Chapter 2

Supply and Demand

The Law of Demand

- *Ceteris paribus*, the amount of a good consumers want to buy will rise as price falls
- **Quantity Demanded**: the amount of a good consumer are willing to buy at a given price
- **Demand Function**: correspondence between quantity demanded, price, and other factors

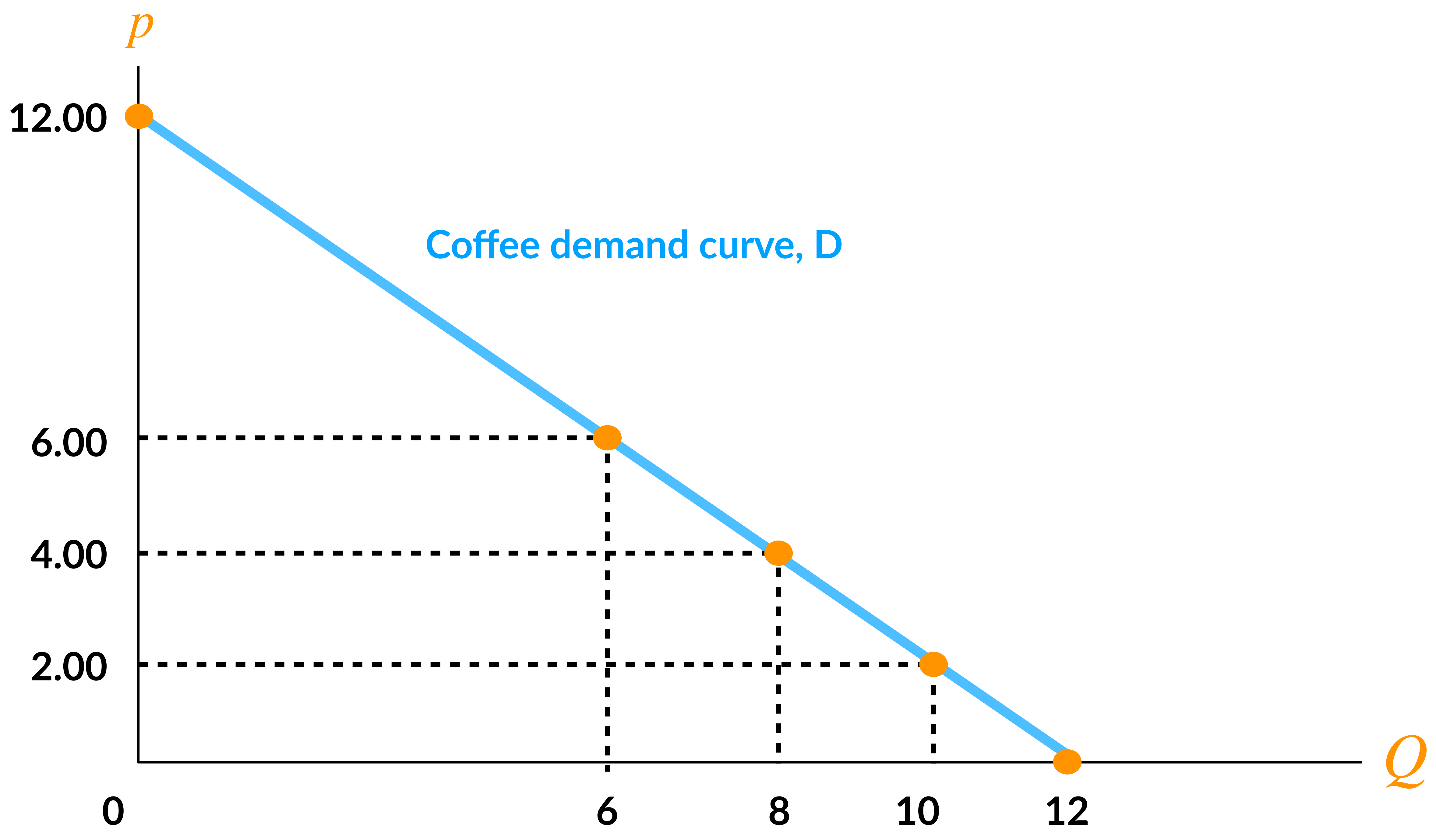
Demand Function

$$Q = D(p, p_s, Y)$$

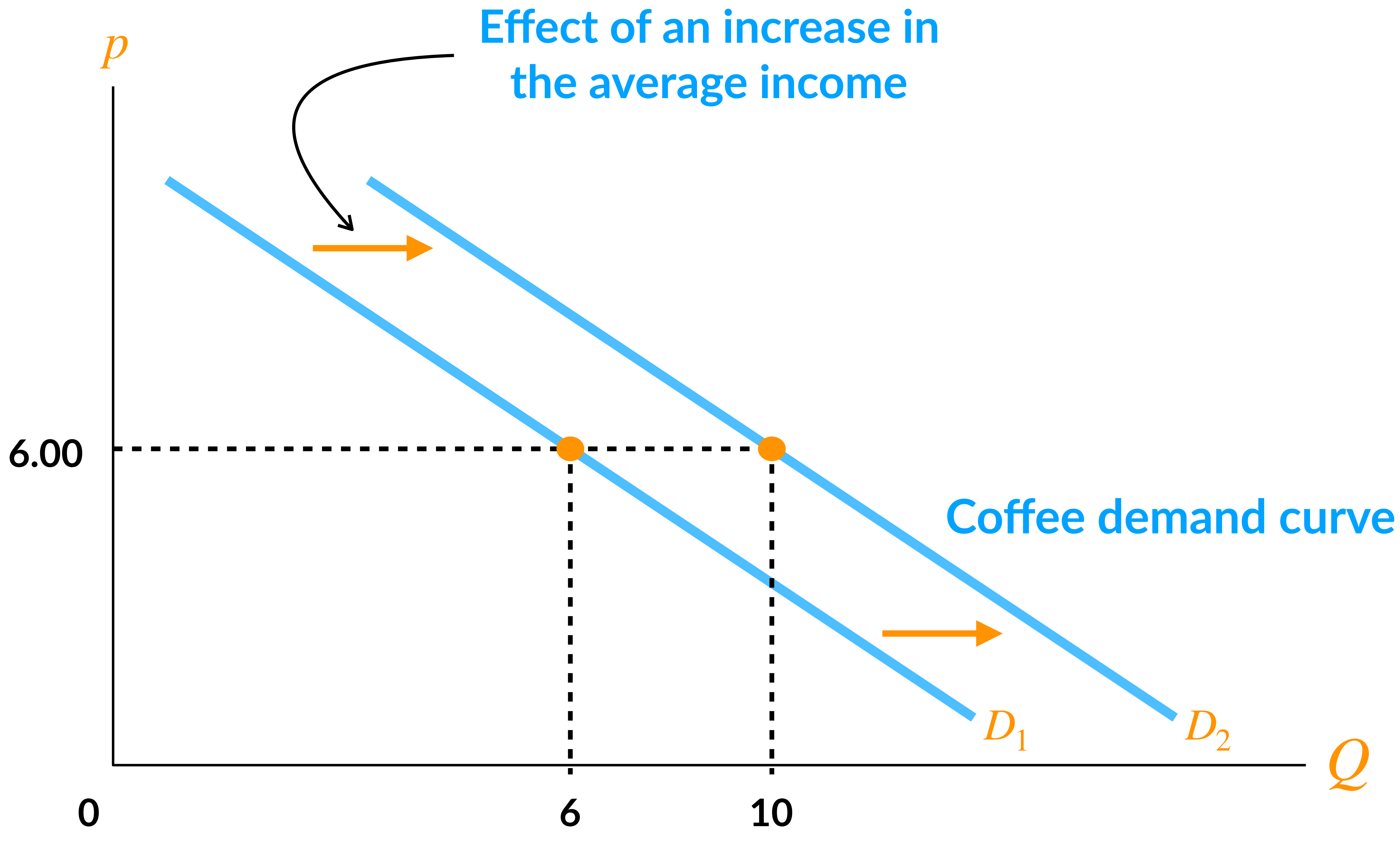
- Quantity of coffee demanded Q varies with the price of coffee p, the price of sugar p_s, and the consumer's income Y
- Above equation is a general functional form
- Example estimated demand function:

$$Q = 8.56 - p - 0.3p_s + 0.1Y$$

Demand Curve



Shifting Demand Curve



What Shifts Demand?

- Changes in:
  1. Tastes and preferences
  2. Prices of related goods (substitutes and complements)
  3. Incomes
  4. Government regulations
  5. Information

Supply

- *Ceteris paribus*, the amount of a good that producers want to produce and sell will rise as the price rises

