# 3.1 — The Supply and Demand Model

## ECON 306 · Microeconomic Analysis · Fall 2020
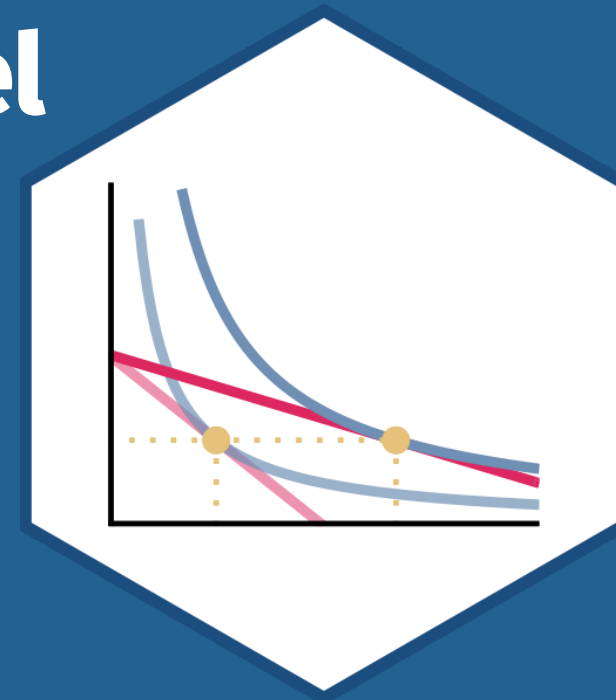
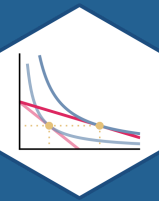Ryan Safner

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⊙ ryansafner/microF20

🌐 microF20.classes.ryansafner.com

# Equilibrium
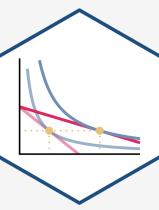
# Recall: 2 Major Models of Economics as a "Science"
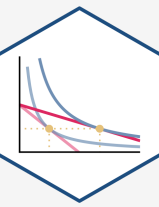
## Optimization

- Agents have **objectives** they value

- Agents face **constraints**

- Make **tradeoffs** to maximize objectives within constraints

## Equilibrium

- Agents **compete** with others over **scarce** resources

- Agents **adjust** behaviors based on prices

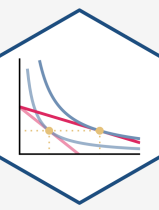- **Stable outcomes** when adjustments stop

# Recall: Optimization and Equilibrium

- If people can *learn* and *change* their behavior, they will always switch to a higher-valued option

- If there are no alternatives that are better, people are at an *optimum*

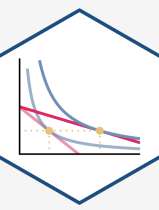- If everyone is at an optimum, the system is in *equilibrium*
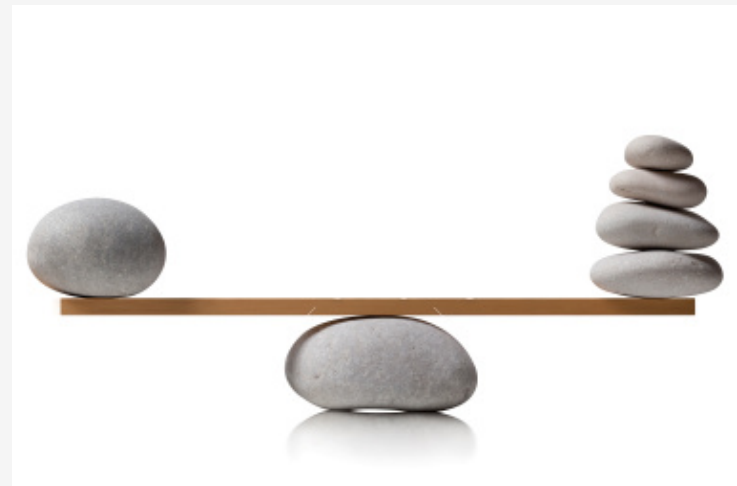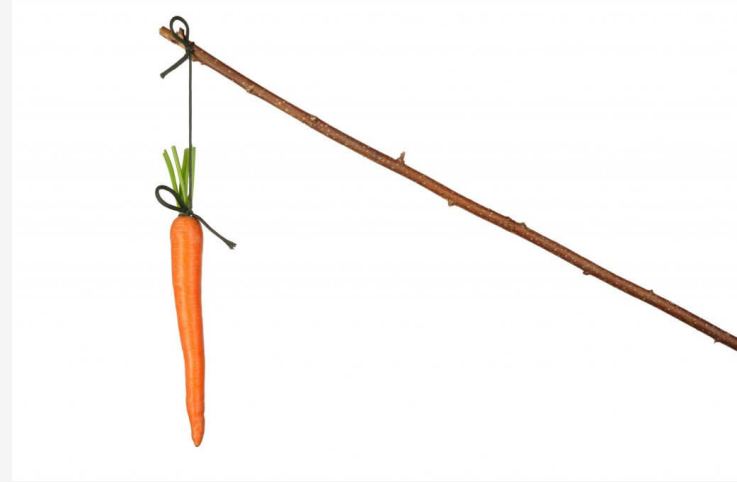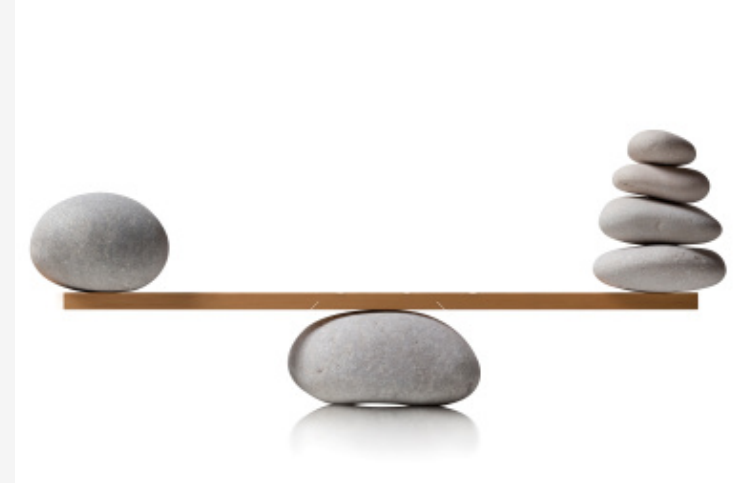
# Equilibrium Analysis: Questions to Answer

- Where do prices come from?

- How do they change?

- How consumers and producers to respond to changes?

# Equilibrium Analysis

- An **equilibrium** is an allocation of resources such that no individual has an incentive to alter their behavior

- In markets: **"market-clearing"** prices where quantity supplied equals quantity demanded

# *Partial* Equilibrium Analysis

- We will only look at **"*partial* equilibrium"** in a single market

- Changes in *one* market often affect *other* markets, affecting the **"*general* equilibrium"**

  - e.g. a change in the price of corn will affect the market for wheat, soybeans, flax, cereal, sugar, candy, ethanol, gasoline, automobiles, etc...
  - think of all of the *complements*, *substitutes*, upstream and
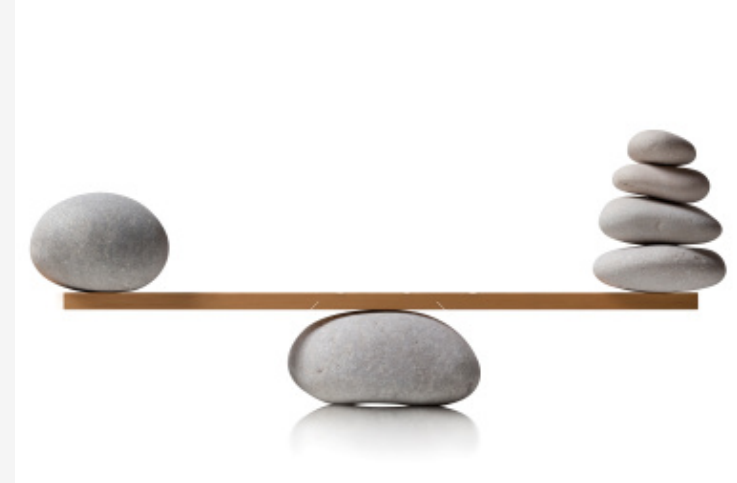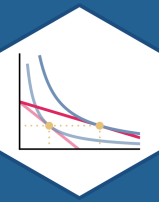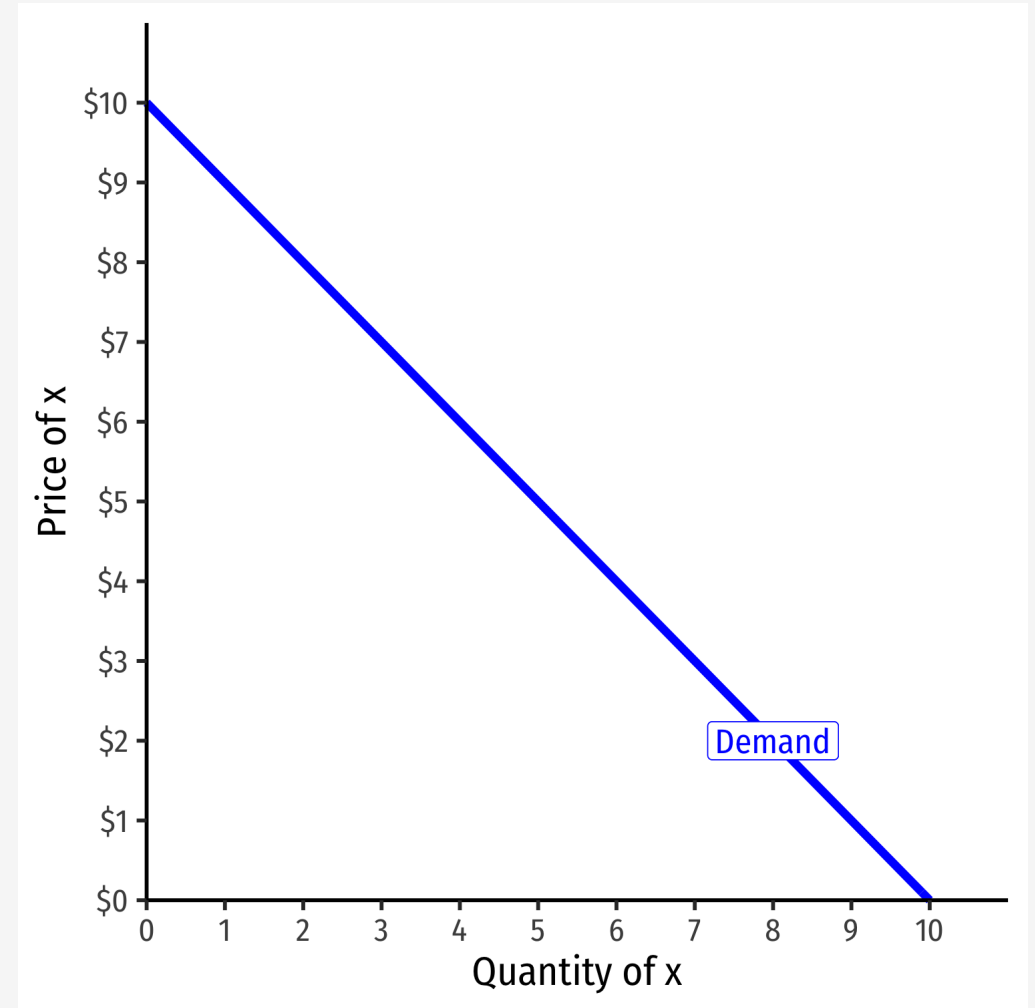
# Recall: Demand

# Demand Function

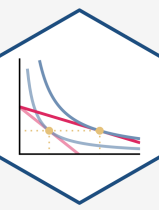- **Demand function** relates quantity to price

**Example**:

$$q = 10 - p$$

- Not graphable (wrong axes)!

