Principles of Economics I: Microeconomics Midterm [11/14/2007]

1. (15%) Suppose that the price of undergraduate dormitory rooms at National Taiwan University is determined by market forces. Currently, the demand and supply schedules are as follows:

Rent/month	Quantity Demanded	Quantity Supplied
NT$2,000	8,000 rooms	5,000 rooms
4,000	7,000	5,000
6,000	6,000	5,000
8,000	5,000	5,000
10,000	4,000	5,000
12,000	3,000	5,000

   a. Draw the demand and supply curves. What is unusual about this supply curve? Why might this be true?
   b. What are the equilibrium price and quantity of rooms?
   c. The College of Law and the College of Social Sciences are moving back to the Main Campus of National Taiwan University in the year 2010. The additional students will have the following demand schedule:

Rent/month	Quantity Demanded
NT$2,000	3,000 rooms
4,000	2,500
6,000	2,000
8,000	1,500
10,000	1,000
12,000	500

   Now add the old demand schedule and the demand schedule for the new students to calculate the new demand schedule for the entire university. What will be the new equilibrium price and quantity?

2. (10%) Suppose that business travelers and student travelers have the following demand for the Taiwan High Speed Railway from Taipei to Kaohsiung:

Price	Quantity Demanded (business travelers)	Quantity Demanded (student travelers)
NT$400	3,000 tickets	6,000 tickets
800	2,800	5,000
1,200	2,600	4,000
1,600	2,400	3,000
2,000	2,200	2,000
2,400	2,000	1,000

   a. As the price of tickets rise from NT$1,600 to $2,000, what is the price elasticity of demand for (i) business travelers and (ii) student travelers? (Use the midpoint method in your calculations.)
   b. Why might student travelers have a different elasticity from business travelers?

3. (25%) A subsidy is the opposite of a tax. With a $200,000 subsidy for each student who attends NTU for one year, the government pays each student $200,000 to study at NTU for one year.
    a. Show the effect of a NT$200,000 per year tuition subsidy on the demand curve for studying at NTU, the effective tuition paid by students, the effective price of education received by the university, and the quantity of students enrolled.
    b. Individually, do students gain or lose from this policy? Does NTU gain or lose? Does the government gain or lose?
    c. How does the subsidy affect consumer surplus of the students, producer surplus of NTU, tax revenue, and total surplus? Does a subsidy lead to a deadweight loss? Explain.
    d. Where does the funding of these subsidies come from? Do you think it's really "fair" to provide NTU students such a subsidy? Why or why not?

4. (20%) Suppose that the market for NTU boxed lunches (小福便當) is described by the following demand and supply equations:

$$Q^S = -50{,}000 + 1{,}500P$$

$$Q^D = 75{,}000 - 1{,}000P$$

    a. Solve for the equilibrium price and quantity of boxed lunches.
    b. Suppose that a tax of NT$5 is placed on the buyers of NTU boxed lunches, so that the new demand function is

$$Q^D = 75{,}000 - 1{,}000(P + 5)$$

    Solve for the new equilibrium. Calculate the price received by sellers, the price paid by buyers, and the quantity sold.
    c. Tax revenue is NT$5 x Q. Use your answer in part (b) to solve for tax.
    d. The deadweight loss of a tax is the area of the triangle between the supply and demand curves. Solve for the deadweight loss caused by this $5 tax.

5. (20%) Assume that Taiwan is an importer of towels and there are no trade restrictions. Taiwan consumers buy 23 million towels per year, of which 8 million are produced domestically and 15 million are imported. (Assume supply and demand are straight lines.)
    a. Suppose that a technological advance among Chinese towel manufacturers causes the world price of towels to fall by NT$20. Draw a graph to show how this change affects the welfare of Taiwanese consumers and Taiwanese producers and how it affects total surplus in Taiwan. (Assume the supply and demand curves are straight lines.)
    b. After the fall in price, Taiwanese consumers buy 30 million towels, of which 2 million are produced domestically and 28 million are imported. Calculate the change in consumer surplus, producer surplus, and total surplus from the price reduction.
    c. If the government responded by putting a $20 tariff on imported towels, what would this do? Calculated the revenue that would be raised and the deadweight loss. Would it be a good policy from the standpoint of Taiwan's welfare? Who might support this policy?