- Difference between Supply and Quantity Supplied same as in demand case

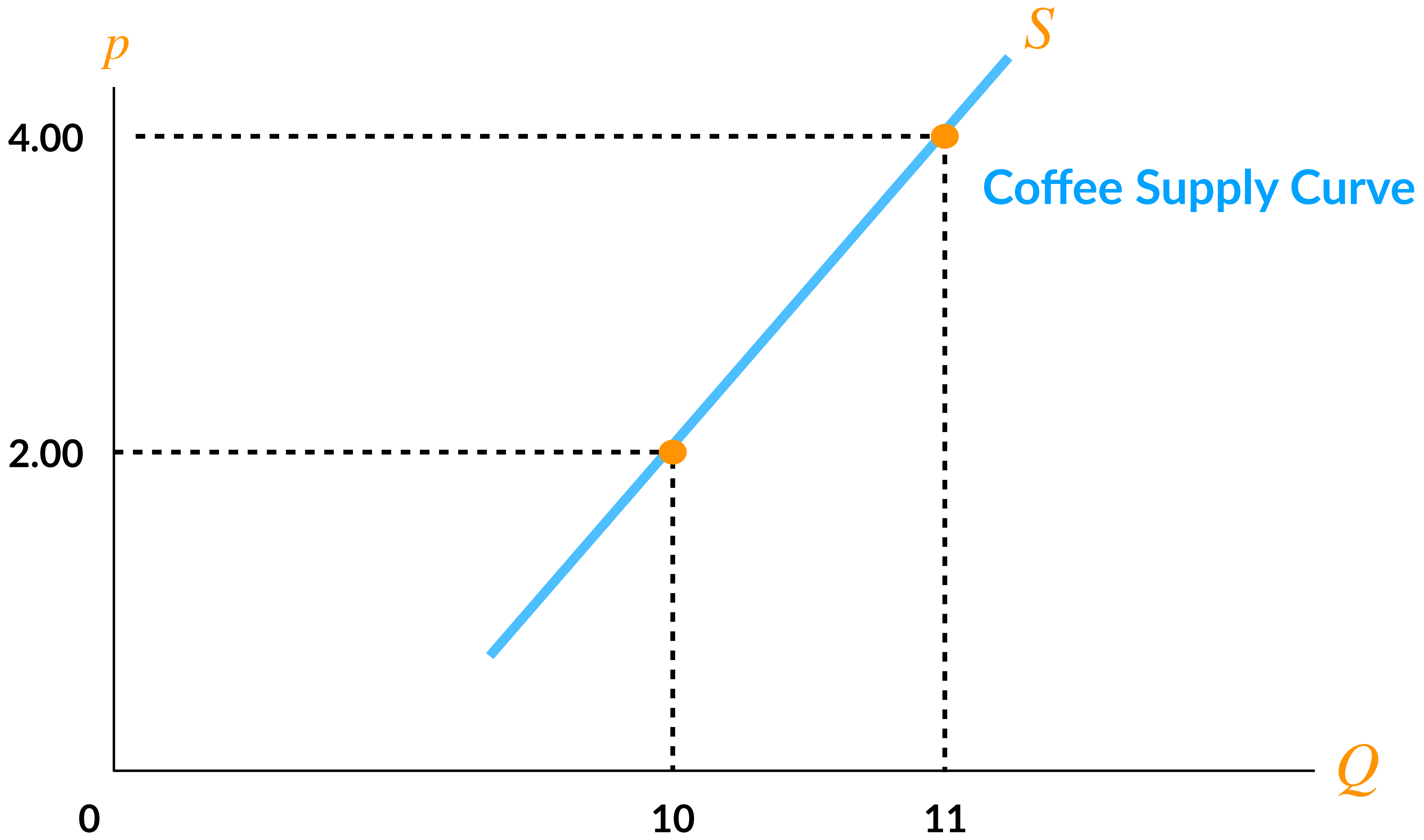
Supply Function

$$Q = S(p, p_c)$$

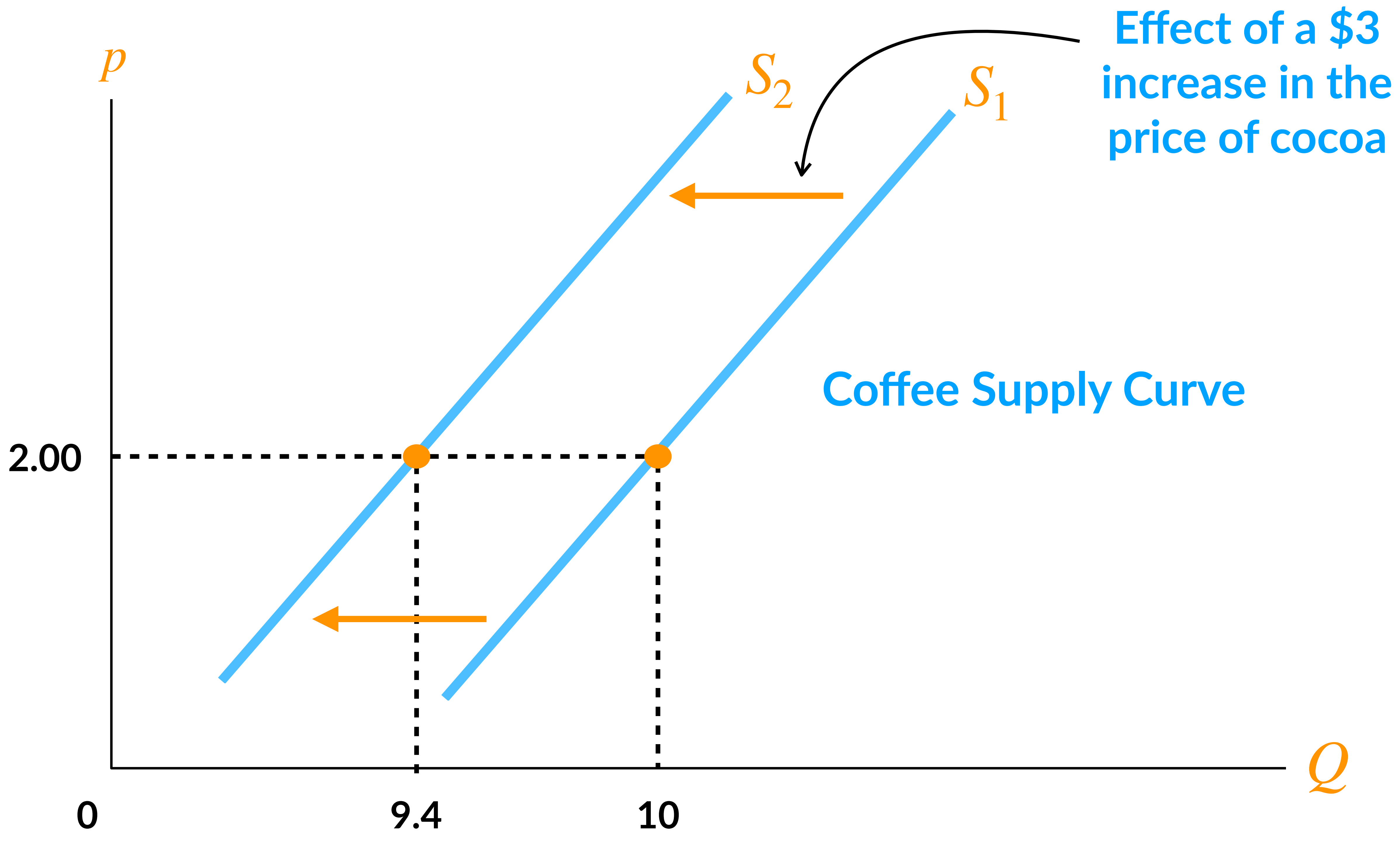
- Quantity of coffee supplied Q varies with the price of coffee p and the price of sugar p_c
- Above equation is a general functional form
- Example estimated supply function:

$$Q = 9.6 + 0.5p - 0.2p_c$$

Supply Curve



Shifting Supply Curve



What Shifts Supply?

- Changes in:
    1. The cost of inputs of production
    2. Production technology
    3. Government policy (e.g. taxes, regulations)
- What about a change in the price of the good?

