ECON 110, Prof. Hogendorn

Problem Set 1

Note that all problem sets include both problems to turn in and review problems. Look over the review problems before working on the problem sets, because often they contain material showing you how to do the problems. Also, note that the review problems tend to be older, so they contain examples that are less current.

1. *Niko.* In 2001, Niko bought four video game consoles: one from Microsoft for $300, one from Sony for $300, and two from Nintendo for $200 each.

   In 2006 Niko checked out the prices for systems from each manufacturer. A new console from Microsoft cost $280, a new console from Sony cost $400, and a new console from Nintendo cost $250.

   (a) Suppose we treat each console as an unchanging good, e.g. a 2001 console from Microsoft is the same as a 2006 console from Microsoft. Assuming all Niko buys are the consoles mentioned above, calculate a consumer price index for 2006 with 2001=100.

   (b) Using the Rule of 70 and your answer to (a), how long will it take for video game prices to double. (Be careful, your answer to part (a) is *five* years of inflation, not one.)

   (c) All three systems are upgraded with many new and better features: Microsfot Xbox to Xbox 360, Sony Playstation 2 to Playstation 3, Nintendo GameCube to Wii. Given this, is Niko worse off from the inflation?

   (d) Recall the three characteristics of money. Would Sony's Playstation 2 from 2001 make a good money?

2. *Movies.* If you were born about 1990, let's guess that your parents were college age in 1978 and your grandparents were college age in 1948. Let's see what has changed since they were young.

   First, some data: with 1983=100, the CPI was 24.1 in 1948, 65.2 in 1978, and it is 207.0 in 2008.

   (a) Today it usually costs $7.00 to go to a movie (I know this seems hard to believe, but that is the official statistic). If movie prices follow the CPI, how much did your parents pay in 1978 and your grandparents in 1948?

   (b) What are the CPIs for 1948, 1978 and 2008 setting 2008 = 100?

   (c) Actually, the real movie price in 1948 was $0.36 and in 1978 it was $2.34. What was the approximate yearly percentage inflation between 1948 and 1978, and 1978 and 2008, using the CPI? Using the actual movie prices? (Hint, figure out how many doublings occurred and use the Rule of 70 backwards.)

   (d) What is wrong with the following statement: "Since movie prices are a part of the CPI, but they don't go up at the same exact rate as the CPI, the CPI must not be calculated correctly."

3. *SUVs.* This question asks you to analyze the market for Sport Utility Vehicles (SUVs) using a *nonlinear* demand curve.

   (a) The demand function (measured in hundreds of thousands of vehicles) for SUVs turns out to be $q^d = 4027p^{-1.5}$, where p is the price of a typical SUV (in this problem we will measure price in tens of thousands of dollars). What are the first and second derivatives of this function? Graph the function and explain how the first and second derivatives relate to the shape of the graph.

   (b) The supply of SUVs turns out to be $q^s = 258.3p$. What is the equilibrium price and quantity?

(c) Suppose that the price of gas rises. Which of the following is more likely to be the new demand curve for SUVs? Why?

$$q^d = 4300p^{-1.5} \qquad q^d = 3700p^{-1.5}$$

(d) Calculate and graph what happens to the equilibrium price and quantity after the demand curve changes.

4. *Healthcare.* Recently in my e-mail, I received notice of a new article published in an economics journal. The article is entitled "A theoretical rationale for an inelastic demand for health care."

(a) OK, you've only taken a few days' worth of economics, but can you provide a theoretical rationale for inelastic demand for health care?

(b) Draw a supply and demand diagram for health care making both functions linear. Draw the diagram so that at the equilibrium, demand is inelastic and supply is perfectly elastic.

(c) If costs rose in the health care industry, show what would happen in your diagram, and discuss the relative size of the changes in the quantity and price of health care.

5. *Tokens3.* Suppose the demand for subway tokens is

$$t(p_t) = 13.39p_t^{-2/3}$$

(a) Graph this demand function and show the price/quantity point where the price of a token is $1.50.

(b) What is the elasticity of demand?

(c) If the transit authority raises the price of subway tokens to $2.00, will revenue rise or fall in the short run? Can justify your answer without actually finding the new revenue?)

Review Problems only, not to turn in:

6. *HardBop.* Identify the following as positive or normative statements:

   (a) "Hard bop" jazz music causes warts and hearing loss.

   (b) Free jazz music is an unparalleled musical experience.

   (c) The U.S. unemployment rate is lower than at this time last year.

   (d) The U.S. unemployment rate is still too high.

   (e) Unemployment in teenage labor markets would go up if the minimum wage were raised.

