ECON 110, Prof. Hogendorn

Problem Set 4

1. *ChinaAutoPartsTariff.* The following excerpt is from John W. Miller, "China-Tariff Discord Escalates," *The Wall Street Journal,* September 13, 2006, A2:

   "BRUSSELS -- The U.S., the European Union and Canada are set to file a joint complaint with the World Trade Organization against China's import tariffs on auto parts, said people familiar with the matter.

   "In March the three governments filed a preliminary complaint against Chinese protection of its auto-parts manufacturers. In negotiations with the governments, China has refused to change its protectionist policy, which charges an average 25% levy on imported auto parts. That leaves formal complaint as a last recourse at the WTO for Washington, Brussels and Ottawa."

   Total U.S. and EU exports of auto parts to China are valued at about $5 billion per year. Let the world price of auto parts be $1, and let China's domestic demand curve be $q(p) = 40.25 - 17p$.

   (a) Draw the effect of the tariff on a graph of the Chinese auto parts market. Show what deadweight losses China causes itself. In words, how do you interpret the deadweight losses?

   (b) Assume that current imports into China of auto parts are 5 billion units. What is the quantity supplied by Chinese producers?

   (c) Suppose that Chinese auto parts suppliers have a supply elasticity of $\varepsilon = 1.2$. What is the change in Chinese producer surplus that results from the tariff?

2. *MexicanFarmers.* Mexico's farmers are about as productive as U.S. farmers, but "local farmers are still going out of business because their costs – from diesel to electricity to credit – are about a third higher than those north of the border." "While the country's farmers are being exposed to the full force of world competition, they are saddled with artificially high costs because much of the rest of the economy consists of public or private monopolies sheltering behind legal and constitutional barriers to competition." (*The Economist,* Nov. 30, 2002, pg. 32.)

   (a) Suppose that U.S. farmers are willing to supply any amount of corn at $2 per bushel. (This is akin to the "world price" of corn.) Suppose that Mexican farmers have supply curve $s(p) = -10 + 10p$. Let Mexican demand for corn be $q(p) = 50 - 5p$. How many bushels do Mexican farmers produce? How many do Mexican consumers buy? How large are imports from the U.S.?

   (b) Draw a graph of (a).

   (c) Actually, the North American Free Trade Agreement (NAFTA) allows Mexico to impose a tariff of about 70% on corn imports from the U.S. With the tariff, how much corn do Mexican farmers produce, and how much is imported?

   (d) Draw the tariff on your graph, and label the changes in producer and consumer surplus, the tariff revenue, and the deadweight losses.

   (e) If the goal is to help Mexican farmers, would the tariff work better if their supply were more elastic? Would the tariff then be better or worse for Mexicans as a whole? (Hint, use your graph and change the slope of the supply curve so that the same tariff causes a larger % increase in supply.)

3. *Lawns.* Grass lawns create a variety of negative externalities, in-

cluding air and noise pollution from mowing, herbicide and pesticide pollution, water scarcity from irrigation, and destruction of woody plants and shrubs that provide better wildlife habitat and carbon sequestration. The average American household spends around $1200 per year on lawn care (obviously this varies enormously by household, but that's the average). Again using an average, there is about 1/3 acre of lawn per household (lawns are America's biggest and most polluting agricultural "crop").

(a) Use the data point of price equals $1.2 thousands and quantity equals 0.33, and suppose that the (private) price elasticity of demand for lawn is $|\varepsilon| = 1.5$. What is a back-of-the-envelope linear demand curve for lawns? (Let $p = 1.2$, this problem is easier in thousands.)

(b) Let the supply curve for lawns (really for lawn care products and services) be $s(p) = 0.25 + 0.067p$. What is the equilibrium price, quantity, consumer, and producer surplus from lawns?

(c) Suppose that the negative externalities from lawn *consumption* add up to $400 per acre. What is the social demand curve $q_s(p)$?

(d) What is the social equilibrium? How much deadweight loss is there? Calculate numerically and show on a graph.