Demand and Supply Functions

- Mathematical representations of the demand and supply processes
- Use them to find the slope (derivative)
    - Tells us how changes in one variable lead to changes in quantity demanded or quantity supplied
- We don't see real world functions because they are much more complicated
- Economists create linear models to help determine p and Q

Linear Demand and Supply Functions

- Demand function:
  $Q_d = f(\text{price, price of related goods, income})$
  $Q_d = 171 - 20p + 20p_b + 3p_c + 2Y$
    - Notice the $-20p$ term
- Supply function:
  $Q_s = f(\text{price, price of inputs})$
  $Q_s = 178 + 40p - 60p_h$
    - Notice the $+40p$ term

Reduced Form

- If we know the variables other than "own price" p, we can simplify:
  $Q_d = 171 - 20p + 20p_b + 3p_c + 2Y$
  - What if $p_b = 4$, $p_c = 3.33$, and $Y = 12.5$?
- Similarly for supply:
  $Q_s = 178 + 40p - 60p_h$
  - What if $p_h = 1.5$?

Market Equilibrium

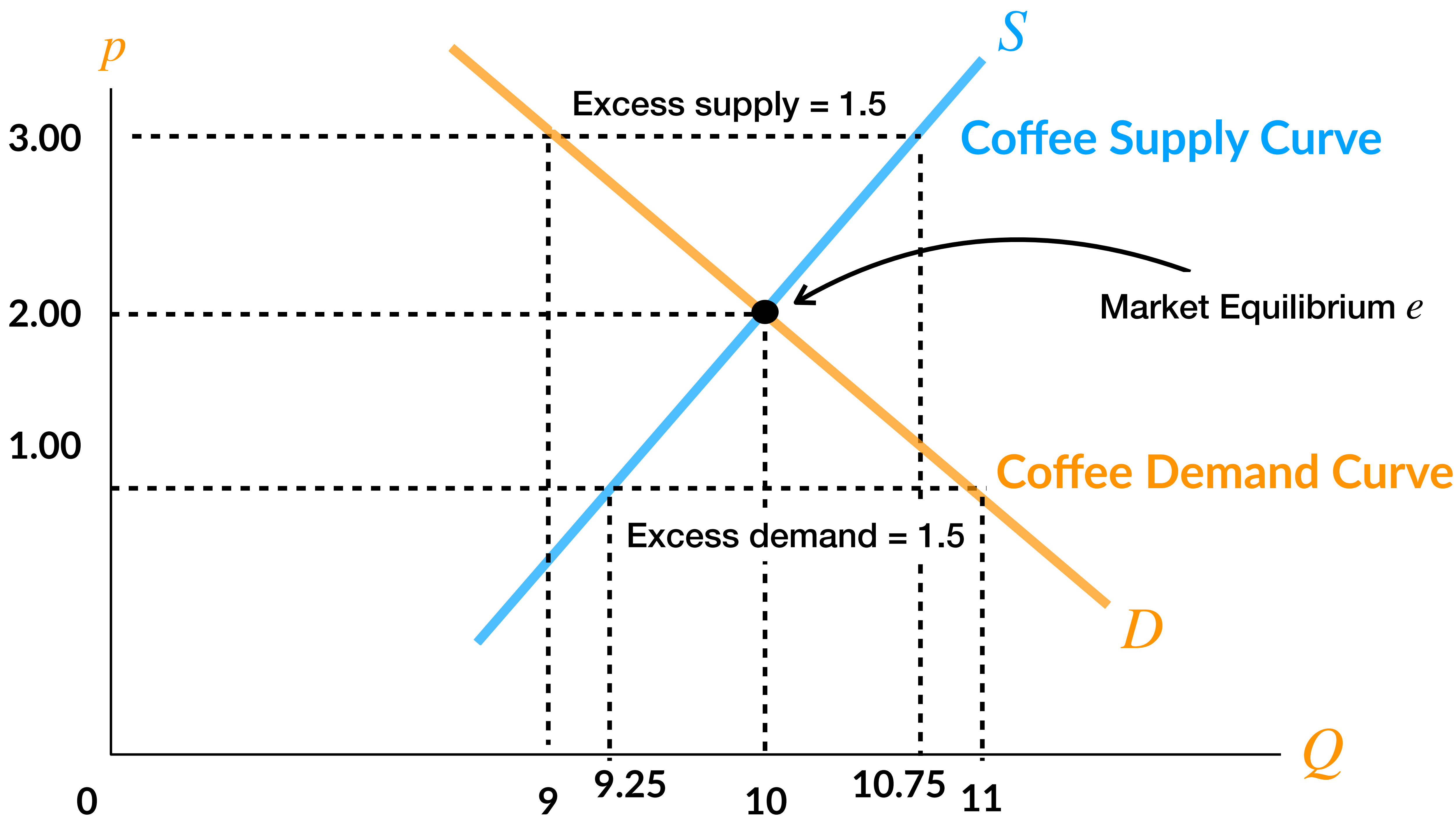
- The intersection of the demand and supply curves gives us the market price p and quantity sold q

- To find equilibrium, find where $Q_d = Q_s$

- We already found $Q_d = 286 - 20p$ and $Q_s = 88 + 40p$, now solve for p:
  $286 - 20p = 88 + 40p$
  $198 = 60p \longrightarrow p = \$3.30$

- What about q?

Market Equilibrium



Comparative Statics

- Economists are often interested in how an equilibrium can change when outside factors change
    - Consumers and producers do not cause the change
- Want to compare one static equilibrium to another — only a change in market conditions has occurred between the two

Comparative Statics Example

- Using the previous Q_d and Q_s:
  $Q_d = 220 - 2p$ and $Q_s = 20 + 3p - 20r$
- Solve for the equilibrium price p **in terms of the value of r**
- Use this equilibrium condition to show how the equilibrium quantity changes as the value of r changes

Why Do the Slopes of the Demand & Supply Curves Matter?