# Inverse Demand Function

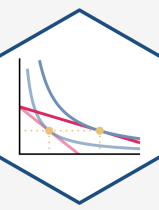- *Inverse* **demand function** relates price to quantity
  - Take demand function and solve for $p$

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**Example**:

$$p = 10 - q$$
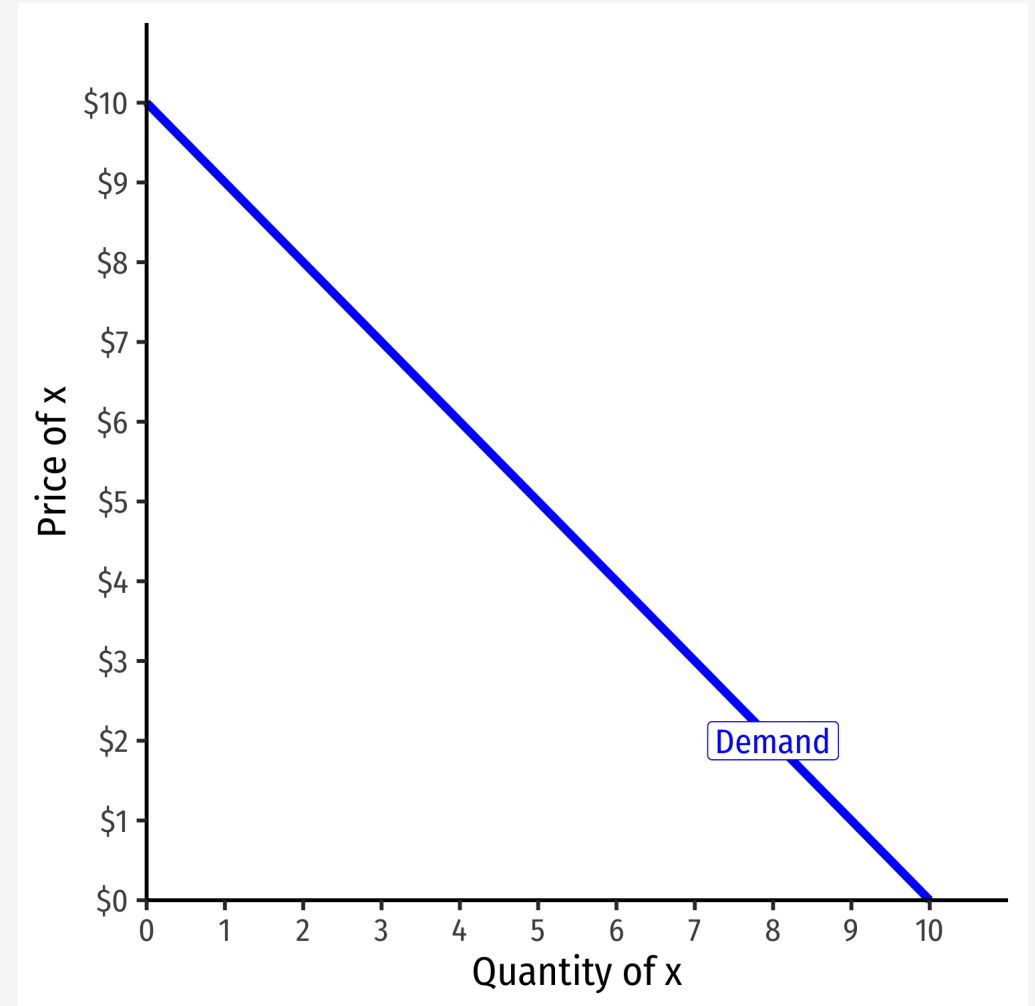
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- Graphable (price on vertical axis)!

# Inverse Demand Function

- *Inverse* **demand function** relates price to quantity
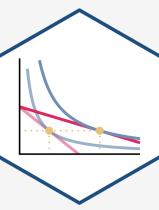  - Take demand function and solve for $p$
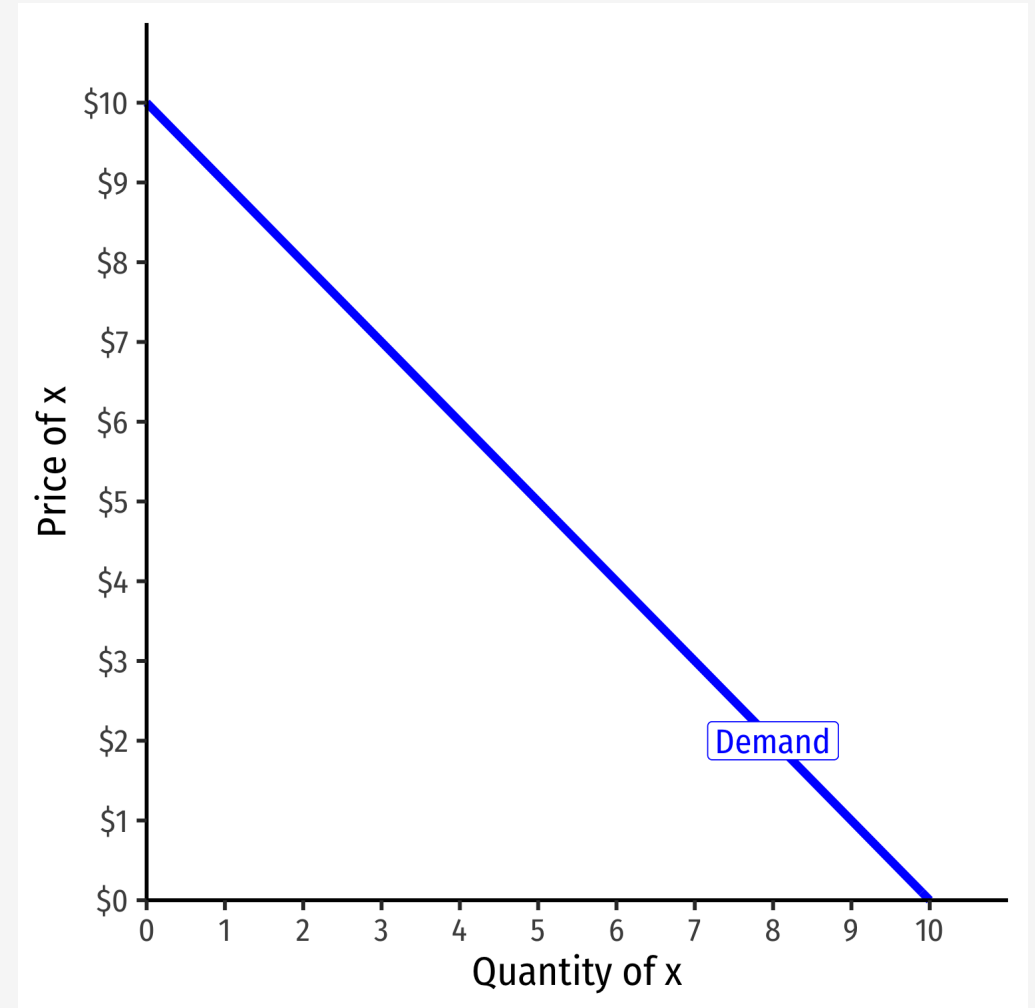
**Example**:

$$p = 10 - q$$

- Vertical intercept (**"Choke price"**): price where $q_D = 0$ ($10), just high enough to discourage *any* purchases
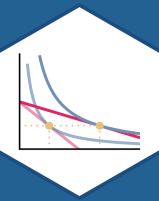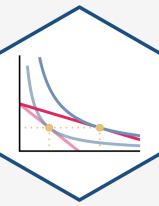
# Inverse Demand Function

- Read two ways:

- Horizontally: at any given price, how many units person wants to buy

- Vertically: at any given quantity, the **maximum willingness to pay (WTP)** for that quantity

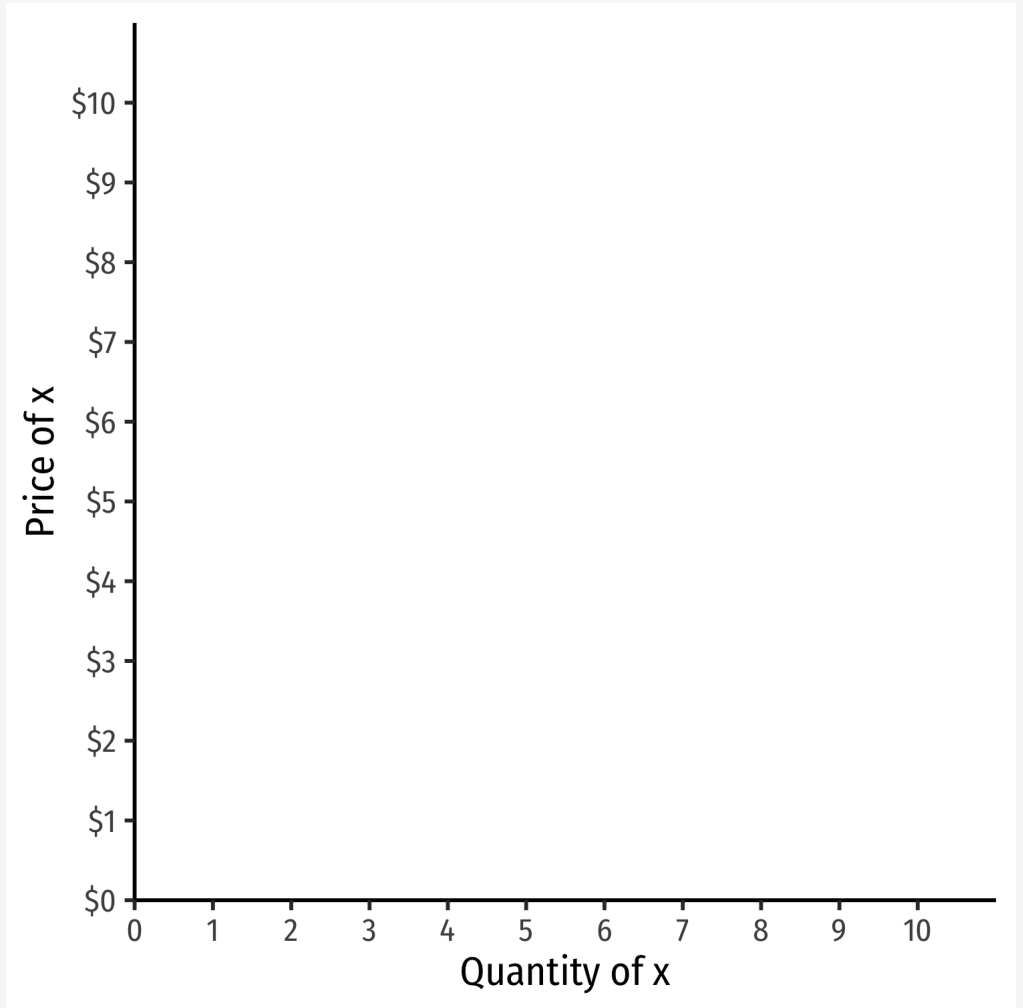  - This way will be very useful later

# Recall: Supply

# Supply Function

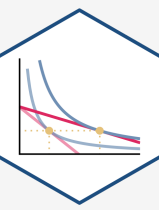- **Supply function** relates quantity to price

> **Example**:
>
> $$q = 2p - 4$$

- Not graphable (wrong axes)!

# Inverse Supply Function

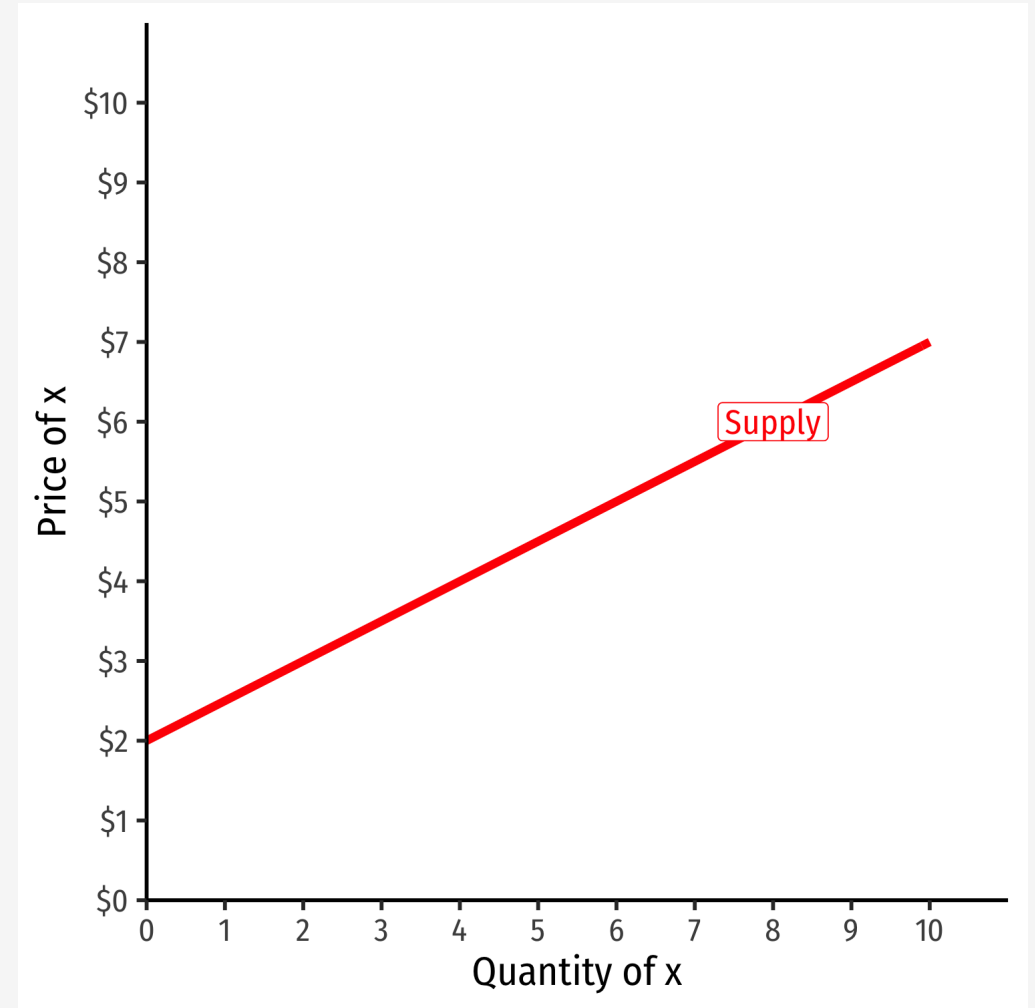- *Inverse* **supply function** relates price to quantity
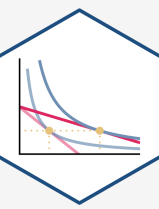  - Take supply function, solve for $p$

