

UN1105 Principles of Economics

Recitation 3: Elasticities and Consumer Theory

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Review of Concepts, Elasticity (i)

Motivation:

- Consider a firm who is choosing whether to increase the price of their good.
- Firm revenue is equal to price times quantity, thus the change in revenue due to a price increase is equal to the sum of
 - (i) A negative quantity effect, because fewer units will be sold, plus
 - (ii) A positive price effect, because units sell for a higher price.

(See figure.)

- Which effect dominates depends on the *responsiveness* of quantity demanded.
- Why not use the slope of the demand curve?
 - $\text{Slope} = \frac{\text{Change in Price}}{\text{Change In Quantity Demanded}}$
 - Thus the slope already tells us how quantity demanded changes as the price changes; flat (steep) demand curves imply that quantity demanded is more (less) sensitive to price changes.
 - However, the slope is scale dependent - change the units of the price (cents, dollars, etc.) or quantity (individual, tonnes, etc.) and the slope changes.

Review of Concepts, Elasticity (ii)

Figure 1: Price v. Quantity Effects

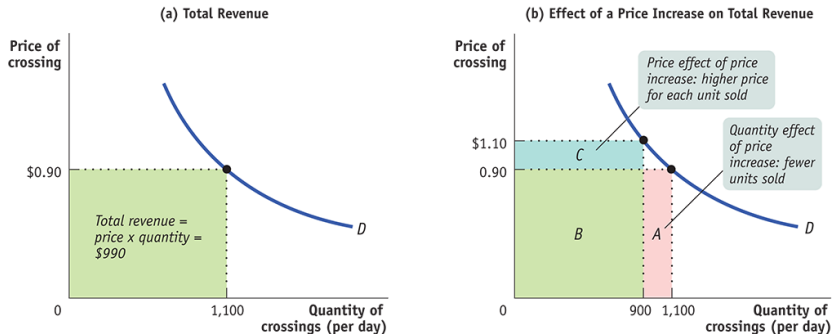


FIGURE 6-4

Krugman/Wells, *Microeconomics*, 5e, © 2018 Worth Publishers

Review of Concepts, Elasticity (iii)

- As such we use a unit-free measure: price-elasticity of demand (PED).
 - $\epsilon_{1,1}^D = \frac{\% \text{ Change in Quantity}}{\% \text{ Change in Price}} = \frac{1}{\text{Slope of Demand}} \times \frac{\text{Initial Price}}{\text{Initial Quantity}}$
 - By normalizing the changes by their initial values, the PED tells us the percentage change in quantity demanded for a 1% increase in the price.
 - This has the added benefit of allowing for comparisons across markets (with different currencies) or across time (under inflation).
- We can classify goods by their PED.
 - $|\epsilon_{1,1}^D| = 0$: perfectly inelastic demand, represented by a vertical demand curve.
 - $|\epsilon_{1,1}^D| < 1$: inelastic, think gasoline or medicine.
 - $|\epsilon_{1,1}^D| > 1$: elastic, think Shell gasoline, air travel for leisure.
 - $|\epsilon_{1,1}^D| = \infty$: perfectly elastic demand, represented by a horizontal demand curve.
- Several factors can affect the elasticity: existence of substitutes; necessity v luxury; share of income; time.

Review of Concepts, Elasticity (iv)

- Similarly, we can define the cross-price elasticity of demand (CPED).

$$\varepsilon_{1,2}^D = \frac{\% \text{ Change in Quantity Demanded of Good 1}}{\% \text{ Change in Price of Good 2}}$$

And we can classify goods by their CPED as follows:

- $\varepsilon_{1,2}^D < 0$: complements
- $\varepsilon_{1,2}^D > 0$: substitutes
- The income elasticity of demand (IED).

$$\varepsilon_{1,Y}^D = \frac{\% \text{ Change in Quantity Demanded of Good 1}}{\% \text{ Change in Income}}$$

And we can classify goods by their IED as follows:

- $\varepsilon_{1,Y}^D < 0$: inferior
- $\varepsilon_{1,Y}^D > 0$: normal
- And the price elasticity of supply (PES).

$$\varepsilon_{1,1}^S = \frac{\% \text{ Change in Quantity Supplied of Good 1}}{\% \text{ Change in Price of Good 1}}$$

The two extreme cases are

- $\varepsilon_{1,1}^S = 0$: perfectly inelastic supply, represented by a vertical supply curve.
- $\varepsilon_{1,1}^S = \infty$: perfectly elastic supply, represented by a horizontal supply curve.

Factors which affect the PES includes the availability of inputs, and time.

