

ECON 110, Prof. 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 problem 7, *Veerman*.

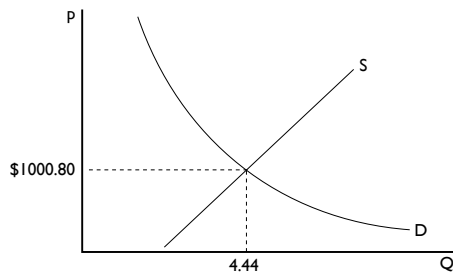
1. *Juvenor*. You take a job at a pharmaceutical market research firm. On your first day, the woman in the cubicle next to you says, “You'd better watch yourself – there was some guy from Amherst here before you, and he only lasted a week.” On your desk you find some handwritten notes:

Assignment: find market equilibrium for *Juvenor* (drug that makes people feel younger) and find consumer surplus.

Data: demand from men: $p = 100 - .02q$, demand from women: $p = 4000q^{-1}$, supply: perfectly inelastic, $q = 1000$.

Solution:

- (a) Find market demand: men+women = $100 - .02q + 4000q^{-1}$.
- (b) set equal to supply: $1000 = 100 - 0.02q + 4000q^{-1} \Rightarrow q = 4.44$
- (c) Draw graph:



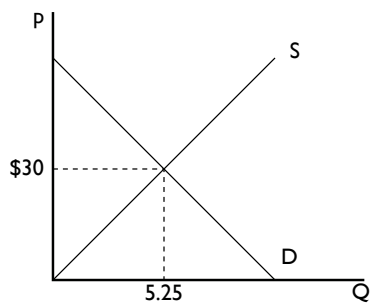
- (d) Find consumer surplus: $CS = \int_0^{4.44} 100 - 0.02q + 4000q^{-1} dq$

At this point, there is some scratch work on the integral, and then a line trailing off to the lower right corner of the page. Your boss tells you that the data are correct, but you should redo each step of the solution, and explain what mistakes your predecessor made.

2. *Accord.* The Honda Accord is a popular midsize car. The base model is called the LX and sells for \$21,180. Honda sold about 24,000 Accords in the USA in the month of September 2010. An economist has estimated that the price elasticity of demand for the Honda Accord is about -4.5.
 - (a) Using the information above, do a back-of-the-envelope calculation to find a linear demand curve for Honda Accords.
 - (b) The elasticity estimate is high in magnitude, certainly far higher than what we discussed in the class about the oil market. Why do you think the elasticity for Accords is so high? Do you think the elasticity of demand for a Tesla Roadster is similarly high? (The Tesla Roadster is a \$109,000 2-seat sports car with an electric motor.)
 - (c) Not all Honda Accords are sold in the LX trim mentioned above. For example, there is also the EX-L V-6, which has a bigger engine and various luxury accessories, but costs about \$29,000. Do consumers who buy the EX-L V-6 get more or less consumer surplus than those who buy the LX? (There is no one correct answer, but you should discuss the various differences between the two cases.)
 - (d) Let the supply curve of Honda Accords be $s(p) = 20,000 + 0.19p$. What is the price elasticity of supply at the price and quantity given above?

3. *Dollar-sales-tax.* Demand is $Q = 40 - 3p$ and supply is $S = 2p$.
- What is the equilibrium price and quantity? What is the consumer and producer surplus?
 - If a \$1 per unit sales tax is imposed on Q , 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* Recently the United Auto Workers union has made some concessions to General Motors, and will likely make the same concession to Ford and Chrysler. These concessions are complex, but the important effect is that, on average, wages will be lower 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 market might look something like this:



Note that both the supply and demand curves in this graph are drawn at 45-degree angles. (Just for information, the prices are in thousands and the quantities are in millions, but it's easier just to work with them as they are on the graph.)

- 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 in 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?
- (d) Suppose the UAW concessions shift 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 or colors to make this clear.)
- (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.
- (f) Explain why the union concessions do not add deadweight loss but the subsidy does.

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. *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 $p = 2$?
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

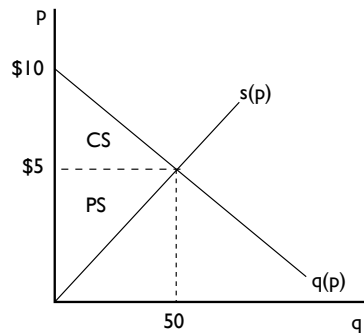
$$s(p) = 1000 + 6.44p$$

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.

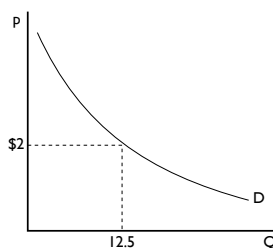


6. *Five-Households_a*. We can simply add quantities up (horizontal addition in the graph). Thus the market demand function is 5 times the individual demand function, or $Q = 50p^{-2}$.

To find the consumer surplus, note there is no choke price, and therefore the integral is improper. But the answer is:

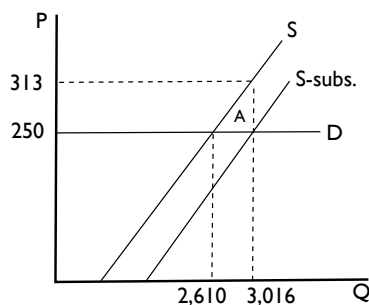
$$\int_2^{\infty} 50p^{-2} = \lim_{t \rightarrow \infty} \int_2^t 50p^{-2} = \lim_{t \rightarrow \infty} -50t^{-1} + 50 \cdot 2^{-1} = 0 + 25 = 25$$

The graph is:



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

deadweight 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 a flat in the sense that it 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.