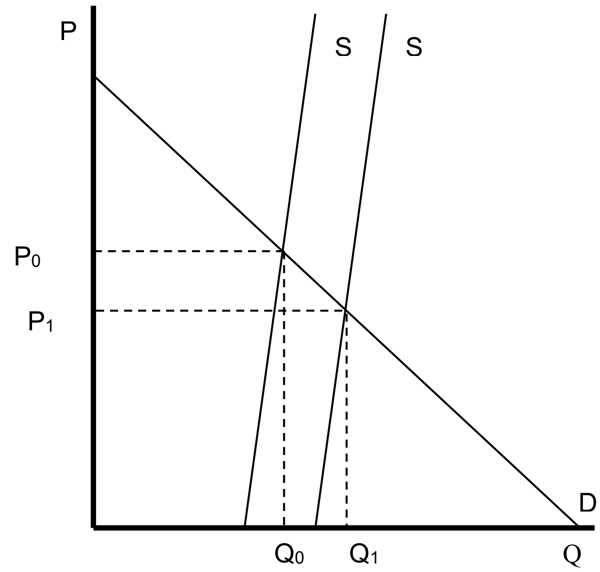
Quantity will fall by 4%.

To find the reduction in terms of number of beverages consumed, simply multiply this by the total number currently consumed (1,000,000). Thus, we find that consumption of alcoholic beverages falls by 40,000.

b) Government revenue will increase. Demand is inelastic. Thus, the decrease in quantity demanded will be small relative to the increase in price resulting from the tax.

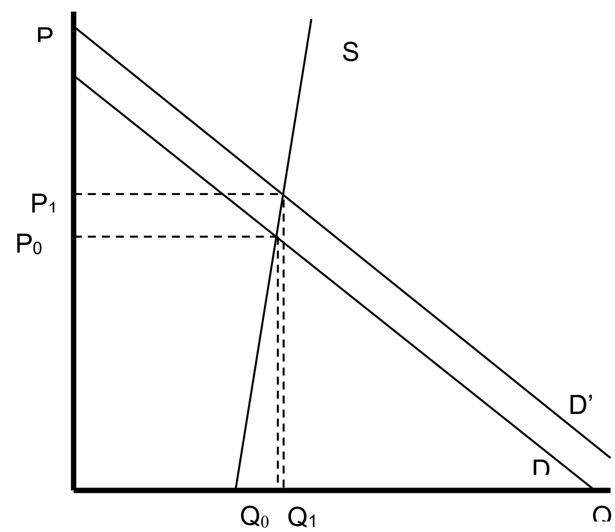
c) One reason that alcoholic beverages have an inelastic demand is because they are addictive. Those who are addicted will purchase alcohol at nearly any price. However, higher prices may discourage new users from consuming alcohol and becoming addicted. Thus, in the long run, demand is likely to be more elastic. The fall in quantity consumed should be greater. The increase in revenue will be smaller, and revenue may decrease if demand becomes elastic.

2. a)



Because there is little room to expand, supply is inelastic. Thus, we use a nearly vertical supply curve. Easing zoning restrictions makes it possible to build more housing. This shifts supply to the right. The equilibrium price falls, and the equilibrium quantity rises.

b)



The subsidy to homeowners affects demand. By giving them more income, they can afford to spend more on homes. This leads to an increase in demand, shown by shifting demand up and to the right. Because of this, the quantity of homes does increase, but not by much, since supply is inelastic. Instead, the bigger impact of this plan is higher housing prices.

c) Because of the inelastic supply of housing, only the plan to ease zoning restrictions has the intended effect of lowering prices and increasing quantity. In contrast, because the subsidy increases demand, it increases both quantity and price. As such, I would recommend the plan to ease zoning restrictions