- The shape of each curve relays important information concerning the degree to which consumers and producers respond to changes in prices

- This sensitivity to price is Elasticity ε

- Elasticity (OF ANY TYPE) relates the percentage change in one variable in response to a corresponding percentage change in another variable

Formulas for Elasticity of Demand

$$\varepsilon = \frac{\%\text{ change in Quantity Demanded}}{\%\text{ change in price}}$$

$$\varepsilon = \frac{\Delta Q/Q}{\Delta p/p} = \frac{\Delta Q}{\Delta p} \times \frac{p}{Q} = \frac{\delta Q}{\delta p} \times \frac{p}{Q}$$

- In the special case of a **linear demand function** (e.g. $Q_d = a - bp$) we can simplify:

$$\varepsilon = -b \times \frac{p}{Q}$$

Formulas for Elasticity of Demand

- Suppose the demand function for a good is expressed as $Q = 100 - 8p$
  - If the price is $10, then what is ε?
  - Hint: is this a linear demand function?

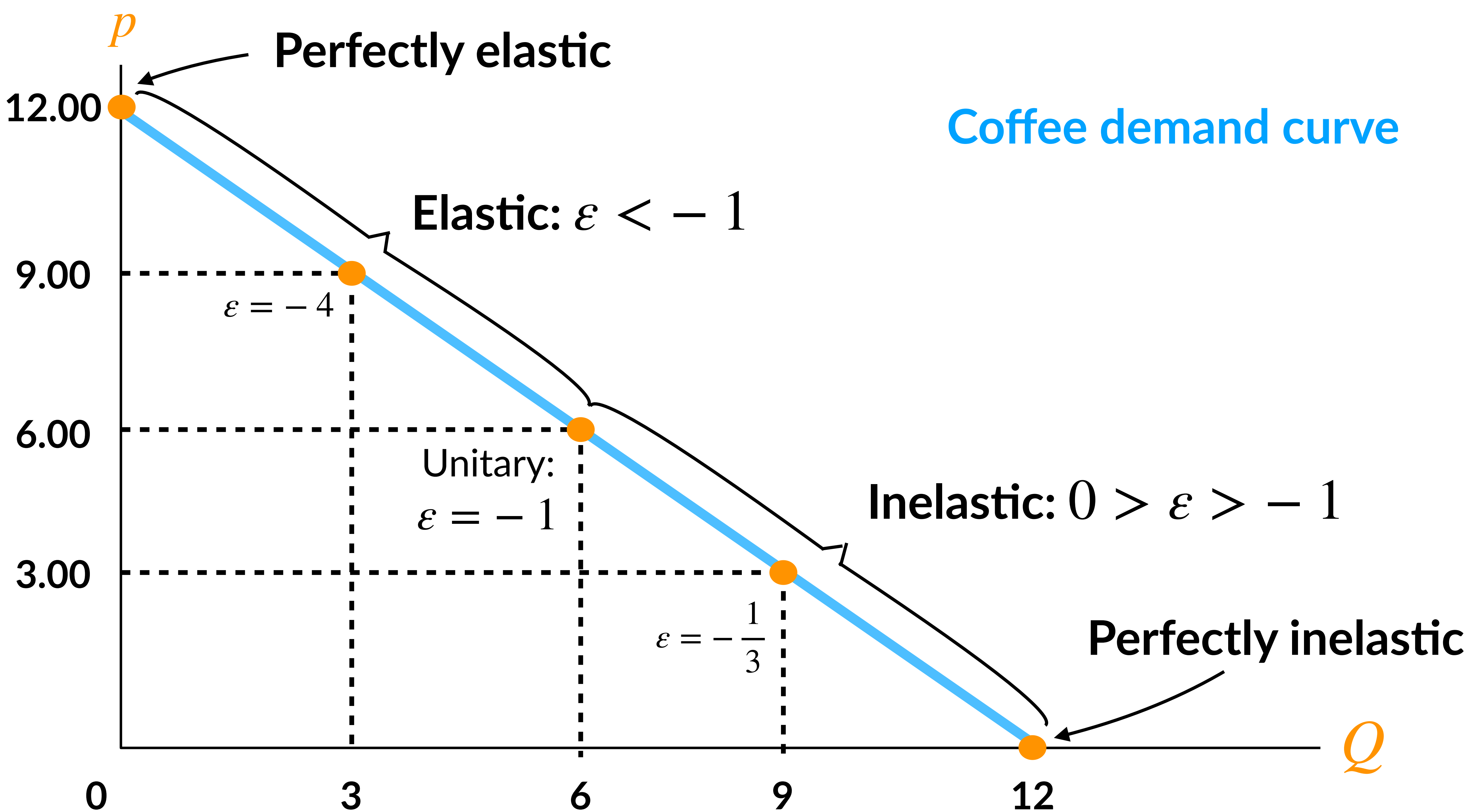
Point Elasticity vs. Interval Elasticity

- Both are useful and can be applied to different situations
- Classroom group exercise for **Interval Elasticity**

