

# Intermediate Microeconomics

## Chapter 3 *Comparative Statics and Demand*

# Comparative statics

- *Comparative statics* = the process of comparing two equilibria (i.e., we are not concerned with *how* we get from one to the other, but rather with the end points)
- Two interesting cases:
  - ◆ own-price changes = what happens to consumption of a good when *its own* price changes
  - ◆ cross-price changes = what happens to consumption of a good when the price of some other good changes

# Demand curve

- We can analyze the consumption of a good for various prices
- This gives us the *individual demand schedule*, a "table" listing the possible quantities demanded by the consumer for various prices
- *(Total) demand schedule* is obtained by summing the individual quantities demanded for each price level
- *Demand curve* = plot of the demand schedule (price on the vertical axis, quantity demanded on the horizontal axis)

# Demand curve



# Cross-price effects

- *Substitutes* = two goods that satisfy similar wants  $\Rightarrow$  an increase in the price of one of them leads to an increase in the quantity demanded of the other, ceteris paribus
- *Complements* = two goods that tend to be used together  $\Rightarrow$  an increase in the price of one of them leads to a decrease in the quantity demanded of the other, ceteris paribus
- *Unrelated goods* = an increase in the price of one of the goods has no effect on the quantity demanded of the other, ceteris paribus

# Changes in income

- *Normal good* = good for which an increase in income increases consumption, ceteris paribus
- *Inferior good* = good for which an increase in income decreases consumption, ceteris paribus

# Demand curve effects

- Movement along the curve:
  - ◆ change in own price
- Shift of the curve:
  - ◆ change in price of substitute or complement good
  - ◆ change in income

# Price elasticity of demand

- A measure of the responsiveness of the demand to price changes, independent of units of measurement
- *Price elasticity of demand* = percentage change in demand due to a 1 percent change in price:

$$\epsilon = -\frac{\% \Delta X}{\% \Delta p} = -\frac{\Delta X}{X} \div \frac{\Delta p}{p} = -\frac{\Delta X}{\Delta p} \cdot \frac{p}{X}$$

where  $X$  is initial quantity demanded,  $p$  is initial price, and  $\Delta$  represents the difference between the final and the initial values ( $\% \Delta$  is the percentage change)



# Price elasticity – example

- When the price of beef is  $p = \$10$  per pound, the quantity demanded is  $X = 200$  pounds
- When the price increases to  $\$10.25$ , the quantity demanded falls to 192
- Hence,  $\Delta p = 0.25$  and  $\Delta X = -8 \Rightarrow$  the elasticity of demand is

$$\epsilon = -\frac{-8}{0.25} \cdot \frac{10}{200} = 1.6$$

- So, a 1% increase in price causes a 1.6% fall in quantity demanded

# Arc elasticity of demand

- If the price change is large, the previous formula does not give the right answer – it gives the *point elasticity*, i.e. the responsiveness of demand around a certain price
- *Arc elasticity of demand* = percentage change in demand corresponding to a 1 percent change in price, but for large price changes:

$$\epsilon = - \frac{\Delta X}{\Delta p} \cdot \frac{\bar{p}}{\bar{X}}$$

where the overline denotes the average between the initial and the final values

# Arc elasticity – example

- When the price of beef is  $p = \$10$  per pound, the quantity demanded is  $X = 200$  pounds
- When the price increases to  $\$15$ , the quantity demanded falls to 120
- Hence,  $\Delta p = 5$ ,  $\Delta X = -80$ ,  $\bar{X} = (200 + 120) / 2 = 160$ , and  $\bar{p} = (10 + 15) / 2 = 12.5 \Rightarrow$  the arc elasticity of demand is

$$\epsilon_a = -\frac{-80}{5} \cdot \frac{12.5}{160} = 1.25$$

# Total expenditure

- *Total expenditure* = the amount of money consumers spend on a commodity:

$$\text{Total expenditure} = p \times X$$

- Types of demand:
  - ◆ *inelastic* ( $\epsilon < 1$ ) = total expenditure increases when price increases and falls when price falls
  - ◆ *elastic* ( $\epsilon > 1$ ) = total expenditure falls when price increases and increases when price falls
  - ◆ *unitary* ( $\epsilon = 1$ ) = total expenditure stays the same, regardless of the price

# Two special cases

- *Perfectly inelastic demand curve* ( $\epsilon = 0$ ) = quantity demanded does not change, regardless of the price
  - ◆ vertical line in the price/quantity demanded graph
- *Perfectly elastic demand curve* ( $\epsilon = \infty$ ) = the consumers are willing to purchase infinite amounts at the ongoing price, but none at any other price level
  - ◆ horizontal line in the price/quantity demanded graph

# Cross-price elasticity of demand

- Until now we focused on own price changes
- *Cross-price elasticity of demand* = percentage change in demand corresponding to a 1 percent change in the price of another good:

$$\epsilon_c = \frac{\% \Delta X}{\% \Delta p_Y} = \frac{\Delta X}{X} \div \frac{\Delta p_Y}{p_Y} = \frac{\Delta X}{\Delta p_Y} \cdot \frac{p_Y}{X}$$

where the  $Y$  subscript denotes the other good

- Note: there is *no negative sign* in the formula!

# Cross-price elasticity – example

- When the price of chicken is  $p = \$5$  per pound, the quantity of beef demanded is  $X = 200$  pounds
- When the price of chicken increases to  $\$5.25$ , the quantity of beef demanded increases to 202 pounds
- Hence,  $\Delta p_y = 0.25$  and  $\Delta X = 2 \Rightarrow$  the cross-price elasticity of demand is

$$\epsilon_c = \frac{2}{0.25} \cdot \frac{5}{200} = 0.2$$

# Cross-price elasticity of demand

- The sign of the cross-elasticity gives the relationship between the two goods
  - ◆ if  $\epsilon_c > 0$ , then the goods are *substitutes* (when the price of good  $Y$  increases, people substitute away from it and into good  $X$ , so the quantity of good  $X$  demanded increases)
  - ◆ if  $\epsilon_c < 0$ , then the goods are *complements* (when the price of good  $Y$  increases, people consume less of it and thus reduce their consumption of good  $X$  as well)
  - ◆ if  $\epsilon_c = 0$ , then the goods are *unrelated*



# Income elasticity of demand

- *Income elasticity of demand* = percentage change in demand due to a 1% increase in income

$$\epsilon_I = \frac{\% \Delta X}{\% \Delta I} = \frac{\Delta X}{X} \div \frac{\Delta I}{I} = \frac{\Delta X}{\Delta I} \cdot \frac{I}{X}$$

- Again, the sign tells something about the good:
  - ◆  $\epsilon_I < 0$ : *inferior good*
  - ◆  $\epsilon_I > 0$ : *normal good*
  - ◆  $\epsilon_I > 1$ : *luxury good*