**Example**:

$$p = 2 + 0.5q$$

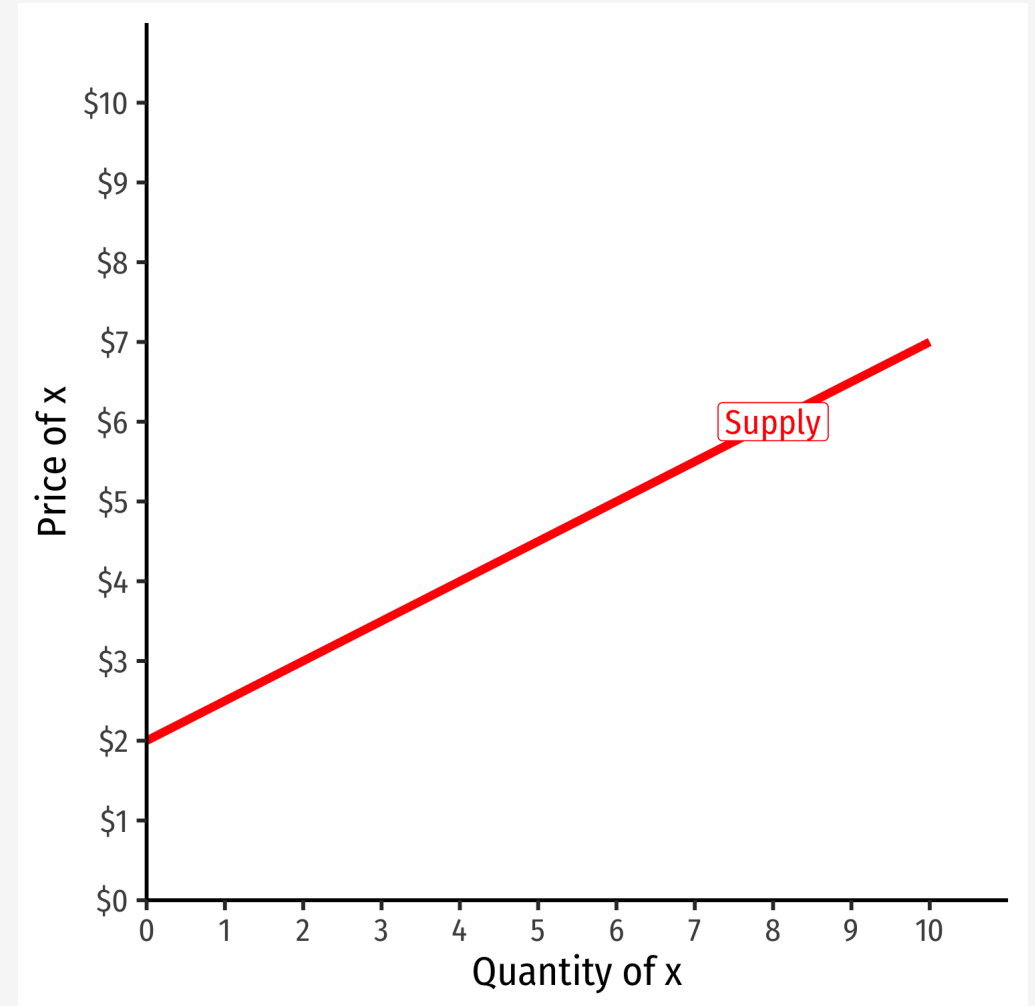- Graphable (price on vertical axis)!

# Inverse Supply Function
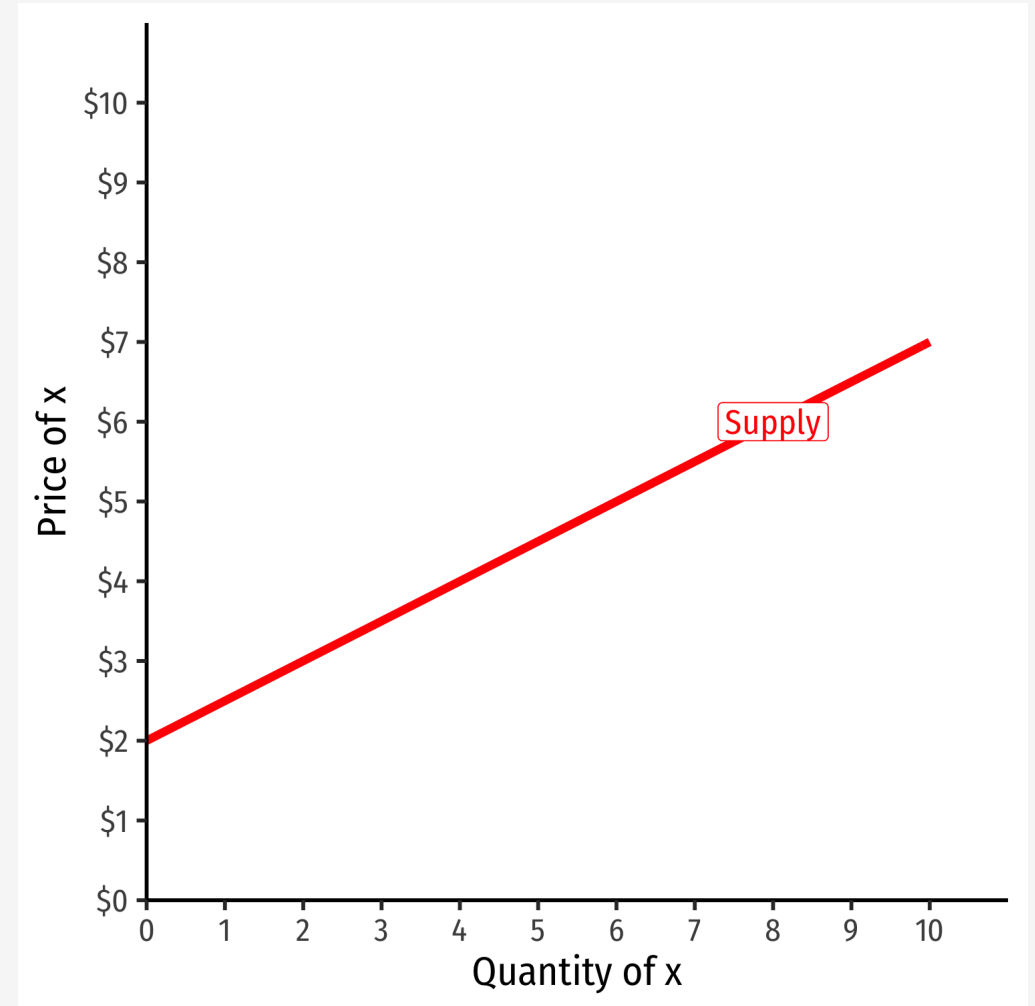
**Example**:

$$p = 2 + 0.5q$$

- Slope: 0.5

- Vertical intercept called the **"Choke price"**: price where $q_S = 0$ ($2), just low enough to discourage *any* sales
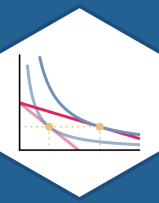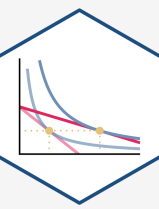
# Inverse Supply Function

- Read two ways:

- Horizontally: at any given price, how many units firm wants to sell

- Vertically: at any given quantity, the **minimum willingness to accept (WTA)** for that quantity
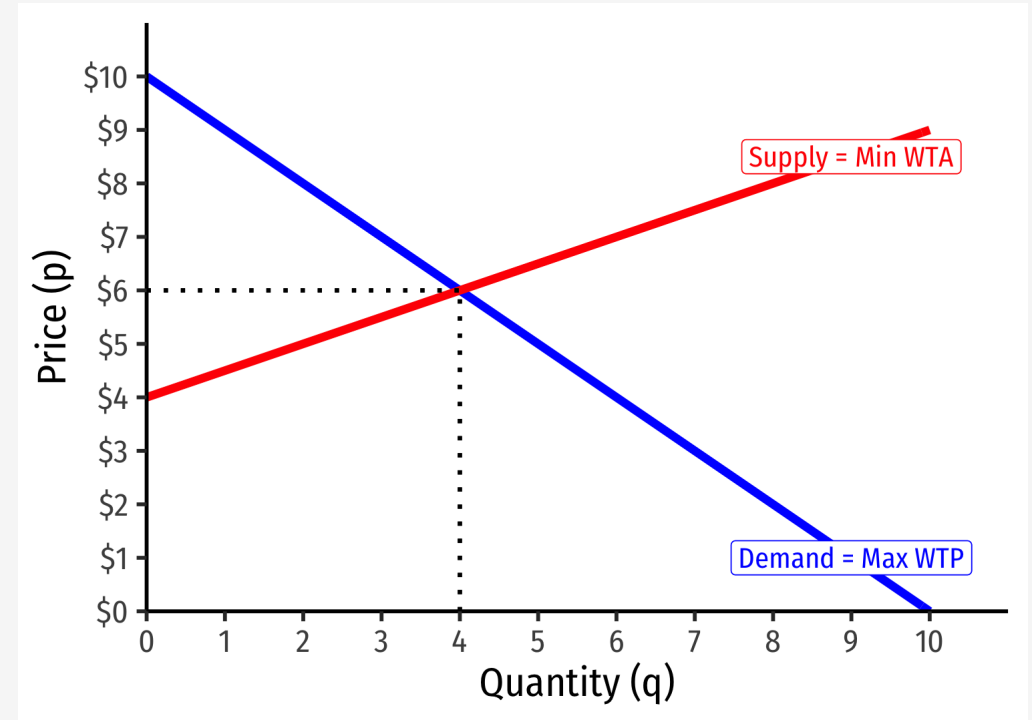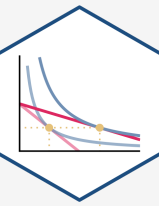
# Market Equilibrium

# Market Equilibrium

- Market-clearing (equilibrium) price ($p^*$): $6.00
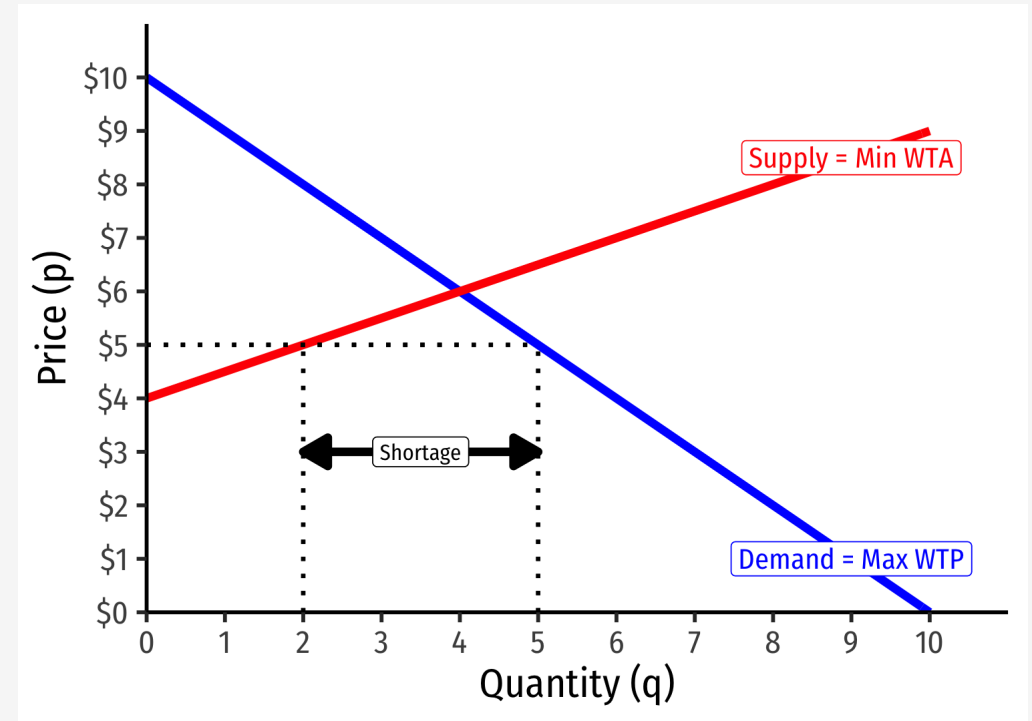
- Market-clearing (equilibrium) quantity exchanged ($q^*$): 4