Review of Concepts, Consumer Theory (i)

- Utility
 - Utility, marginal utility, and the utility function,
 - Principle of diminishing marginal utility.
- Budget constraints
 - Expenditure cannot exceed income.
 - The set of feasible bundles are defined by (i) income and (ii) prices.
- Optimal consumption
 - Optimal consumption bundle must lie on the BL, plus
 - Marginal dollar analysis: $MU_C/P_C = MU_P/P_P$
 - Or equivalently, tangency of IC and BL: $MU_C/MU_P = P_C/P_P$
- Marginal utility, the substitution effect, and the law of demand
 - If the price of a good rises (falls), the MU per dollar of that good falls (rises) and gives the consumer an incentive to consume fewer (more) units.
- Income effect
 - When the price of a good that constitutes a large share of income rises, consumers of that good are poorer because their purchasing power falls.
 - For normal (inferior) goods, this effective reduction in income causes the consumer to demand less (more).

Analytical Questions, Q1: K&W Problem 6.02(i)

In the United States, 2015 was a bad year for growing wheat. And as wheat supply decreased, the price of wheat rose dramatically, leading to a lower quantity demanded (a movement along the demand curve). The accompanying table describes what happened to prices and the quantity of wheat demanded.

Table 1: Wheat Outcomes, by Year

	2014	2015
Quantity demanded (billions of bushels)	2.2	2.0
Average price (per bushel)	\$3.42	\$4.26

Analytical Questions, Q1: K&W Problem 6.02(ii)

- (a) Using the midpoint method, calculate the price elasticity of demand for winter wheat.

$$\varepsilon_D^{mid} = \frac{\left(\frac{\text{Change in Quantity}}{\text{Average Quantity}} \right)}{\left(\frac{\text{Change in Price}}{\text{Average Price}} \right)} = \frac{\left(\frac{Q_{2015} - Q_{2014}}{0.5(Q_{2014} + Q_{2015})} \right)}{\left(\frac{P_{2015} - P_{2014}}{0.5(P_{2014} + P_{2015})} \right)} = \frac{\left(\frac{-0.2}{2.1} \right)}{\left(\frac{0.84}{3.84} \right)} = \frac{-0.095}{0.22} = -0.43$$

- (b) What is the total revenue for U.S. wheat farmers in 2014 and 2015?

The total revenue in 2014 is the price per bushel in 2014 times the quantity of bushels demanded in 2014, which is $\$3.42 \times 2.2 \text{ billion} = \7.524 billion . Similarly, total revenue in 2015 is $\$4.26 \times 2.0 \text{ billion} = \8.52 billion .

- (c) Did the bad harvest increase or decrease the total revenue of U.S. wheat farmers? How could you have predicted this from your answer to part (a)?

The rise in price from 2014 to 2015 increased U.S. wheat farmers' total revenue. This could have been predicted by observing that demand is inelastic, as calculated in part (a). When demand is inelastic, the price effect of this price rise (which tends to increase total revenue) outweighs the quantity effect (which tends to decrease total revenue).

Analytical Questions, Q2: K&W Problem 10A.06(i)

Kory has an income of \$50, which she can spend on two goods: music albums and cups of hot chocolate. Both are normal goods for her. Each album costs \$10, and each cup of hot chocolate costs \$2. For each of the following situations, decide whether this is Kory's optimal consumption bundle. If not, what should Kory do to achieve her optimal consumption bundle?

Sidenote: The optimal bundle must satisfy two conditions: (i) the bundle must lie on the budget line, and (ii) the tangency condition must be satisfied, which requires the slope of the indifference curve, or MRS, is equal to the slope of the budget line.

(a) Kory is considering buying 4 albums and 5 cups of hot chocolate. At that bundle, her marginal rate of substitution of albums in place of hot chocolate is 1; that is, she would be willing to forgo only 1 cup of hot chocolate to acquire 1 album.

- Is the bundle on the budget line? $P_A Q_A + P_{HC} Q_{HC} = \$10 \times 4 + \$2 \times 5 = \50 .
- Is the tangency condition satisfied? No, as $MRS = 1 \neq 5 = \frac{10}{2} = \frac{P_A}{P_{HC}}$.
- The MRS tells us that Kory would be equally happy with one more album or one more hot chocolate, but at current prices one could obtain 5 hot chocolates by forgoing one album. Therefore, Kory should shift consumption towards hot chocolates until her MRS is the same as the relative price of albums.

Analytical Questions, Q2: K&W Problem 10A.06(i)

- (b) Kory is considering buying 2 albums and 15 cups of hot chocolate. Kory's marginal utility of the second album is 25, and her marginal utility of the fifteenth cup of hot chocolate is 5.
- Is the bundle on the budget line? $P_A Q_A + P_{HC} Q_{HC} = \$10 \times 2 + \$2 \times 15 = \50 .
 - Is the tangency condition satisfied? Yes, $MRS = \frac{MU_A}{MU_{HC}} = \frac{25}{5} = 5 = \frac{10}{2} = \frac{P_A}{P_{HC}}$
 - Therefore this is the optimal consumption bundle.
- (c) Kory is considering buying 1 album and 10 cups of hot chocolate. At that bundle, her marginal rate of substitution of albums in place of hot chocolate is 5; that is, she would be just willing to exchange 5 cups of hot chocolate for 1 album.
- Is the bundle on the budget line? No,
 $P_A Q_A + P_{HC} Q_{HC} = \$10 \times 1 + \$2 \times 10 = \30 .
 - Is the tangency condition satisfied? Yes, $MRS = 5 = \frac{10}{2} = \frac{P_A}{P_{HC}}$
 - Therefore this cannot be the optimal bundle. Because both goods are normal, Kory would have higher utility by spend the remaining \$20 on more of each good.