   (f) The government should raise the minimum wage.

7. *SW25.1* Which of the three traits of money do the following assets have, and which are they missing: a house, a day pass to an amusement park, Euros held by a resident of New Haven, CT, a painting, gold.

8. *psquared*. Suppose the demand function for a good is $q = 100 - 2p^2$.

   (a) Find the first and second derivatives of this demand function. What are the signs of the derivatives?

   (b) Graph this demand function. Explain how your answer to part (a) affects the shape of the curve.

9. *Tradition.* According to Jerry Muller's book *The Mind and the Market,* what were the two traditions in Western thought that made commerce and money-lending disreputable occupations?

10. *Shifters*. Illustrate and explain the impact on equilibrium market price and quantity exchanged of each of the following changes:

    (a) An improvement in the technology of production

    (b) An increase in individuals' desire for the good

    (c) A decrease in the wage paid to all workers (be careful here)

11. *Accord.* The elasticity of demand for Honda Accords is 4.798 (really!). Suppose the base price of an Accord is $17,445 (LX 2 door with manual transmission). Suppose a Honda dealer sells 40 Accords per month.

    (a) Find a linear demand curve for Honda Accords at this dealership.

    (b) What is the dollar amount of the change in revenue if the dealer offers a $500 incentive discount?

    (c) Why do you think the elasticity is so high?

12. *Axolotls.* Suppose the market demand for axolotls, is given by the function $q = \frac{A}{p}$, where q denotes quantity demanded, p is the market price of axolotls, and A is a constant.

    (a) Graph this demand function.

    (b) Using calculus, derive an expression for the price elasticity of demand as a function of p. How does elasticity vary with the price?

    (c) For any given point on the demand function, determine the impact of changing price on consumers' total expenditure on this good.

    (d) Now suppose the demand function were instead given by $\frac{A}{p+z}$, where z is the price of zuzus, a different good. Are axolotls and zuzus substitutes or complements? Explain.

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

14. *London.* In February 2003, drivers entering central London began paying a toll of £5 to help mitigate congestion. Previously there was no toll, and about 250,000 cars entered central London each day. The

toll cut traffic by 15% and the city uses the toll revenue to fund public transportation projects.

(a) Using the data above, find an approximate linear demand curve for automobile access to central London. (Hint: do not try to use elasticity to do this.)

(b) Using your demand curve, what is the approximate price elasticity of demand with the £5 toll in place?

(c) What was the price elasticity of demand without the toll? Do not use any math to answer this question.

(d) How much revenue does the toll generate? Do you know whether London could obtain more revenue by raising the toll?

Answers to Review Problems:

6. *HardBop_a*

   (a) P

   (b) N

   (c) P

   (d) N or P, depending on interpretation of "too high:"' "too high to achieve positive condition X"' or "undesirably high."

   (e) P

   (f) N

7. *SW25.1_a.* House: store of value, not a medium of exchange because it is difficult to buy a loaf of bread with a house, not a unit of account because it would be difficult and irrelevant to calculate the number of houses it would take to buy a loaf of bread.

   Day pass: a store of value, provided you can use the pass for some future day, not a medium of exchange except at the amusement park itself

where the pass buys you admission, not a unit of account because prices are not measured in terms of day passes.

Euros in New Haven: a store of value, not a medium of exchange because very few people in New Haven will accept Euros in exchange for goods, not a unit of account because in New Haven the value of goods is measured in dollars.

Painting: a store of value.

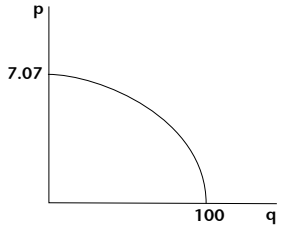
Gold: a store of value, an imperfect medium of exchange since there are probably some people (but not many) who will accept gold as a means of payment, not a unit of account because we do not measure the price of goods in grams of gold.

8. *psquared_a.*

   (a) The derivatives are:

$$\frac{dq}{dp} = -4p < 0 \qquad \frac{d^2q}{dp^2} = -4 < 0$$

   (b) From (a) we know that the function is downward sloping and concave:



9. *Tradition_a.* The first tradition is the *civic* tradition, alternatively the *civic republican* or *classical* tradition. Going back to Aristotle, it says that a citizen's proper focus is the *polis* or state. The state is best served by citizens engaged in public affairs and managing their estates for agriculture. Commerce and labor are distasteful and should be left to foreigners and slaves.