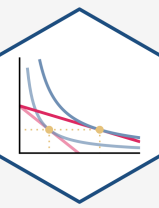# Why Markets Tend to Equilibrate

# Excess Demand I

**Example**: Consider *any* price below $6, such as $5:

- $Q_d = 5 \quad Q_s = 2$

- $Q_d > Q_s$: **excess demand**

- A **shortage** of 3 units

# Excess Demand II

**Example**: Consider *any* price below $6, such as $5:

- $Q_d = 5 \quad Q_s = 2$

- $Q_d > Q_s$: **excess demand**

- A **shortage** of 3 units

- Sellers will not supply more than 2 units

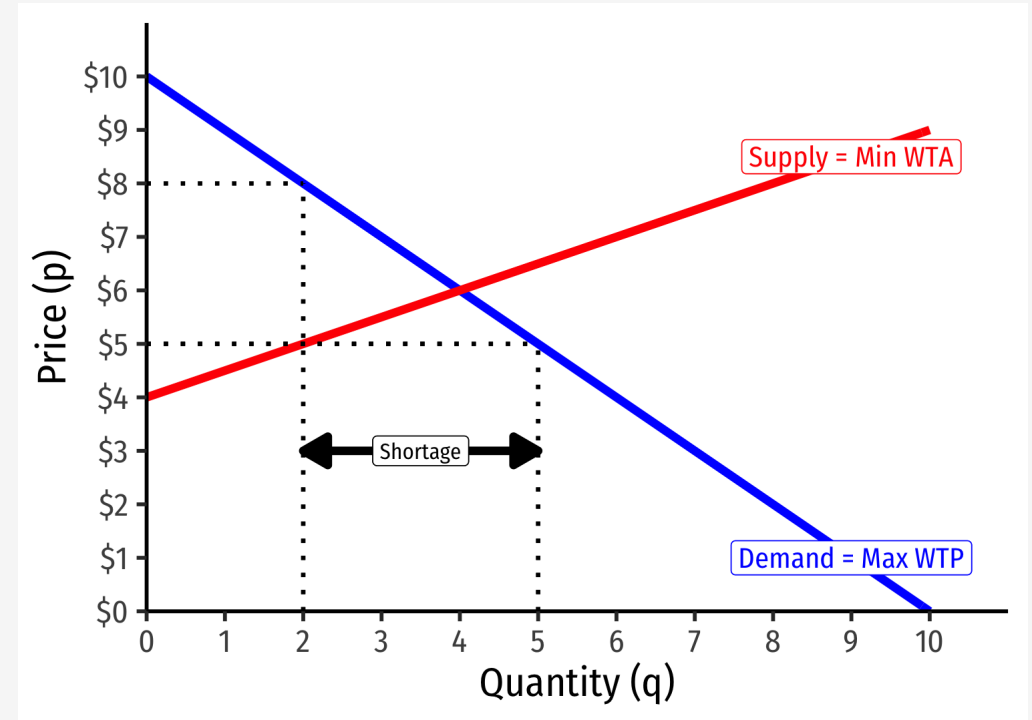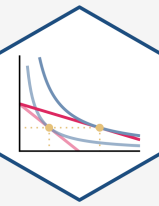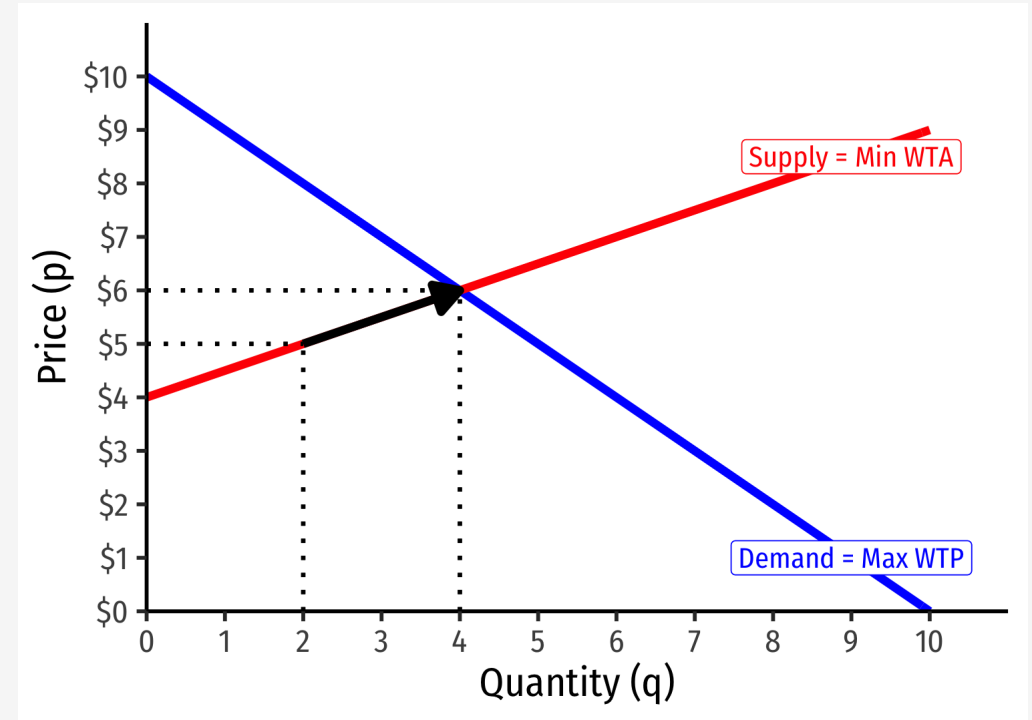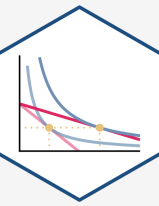- For 2 units, some buyers are willing to pay more than $5

# Excess Demand III

**Example**: Consider *any* price below $6, such as $5:

- $Q_d = 5 \quad Q_s = 2$

- $Q_d > Q_s$: **excess demand**

- A **shortage** of 3 units

- Buyers will **raise their bids** against one another, raising the price

- At higher prices, sellers willing to sell more!

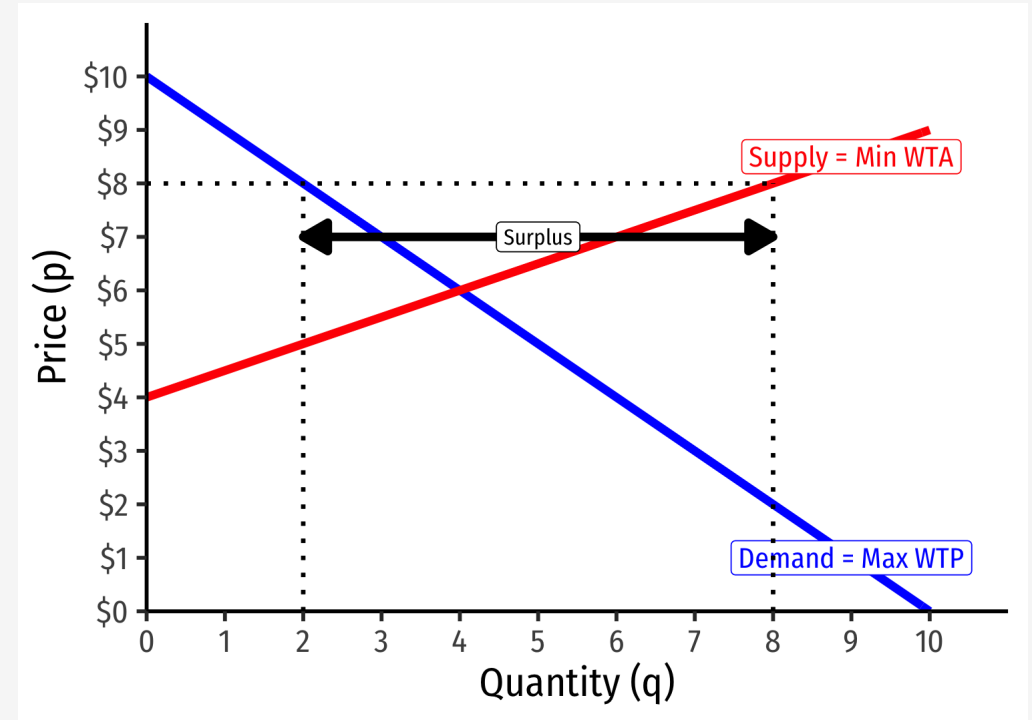- Until **equilibrium**, no pressure for change, $Q_d = Q_s$
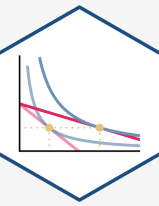
# Excess Supply I

**Example**: Consider *any* price above $6, such as $7:

- $Q_d = 2 \quad Q_s = 8$

- $Q_d < Q_s$: **excess supply**

- A **surplus** of 6 units

# Excess Supply II

**Example**: Consider *any* price above $6, such as $7:

- $Q_d = 2 \quad Q_s = 8$

- $Q_d < Q_s$: **excess supply**

- A **surplus** of 6 units

- Buyers will not buy more than 2 units

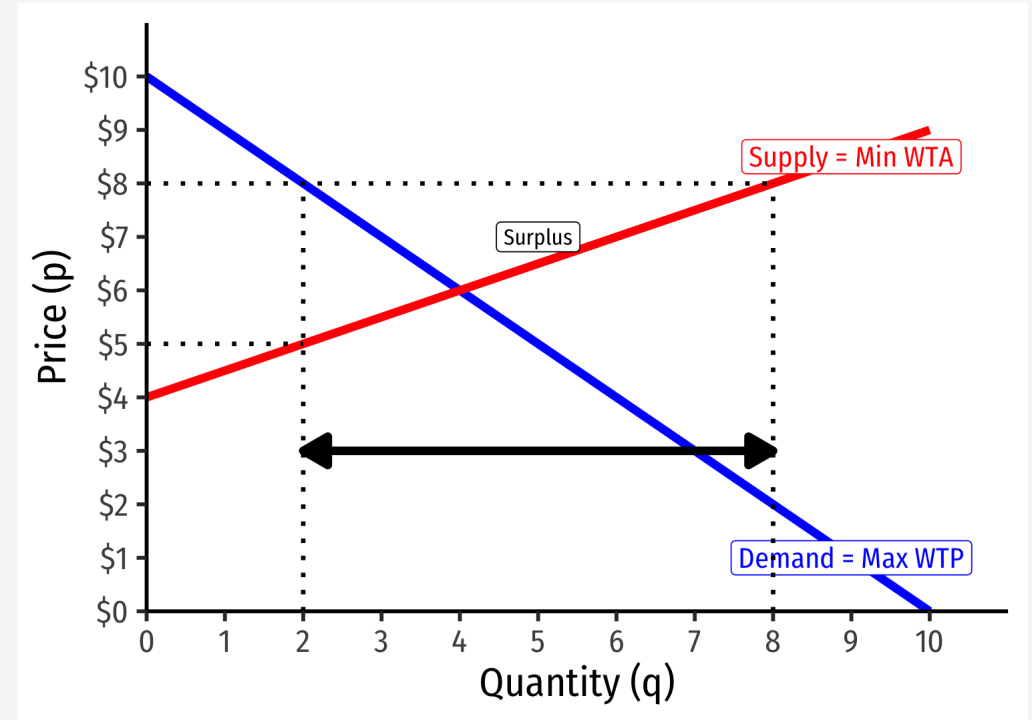- For 2 units, some sellers willing to accept less than $8