3. a) For this problem, we simply use the elasticity formula:

$$\varepsilon = \frac{\%\Delta Q}{\%\Delta P}$$

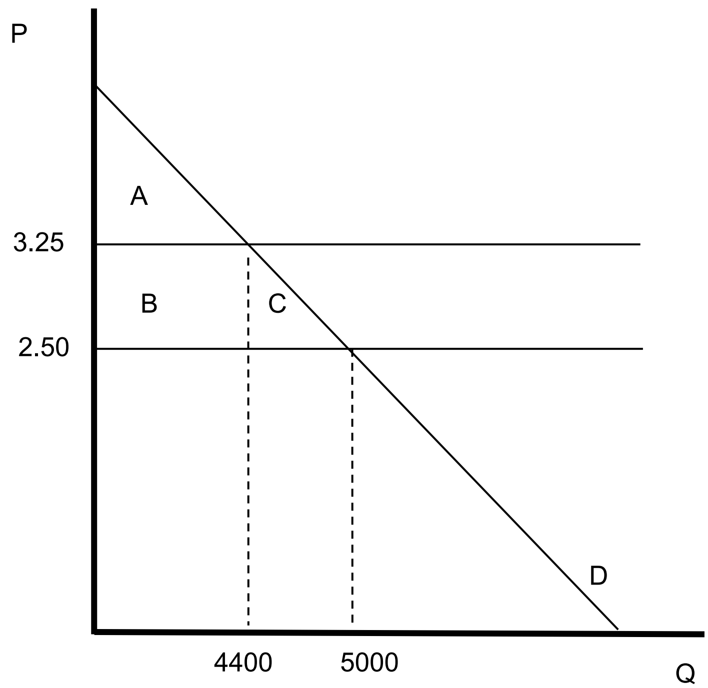
Recall that the $\%\Delta P = \Delta P/P$. Thus, the percentage change in price = \$0.75/\$2.5 = 0.3. Since we know the elasticity, we can plug this into the elasticity formula:

$$-0.4 = \frac{\%\Delta Q}{0.3}$$

$$\%\Delta Q = (-0.4)(0.3) = -0.12$$

Quantity will fall by 12%. To find the number of trips, we need to find how many fewer trips will be taken after the fare increase. This equals 5,000 x -0.12 = -600. The number of trips falls by 600, leaving **4,400** trips after the fare increase.

b) Note that, unlike the examples we've done so far, you don't need to know the end points of the demand curve to find the lost consumer surplus, nor do you need the supply curve. The illustration below shows what we are looking for:



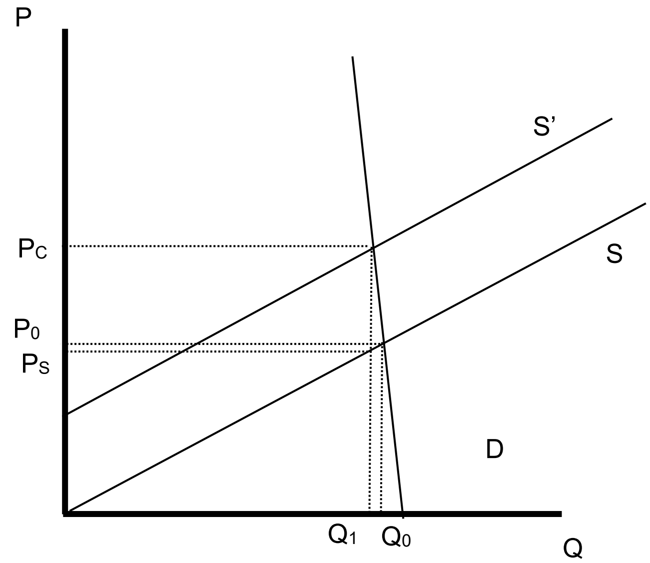
With the original fare of \$2.50, consumer surplus is areas A, B, & C. When the fare rises to \$3.5, consumer surplus is only A. Thus, we can find the lost consumer surplus by calculating areas B & C. Even though we don't know the *y*-intercept of the demand curve, we do know enough to calculate this area.

