Demand Slides

Econ 360

Summer 2025

Learning Outcomes/Goals

1. Algebraically and graphically if a good is ordinary versus Giffen, and normal versus inferior from a consumer's utility function.
2. Algebraically and graphically determine if two goods are substitutes, complements, or neither.
3. Understand where the demand curves you see in other classes ultimately come from!

Where We Are/Going

- We **know** how to find a consumer's optimal bundle.
  - Where the optimal bundle is based on prices of the commodities and the consumer's income, wealth, or amount of money they have to spend.
- A demand curve from intro micro shows quantity demanded for **any** price.
  - How can we use what we know to make a demand curve for any consumer?

A consumer's demand

- Consider a Cobb-Douglass utility function $U = x^{\alpha} y^{\beta}$ with budget $p_x x + p_y y \leq m$.
- **Review**: We know optimal bundles!
  - $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - $y^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_y}$.
- So if we increase the price of either x, and keep price of y the same, then the amount of x the consumer buys at the optimum goes down!
- And therefore, the consumer's demand for x decreases as the price increases, just like a classical demand curve you have seen before.

A consumer's demand

- Consider a Cobb-Douglass utility function $U = x^{\alpha} y^{\beta}$ with budget $p_x x + p_y y \leq m$.
  - $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - $y^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_y}$.
- As income increases, $m \uparrow$ and consumer demand increases as income increases.
- Let's add some formal econ vocabulary to these concepts!

The 4 Types of Goods

		Income ↑	
		Demand ↑	Demand ↓
Price of X↑	Demand ↑	Giffen, Normal	Giffen, Inferior
	Demand ↓	Ordinary, Normal	Ordinary, Inferior

- **Note**: How we characterize a good based on price changes is **unrelated/independent of** how we characterize a good based on income changes!

Substitutes, Complements, or Neither

- **Substitutes**
  - We know perfect substitutes are when a consumer is always willing to trade between two goods a fixed ratio.
  - But what about when a consumer is willing to trade between goods, just at a non-fixed, or variable, rate?
  - For example, Dr.Pepper and Ginger-Ale.
- **Complements**
  - We know perfect complements are when a consumer always consumers two goods in a fixed ratio.
  - But what about when a consumer likes consuming both goods together, just not in a fixed ratio?
  - For example: peanut butter and jelly.
- **Question**: How can we use our demand function to tell if two goods are complements or substitutes?

Demand and Substitutes

- Consider the following demand equations for two goods x and y with prices p_x, p_y and income m.
  - $x^* = m \cdot p_y$.
  - $y^* = m \cdot p_x$.
- For each good, when the price of the other good increases demand increases.
  - For example, $\frac{\partial x^*}{\partial p_y} = m > 0$, so x and y are substitutes!

Demand and Complements

- Consider the following demand equations for two goods x and y with prices p_x, p_y and income m.
  - $x^* = \frac{m}{p_y}$.
  - $y^* = \frac{m}{p_x}$.
- For each good, when the price of the other good increases demand decreases.
  - For example, $\frac{\partial x^*}{\partial p_y} = \frac{-m}{p_y^2} < 0$, so x and y are complements!

Back to our example

- Consider a Cobb-Douglass utility function $U = x^{\alpha} y^{\beta}$ with budget $p_x x + p_y y \leq m$.
  - $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - $y^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_y}$.
- Question: How would you characterize these two goods? Normal vs Inferior, Ordinary vs Giffen?
- Are these two goods substitutes, complements, or neither?

Characterizing Goods

- Consider a Cobb-Douglass utility function $U = x^{\alpha} y^{\beta}$ with budget $p_x x + p_y y \leq m$.
  - $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - $y^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_y}$.
- **Normal or Inferior?**
  - $\frac{\partial x^*}{\partial m} = \frac{\alpha}{\alpha+\beta} \cdot \frac{1}{p_x}$.
  - $\frac{\partial y^*}{\partial m} = \frac{\alpha}{\alpha+\beta} \cdot \frac{1}{p_y}$.
  - These are both positive, so x and y are **Normal**.
- **Ordinary or Giffen?**
  - $\frac{\partial x^*}{\partial p_x} = \frac{\alpha}{\alpha+\beta} \cdot \frac{-m}{p_x^2}$.
  - $\frac{\partial y^*}{\partial p_y} = \frac{\alpha}{\alpha+\beta} \cdot \frac{-m}{p_y^2}$.
  - These are both negative, so x and y are **Ordinary**.

