ECON 110, Professor Hogendorn

Problem Set 2

1. *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)

2. *Accord.* The Honda Accord is a popular midsize car. The base model is called the LX and sells for $21,000. Honda sold about 33,000 Accords in the USA in the month of September 2015. An economist has estimated that the average price elasticity of demand for a particular make and model of car is -3.1.

   (a) Using the information above, do a back-of-the-envelope calculation to find a linear demand curve for Honda Accords.

   (b) Draw a diagram of the Honda Accord demand curve, showing the current price and quantity. Show the total spending on Accords and how it would change if Honda increased the price by $1,000. Would total spending go up or down from the price increase? How do you know?

   (c) Let the supply curve of Honda Accords be $Q_s = 29,010 + 0.19p$. What is the price elasticity of supply at the price and quantity given above?

3. *MTA.* On December 30, 2010, the fare for one subway ride in New York City was raised from $2.25 to $2.50. Annual ridership was about 1.6 (measured in billions).

Suppose that demand turns out to be

$$Q_d = 2.21P^{-0.4}$$

(a) Graph this demand function and show the price/quantity point where the price of a ride is \$2.25.

(b) Find the elasticity of demand using the derivative.

(c) Did the increase in fare to \$2.50 increase or decrease revenue in the short run based on the data in this problem? Can you justify your answer without actually finding the new revenue?

(d) Suppose that you find out that ridership in 2011 was *higher* than 1.6. What do you think is the most likely explanation for such a finding? Illustrate your answer with your graph.

Review Problems only, not to turn in:

4. *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.

5. *psquared*. 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.

6. *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.

7. *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:

4. *SUVs_a.*

(a) The derivatives are:

$$\frac{dQ}{dP} = -6040.5P^{-2.5} < 0 \qquad \frac{d^2Q}{dP^2} = 15101.25P^{-3.5} > 0$$

The first derivative is negative (for any value of P), thus the function must slope down. The second derivative is positive, thus the slope must be getting less steep as price increases. The graph looks is like in part (d).

(b) Setting demand equal to supply gives:

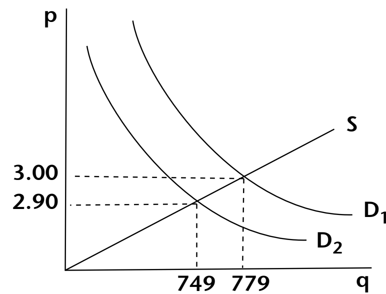
$$\begin{aligned} 4027P^{-1.5} &= 258.3P \\ 15.59 &= P^{2.5} \\ P = 3 & \qquad Q = 775 \end{aligned}$$

(c) Gas is a ***complement*** to SUVs. If the price of a complement rises, it produces a negative demand shift. Therefore, we would expect to see a lower demand for SUVs at *any* price of SUVs, and the demand curve $Q = 3700P^{-1.5}$ is the more likely result.

(d) Setting demand equal to supply gives:

$$\begin{aligned} 3700P^{-1.5} &= 258.3P \\ 14.32 &= P^{2.5} \\ P = 2.90 & \qquad Q = 749 \end{aligned}$$

The graph of what happened is:

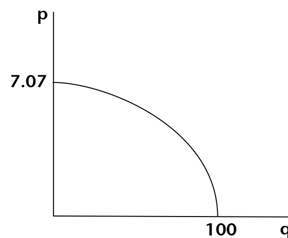


5. *psquared_a.*

   (a) The derivatives are:

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

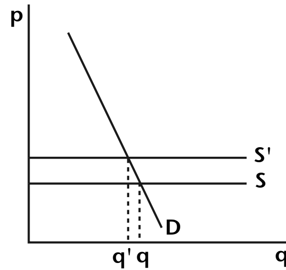
   (b) From (a) we know that the function is downward sloping and concave:



6. *Healthcare_a.*

   (a) Healthcare has very few substitutes because sick people have very limited alternatives. The only source of any elasticity is people delaying elective and preventive care and the poorest people going without care altogether.

   (b) Supply must be horizontal and it must intersect the demand curve below its midpoint.



(c) Higher costs in the industry shift the supply curve up. At the new equilibrium, the percentage increase in price is greater than the percentage increase in supply due to the fact that demand is inelastic.

7. *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:

$$Q = 250,000 - 7,500p$$

(b) $\epsilon = \frac{dQ}{dp}\frac{p}{Q} = -7,500\frac{5}{212,500} = -0.16$

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