(e) If the government administered a Pigouvian tax by making each household pay $400 per acre of lawn, how much tax revenue would be generated? Calculate numerically and show on a graph.

4. *Silicon Valley.* In Silicon Valley, there are many information technology (IT) firms clustered in one place. This is usually attributed to positive externalities in production: when firm produces a product, the skilled workers can exchange ideas with one another, with

venture capitalists, and so on. Thus, firms in Silicon Valley are more productive than similar firms elsewhere.

(a) Graph the supply and demand curves for one IT good (e.g. web servers) in Silicon Valley. Show the positive externality in production.

(b) Label the graph to show the external benefits and the deadweight loss in both the free-market and the socially optimal situations.

(c) If the California government were to intervene in this market, what should it do?

Review Problems only, not to turn in:

5. *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 Europe 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.

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 $\varepsilon = -1.2$. 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.

7. *Tariff*. Let domestic demand be $q(p) = 60 - 2p$ and supply is $s(p) = p$. Let the world price be 10.

   (a) Under free trade, what is the quantity imported and what is domestic consumer and producer surplus?

   (b) If the government imposes a tariff of $5 per unit imported, how much revenue is generated, and what are the new domestic consumer and producer surpluses? How big is the deadweight loss?

8. *Sugar.* Read the following beginning to an article:

Michael Schroeder, "Sugar Growers Hold Up Push For Free Trade," *The Wall Street Journal,* February 3, 2004, pg. A13.

WASHINGTON – The sugar industry – which accounts for less than 1% of all U.S. farm sales but 17% of agriculture's political contributions since 1990 – is proving to be an obstacle to Bush administration efforts to keep the free-trade ball rolling.

The industry not only is the sticking point in the administration's plans to get congressional backing for a free-trade pact with Central America, but also is gumming up talks toward a free-trade pact with Australia.

Australia, the world's fourth-largest sugar exporter, wants to sell more sugar to the U.S. in exchange for lowering the tariffs it levies on U.S.-made goods. Australia currently sells the U.S. 87,000 metric tons of sugar a year, less than 1% of the 10 million tons of sugar consumed in the U.S. Caps on sugar imports long have kept the U.S. price of refined sugar at twice the world market price.

(a) Assume that all U.S. imports of sugar come from Australia for the purposes of this problem, and assume that sugar is subject to a *tariff.* Draw a supply and demand diagram of the U.S. market for sugar, showing the tariff and the amount of imports and sugar consumed. You don't have to draw the diagram perfectly to scale, but try to capture all of the information in the final paragraph above.

(b) Label the effects of the tariff, showing changes in producer and consumer surplus, deadweight losses, etc. With reference to these effects, describe why the sugar industry works hard to maintain the trade barrier and why the government, on behalf of the country in general, is working to end it.

9. *Fatburgers.* There are 400 fatburger consumers and 100 fatburger producers. The price of a fatburger, p, is measured in cents. Each of the 400 consumers has demand curve

$$q_i(p) = 100 - \frac{p}{4}$$

Each producer has supply curve

$$s_i(p) = 4(p - 5)$$

(a) Determine the market supply and demand, find the equilibrium price, and draw on a graph.

(b) The government imposes a per-unit sales tax of t cents per fatburger. Find the new equilibrium price and quantity as a function of t.

(c) Show that the government achieves the maximum possible tax revenue when it sets $t = 197.5$ cents. You will need to find and maximize the government's revenue as a function of t.

(d) How much does the tax in part (c) reduce consumer surplus and producer surplus, and how much deadweight loss does it cause? Show on a graph as well as giving numerical results.

(e) You have just learned that when people eat fatburgers, it causes significant long-term health problems. Much of the cost of these health problems is paid for by the government rather than the individuals. In fact, careful analysis suggests that the government ends up paying $1.975 in health costs for every fatburger eaten. Show how this information changes the graphical analysis of part (d). (Numerical results are not necessary.)

