Surplus Slides

Econ 360

Summer 2025

Learning Outcomes/Goals

1. Derive market demand from individual demand.
2. Algebraically calculate own-price and cross-price elasticity of demand.
3. Use elasticities to determine if 2 goods are complements, substitutes, or neither.

Where We Are/Going

- In the slides on choice, we figured out how much of each good a consumer wanted to buy given prices and income.

- We used those optimal bundles to figure out an individual's demand curve for one good based on
  1. The price of that good.
  2. The price of other goods.
  3. The individual's income.

Individual to Market Demand

- Suppose we are thinking about market demand for good x.
- Also suppose there are N consumers. They could all have the same preferences, but they don't need to.
- If each consumer's optimal amount of good x at price level p is $x^*(p)$, then aggregate or market demand is given by

$$\Sigma_{i=1}^{N} x^*(p) = X^*(p) = Q^D(P)$$

- "The sum of every consumer's individual demand is equal to market demand".
- Where $Q^D(P)$ is simply the Quantity Demanded by the market at price p.

Adding up Demand Curves

- Suppose there are 10 consumers with the following demand schedule for coffee:
  - At $p = 1$, each consumer demands 8 coffees.
  - At $p = 2$, each consumer demands 6 coffees.
  - At $p = 3$, each consumer demands 4 coffees.
  - This pattern continues, until $p = 5$ when each consumer demands 0 coffees.
- **Question**: What is the market demand schedule?

Adding up Demand Curves

- At $p = 1$, each consumer demands 8 coffees $\implies$ Market Demand=100.
- At $p = 2$, each consumer demands 6 coffees $\implies$ Market Demand=80.
- At $p = 3$, each consumer demands 4 coffees $\implies$ Market Demand=60.
- And so on until $p = 5$ when Market Demand=0.
- **Question**: How can we use demand functions to derive Market Demand.

Adding up Demand Curves

- Each consumer's demand function can be written as $x^*(p) = 10 - 2p$.
- We could also write each consumer's demand as $p = 5 - \frac{x}{2}$.
- **Question**: Does adding these demand curves up work either way?
- Let's find out! Since all consumers are the same we can simply multiply our demand curves by 10

Adding up Demand Curves

$$10 * x^*(p) = 10(10 - 2p) = 100 - 20p$$

- At $p = 1$, Market demand is 100-20=80.
- At $p = 2$, Market demand is 100-40=60.
- At $p = 3$, Market demand is 100-60=20.
- This worked because we were summing $x^*(p)$, or the quantity demanded.
- The demand function was quantity as a function of price.
- This is like adding demand functions **Horizontally**.

Adding up Demand Curves

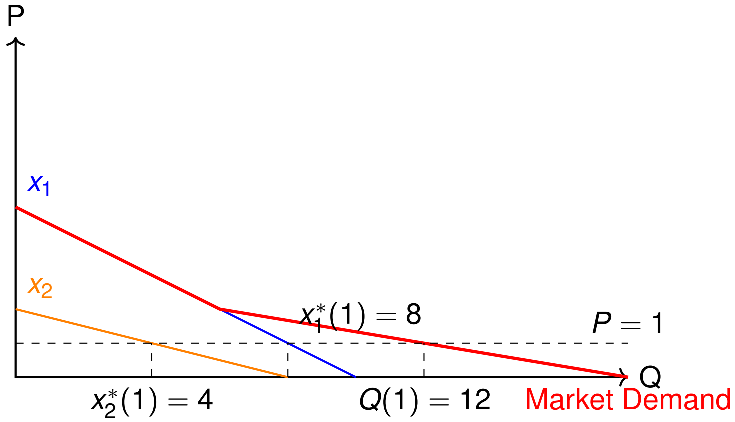
$$10 * p(x^*) = 10(5 - \frac{x}{2}) = 50 - 5x^* \implies x^*(p) = 10 - \frac{p}{5}$$

- At $p = 1$, Market demand is $10 - \frac{1}{5} \neq 80$.
- At $p = 2$, Market demand is $10 - \frac{2}{5} \neq 60$.
- At $p = 3$, Market demand is $10 - \frac{3}{5} \neq 40$.
- This did not work because we aggregated demand based on prices not based on quantity demanded.
- This is like adding demand functions **Vertically**.
- **When adding demand functions, we need to do it horizontally.**

Horizontal vs Vertical: Graphed

- Let's do a different example with 2 consumers.
- Consumer 1's demand function is $x_1^*(p) = 10 - 2p$.
- On the next slide, I draw Consumer 1's demand in blue.
- Consumer 2's demand function is $x_2^*(p) = 8 - 4p$.
- On the next slide, I draw Consumer 2's demand in orange.
- I then pick a price of 1 and show how the horizontal addition works.
- I show market demand in red.

Horizontal vs Vertical: Graphed



- Does this graph make sense? Bring questions to class!

Elasticities

- Remember in choice/demand we talked about how a consumer's demand changes based on prices and income.

- We can do the same thing with market demand.

- Our goal is still to ask how quantity demanded changes with price.

Calculating Own-Price Elasticity

- We want to calculate this elasticity as a **percentage** change.

- Therefore simply taking the derivative of Q^d with respect to price will not be enough.

- So we combine derivatives with the formula for percentage changes to get:

$$\frac{\%\Delta Q^D}{\%\Delta P} = \frac{\frac{Q_{new}-Q_{old}}{Q_{old}}}{\frac{P_{new}-P_{old}}{P_{old}}} = \frac{Q_{new}-Q_{old}}{P_{new}-P_{old}} \cdot \frac{P_{old}}{Q_{old}}$$

Calculating Own-Price Elasticity

$$\frac{\%\Delta Q^D}{\%\Delta P} = \frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \cdot \frac{P_{old}}{Q_{old}}$$

- As we shrink the difference between the “old” and “new” Q and P, the first part becomes the derivative and we get

$$\varepsilon_D = \frac{\partial Q^d}{\partial P} \cdot \frac{P}{Q}$$

Range of Elasticities

- We often use “Inelastic” or “Elastic” to describe demand functions (and also later, supply).
- We focus on the absolute value of elasticity.
- If elasticity is higher than 1, that means the change in quantity is higher than the change in price, so we say demand is **Elastic**.
- If elasticity is lower than 1, that means the change in quantity is lower than the change in price, so we say demand is **Inelastic**.
- If elasticity is exactly 1, we say demand is **unit elastic.**
- **Question**: Is elasticity constant along a demand curve, even if the demand curve is linear?