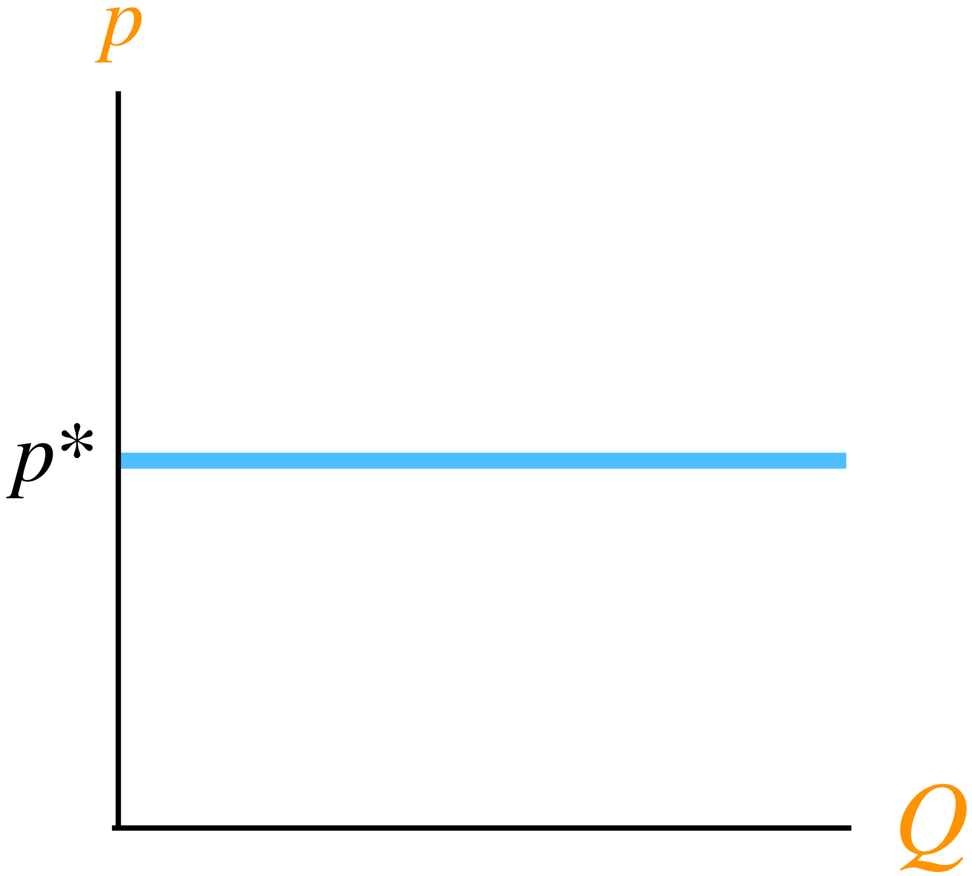
Post Activity Questions

- Does the interval elasticity take the same value if we consider both "directions" of a pair of prices?
- Should elasticity always be the same value or can it change?
- What sign $(+ / -)$ can the elasticity of demand take?
- What value(s) are important cut-offs for discussing the nature of elasticity of demand?

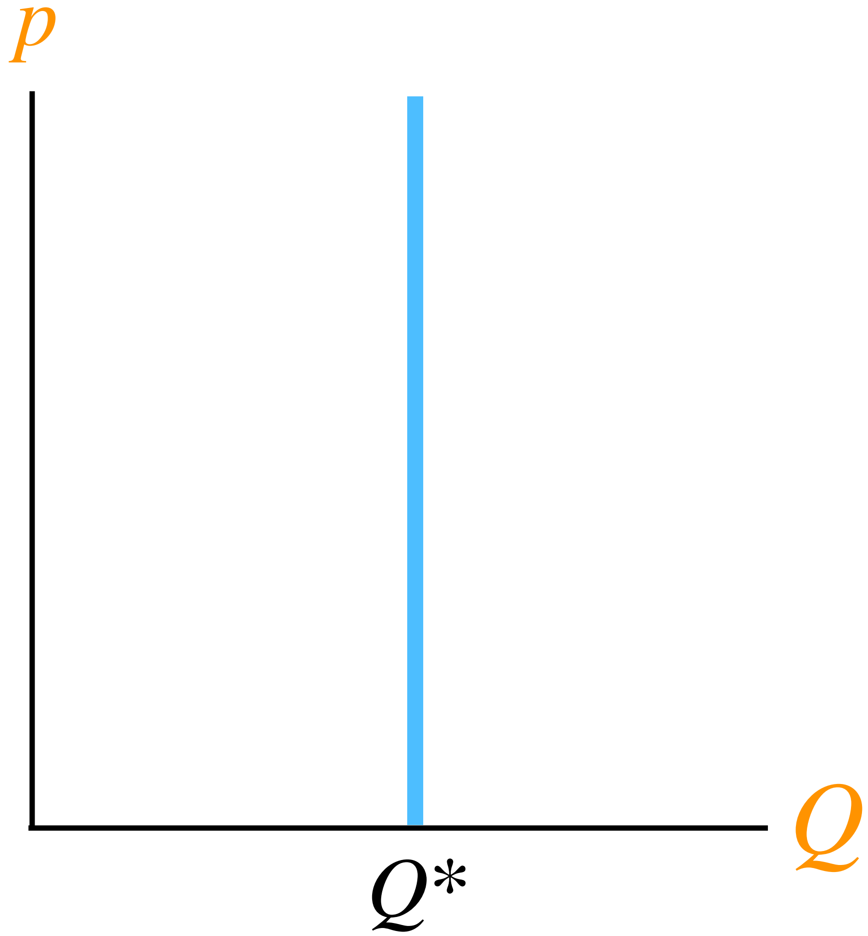
Elasticity Along the Coffee Demand Curve



Special Cases: Vertical and Horizontal Demand Curves



Perfectly Elastic Demand



Perfectly Inelastic Demand

Special Elasticity Cases

- Perfectly Elastic (Horizontal) Demand
  - $\varepsilon = -\infty$ (Q_d responds infinitely to price changes)
  - May indicate a perfect substitute is present
- Perfectly Inelastic (Vertical) Demand
  - $\varepsilon = 0$ (Q_d does not respond to price changes at all)
  - May indicate a true "essential" good
- Unitary Elasticity
  - $\varepsilon = -1$ (Q_d responds to price changes at exactly the same rate)
  - Occurs at only one point on a linear demand curve

Other Demand-Related Elasticities

- Q_d was also a function of income, so we can define the **income elasticity of demand** ξ

$$\xi = \frac{\Delta Q/Q}{\Delta Y/Y} = \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q} = \frac{\delta Q}{\delta Y} \times \frac{Y}{Q}$$

- Some points:
  - The same rule for linear coefficients applies!
  - Notice that the position of the Q's all stayed the same and we made a clean swap of Y for p
- What values (+ / —) can this take?