6. Use no more than 200 words each (and/or < 3 graphs) to answer the following questions:
    a. (8%) 1988 was the "year of dragon." Can you predict whether the number of births in Taiwan was temporary high or low in that year? How does this (baby boom or bust) affect the competitiveness of the college admission in 2006? What about the price of high-school tutors in 2004 and 2008?
    b. (2%) Why do the same people allow their dogs to pooh-pooh in the park, but not in their living room? (What are the "incentives" people face in each situation?)

7. (Bonus Question: 40%) The Love River running nearby Kaohsiung city has two polluting pig feeding companies on its banks. Ace Pig and Big Fat Piggy each dump 100 tons of glop into the river each year. The cost of reducing glop emissions per ton equals NT$1,000,000 for Ace Pig and NT$50,000 for Big Fat Piggy. To make the Love River cleaner, the local government wants to reduce overall pollution from 200 tons to 100 tons.
    a. Is the Love River a public good or a common resource? Would people overuse or under-use Love River? Is a pollution reduction a public good or a common resource? Would people over-reduce or under-reduce pollution?
    b. If the government knew the cost of reduction for each firm, what reductions would it impose to reach its overall goal? What would be the cost to each firm and the total cost to the firms together?
    c. In a more typical situation, the government would not know the cost of pollution reduction for each firm. If the government decided to reach its overall goal by imposing uniform reductions on the firms, calculate the reduction made by each firm, the cost to each firm, and the total cost to the firms together.
    d. Suppose the government decides to give each firm 50 tradable pollution permits. Who sells permits and how many do they sell? Who buys permits and how many do they buy? Briefly explain why the sellers and buyers are each willing to do so. (Where did the gains from trade come from?) What is the total cost of pollution reduction in this situation?
    e. Compare the total cost of pollution reduction in parts (b), (c) and (d). If the government does not know the cost of reduction for each firm, what is the best way to proceed?
    f. Suppose the government has to compensate the cost, but can only offer the same compensation for all firms. What is the minimum compensation the government has to pay each firm so that both would accept a uniform pollution reduction of 50 tons each? What is the total cost?
    g. Suppose the firms are each granted 100 tradable pollution permits. If the government wants to buy back 100 permits, what is the minimum price per permit it has to pay? Who will sell the permit to the government at this price? What is the total cost? Is this less costly than that of part (f)?
    h. What is the difference between property rights in part (d) and (g)? What is the difference in terms of outcome efficiency? Explain why according to the Coase Theorem, this result is more or less expected.
    i. By creating a tradable pollution permit market, the government defined property rights clearly and lowered transaction cost and realized some gains from trade previously unavailable. What are some other things that can benefit from such a property right and market creation process?

Midterm Suggested Answers
[Note: The graphs have the wrong numbers and caption, but you get the idea.]

1. a. (5%) As Figure 1 shows, the supply curve is vertical. The constant quantity supplied makes sense because the undergraduate dormitory has a fixed number of rooms at any price.

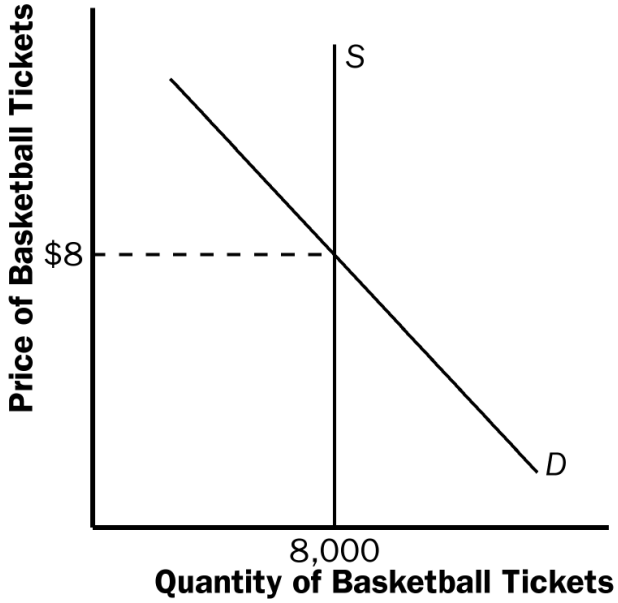

Figure 1

b. (5%) Quantity supplied equals quantity demanded at a rent of NT$8,000 per month. The equilibrium quantity is 5,000 rooms.

c. (5%)

Rent / month	Quantity Demanded	Quantity Supplied
NT$2,000	11,000	5,000
4,000	9,500	5,000
6,000	8,000	5,000
8,000	6,500	5,000
10,000	5,000	5,000
12,000	3,500	5,000

The new equilibrium price will be NT$10,000, which equates quantity demanded to quantity supplied. The equilibrium quantity remains 5,000 rooms.