B is a rectangle with a height of 0.75 and a length of 4,400. Thus, its area is 3,300.

C is a triangle with a height of 0.75 and a length of 600 (= 5,000 – 4,400). Its area is 0.5(0.75)(600) = 225.

Thus, the lost consumer surplus = 3,300 + 225 = **\$3,525**.

4. The tax will not have the desired effect. Demand for medication is very inelastic. People are not sensitive to changes in price because medication is a necessity. Inelastic demand is represented on the graph below by a very steep demand curve.



We represent the tax by shifting the supply curve, since the *legal incidence* of the tax (e.g. who the government collects payments from) is on pharmaceutical companies. However, because demand is inelastic, pharmaceutical companies are able to pass along their higher costs to consumers. Intuitively, consumers need medication, so they are willing to pay higher prices when the companies pass the costs of the tax on to them. The price consumers pay, P_C, is well above the original equilibrium price, P_0. But there is little change in quantity of medication sold (falls from Q_0 to Q_1) and little change in the price producers receive (P_S). Thus, their profits remain nearly identical. Because of inelastic demand, the *economic incidence* of the tax is on consumers.

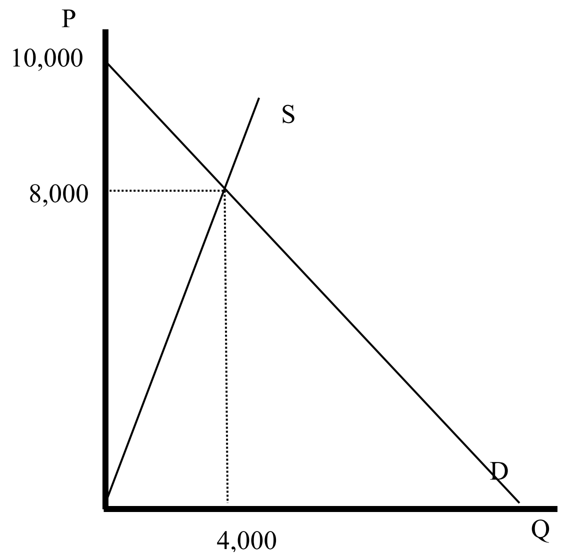
5. a) The equilibrium price and quantity are:

$$10{,}000 - 0.5Q = 2Q$$
$$10{,}000 = 2.5Q$$
$$Q = 10{,}000/2.5$$
$$\mathbf{Q = 4000}$$

Substitute this into either supply or demand to get:

P = $8,000

b)

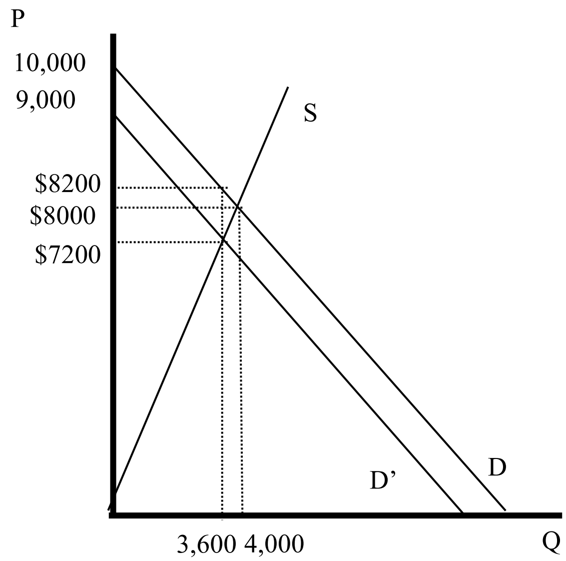


Consumer surplus is the triangle above the price and below demand. It has a height of 2,000 (= 10,000 – 8,000) and a base of 4,000. Its area = 0.5(2,000)(4,000) = **$4,000,000**.