Other Demand-Related Elasticities

- Q_d was also a function of the price of related goods, so we can define the **cross price elasticity of demand** ε_{cp}

$$\varepsilon_{cp} = \frac{\Delta Q/Q}{\Delta p_o/p_o} = \frac{\Delta Q}{\Delta p_o} \times \frac{p_o}{Q} = \frac{\delta Q}{\delta p_o} \times \frac{p_o}{Q}$$

- Some points:
  - The same rule for linear coefficients applies!
  - Again the Q's all stayed the same and we made a clean swap of the price of the related good p_o for p
- What values (+ / —) can this take?

Formulas for Elasticity of Supply

$$\eta = \frac{\text{\% change in Quantity Supplied}}{\text{\% change in price}}$$

$$\eta = \frac{\Delta Q/Q}{\Delta p/p} = \frac{\Delta Q}{\Delta p} \times \frac{p}{Q} = \frac{\delta Q}{\delta p} \times \frac{p}{Q}$$

- ε was always negative. Also true for η?
- The same rule about linear coefficients applies
- Same use of "elastic" and "inelastic"
- **Draw a number line showing the relevant distinctions for both types!**

Long vs. Short-Run Elasticities

- What determines long vs. short run?
- Demand elasticities over time
  - Sometimes it is easier to substitute away from a good in the long run (gas cars)
  - Sometimes the opposite is true, higher short run elasticities (frozen foods)
- Supply elasticities over time
  - Generally will be much more elastic in the long run—why?

Effect of a Sales Tax

- Two types of sales taxes:
  - **Ad valorem tax** is in percentage terms
    - California's state tax rate is 8.25%
  - **Specific (unit) tax** is in dollar terms
    - U.S. gasoline tax is $0.18 per gallon
- The effect of a sales tax on price and quantity depends on elasticities of demand and supply
- With price p, producers receive $p - \tau$ where τ is tax amount

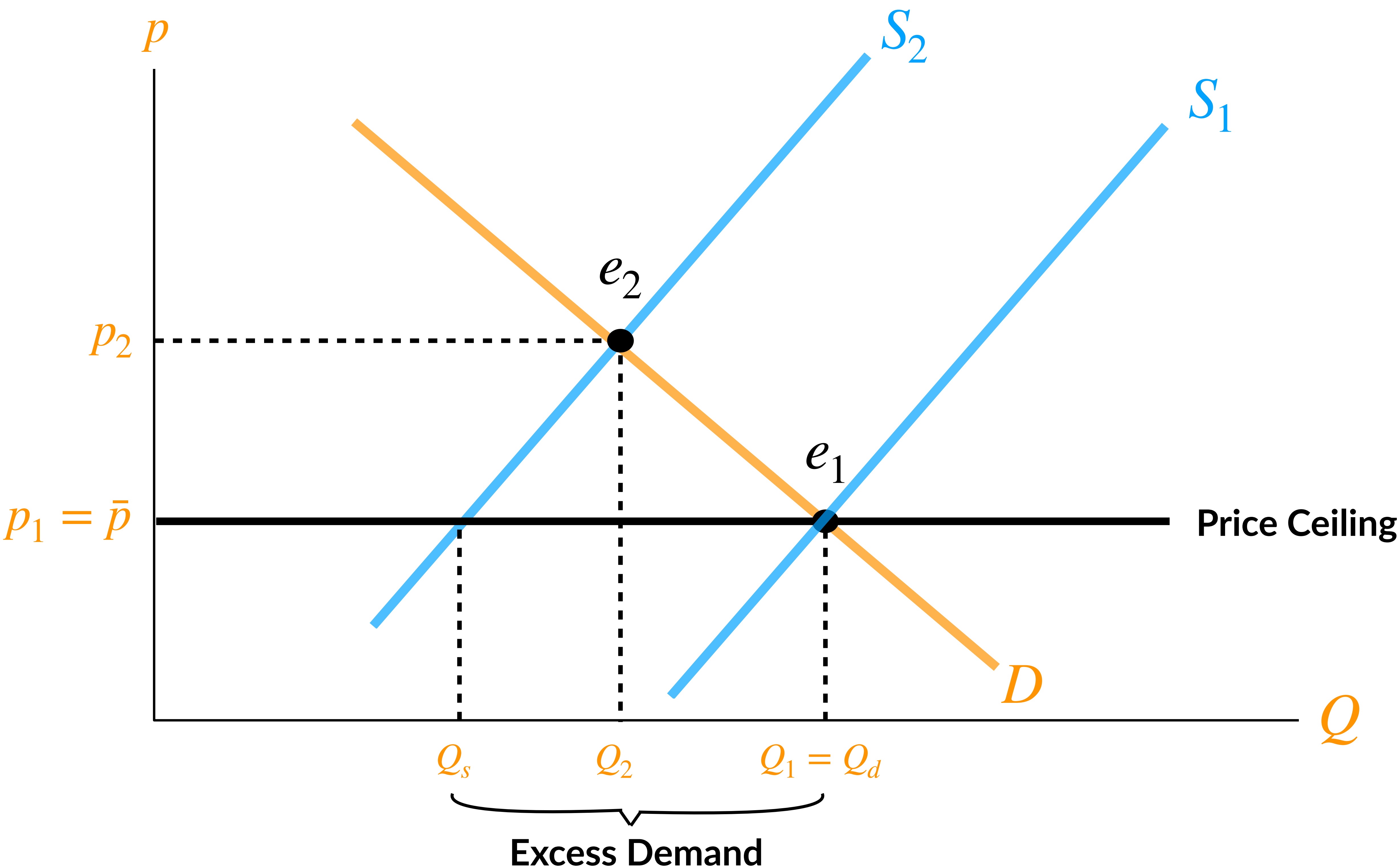
Must Quantity Supplied and Quantity Demanded be Equal?

