

Problem Set # 2
Answers Due Session 4

This week's problems focus on working with different aspects of elasticity.

1) The Washington DC Metro system currently averages 700,000 trips per day at an estimated average fare of \$4.00 per trip. To deal with financial problems, the system is considering raising the average fare per trip by 14 percent. What can you say about the numerical range of demand elasticities needed if the fare increase is to produce increased revenue? **(If it takes you more than 20 seconds or more than one written line of text to answer this question, reread the textbook).**

2) Consider a stylized market for low-skilled labor. In this market, the minimum wage is currently \$5.15 per hour. At that wage level, 13 million workers are employed and another .5 million are unemployed – i.e. they are willing to work at the existing wage rate but they cannot find work. Around this wage level, the elasticity of the demand curve for labor is -0.4 , while the elasticity of the labor supply curve is $+0.5$ (In this demand and supply curve, the wage takes the role of price.)

a) Suppose the government passes legislation raising the minimum wage to \$5.50 per hour. Calculate the change in both the total number of persons employed and the total amount of money going to minimum wage workers. Illustrate your calculations with a diagram.

b) We have defined an unemployed person as someone who is willing to work at the existing wage rate but who cannot find work.¹ Using this definition, calculate the increase in unemployed persons caused by the increase in the minimum wage.

c) You are part of a community organization in San Antonio, Texas organizing a living wage campaign in which you use negotiation, political pressure and publicity to get employers to raise the base wage they pay. There are three candidates for the first firm you select for your action: a large hotel, an equally large firm doing light assembly of electronics components, and a large medical center. Like every other firm, each of these three firms has its own demand curve for labor. Think about the elasticity of each of these labor demand curves. Explain how a comparison of the elasticities should help you select the firm for your first organizing action.

¹ The true definition of an unemployed person is someone who is actively looking for work – i.e. someone who has undertaken any of a series of activities like answering an ad or visiting the state unemployment office in previous weeks. Determining this activity lies beyond our simple supply/demand models.

- d) Briefly explain the implication of your answer in (c) for the wages of U.S. factory production workers.
- 3) The suburb of Arlington, Massachusetts has a number of restaurants, four video/DVD rental stores (hereafter video stores), two movie theaters, and a coffee house that features live music.
- a) Using the concept of elasticity, compare, in as much detail as you can, what you expect to happen to the demand for videos and DVD's under each of the following scenarios:
- i) One video store – Red Sox Video – raises its rates by \$1.00 per rental of both videos and DVD's – a 25% increase. The three other video stores leave their rental rates unchanged.
 - ii) All four video stores in Arlington raise their rental rates by \$1.00 per rental.
- b) Suppose that all four video stores raise their rental rates by \$1.00 and the result is a 35% decline in video/DVD rentals. What might account for such an elastic demand for video/DVDs?

As we did in class, we can write the elasticity for “product x” as follows:

$$\varepsilon = (\Delta Q_x / Q_{x0}) / (\Delta P_x / P_{x0}).$$

This is known as the “own price” elasticity of demand - the percentage change in a product's quantity demanded brought about by a one percent change in its **own** price from a starting point, Q_{x0} , P_{x0} .

A related concept is the **cross**-elasticity of demand, the percentage change in a product's quantity demanded brought about by a one percent change in **some other product's** price. For example, we can think about calculating the elasticity of demand for movie theater tickets with respect to the rental price of DVD's. Let MiT stand for tickets bought for a movie-in-theater:

$$\varepsilon_{\text{Movie-in-Theater, DVD rental}} = (\Delta Q_{MiT} / Q_{MiT0}) / (\Delta P_{DVD} / P_{DVD0})$$

- c) What size and sign of this cross-elasticity would help explain the response observed in (b)?
- d) When a company is accused of having a monopoly in a particular market – say an airline having a monopoly on air travel between Madison, Wisconsin and Chicago - the legal proceedings that follow often make extensive use of estimated cross-elasticities of demand. Suppose you defending an airline in this

case. You wanted to argue that just because the airline had the only flights between Madison, Wisconsin and Chicago, that didn't mean it had a monopoly. What kind of cross elasticity would you estimate and what would you want it to show? (If you are unfamiliar with these cities, it is probably useful to look at a U.S. map.)