# Excess Supply III

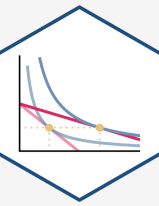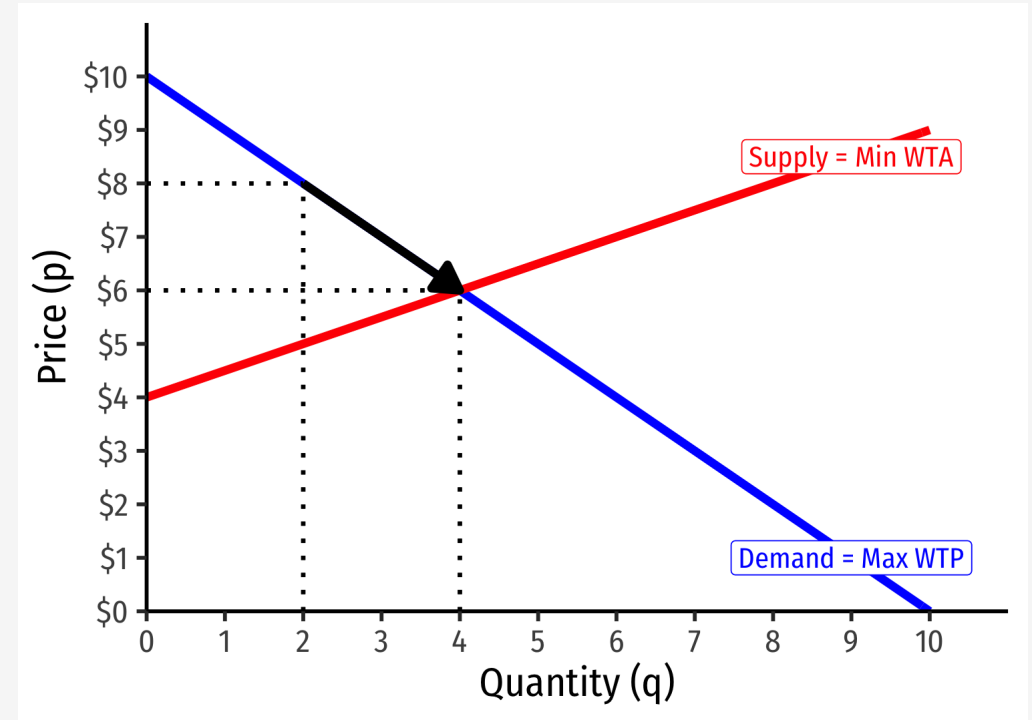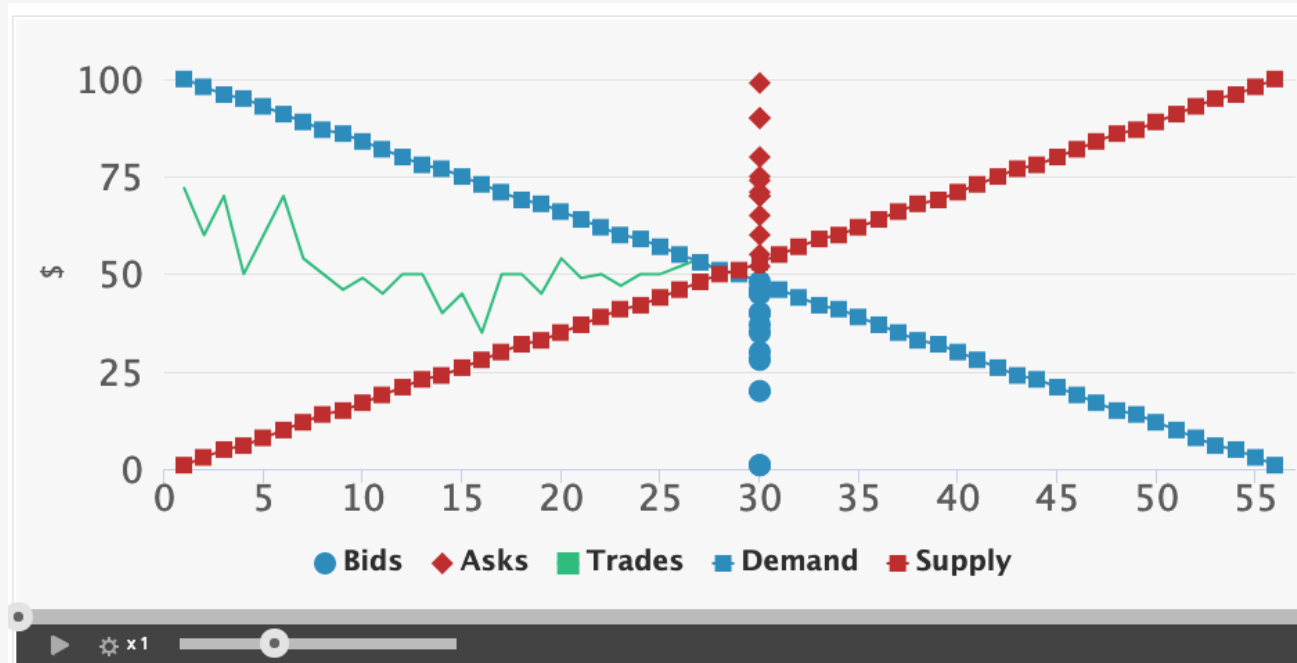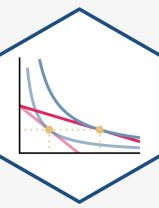**Example**: Consider *any* price above $6, such as $7:

- $Q_d = 2 \quad Q_s = 8$

- $Q_d < Q_s$: **excess supply**

- A **surplus** of 6 units



- Sellers will **lower their asking prices** against one another, lowering the price

- At lower prices, buyers willing to buy more!

- Until **equilibrium**, no pressure for change, $Q_d = Q_s$
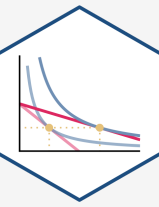
# Why Markets Tend to Equilibrate

# Comparative Statics

# Ceterus Paribus I

- Supply function and demand function relate *quantity* (supplied or demanded) to *price* **only**

  - Describes how buyers/sellers respond to changes in market price

- Certainly there are many *other* factors that influence how much a buyer or seller will purchase at a particular price!

  - income, preferences, prices of other goods, expectations, etc.

- A supply or demand function (or graph) requires **"ceterus paribus"** (all else equal)

# Recall (for example), Demand I
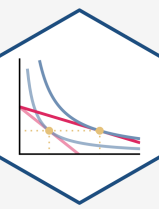
- A consumer's **demand** (for good x) depends on current prices & income:
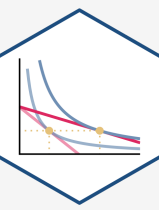
$$q_x^D = q_x^D(m, p_x, p_y)$$

- How does **demand for x** change?

1. **Income effects** $\left(\frac{\Delta q_x^D}{\Delta m}\right)$: how $q_x^D$ changes with changes in income

2. **Cross-price effects** $\left(\frac{\Delta q_x^D}{\Delta p_y}\right)$: how $q_x^D$ changes with changes in prices of *other* goods (e.g. $y$)

3. **(Own) Price effects** $\left(\frac{\Delta q_x^D}{\Delta p_x}\right)$: how $q_x^D$ changes with changes in price (of $x$)

# Recall (for example), Demand II

- A change in one of the **"determinants of demand"** will **shift** demand curve!

  - Change in **income** (m)
  - Change in **price of other goods** (p_y) (substitutes or complements)
  - Change in **preferences** or **expectations** about good (x)
  - Change in **number of buyers**

- Shows up in (inverse) demand function by a **change in intercept (choke price)**!

- Again, see my Visualizing Demand Shifters

See Class 1.9 for a reminder.
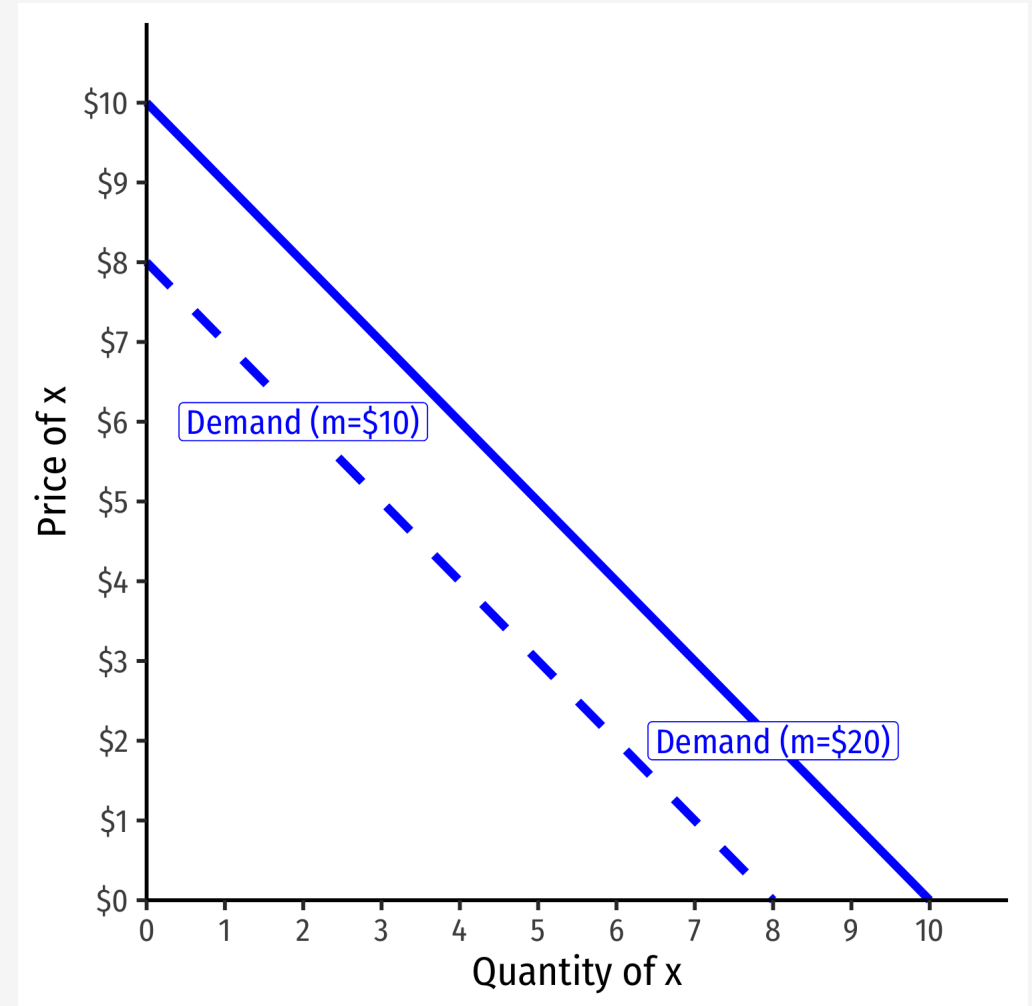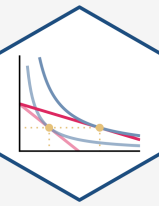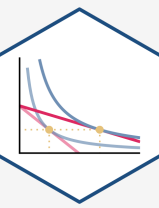
# Ceterus Paribus II

- Consider our demand function:

$$q_D = 10 - p$$

- If the **market price** $(p)$ **changes** (perhaps because supply changes), that results in a **change in *quantity demanded*** $(q_D)$

  - We move *along* the existing demand curve

- *Ceterus paribus* has not been violated

# Ceterus Paribus III

- Consider our demand function:

$$q_D = 10 - p$$

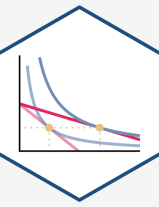- If the **something other than price changes** (income, preferences, price of a complement, etc), that results in a **change in *demand***

  - We need to draw a new demand curve (or demand function)