[This question is similar to homework---Ch.4, Problem 12.]

2. a. (8%) For business travelers, the price elasticity of demand when the price of tickets rises from $1,600 to $2,000 is [(2,400 – 2,200)/2,300]/[(2,000 – 1,600)/1,800] = 0.087/0.222 = 0.39. For student travelers, the price elasticity of demand when the price of tickets rises from $1,600 to $2,000 is [(3,000 – 2,000)/2,500]/[(2,000 – 1,600)/1,800] = 0.40/0.222 = 1.8.

b. (2%) The price elasticity of demand for vacationers is higher than the elasticity for business travelers because students can choose more easily a different mode of

transportation (like driving or taking the train) or less frequent trips back home. Business travelers are less likely to do so because time is more important to them and their schedules are less adaptable.

[This question is similar to homework---Ch.5, Problem 2.]

3. a. (5%) The effect of a NT$200,000 per year subsidy is to shift the demand curve up by $200,000 at each quantity, because at each quantity a student's willingness to pay is $200,000 higher. The effects of such a subsidy are shown in Figure 5. Before the subsidy, the price is P_1. After the subsidy, the price received by NTU is P_S and the effective tuition paid by students is P_D, which equals P_S minus $200,000. Before the subsidy, the quantity of students enrolled is Q_1; after the subsidy the quantity increases to Q_2.

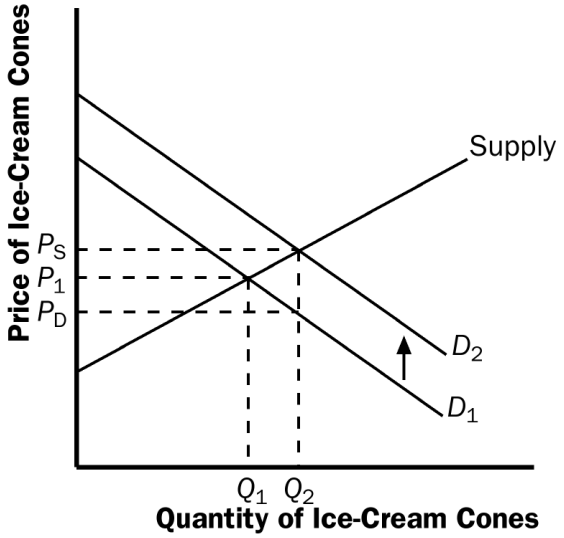

Figure 3

b. (5%) Because of the subsidy, students are better off, because more students enroll at a lower price. NTU is also better off, because they enroll more students at a higher "price." The government loses, because it has to pay for the subsidy.

c. (10%) Figure 4 illustrates the effects of the NT$200,000 subsidy on tuition. Without the subsidy, the equilibrium price is P_1 and the equilibrium quantity is Q_1. With the subsidy, students pay price P_B, NTU receive price P_S (where $P_S = P_B$ + NT$200,000), and the quantity sold is Q_2. The following table illustrates the effect of the subsidy on consumer surplus, producer surplus, government revenue, and total surplus. Because total surplus declines by area D + H, the subsidy leads to a deadweight loss in that amount.