Substitutes or Complements?

- Consider a Cobb-Douglass utility function $U = x^\alpha y^\beta$ with budget $p_x x + p_y y \leq m$.
  - $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - $y^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_y}$.
- **Substitutes, Complements, or Neither?**
  - $\frac{\partial x^*}{\partial p_y} = 0$.
  - $\frac{\partial y^*}{\partial p_x} = 0$.
  - These are both 0, so the two goods are neither substitutes nor complements.

Creating a Demand Curve for X

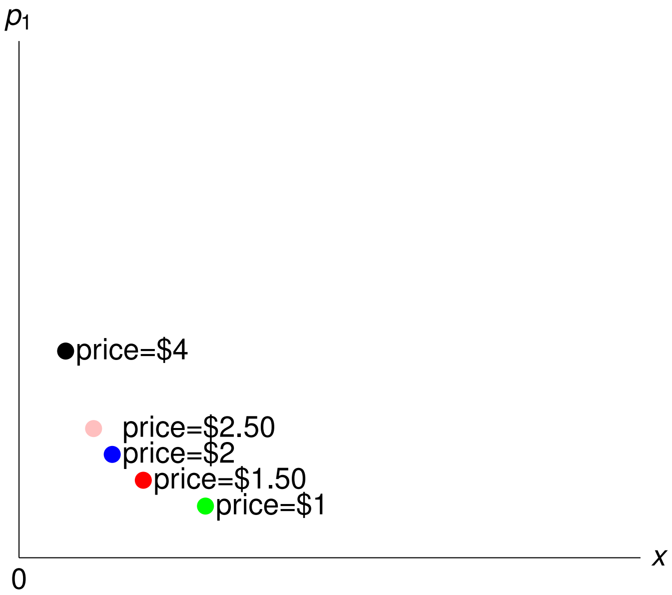
- What is a demand curve?

- It is a relationship between price and quantity demanded, holding constant all other prices and income.

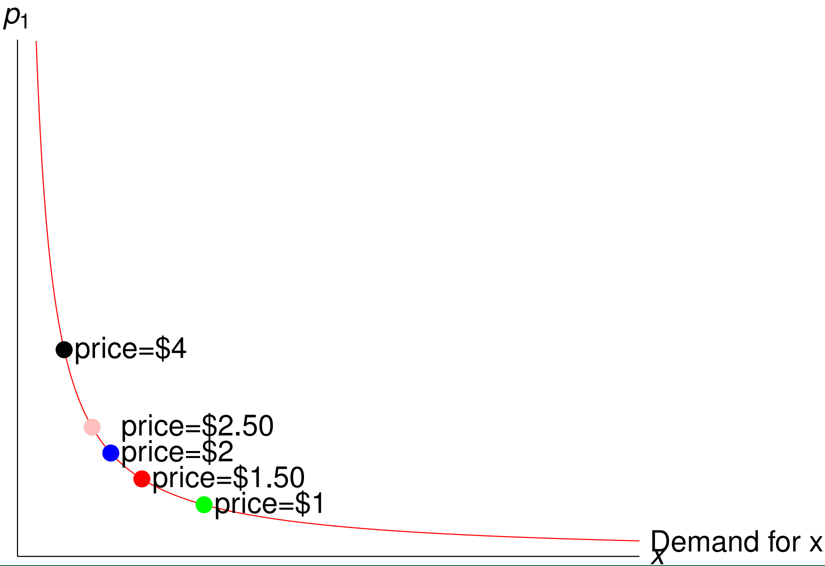
- Let's use our demand for x: $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
  - We will hold constant m and p_y. Let's plug in a bunch of different prices and plot this!