$$q_D = 12 - p$$

# Ceterus Paribus IV

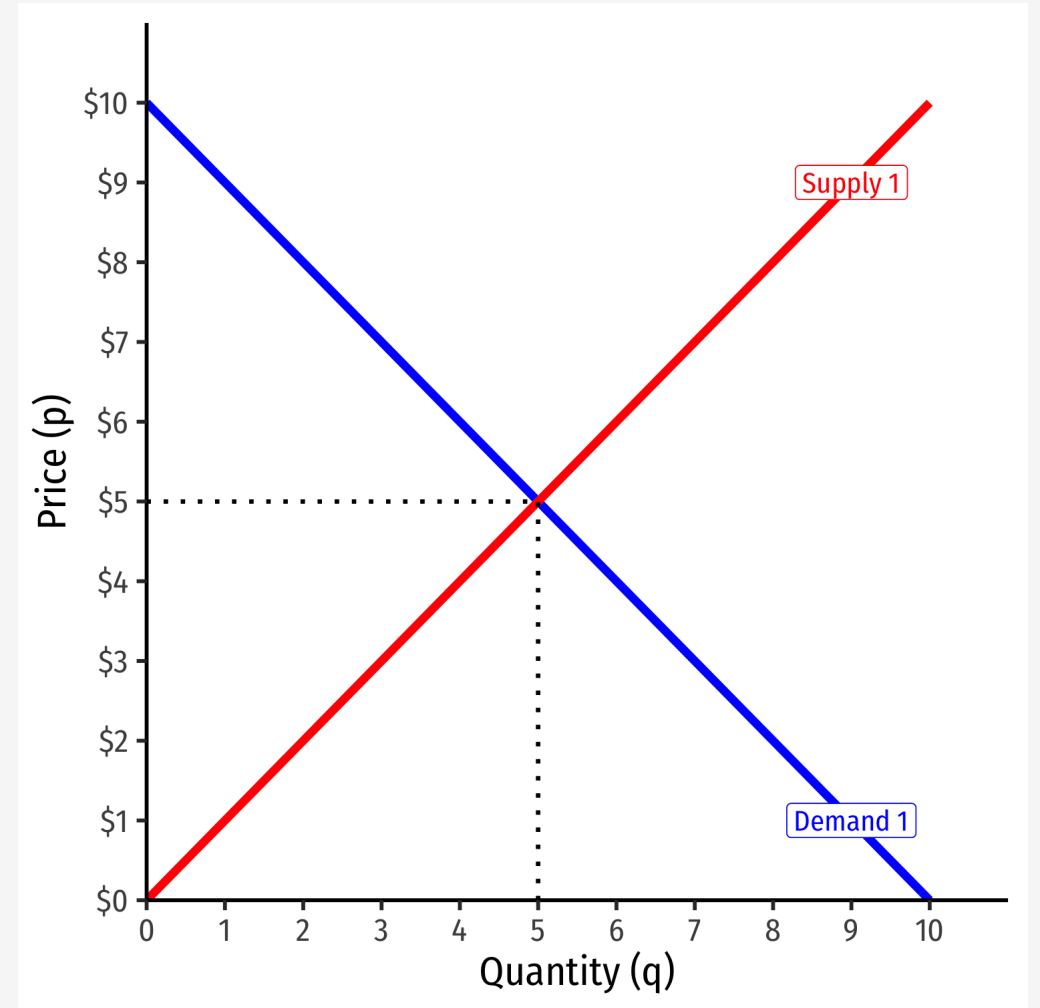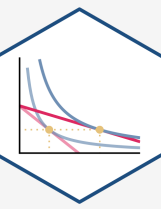- **There is a big difference between a change in "quantity demanded" and a change in "demand"!**
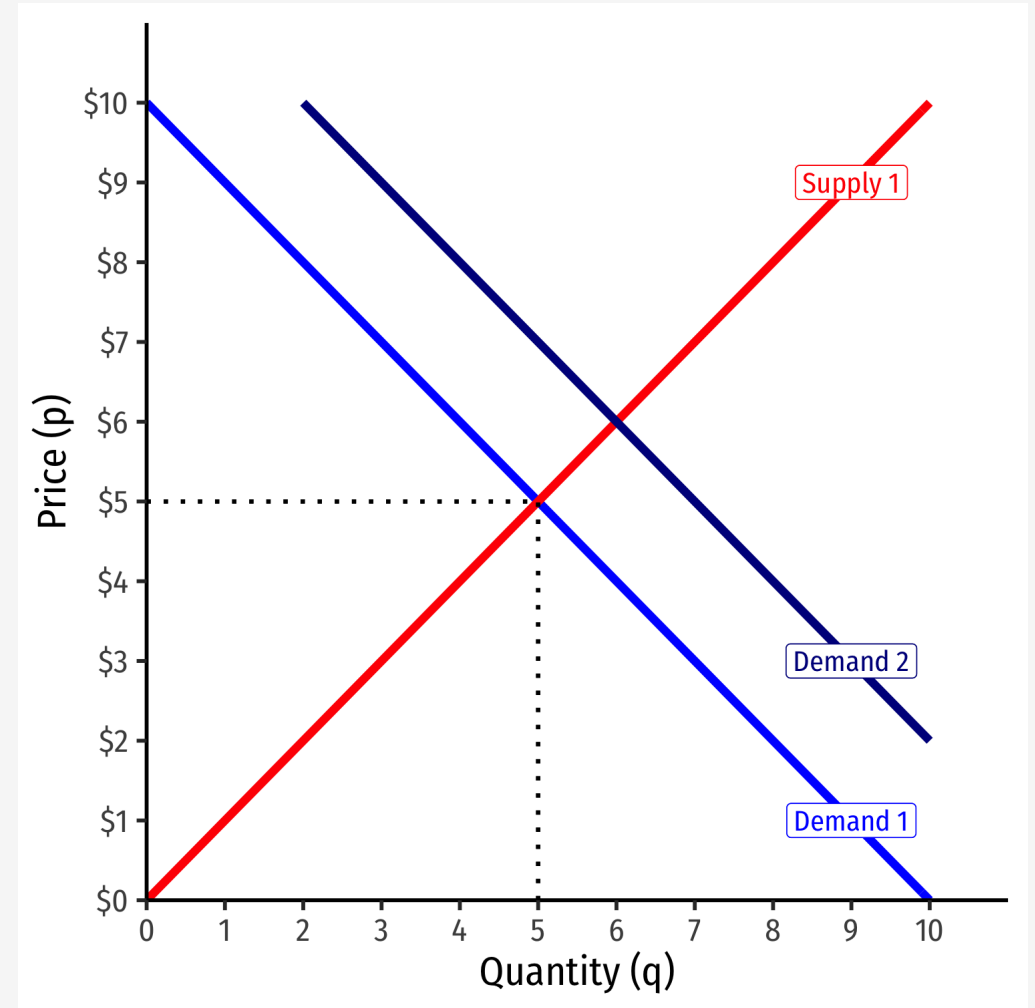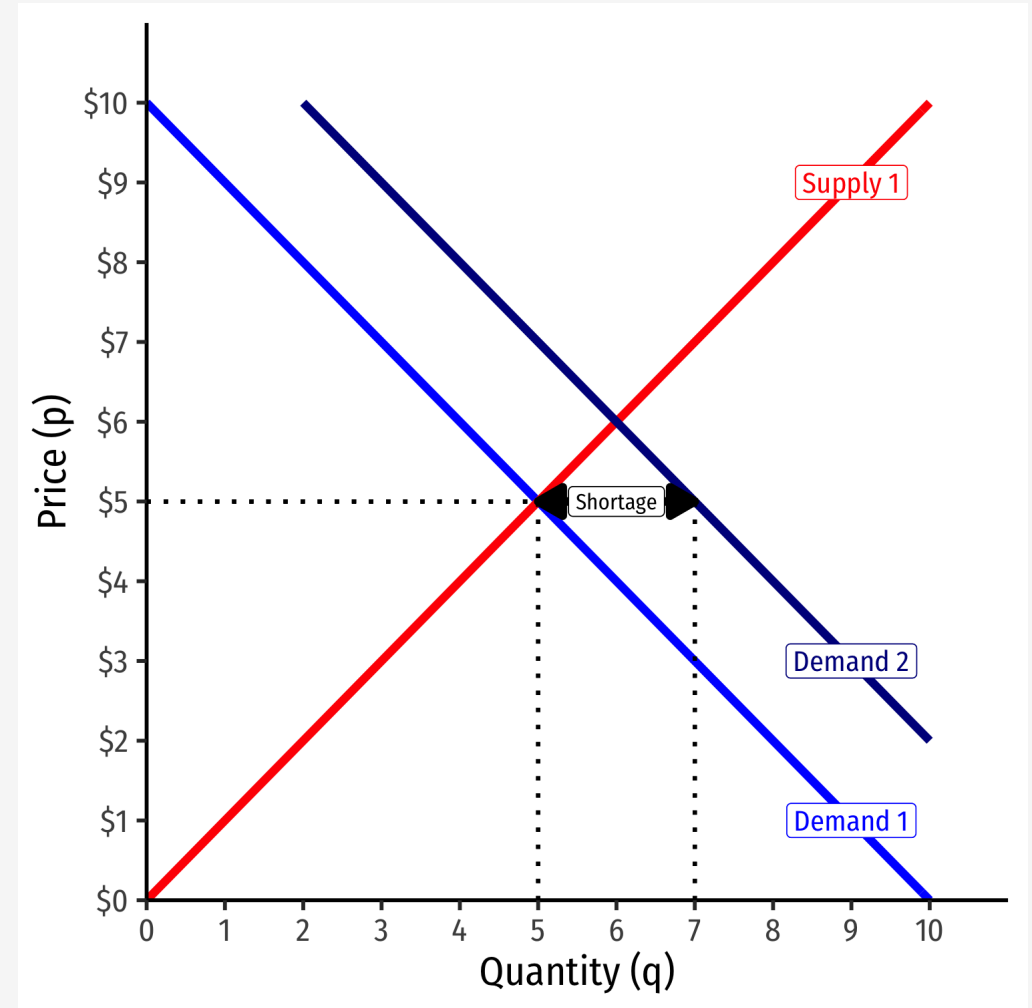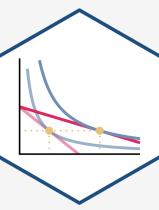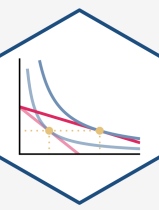
# Increase in Demand

# Increase in Demand

- More individuals want to buy more of the good at *every* price

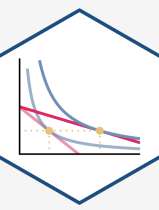- Entire demand curve shifts to the *right*
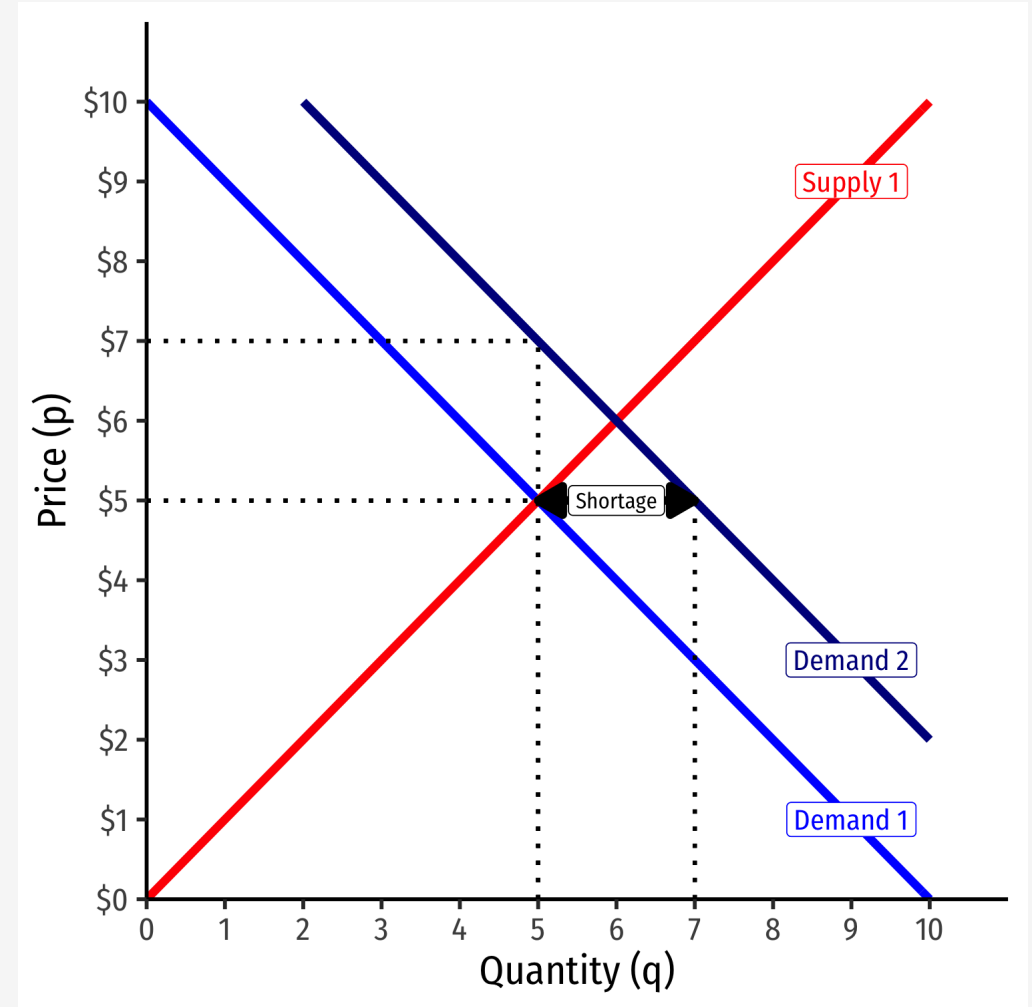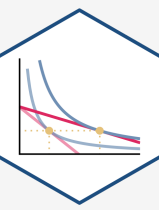
# Increase in Demand