	OLD	**NEW**	**CHANGE**
Consumer Surplus	A + B	A + B + E + F + G	+(E + F + G)
Producer Surplus	E + I	B + C + E + I	+(B + C)
Government Revenue	0	–(B + C + D + E + F + G + H)	–(B + C + D + E + F + G + H)
Total Surplus	A + B + E + I	A + B – D + E – H + I	–(D + H)

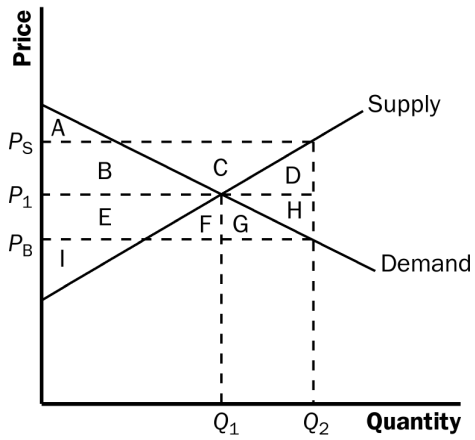

Figure 4

d. (5%) The government subsidy of NTU education is funded by tax dollars. This may not be "fair" since most NTU students come from relatively wealthy families, making this subsidy a reverse redistribution (from the poor to the rich).

[This question is similar to homework---Ch.6, Problem 11; Ch.8, Problem 10.]

4. a. (5%) Setting quantity supplied equal to quantity demanded gives -50,000 + 1,500P = 75,000 – 1,000P. This gives us 2,500P = 125,000. Dividing both sides by 2,500 gives P = 50. Plugging P = 50 back into either equation for quantity demanded or supplied gives Q = 25,000.

b. (9%) Now P is the price received by sellers and $P + T$ is the price paid by buyers. Equating quantity demanded to quantity supplied gives -50,000 + 1,500P = 75,000 – 1,000(P+T). Adding 1,000P to both sides of the equation and plugging in T =5 gives 2,500P = 120,000. Dividing both sides by 2,500 gives P = 48. This is the price received by sellers. The buyers pay a price equal to the price received by sellers plus the tax ($P + T$ = 53). The quantity sold is now Q = 22,000.

c. (1%) Since Q = 22,000, tax revenue equals T x Q and \$110,000.

d. (5%) As Figure 5 shows, the area of the triangle (laid on its side) that represents the deadweight loss is 1/2 x base x height, where the base is the change in the price, which is the size of the tax (\$5) and the height is the amount of the decline in quantity (3,000). So the deadweight loss equals 1/2 x \$5 x 3,000 = \$ 7,500.

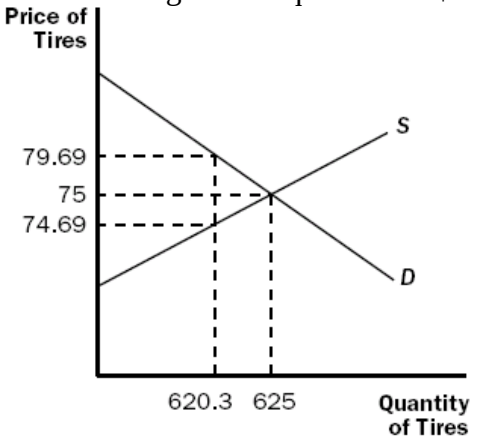

Figure 5

[This question is similar to homework---Ch.8, Problem 12.]

5. a. (5%) When a technological advance lowers the world price of towels, the effect on Taiwan, an importer of towels, is shown in Figure 6. Initially the world price of towels is P_1, consumer surplus is A + B, producer surplus is C + G, total surplus is A + B + C + G, and the amount of imports is shown as "Imports$_1$". After the improvement in technology, the world price of towels declines to P_2 (which is P_1 – NT$20), consumer surplus increases by D + E + F, producer surplus declines by C, total surplus rises by D + E + F, and the amount of imports rises to "Imports$_2$".

