EconS 305 - Elasticities - Part 2

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September 9, 2015

Introduction

- Today, we will finish our discussion on elasticities with two more types.
  - Cross-Price Elasticity
  - Elasticity of Supply
- Recall from last time that elasticities (when associated with demand) measure how sensitive quantity demanded is to a given factor.
  - We looked at price elasticity of demand, which measures quantity demanded's sensitivity to price.
  - We also looked at the income elasticity, which measures quantity demanded's sensitivity to income.

Cross-Price Elasticity

- We can also calculate elasticities for the price of *other* goods, known as the **cross-price elasticity**. These measure how sensitive quantity demanded is to changes in the price of a *different* good. Just like price elasticity of demand and income elasticity, it follows a similar formula

$$\varepsilon_t = \frac{\Delta q}{\Delta p_t} \frac{p_t}{q}$$

where p_t is the price of the other good. Like our other elasticities, we can substitute for $\frac{\Delta q}{\Delta p_t}$ in a linear demand function. Consider the function

$$q_D = a - bp + cY + dp_t$$

- We have that d is the slope coefficient for the price of the other good, so $\frac{\Delta q}{\Delta p_t} = d$. We can substitue that value into the cross-price elasticity formula for simple calculations.

Cross-Price Elasticity

- The sign of ε_t is also the most important part
  - If $\varepsilon_t > 0$, then as the price for good t goes up, the demand for our good will also rise. This means that as the price for good t increases, people substitute away from that good and into our good. We then refer to good t as a **substitute** for our good.
    - Examples: Coke and Pepsi. Coffee and Tea.
  - If $\varepsilon < 0$, then as the price for good t goes up, the demand for our good will fall. This means that as the price of good t increases, people buy less of both our good and good t. We refer to good t as a **complement** for our good.
    - Examples: Peanut Butter and Jelly. Hot dogs and buns.

Example

- The market for motels in Pullman faces the following linear demand function

$$q_D = 100 - 2p - 0.5Y - 0.25p_g$$

  where p is the price for motels in Pullman, Y is the average income of tourists visiting Pullman, and p_g is the price of gasoline.
- Are motels a normal or inferior good?

Example

$$q_D = 100 - 2p \underbrace{-0.5}_{\frac{\Delta q}{\Delta Y}} Y - 0.25 p_g$$

- We know that $\frac{\Delta q}{\Delta Y} = -0.5$ in this case. Plugging that value into our income elasticity gives

$$\xi = -0.5 \frac{Y}{q} < 0$$

  Thus, the income elasticity is negative and motels are an inferior good.

  - Why would motels be an inferior good?
- Is gasoline a substitute or a complement for motels?

Example

$$q_D = 100 - 2p - 0.5Y \underbrace{-0.25}_{\frac{\Delta q}{\Delta p_g}} p_g$$

- We know that $\frac{\Delta q}{\Delta p_g} = -0.25$ in this case. We can plug this into the cross-price elasticity to obtain

$$\varepsilon_g = -0.25\frac{p_g}{q} < 0$$

And since the cross-price elasticity is negative, gasoline and motels are complements.

  - Does this make economic sense?

Application: Coke vs. Pepsi

- Let's look at some more real world data. Below are estimated elasticities for both Coke and Pepsi.

	Coke	Pepsi
Price Elasticity of Demand	-1.74	-1.55
Income Elasticity	0.58	1.38
Cross-Price Elasticity	0.52	0.64

- What do these numbers tell us about the relationship between these two goods?

Application: Coke vs. Pepsi

	Coke	Pepsi
Price Elasticity of Demand	-1.74	-1.55

- Let's start with the price elasticity of demand.
  - If the price of Coke increases by 1%, we can expect a 1.74% *decrease* in the amount of Coke sold.
    - Coke is an elastic good.
  - If the price of Pepsi increases by 1%, we can expect a 1.55% *decrease* in the amount of Pepsi sold.
    - Pepsi is an elastic good.
  - Coke is slightly more elastic than Pepsi.
    - Why? Does this make economic sense?

Application: Coke vs. Pepsi

	Coke	Pepsi
Income Elasticity	0.58	1.38

- Now, let's look at the income elasticities.
  - If the income of consumers increases by 1%, we can expect a 0.58% *increase* in the amount of Coke sold.
    - Coke is a normal good.
  - If the income of consumers increases by 1%, we can expect a 1.38% *increase* in the amount of Pepsi sold.
    - Pepsi is a normal good.
  - Does this make economic sense?