10. *NetAlone.* Suppose netalone.com is an Internet startup that specializes in e-business consulting. The following table summarizes the company's projected earnings in the next 5 years:

Year	Earnings
2009	100,000
2010	300,000
2011	500,000
2012	700,000
2013	1,000,000

The CEO of netalone.com announced that the company was going to issue 10,000,000 shares of common stock and the IPO (initial public offering) price was set at $1 per share. (A share of stock entitles you to a share of ownership of the company, and the company's value is based on its earnings.) Suppose the market discount rate is 10%. Based on the above earnings forecast, will you buy the stock? What do you think is a more reasonable price?

Answers to Review Problems:

5. *JFK_a.*

   (a) The equilibrium point must be on the upper half of the demand curve, and the supply curve must intercept the horizontal axis.
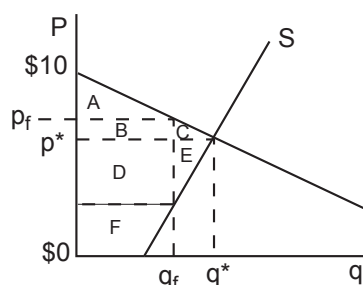
   (b) Demand must be the governing curve because it is not possible to sell more than people are willing to buy. CS is reduced by $B + C$ and PS is reduced by E but increased by B. $C + E$ is the deadweight loss.

(c) First, note that we are talking about just your firm, while the curves represent all firms. *Some* firm(s) will lose customers under the price floor, since the quantity sold falls. If you are concerned that your firm will suffer a disproportionate share of this reduction, you might not favor the price control.

Also, these curves are probably short-run curves. In the long run, elasticity of demand is likely to rise, as consumers find new airports and new alternatives for shipping air freight. Thus the gains today may be smaller or even turn to losses in the future.

6. *Fluff_a.*

(a) $CS = A + B, PS = C + D + E$. Adding area E to PS may seem surprising, but the resellers of used Fluffs have no opportunity cost and their original retail purchase cost is sunk by the time we get to the secondary market.
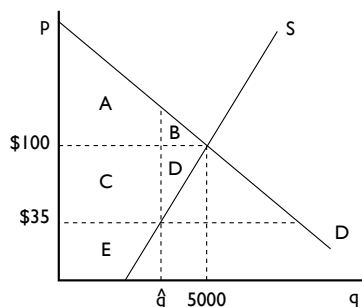
(b) By filling in the blanks in the elasticity formula, we can find the slope of the linear demand curve:

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

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:

$$5000 = a - 60 \times 100 \Rightarrow a = 11000$$

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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. *Tariff_a.*

(a) $q(10) = 60 - 2 \cdot 10 = 40$ and $s(10) = 10$, so imports are 30. The choke price is 30, so consumer surplus is $\frac{1}{2}(30 - 10)40 = 400$. Domestic producer surplus is $\frac{1}{2}10 \cdot 10 = 50$. Total surplus is 450.

(b) The price with the tariff is 15, so $q(15) = 60 - 2 \cdot 15 = 30$ and $s(15) = 15$. Imports fall to 15 units, and government revenue is $15 \cdot 5 = 75$. The new consumer surplus is $\frac{1}{2}(30 - 15)30 = 225$ and the new domestic producer surplus is $\frac{1}{2}15 \cdot 15 = 112.5$. The total surplus is 412.5, so the deadweight loss is 37.5.

8. *Sugar_a.*

(a)
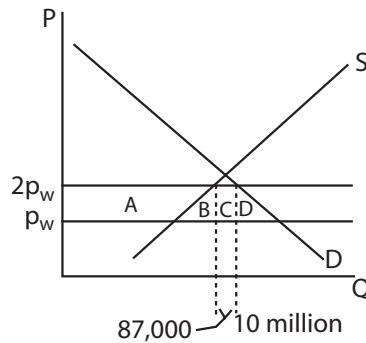
(b) The effect of the tariff is to reduce consumer surplus by $A +$ $B+C+D$. A is an increase in producer surplus, C is the tariff revenue, and B and D are deadweight losses. The sugar industry gains a great deal from the tariff, since A is quite large, but for the country as a whole the tariff is bad. True, A and C are just transfers between the government's various constituents, but B and D are lost entirely to the U.S. economy. The country as a whole is better off with no tariff.
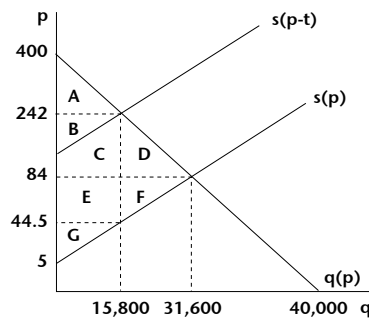
9. *Fatburgers_a.*