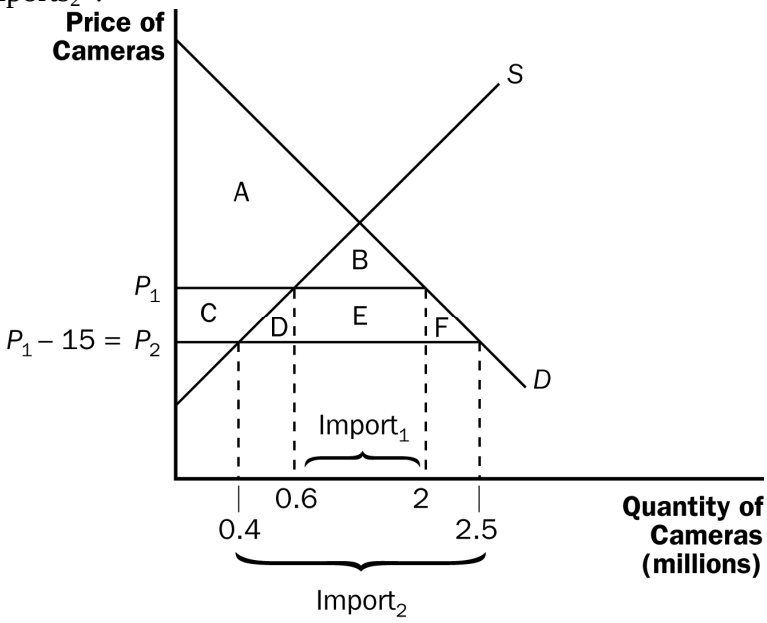

Figure 6

	P_1	P_2	CHANGE
Consumer Surplus	A + B	A + B + C + D + E + F	C + D + E + F
Producer Surplus	C + G	G	–C
Total Surplus	A + B + C + G	A + B + C + D + E + F + G	D + E + F

b. (7%) The areas are calculated as follows: Area C = (8 + 2 million)*0.5*(NT$20) = NT$100 million. Area D = (0.5)(6 million)(NT$20) = NT$60 million. Area E = (15million)(NT$20) = NT$300 million. Area F = (0.5)(7 million)(NT$20) = $70 million.

Therefore, the change in consumer surplus is NT$530 million. The change in producer surplus is -NT$100 million. Total surplus rises by NT$430 million.

c. (8%) If the government places a NT$20 tariff on imported towels, consumer and producer surplus would return to their initial values. That is, consumer surplus would fall by areas C + D + E + F (a decline of NT$530 million). Producer surplus would rise by NT$100 million. The government would gain tariff revenue equal to (NT$20)(15 million) = NT$300 million. The deadweight loss from the tariff would be areas D and F (a value of NT$130 million). This is not a good policy from the standpoint of Taiwan's welfare because total surplus is reduced after the tariff is introduced. However, domestic producers will be happier as they benefit from the tariff.

[This question is similar to homework---Ch.9, Problem 10.]

6. a. (8%) Taiwanese people enjoy having their children during the year of the dragon since that means their children are sons and daughters of the dragon (龍子龍女). Hence, there would be a temporary high birth rate in 1988, which would intensify the competition for college admission in 2006 when these "children of the dragon" turn 18. A temporarily high birth rate in the year 1988 leads to opposite effects on the price of high school tutoring services in the years 2004 and 2008. In the year 2004, there are more 16-year old high school students who need tutors, so the demand for high school tutoring services rises, as shown in Figure 2. The result is a higher price for tutoring services in 2004. However, in the year 2008, the increased number of 20 year old college juniors shifts the supply of high school tutors to the right, as shown in Figure 3. The result is a decline in the price of high school tutoring services.

