ECON 110, Professor Hogendorn

Problem Set 3

Note: problem 4 *UAW* mentions a subsidy, which is just the opposite of a sales tax. To see how it works, look at review problems *Veerman* and *UAW*.

1. *Five-Households.* Suppose there are 5 households, each with demand curve $Q = 10p^{-2}$. Derive and graph the market demand curve. What is the total consumer surplus when $p = 2$?

2. *JFK.* You take a job with a cargo company at JFK Airport in New York City. JFK's air cargo business has been suffering in recent years because new aircraft are able to fly directly from international destinations to interior U.S. airports such as Memphis and Kansas City. Some of the other cargo firms serving JFK decide to petition the Port Authority of New York and New Jersey to intervene in the market. Based on your economics training, you believe that demand is quite elastic (because there are many substitute airports) and supply is inelastic (because it is hard to leave or enter the industry).

   (a) Draw a supply and demand diagram with linear curves (be careful about the elasticities). Label the equilibrium price and quantity.

   (b) Some firms are lobbying for a price floor p_f above the market equilibrium price. Show the resulting quantity q_f and show the effect on consumer and producer surplus and deadweight loss.

(c) Do you recommend that your firm lobby for this policy? Remember that you are only considering the costs and benefits for your firm, but these may differ in the short and long run. The answer is ambiguous, so state your reasoning.

3. *Dollar-sales-tax.* Demand is $Q = 40 - 3p$ and supply is $S = 2p$.

   (a) What is the equilibrium price and quantity? What is the consumer and producer surplus?

   (b) If a \$1 per unit sales tax is imposed on this good, what is the new equilibrium price and quantity? What is the new consumer and producer surplus? What is the deadweight loss of the tax? How much revenue does the tax generate?

4. *UAW.* In the aftermath of the financial crisis of 2008, the United Auto Workers union made certain concessions to American carmakers. These concessions were complex, but the important effect is that, on average, wages fell in the American auto industry.

   Let's treat the market for GM, Ford, and Chrysler cars separate from other carmakers so we don't have to worry about imports. The car market might look something like this:
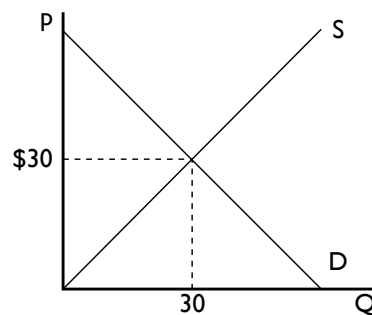
   Note that both the supply and demand curves in this graph are drawn at 45-degree angles.

(a) Using the equilibrium point and the 45-degree slopes of the curves, find the demand and supply equations Q(p) and S(p).

(b) What is the price elasticity of demand and price elasticity of supply at the equilibrium point? (Answer the easiest way that you can.)

(c) How much money is spent on cars? How much of this spending is producer surplus? How much is costs? (Illustrate on a graph and give numerical answers.)

(d) Suppose the UAW concessions shifted the supply curve down by $1 (a parallel shift). Redraw the graph showing the old and new curves, and label the increase in consumer surplus, the decrease in costs, and the increase in producer surplus. (These will overlap, so you will need to use letters.)

(e) Redraw the same diagram, with the same downward shift of the supply curve. But this time the shift is caused by a government subsidy. Show the total cost of the subsidy and the deadweight loss.

Review Problems only, not to turn in:

5. *Textbooks.* Suppose the market supply curve for economics textbooks is given by $S = 10p$ and the market demand by $Q = 100 - 10p$. Derive and graph the competitive equilibrium price, quantity exchanged, and consumer and producer surplus.

6. *Fluff.* Fluff toys are very popular. Originally they sold for $35 each, but the manufacturer has run out. So now, the only way to get one is on eBay, where the equilibrium price is $100 and the quantity is 5000.

    (a) Draw a graph of the supply and demand curves in the eBay market. Assume a linear demand curve and an inelastic (but

not perfectly inelastic) supply curve. Label the consumer and producer surpluses.

(b) Suppose that at equilibrium, the price elasticity of demand on eBay is $\epsilon = -1.2$. How many would people want to buy at the official retail price of $35?

(c) Show what would happen if a government law prohibited sales at prices above the official retail price. Label the changes in producer and consumer surplus under the law. Label the deadweight loss. (You can just use letters instead of calculating numerically.)

7. *Veerman.* Former Dutch agriculture minister Cees Veerman owns farms in Holland and France. Let's suppose that he grows turnips, and that his supply curve for turnips is

$$s(p) = 1000 + 6.44p$$

Because he is a small producer, the demand curve for Veerman's turnips is perfectly elastic; that is, he has to accept the market price. Currently that price is €250 per tonne.