4) A straight line demand curve has the same slope at every point (duh!) But it does not follow that the demand curve has the same elasticity at every point. In this problem, we – actually, you – will demonstrate this idea.

Suppose you make pies at home that you sell (in your spare time) and the straight-line demand curve for your pies can be written:

$$P = \$15.00 - .10Q$$

Where Q is the number of pies sold per week.

Before we go further, sketch a graph of this demand curve, carefully marking where the curve hits the P axis (you can interpret this intercept as the price that is just high enough to eliminate all demand for the pies) and where the curve hits the Q axis (you can interpret this as the number of pies you could give away if the price were zero). Also satisfy yourself that you know the slope of this curve.

Next, choose a point on the demand curve which we will call (Q_0, P_0) – i.e. a particular quantity and price. At that point, we can write the formula for elasticity as:

$\varepsilon = (\Delta Q / Q_0) / (\Delta P / P_0)$, and if we rework this expression a little, it becomes:

$$[(\Delta Q / \Delta P) * (P_0 / Q_0)]$$

In the case of a straight line demand curve, this expression is easy to work with because $(\Delta Q / \Delta P)$ is the just the inverse of $(\Delta P / \Delta Q)$ - the straight line demand curve's slope.

a) Take three values of price: \$12.00, \$7.50 and \$3.00. For each price, calculate the quantity of pies sold at that price and the elasticity of the demand curve at that price and verify the proposition that elasticity changes along a straight line demand curve.

b) Suppose that this week, you set your price at \$14.00 per pie; next week, you dropped the price to \$13.00 per pie; the week after that, you cut the price to \$12.00 per pie and so on. Based on your answer in (a) explain in a general way what you would expect to happen to your revenue as this process continued. No need to do calculations.

5) In class, we briefly (and not too clearly) discussed the “cobweb” market for radiologists – a market which had trouble reaching equilibrium because it took so long to train radiologists. This problem helps you to work through that idea.

In many markets – not just the market for medical students – the fact that it takes some time to produce new supply means that it is useful to consider two supply curves: a short-run supply curve and a long run supply curve. Pigs are a case in point. Roughly speaking, the pigs that are being sold in supermarkets today are based on breeding decisions made two years ago. Breeding decisions that are made today will determine the number of pigs brought to market two years from now, etc. In this situation, we have to consider two supply curves for pigs.

- The short run supply curve shows how the supply of pigs responds immediately to a change in price.
- The long run supply curve shows how the supply of pigs responds to a change in price after two years – i.e. after farmers have adjusted breeding decisions and the new pigs have had the time to come to market, etc.

Because of the two year time lag, farmers have to make breeding decisions today based on their best guess of what the market will look like in two years. The result can be instability in the market – i.e. the cobweb.

a) To show this instability, begin by drawing a market for pigs with a standard demand-supply equilibrium. In your drawing, draw *two* supply curves passing through the equilibrium point – the short run supply curve and the long run supply curve. Briefly explain which supply curve is the more elastic and why.

b) A page 1 article in the *Wall Street Journal* reports a medical study that shows that eating pork loin roast, ham, bacon, etc. helps maintain a youthful complexion well into a person’s 80s. The headline says: “***Eat Lots of Pigs = No Wrinkles***”. Using your diagram in (a), show the immediate effect on the price and quantity sold of pigs. Question: Which of the two supply curves is relevant here?

c) Farmers are delighted in the change in the market. They base their current breeding decisions on the new price that you have shown in (b). Using your diagram, show how many pigs will come to market in two years. Also show what the price must be in two years if that supply of pigs is to be sold. Is this what the farmers expected?