- In a supply-and-demand model, prices will fluctuate until $Q_d^* = Q_s^*$
- This doesn't necessarily hold if policy interventions prohibit the free fluctuation of prices
    - Price ceilings, price floors are examples of price controls
- Can you think of examples?

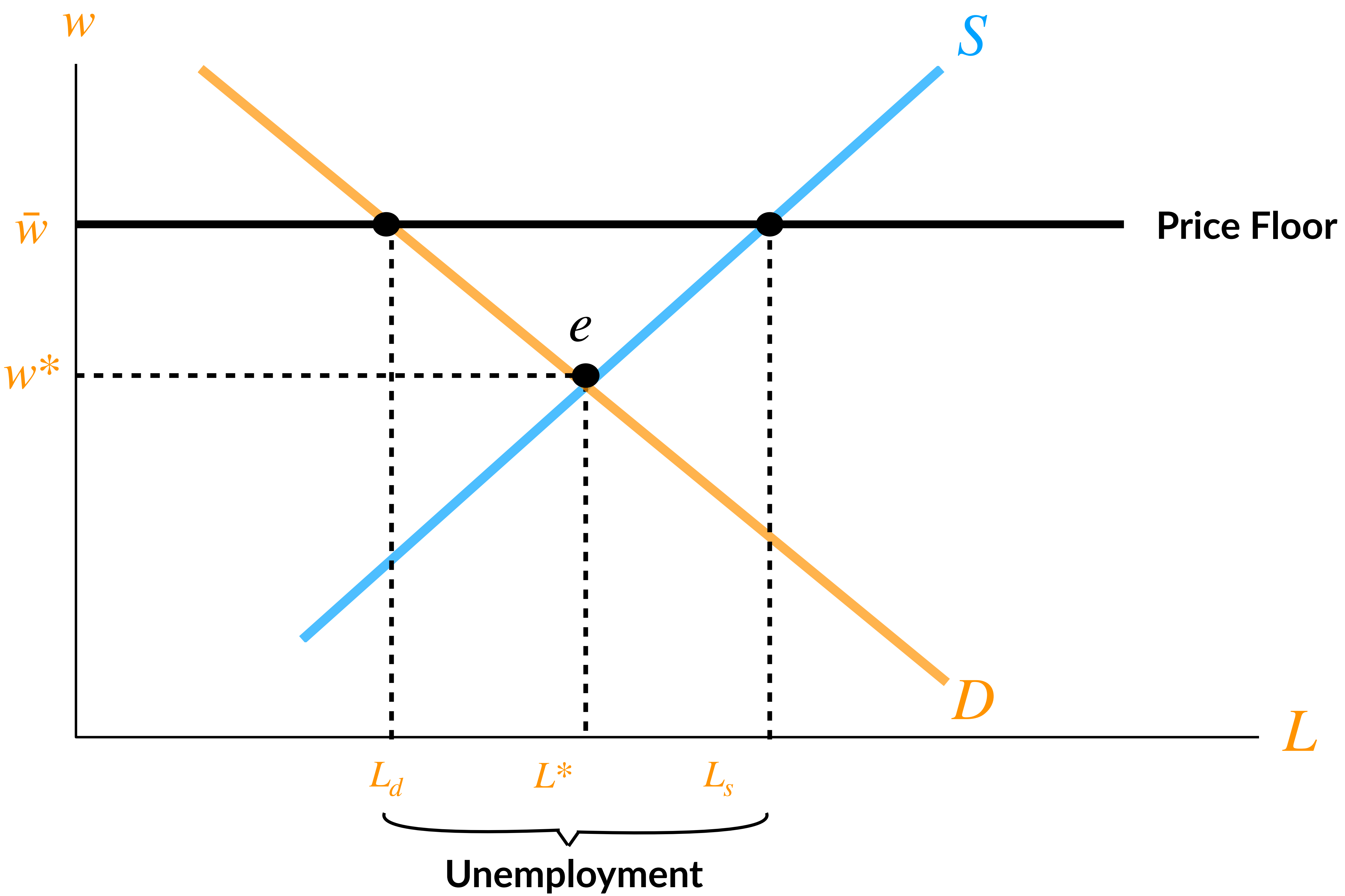
Price Control Examples

- Price Ceilings: rent control, maximum legal interest rates, gas prices in the 70s, price gauging laws
- Price Floors: minimum wages, certain agricultural products

Gas Price Ceiling



Minimum Wage



Summary of Price Controls

- The supply-demand model predicts that:
  - Binding price ceilings will lead to a shortage in the market
  - Binding price floors will lead to a surplus
- What does the supply-demand model predict will happen if a non-binding price control is implemented?

When to Use the Supply-Demand Model

- When firms sell identical products, many buyers and sellers
- Buyers have perfect information about price and quality of goods
- Costs of trading are low and no barriers to entry
- Taken together, we say a market is perfectly competitive when all these conditions are met