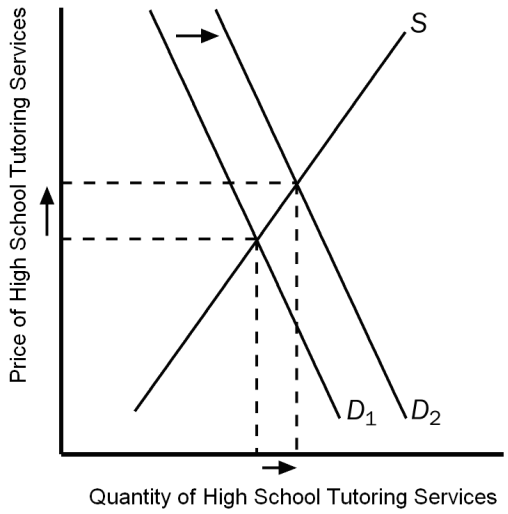

Figure 7

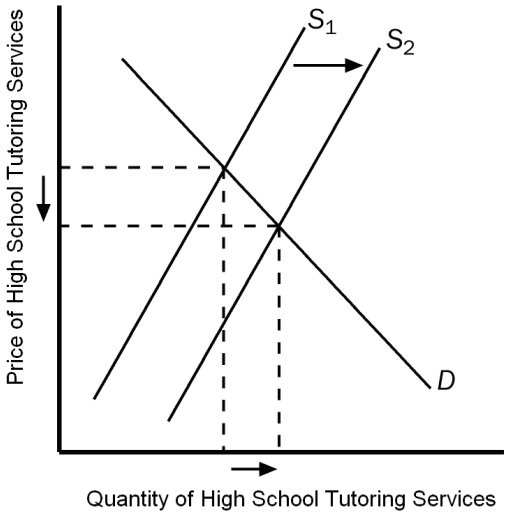

Figure 8

b. (2%) When a person allows his or her dog to pooh-pooh in a public park, others bear the negative externality, so the private costs are low. Allowing your dog to pooh-pooh in your own living room imposes costs on you, so it has a higher private cost and is thus rare.

[This question is similar to homework---Ch.4, Problem 8; Ch.11, Problem 6.]

7. a. (4%) The Love River is a common resource, so people would overuse it; reduction of pollution is a public good, so people would under-reduce pollution.

b. (5%) If the government knew the cost of reduction at each firm, it would only require Big Fat Piggy eliminate all its pollution (at a cost of NT$50,000 per ton times 100 tons = NT$5 million). This minimizes the total cost ($5 million) of reducing the remaining pollution to 100 tons.

c. (5%) If each firm had to reduce pollution to 50 tons (so each had to reduce pollution by 50 tons), the cost to Ace Pig would be 50 x NT$1,000,000 = NT$50 million and the cost to Big Fat Piggy would be 50 x NT$50,000 = $2,500,000. The total cost would be NT$52.5 million.

d. (8%) A permit is worth NT$1,000,000 to Ace Pig and NT$50,000 to Big Fat Piggy, because that is the cost of reducing pollution by one ton. Because Ace Pig faces the highest costs of reducing pollution, it will keep its own 50 permits and buy all 50 permits from Big Fat Piggy, so that it can pollute 100 tons. Thus Ace Pig will not reduces its pollution at all, but Big Fat Piggy will reduce its pollution by 100 tons at a cost of NT$50,000 x 100 = NT$5 million. The total cost of pollution reduction is NT$5 million.

e. (2%) In Part (b) and (d), it costs NT$5 million to reduce total pollution to 100 tons, but in Part (c) it costs NT$52.5 million. So it is definitely less costly to have Big Fat Piggy reduce all of its pollution. Even without knowing the costs of pollution reduction, the government could achieve the same result by auctioning off pollution permits that would allow only 100 tons of pollution. This would ensure that Big Fat Piggy reduced its pollution to zero (because Ace Pig would outbid it for the permits).

f. (3%) If the government has to compensate the cost, it would have to pay each firm at least NT$50 million for a uniform pollution reduction of 50 tons since that is the cost for Ace Pig to reduce its pollution by 50 tons. The total cost is NT$100 million.

g. (6%) If the government has to buy back tradable pollution permits issued and current pollution, it only has to pay NT$50,000 each and buy 100 permits from Big Fat Piggy (since Ace Pig would be outbid). This costs NT$5 million, and is 1/20 of the cost of part (f).

h. (5%) In part (d), the government / people have the property right to a clean Love River, and decided to limit pollution to 100 tons. In part (g), the firms have to property right to use Love River as their dumpster and pollution at will (up to their current amount of 100 tons). However, in both cases, after the trade takes place, it is always Big Fat Piggy who sells all his permits and reduces pollution to zero (possibly by leaving the pig feeding industry entirely), which is the efficient outcome as in part (b).

According to the Coase Theorem, as long as property rights are clearly defined, and the transaction cost of bargaining are negligible, people will cut a deal and induce the socially efficient outcome on their own. Since in both part (d) and (g), property rights are well defined and there is a permit trading market to minimize transaction cost, the final outcomes would both be efficient (and hence, the same).

i. (2%) As Professor Al Roth discussed in the Google video (see class website), organ donation could also benefit from creating an organ market. Moreover, even if paying for a kidney is still out of the question, we may still create a “three way exchange system” as proposed by Roth to realize some of the gains from trade previously unavailable. Another example would be adoption (instead of a baby market), which provide infertile parents a chance to raise children who come from, say, teenage pregnancy.

[This question is a combination of real world questions and several homework--- Ch.10, Problem 8 and 12; Ch.11, Problem 1.]