Application: Coke vs. Pepsi

	Coke	Pepsi
Cross-Price Elasticity	0.52	0.64

- Finally, let's look a the cross-price elasticities (the most interesting one).
  - If the price of Coke increases by 1%, we can expect a 0.64% *increase* in the amount of Pepsi sold.
  - If the price of Pepsi increases by 1%, we can expect a 0.52% *increase* in the amount of Coke sold.
    - Coke and Pepsi are substitutues.
  - Does this make economic sense?

Application: Coke vs. Pepsi

- Firms use elasticities when planning sale data.
  - For example, what if Coke decided to have a temporary sale where they reduced their price by 10%.
    - They could expect (approximately) a 17.4% increase in their quantity sold. This is approximate since it is doubtful that the elasticity is constant along the line.
    - At the same time, they could expect Pepsi's quantity sold to decrease by approximately 6.4%.
- It is a great method for arguing how to allocate shelf space at a grocery store.

Elasticity of Supply

- We have one last type of elasticity to look at, the **elasticity of supply**.
  - This measures how sensitive the quantity supplied is to changes in the price.
- For the most part, we interpret this measurement the same way we interpret the price elasticity of demand.
- In fact, its formula is almost identical

$$\varepsilon_S = \frac{\Delta q_S}{\Delta p} \frac{p}{q_S}$$

where $\frac{\Delta q_S}{\Delta p}$ is simply the slope of the supply function.

Elasticity of Supply

- Like price elasticity of demand, we are interested in the magnitude of the elasticity of supply, rather than the sign.
  - Why? The elasticity of supply should always be positive, based on the law of supply.
    - Supply curves are always upward sloping!
- Again, when $\varepsilon_S > 1$, we would say that the elasticity of supply is "elastic." If $\varepsilon_S < 1$, the elasticity of supply is "inelastic," with $\varepsilon_S = 1$ being "unit elastic."

Elasticity of Supply

- Consider the following supply function

$$q_S = -1 + \frac{1}{2}p$$

- What is the elasticity of supply when $p = 4$?

Elasticity of Supply

- Just like with the last lecture, we want to start with the elasticity of supply formula,

$$\varepsilon_S = \frac{\Delta q_S}{\Delta p}\frac{p}{q_S}$$

and substitute out for the $\frac{\Delta q_S}{\Delta p}$ term. Recall that $\frac{\Delta q_S}{\Delta p}$ is the same thing as the slope of a line, or more importantly, the slope of our supply function

$$q_S = -1 + \underbrace{\frac{1}{2}}_{=\frac{\Delta q_S}{\Delta p}} p$$

- Thus, we can substitute this value into our supply function yielding

$$\varepsilon_S = \frac{1}{2}\frac{p}{q_S}$$

Elasticity of Supply

- Next, we need to find our quantity supplied to match the $p = 4$ given to us. This is done by just plugging the price into our supply function

$$q_S = -1 + \frac{1}{2}p = -1 + \frac{1}{2}(4) = 1$$

- Finally, we just insert all of the numbers into our elasticity formula and obtain our solution

$$\varepsilon_S = \frac{1}{2}\frac{p}{q_S} = \frac{1}{2}\frac{4}{1} = 2$$

- As we can see, since $\varepsilon_S = 2 > 1$, the quantity supplied is elastic at this point. A 1% increase in price would yield a 2% increase in the quantity supplied.
  - We would need a demand function to see what this would do to revenue.

Summary

- Elasticities are great tools. We can use them to obtain a unitless measure for how things react to changes in other things.

Preview for Friday

- Taxes!
  - What kinds do we have? Who pays them? Who likes them?

Assignment 1 & 2 (1 of 1)

1. Consider the market for football tickets. It faces the following supply and demand functions

$$\begin{aligned} q_S &= -2 + 2p \\ q_D &= 8 - 3p + 2Y + p_B \end{aligned}$$

where p is the price for football tickets, Y is average income in 10,000's and p_B is the price of basketball tickets. Let $Y = 4$ and $p_B = 2$.

   a. Plot both the supply and demand curve.
   b. Find the market equilibrium price and quantity.
   c. Calculate the price elasticity of demand, income elasticity, and cross-price elasticity at the equilibrium price and quantity that you found in part (b).
   d. Explain your results. Do they make economic sense?