Producer surplus is the triangle below price and above supply. It has a height of 8,000 and a base of 4,000. Its area = 0.5(4,000)(8,000) = **$16,000,000**.

c) The result of the tax is to shift either the supply curve or demand curve in. Since the legal incidence of the tax is on consumers, we shift the demand curve.

The demand curve shifts in by the amount of the tax. The new demand curve represents the demand curve faced by suppliers. To graph it, reduce the y-intercept of the demand equation by the amount of the tax: $1000.



Algebraically, recall that P_C – tax = P_S. Subtracting the tax represents the downward shift of the demand curve. We thus have:

$$P_C = 10{,}000 - 0.5Q - 1{,}000 = 2Q = P_S, \text{ or}$$
$$9{,}000 - 0.5Q = 2Q$$

We begin by finding the new equilibrium. Equate the new demand curve with the old supply curve.

$$9{,}000 - 0.5Q = 2Q$$
$$2.5Q = 9{,}000$$
$$Q = 9{,}000/2.5$$
$$\mathbf{Q = 3{,}600}$$

We plug this quantity into the *original* supply curve to get the price suppliers keep:

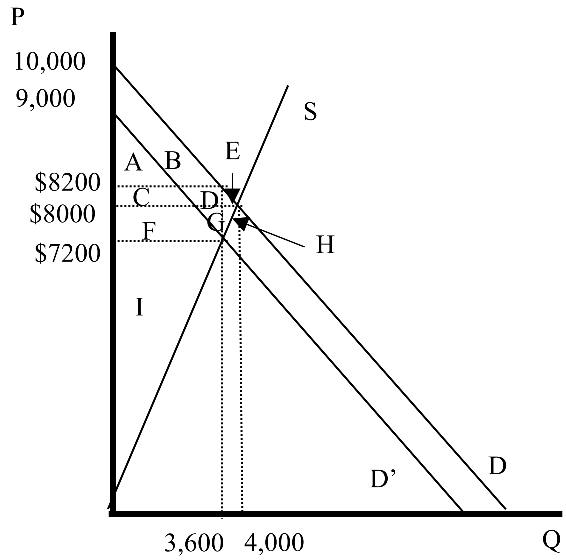
$$P_S = (2)(3{,}600) = \mathbf{\$7{,}200}$$

Similarly, we plug the new quantity into the *original* demand curve to get the price consumers must pay:

$$P_C = 10{,}000 - 0.5(3\ 600) = \mathbf{\$8{,}200}$$

To check our work, note that the difference between these two prices is $1,000, which is the amount of the tax.

d)



Note that we use the original supply and demand, at the new prices and quantities, to find consumer and producer surplus.

Areas A and B in the above graph represents consumer surplus. This is a triangle with a height of 1,800 (= 10,000-8,200) and a base of 3,600. Its area = 0.5(1,800)(3,600) = **$3,240,000**.

Area I in the above graph represents producer surplus. This is a triangle with a height of 7,200 and a base of 3,600. Its area = 0.5(7,200)(3,600) = **$12,960,000**.

e) Revenue is simply the tax times the quantity sold.

$1,000 x 3,600 = **$3,600,000**.

On the above graph, revenue is the rectangle represented by areas CDFG.

f) Before the tax, the sum of consumer and producer surplus was $20,000,000. Afterwards, the sum of consumer surplus, producer surplus, and revenue is $19,800,000. The difference is $**200,000**. Graphically, this is the area of triangles E & H.

This difference is the deadweight loss. It is the value of lost opportunities, because some potentially beneficial transactions do not occur after the tax. For the quantities between 3,600 and 4,000, demand is above supply. This tells us that consumers are willing to pay more than the marginal cost of producing a sailboat. However, because of the tax, these units are not sold. The potential producer or consumer lost because of this is the deadweight loss.

g) Suppliers bear the bigger burden. Their price received falls by $800, while the price paid by consumers increases by only $200. Since we know that the more inelastic party bears the larger burden of a tax, this tells us that supply is more inelastic than demand.