Spring 2007
14.44-14.444

Problem Set 3
Due March 2, 2007

1. a. What is the difference (conceptually) between the short run price and income elasticities of the demand for gasoline and the long run price and income elasticities of the demand for gasoline?

b. Why are measured long-run elasticities larger than measured short-run elasticities?

c. Assume that the government offered a payments of (say) $1000 to car owners who scrapped cars older than 8 years. How would this affect the measured long-run price elasticity of the demand for gasoline?

2. Assume that a consumer has a choice between the following three different air conditioner models that have the same cooling capacity but different energy efficiency ratings. The air conditioners last for ten years

Model	Purchase Price	Annual Operating Cost
1	$200	$75
2	$250	$60
3	$300	$50

a. Calculate the total life-cycle cost for each model assuming that the AC unit is purchased at the beginning of year 1 and the annual interest rate is 10% per year

b. Which model would a consumer with a 10% discount rate choose?

c. Which model would a consumer with a 15% discount rate choose?

d. How high would a consumer's discount rate have to be for her to choose Model #1?

3. There is a fixed amount of coal (Q) available that can be consumed in period 1 (q_1) and/or period 2 (q_2). The demand function for coal in each period is the same and is qiven by

$$q_1 = 200 - p_1$$

$$q_2 = 200 - p_2$$

$$Q = q_1 + q_2$$

where p_1 and p_2 are the prices for coal in each period. Assume that the marginal extraction cost is zero.

a. Calculate the equilibrium price and quantity in each period assuming that Q = 169, the discount (interest) rate used by coal suppliers is 10% per year, and coal suppliers are price takers (behaves competitively)

b. Calculate the equilibrium price and quantity in each period assuming that Q = 169, the discount (interest) rate used by coal suppliers is 20% per year, and coal suppliers are price takers (behaves competitively).

c. Calculate the equilibrium price and quantity in each period assuming that Q = 400, the discount (interest) rate used by coal suppliers is 10% per year, and coal suppliers are price takers (behaves competitively).

d. How would an increase in the interest rate to 20% in (c) affect your answer and why?

e. Calculate the equilibrium price and quantity in each period assuming that Q = 169, there is a monopoly coal supplier that owns the entire resource, and the monopoly uses a discount (interest) rate of 10% per year.

4. About 75 million barrels per day of oil were produced and consumed globally just prior to the war in Iraq and the world market price (P) was $30/barrel. At the beginning of the war in Iraq about 3.0 million barrels per day of Iraqi supplies were taken off of the market.

a. Assume that the short-run world demand (Q_d) for oil can be characterized by the following demand curve and that the short-run supply (Q_s) of oil from other suppliers is perfectly inelastic:

$$Q_D = 78.75 - .125P$$

$$Q_S = 75 - \text{curtailments}$$

What is the effect on world market prices of curtailments of 3 million barrels per day?

b. Assume instead that there is some short run supply response that can be characterized by the short-run supply function:

$$Q_S = (67.5 - \text{curtailments}) + .25P$$

What is the effect on world oil prices of curtailments of 3 million barrels per day under these short-run supply conditions?

5. Adherents to Hubbert's "peak oil" theories have continually had to revise their projections upward for the year that global supplies of petroleum would peak and begin to decline. List and discuss briefly four reasons for this phenomenon.

6. Discuss (briefly) how you would go about determining empirically whether or not OPEC is an effective cartel?

<u>For those enrolled in 14.444 only</u>

7. Discuss briefly the reasons why the rate of extraction of an exhaustible natural resource produced by profit maximizing firms in a competitive market may differ from the socially optimal rate of extraction? In which direction is it likely to deviate and why?