  - Suppose $\alpha = \beta = 1$ and $m = 6$.

Creating a Demand Curve for X



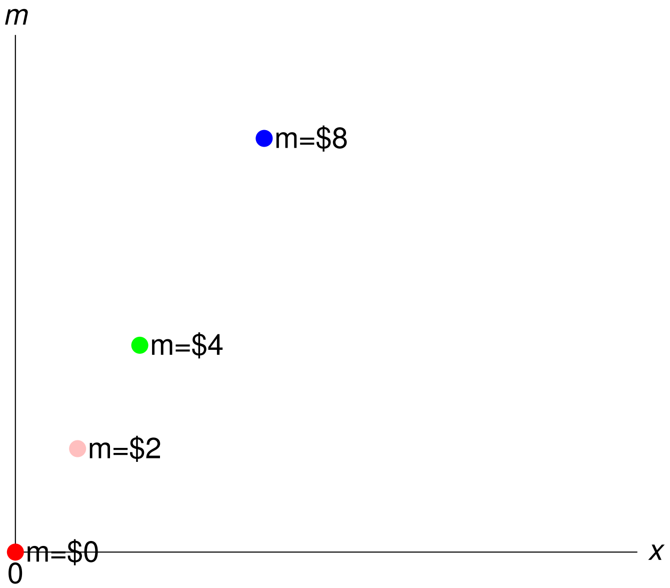
Creating a Demand Curve for X



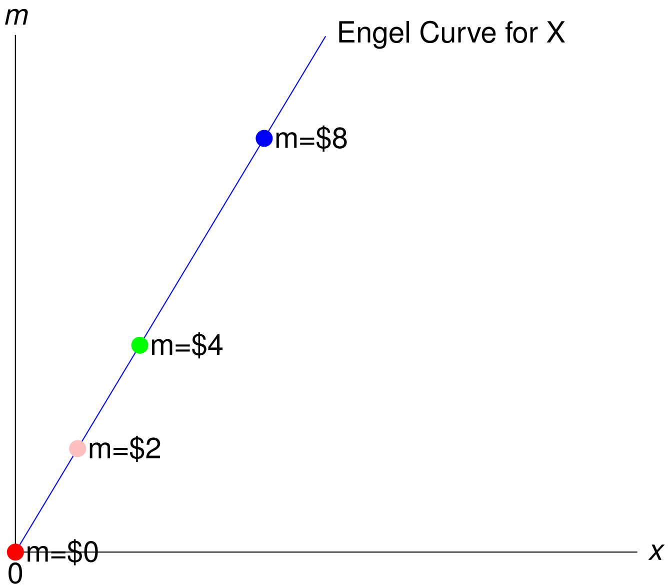
What about Demand vs Income?

- We can create a similar graph showing demand for x holding constant p_x, p_y, and changing m.
- We call that an Engel curve.
- Let's again use our demand for x: $x^* = \frac{\alpha}{\alpha+\beta} \cdot \frac{m}{p_x}$.
- Suppose $\alpha = \beta = 1$ and $p_x = p_y = 1$.
- So $x_1 = \frac{1}{2} \cdot m$.

Engel Curve



Engel Curve



Wealth Expansion Curve and Price Offer Curve

- Demand curves and Engel curves show a single good.

- What if we want to show both goods on one graph when i)income changes and ii)the price of only one good changes?
  - i) Wealth Expansion
  - ii) Price Offer Curve

Big Question for Class

How can we use our utility maximization diagram to trace out a demand curve and an Engel curve for good x?

Elasticities Preview

- In 160, you found elasticities as the percentage change in quantity demanded for a 1% change in price, or $\frac{\Delta Q^d}{\Delta P}$.

- Our Q^d is just the demand for each good, and we have the price in the demand function.

- So we can use the derivative of demand to not only say whether a good is ordinary or Giffen, but also a consumer's elasticity of demand!

- This will come back later in the semester and when we talk about aggregate demand/supply!