Intermediate Microeconomics

Chapter 3
Comparative Statics and Demand

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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

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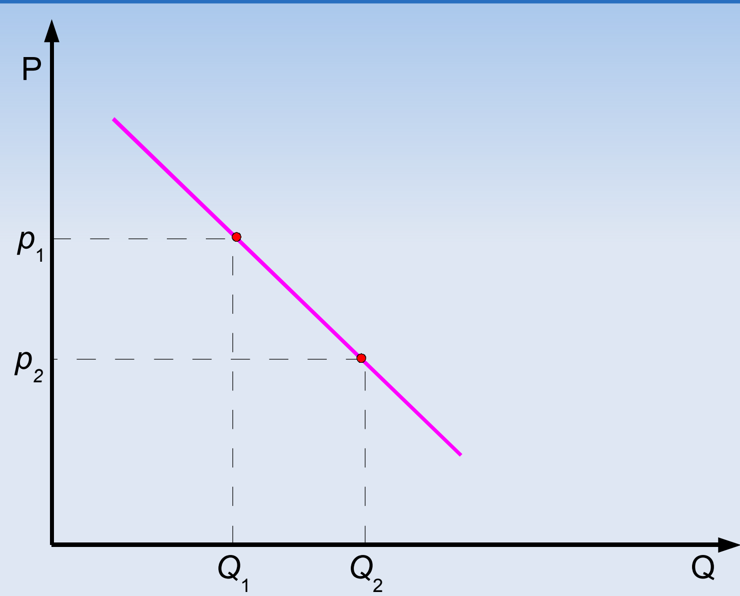
Demand curve

- 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 ⇒ 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 ⇒ 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

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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 Δ represents the difference between the final and the initial values ($\%\Delta$ is the percentage change)

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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:

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

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

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

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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

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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 cicken 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

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

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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*

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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*

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