Short-answer Questions, Q3: Cross-price elasticity

Suppose the cross-price elasticity between two goods is zero. What does this tell you about these two goods?

A cross-price elasticity of zero implies that as the price of one good increases, the demand for the second good is unchanged. As such, we can infer that the consumption of the two goods are unrelated. Such goods are known as *independent* goods, and represent the intermediate case between complements, where the cross price elasticity is negative, and substitutes, where the cross price elasticity is positive.

Short-answer Questions, Q4: K&W Problem 6.01 (i)

For the following, decide whether Al has diminishing marginal utility. Explain.

- (a) The more economics classes Al takes, the more he enjoys the subject. And the more classes he takes, the easier each one gets, making him enjoy each additional class even more than the one before.

The first sentence implies that Al's marginal utility of economics classes is positive, but not whether it is diminishing. The second sentence implies that Al's marginal utility of economics classes increases as he takes an additional class, therefore, he does not have diminishing marginal utility.

- (b) Al likes loud music. In fact, according to him, "the louder, the better." Each time he turns the volume up a notch, he adds 5 utils to his total utility.

Al's marginal utility is the same for each additional notch of volume of music, hence he does not have diminishing marginal utility.

Short-answer Questions, Q4: K&W Problem 6.01 (ii)

- (c) Al enjoys watching reruns of the X Files. He claims that these episodes are always exciting, but he does admit that the more times he sees an episode, the less exciting it gets.

Al has diminishing marginal utility of X Files episodes. Although additional episodes increase his total utility, they do so less and less.

- (d) Al loves toasted marshmallows. The more he eats, however, the fuller he gets and the less he enjoys each additional marshmallow. And there is a point at which he becomes satiated: beyond that point, more marshmallows actually make him feel worse rather than better.

Yes, because we are told the more he eats the less he enjoys each additional marshmallow. In fact, his marginal utility becomes smaller and smaller and eventually becomes negative beyond the satiation point.

Short-answer Questions, Q5: K&W Problem 10.10 (i)

In each of the following situations, describe the substitution effect and, if it is significant, the income effect. In which direction does each of these effects move? Why?

- (a) Ed spends a large portion of his income on his children's education. Because tuition fees rise, one of his children has to withdraw from college.
- As tuition fees rise, college education becomes relatively more expensive compared to other goods. So Ed decides to substitute away from college education and toward other goods. This is the substitution effect.
 - Since tuition takes up a large portion of his income, the income effect will also be significant. As tuition rises, Ed, in a real sense, becomes poorer: the purchasing power of his income falls. As a result, he will buy less of all normal goods. College education is a normal good, so the income effect also moves in the direction of less college education.
 - The effects reinforce each other.

Short-answer Questions, Q5: K&W Problem 10.10 (ii)

- (b) Homer spends much of his monthly income on home mortgage payments. The interest on his adjustable-rate mortgage falls, lowering his mortgage payments, and Homer decides to move to a larger house.
- As mortgage payments decrease, large homes become cheaper compared to other goods. So Homer will substitute toward buying a larger home. This is the substitution effect.
 - Since he spends much of his income on mortgage payments, the fall in mortgage rates also increases his income in a real sense: the purchasing power of his income is now higher. This implies that Homer will now buy more of all normal goods. Housing is a normal good, so the income effect will also move in the direction of more housing.
 - The effects reinforce each other.

Short-answer Questions, Q5: K&W Problem 10.10 (ii)

- (c) Pam thinks that Spam is an inferior good. Yet as the price of Spam rises, she decides to buy less of it.
- As its price rises, Spam becomes relatively more expensive compared to other goods. So Pam will substitute away from Spam and toward other goods. This is the substitution effect.
 - Spam probably does not account for a large portion of Pam's income, so the income effect is likely to be negligible. However, we do know that since Spam is an inferior good, the income effect would make Pam want to consume more of it. As the price of Spam rises, Pam is now, in a real sense, poorer: her income buys fewer goods. Since she is now poorer, she will buy more inferior goods.
 - The effects are in opposing directions, however, we are told that overall she buys less Spam as its price rises, so the substitution effect outweighs the income effect; this is unsurprising given that spam does not account for a large portion of expenses for most individuals.