- More individuals want to buy more of the good at *every* price

- Entire demand curve shifts to the *right*

- At the original market price, a **shortage!** $(q_D > q_S)$

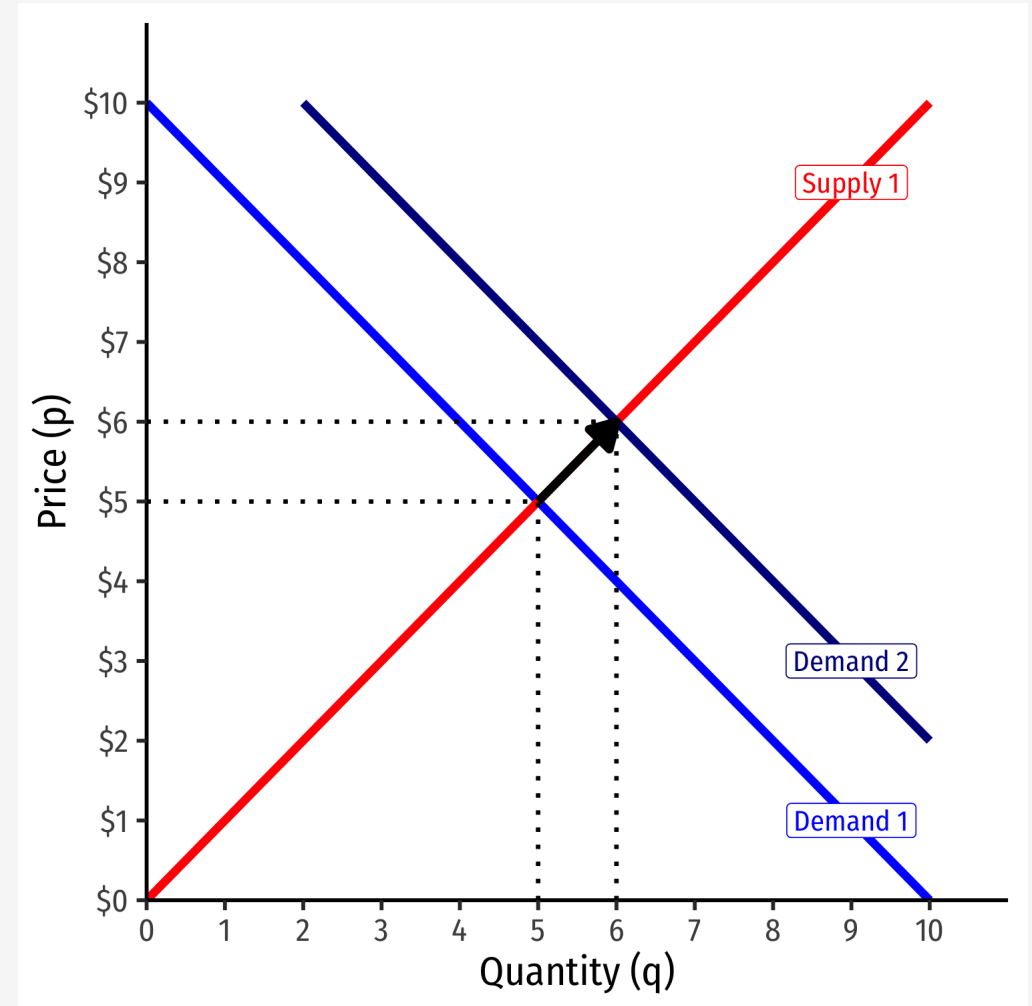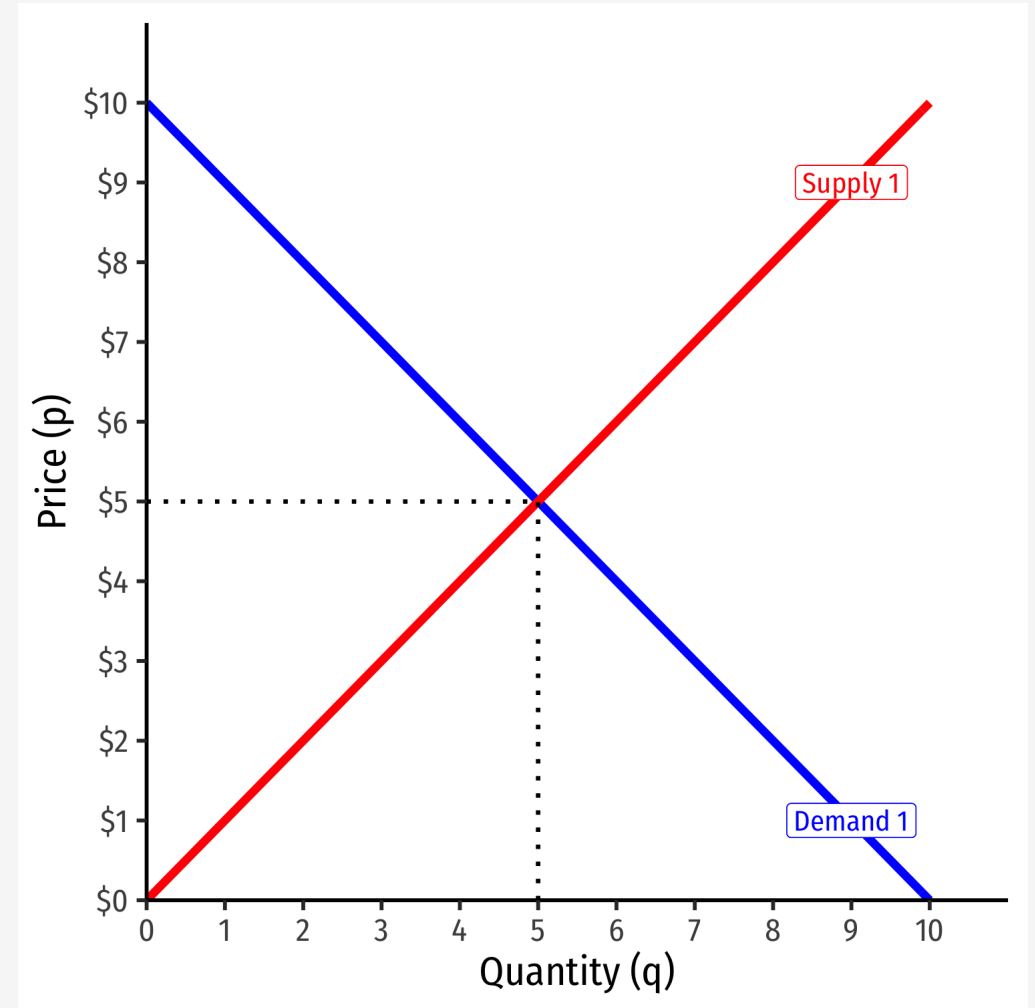# Increase in Demand

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- Entire demand curve shifts to the *right*

- At the original market price, a **shortage!**
  $$(q_D > q_S)$$

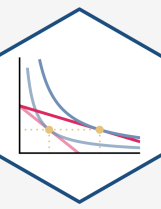- Some buyers willing to pay more at this quantity
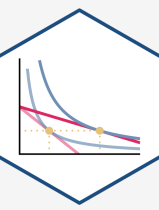
# Increase in Demand

- More individuals want to buy more of the good at *every* price

- Entire demand curve shifts to the *right*

- At the original market price, a **shortage!**
$$(q_D > q_S)$$

- Some buyers willing to pay more at this quantity

- Buyers raise bids, inducing sellers to sell more

- Reach new equilibrium with:

  - **higher market-clearing price**
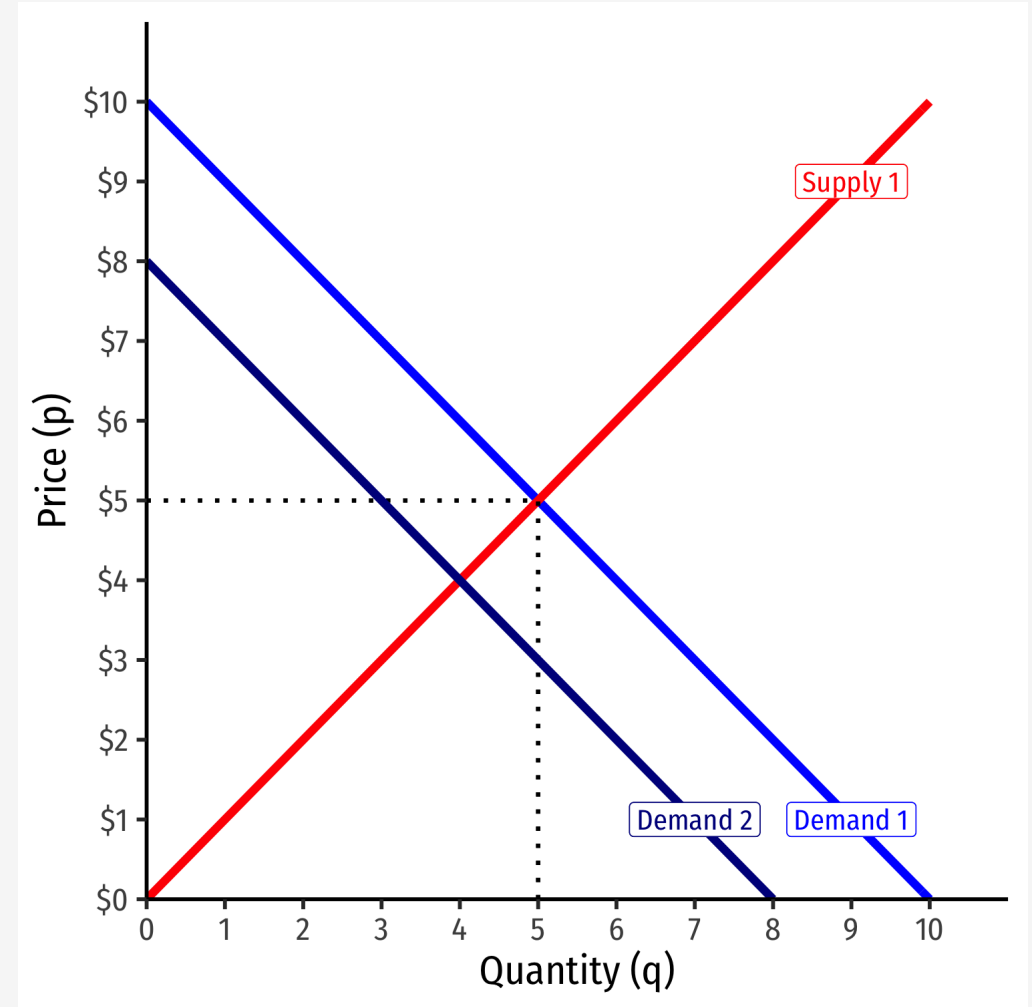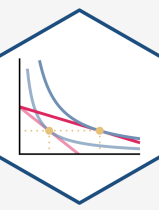  - **larger market-clearing quantity exchanged**
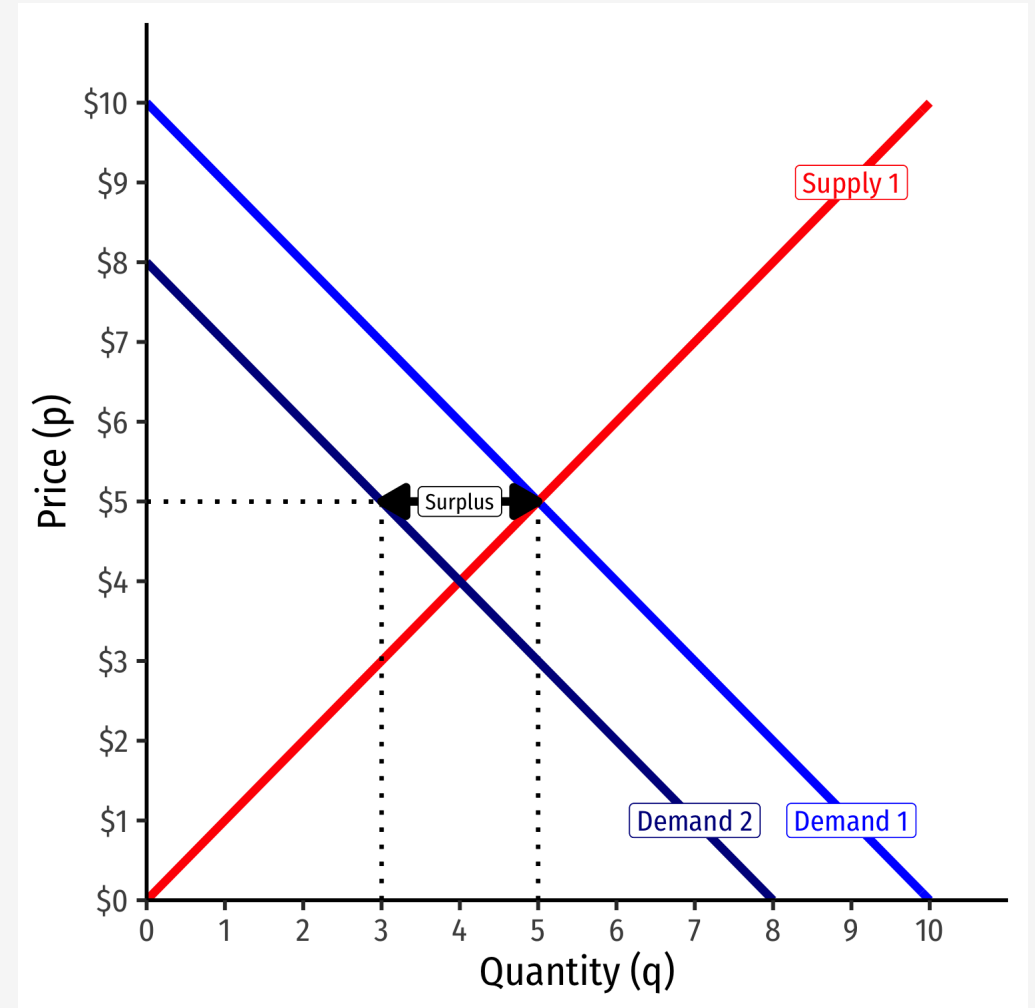
# Decrease in Demand