(a) Draw and label the supply and demand curves, including the quantity produced by Veerman.

(b) Suppose the European Union offers Veerman a per-unit subsidy of €63 per tonne. The subsidy is paid directly to Veerman. Show the effects of the subsidy in your diagram, including Veerman's new quantity produced.

(c) How much money does Veerman get in subsidy from the EU? How large is the deadweight loss?

(d) What do you think, is the turnip subsidy progressive in the sense that lower income farmers receive a larger subsidy per euro of income? (given the information in this problem, there

is no one correct answer, but you must justify your reasoning.)

Answers to Review Problems:

5. *Textbooks_a.* Supply equals demand when $10p = 100 - 10p$, or $p = 5$. At this price, $q = 50$. The choke price is 10; thus consumer surplus is $\frac{1}{2}(10 - 5)50 = 125$. Producer surplus is $\frac{1}{2}(5 - 0)50 = 125$ as well.
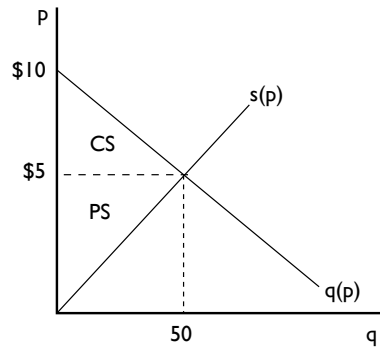
6. *Fluff_a.*

   (a) $CS = A + B$, $PS = C + D$. It might also be fair to add E to the producer surplus. This is because we are diagramming *resellers,* not manufacturers. These resellers are just selling out of a fixed inventory and whatever they paid for each Fluff, whether \$35 or something else, is sunk by the time we get to the secondary market.

5
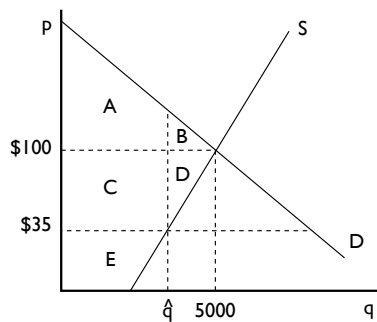
(b) By filling in the blanks in the elasticity formula, we can find the slope of the linear demand curve:

$$\epsilon = \left| \frac{dq}{dp} \frac{p}{q} \right| \Rightarrow 1.2 = \frac{dq}{dp} \frac{100}{5000} \Rightarrow \left| \frac{dq}{dp} \right| = 60$$

Now we know that there is a linear demand curve $q(p) = a - 60p$ and we know it goes through the point $(100, 5000)$. Thus:
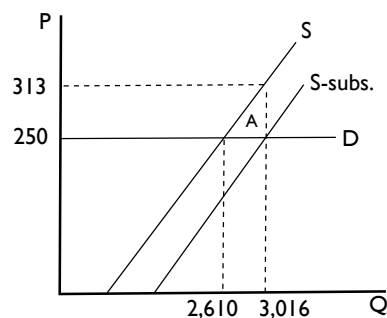
$$5000 = a - 60 \times 100 \Rightarrow a = 11000$$

Then if the price is \$35, the quantity demanded will be

$$q(35) = 11000 - 60 \times 35 = 8900$$

(c) With the price control in place, supply would be the governing curve. The quantity traded would be reduced to q^c. Consumer surplus would change by $C - B$, while producer surplus would change by $-C - D$. The deadweight loss is $B + D$.

7. *Veerman.*

(a) Veerman takes the €250 price as given:

(b) In the graph above, Veerman's supply curve is effectively shifted down by €63 because this represents a decrease in costs to him. As a result, his quantity increases.

(c) The total subsidy to Veerman is €63 times the quantity 3,016, a total of €190,008. The area marked A in the diagram is dead-weight loss. In that area, the costs to Veerman, represented by line S, are greater than the value of 250 that consumers place on turnips. The area of A, one-half the base times the height, is $\frac{1}{2}(3016 - 2610) \times 63 = 12,789$.

(d) We know the turnip subsidy is the same regardless of the quantity of turnips produced. So the answer to the question depends on whether small turnip producers have *proportionately* larger or smaller incomes than large turnip producers. I think there are several reasons to support the regressive story: (1) large turnip producers have large amounts of land, which is probably associated with large income from other sources; (2) there are probably fixed costs associated with turnip production (tractors and equipment, farm buildings, etc.), and large turnip producers can spread this overhead across their output, thus lowering their average cost. But other stories could be told to justify a progressive argument.