The second tradition is the *Christian* tradition which is based on Biblical passages including Gospel accounts of Jesus' sayings and actions. These regard commerce and especially money-lending as immoral. They are based on zero-sum thinking that if one person gets richer, it necessarily means someone else gets poorer. Later Christian thinkers drew on Aristotle's notions of natural and unnatural uses of goods to bolster this tradition.

The two traditions were combined to force Jews into the money-lending role in the late Middle Ages, since Jews could be classified as both foreigners and non-Christians.

10. *Shifters_a.*

    (a) Technology affects only supply. An improvement means a greater quantity supplied at any given price, hence a right shift of the supply curve. Market equilibrium price falls and quantity rises.

    (b) "Desire" reflects tastes, which affect the demand curve. Increased desire means a higher quantity demanded at any given price, hence a right shift of the demand curve. Market equilibrium price rises and quantity rises.

    (c) Since wages of *all* workers fall, we can expect two effects. First, for any particular good, demand will shift to the left because of lower incomes (assuming the good is a normal good). Second, the lower wage is a lower cost to firms, so supply will shift to the right. The market equilibrium price will definitely fall, but the effect on quantity exchanged is indeterminate.

    This type of problem is important in macroeconomics, and we will model it more completely later in the course.

11. *Accord_a.*

(a)

$$\begin{aligned} \epsilon &= \left|\frac{dq}{dp}\frac{p}{q}\right| \\ 4.798 &= \frac{dq}{dp}\frac{17445}{40} \\ 0.011 &= \frac{dq}{dp} \end{aligned}$$

If we approximate using linear demand $q = a - bp$,

$$\begin{aligned} b &= 0.011 \\ a - b17445 &= 40 \\ a &= 231.895 \end{aligned}$$

(b) The new price is 16945, so the new quantity is

$$231.895 - 0.011 \cdot 16945 = 45.5$$

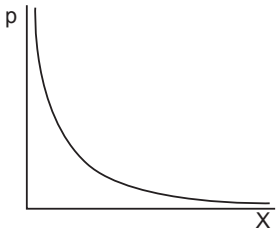
Then the change in revenue is:

$$16945 \cdot 45.5 - 17445 \cdot 40 = 770997.5 - 697800 = 73197.5$$

(c) Since the Accord is just one particular type of car, there are many close substitutes available to consumers. Then even a small percentage reduction in the price of the Accord will bring in a large percentage increase in the quantity purchased. In general, the more broadly one defines a ``good,'' the lower the price elasticy. E.g. Accords have a higher elasticity than mid-size cars, which in turn have higher elasticity than all cars, which in turn have higher elasticity than all vehicles, etc.

12. *Axolotls_a*.

(a) The graph is:



(b)

$$\varepsilon = \left| \frac{dq}{dp} \frac{p}{q} \right| = \frac{A}{p^2} \frac{p}{\frac{A}{p}} = 1$$

This is an example of a *constant elasticity demand function* along which elasticity does not vary with price. In this case, it's unit elastic along the entire curve.

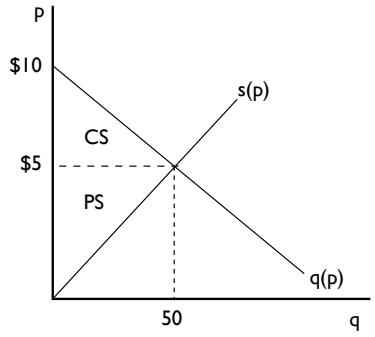
(c) On this curve, total expenditure is $pq = p\frac{A}{p} = A$. Thus total expenditure on the good is A regardless of the price. This makes sense since the curve is unit elastic: total spending/revenue does not change as price changes.

(d) Suppose z increases. We find the effect on demand by taking the derivative with respect to z :

$$\frac{dq}{dz} = -\frac{A}{(p+z)^2} < 0$$

Since the derivative is negative, an increase in z reduces demand for axolotls which means the goods are complements.

13. *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.



14. *London_a.*

    (a) The original point was $(p, q) = (0, 250000)$. Finding that 15% of 250,000 is 37,500, the new point is $(5, 212500)$. The equation for a linear demand curve that connects these points is:

    $$q(p) = 250,000 - 7,500p$$

    (b) $\epsilon = \left|\frac{dq}{dp}\frac{p}{q}\right| = 7,500\frac{5}{212,500} = 0.16$

    (c) Demand is linear, and without the toll we are at the bottom of a linear demand curve where elasticity is 0. Alternatively, if price is 0, any increase in price is an infinity percent increase, and any percent change in quantity divided by infinity is 0.

    (d) The toll generates $5 \cdot 212,500 = £1,062,050$ in revenue. Since demand is inelastic at this point, increasing the toll will increase revenue.