(a) Market demand: $q(p) = 400q_i(p) = 40,000 - 100p$. Market supply: $s(p) = 100s_i(p) = 400(p - 5)$.

$$
\begin{aligned}
40,000 - 100p &= 400(p - 5) \\
42,000 &= 500p \\
p &= 84 \\
q(84) &= 31,600
\end{aligned}
$$

(b) This is a sales tax, so it is paid by producers and thus shifts the supply curve to $s(p-t)$ in the diagram. The new equilibrium price and quantity is found as follows:

$$
\begin{aligned}
40,000 - 100p &= 400(p - t - 5) \\
42,000 &= 500p - 400t
\end{aligned}
$$

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$$p(t) = 84 + \frac{4}{5}t$$
$$q(p(t)) = 31,600 - 80t$$

(c) The government's revenue function is $R(t) = tq(p(t)) = 31,600t - 80t^2$. We can maximize this function by taking the derivative and setting equal to 0:

$$\frac{dR(t)}{dt} = 31,600 - 160t = 0 \Rightarrow t^* = 197.5$$

(d) First, using the formulas from (b) we can find that $p(197.5) = 242$ and $q(p(197.5)) = 15,800$. Then in the graph, we have the following:

$\Delta CS = -B - C - D$
$= -(242 - 84)15,800 - \frac{1}{2}(242 - 84)(31,600 - 15,800) = -3,744,600.$
$\Delta PS = -E - F$
$= -(84 - 44.5)15,800 - \frac{1}{2}(84 - 44.5)(31,600 - 15,800) = -936,150$
$DWL = D + F = \frac{1}{2}(242 - 44.5)(31,600 - 15,800) = 1,560,250$

(e) This is a very tricky question! There is actually a negative externality in *consumption* of fatburgers. That means that the social benefit is less than the demand curve. But we don't actually know anything about the shape of the q_{soc} curve, perhaps it is some nonlinear curve like in the diagram below. All that we know is that at the $q = 15,800$ point, the negative externality is exactly equal to the sales tax.
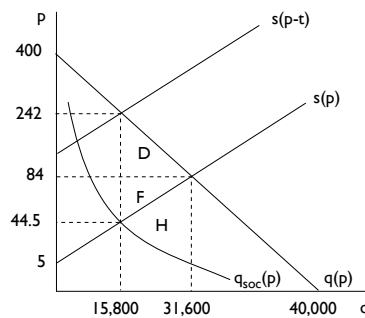
Without the tax, there would be a deadweight loss of area H. There would be too much consumption, and the costs $s(p)$ would exceed the benefits q_{soc}.

The sales tax corrects for the externality perfectly at the $q = 15,800$ point. It is not a true Pigouvian tax in the sense that if there were any shifts in the supply curve, it would no longer be optimal. But the supposed deadweight loss of $D + F$ that we found in part (d) turns out not to be a deadweight loss at all. Instead, it turns out that it was private consumer and and producer surplus that was exactly offset by the negative health externality.

10. *NetAlone_a.*

  (a)

  $$PV = \frac{100000}{1.10} + \frac{300000}{1.10^2} + \frac{500000}{1.10^3} + \frac{700000}{1.10^4} + \frac{1000000}{1.10^5} = 1813531$$

  The present value of the earnings per share is thus $0.18. Paying $1 per share is too much unless there will be extremely spectacular growth after 2013. A price of $0.18 per share would be the fair value assuming that earnings beyond 2013 are not counted.