# Decrease in Demand

- Fewer individuals want to buy less of the good at *every* price
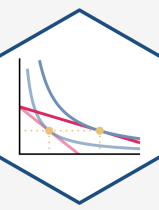
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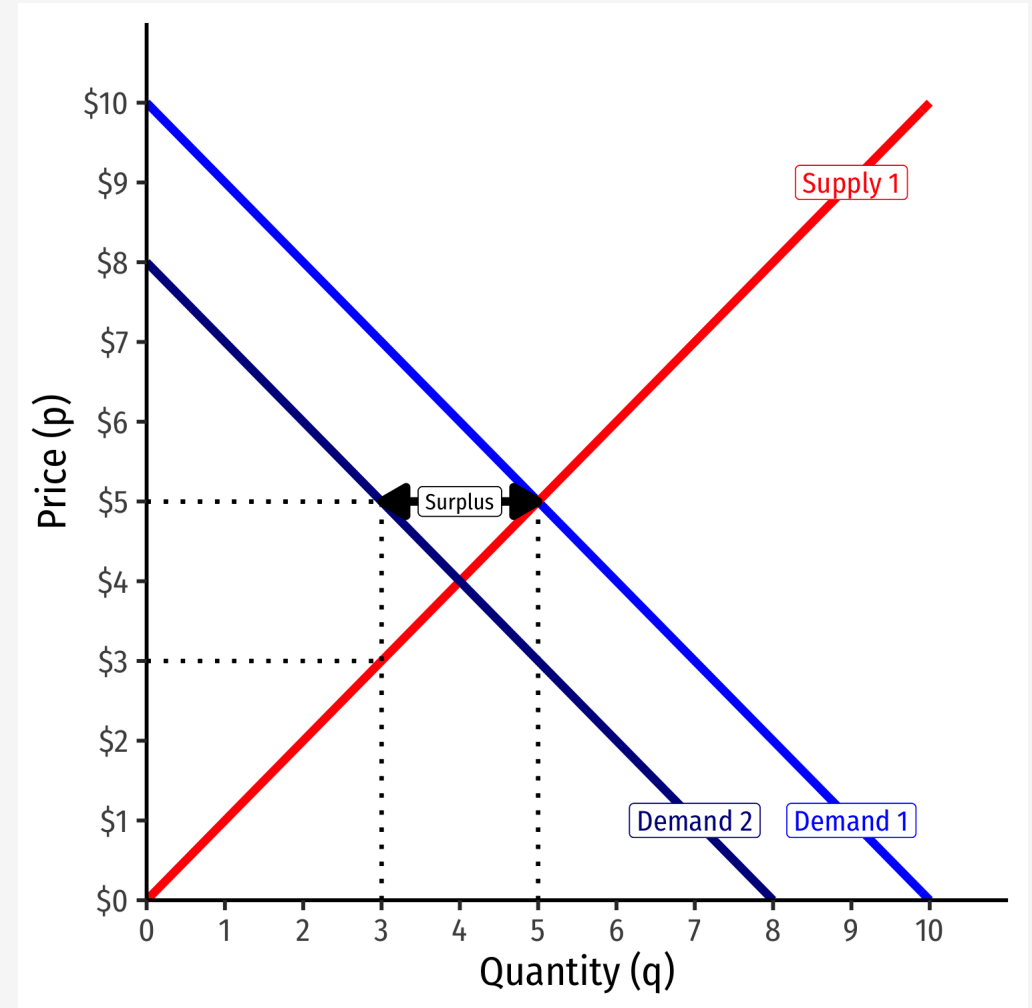
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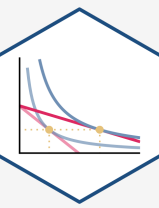  $(q_D < q_S)$
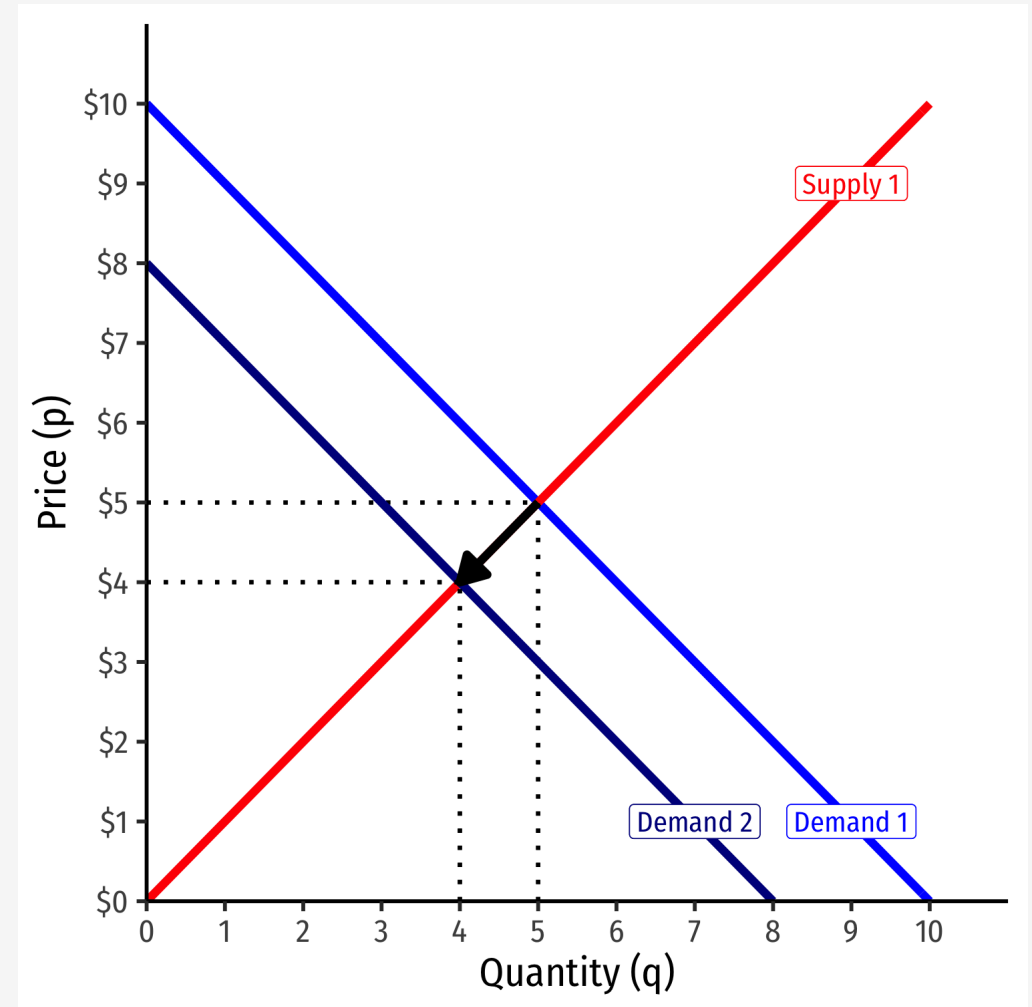
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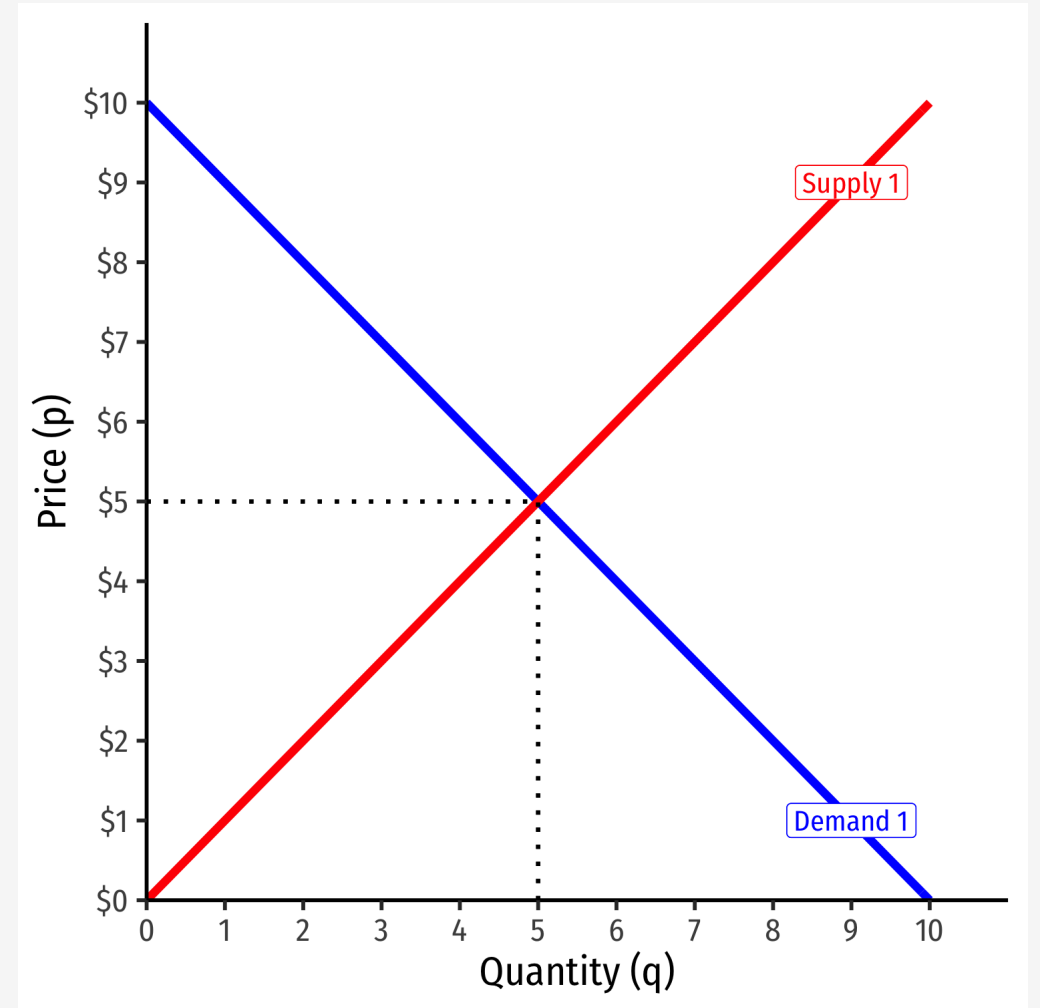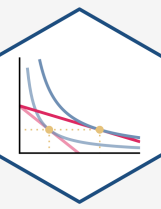- Some sellers willing to accept less at this quantity
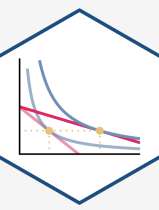
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- Reach new equilibrium with:
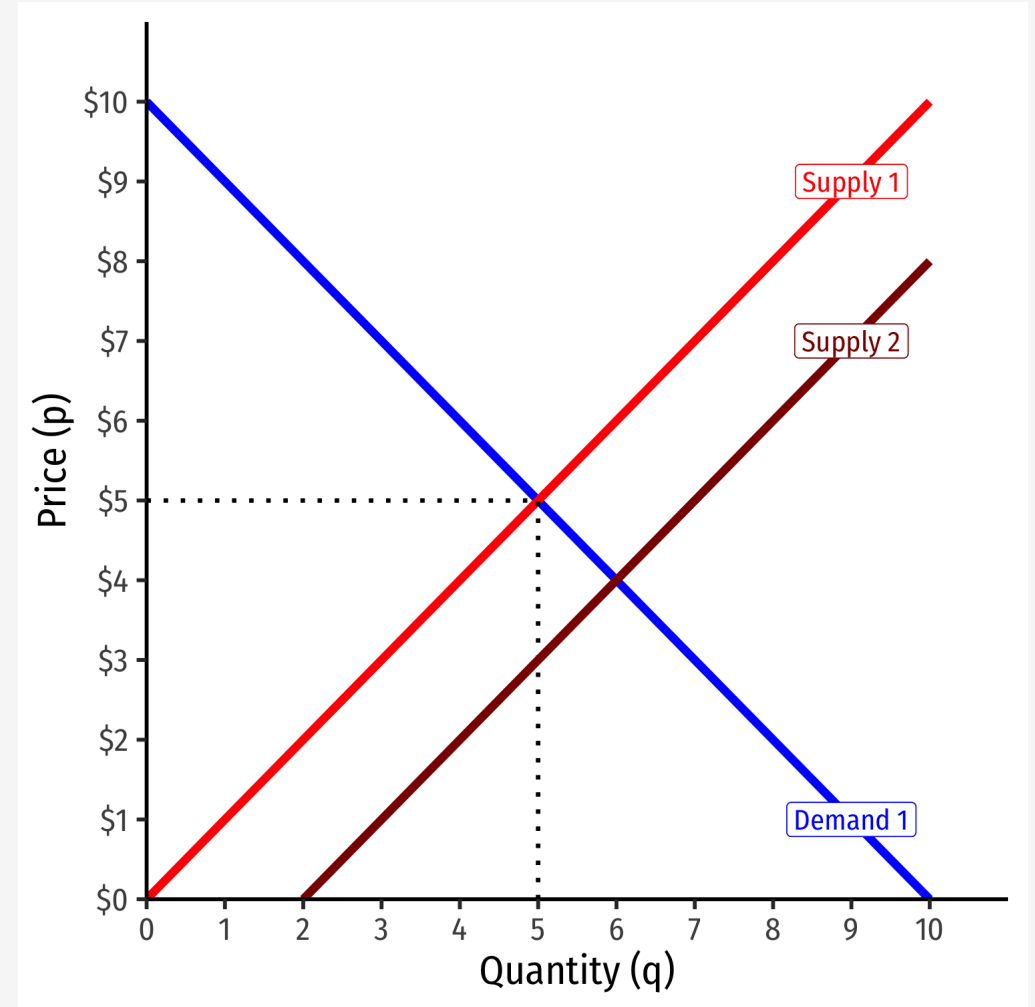
  - **lower market-clearing price**
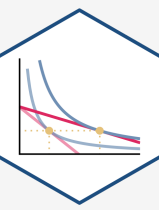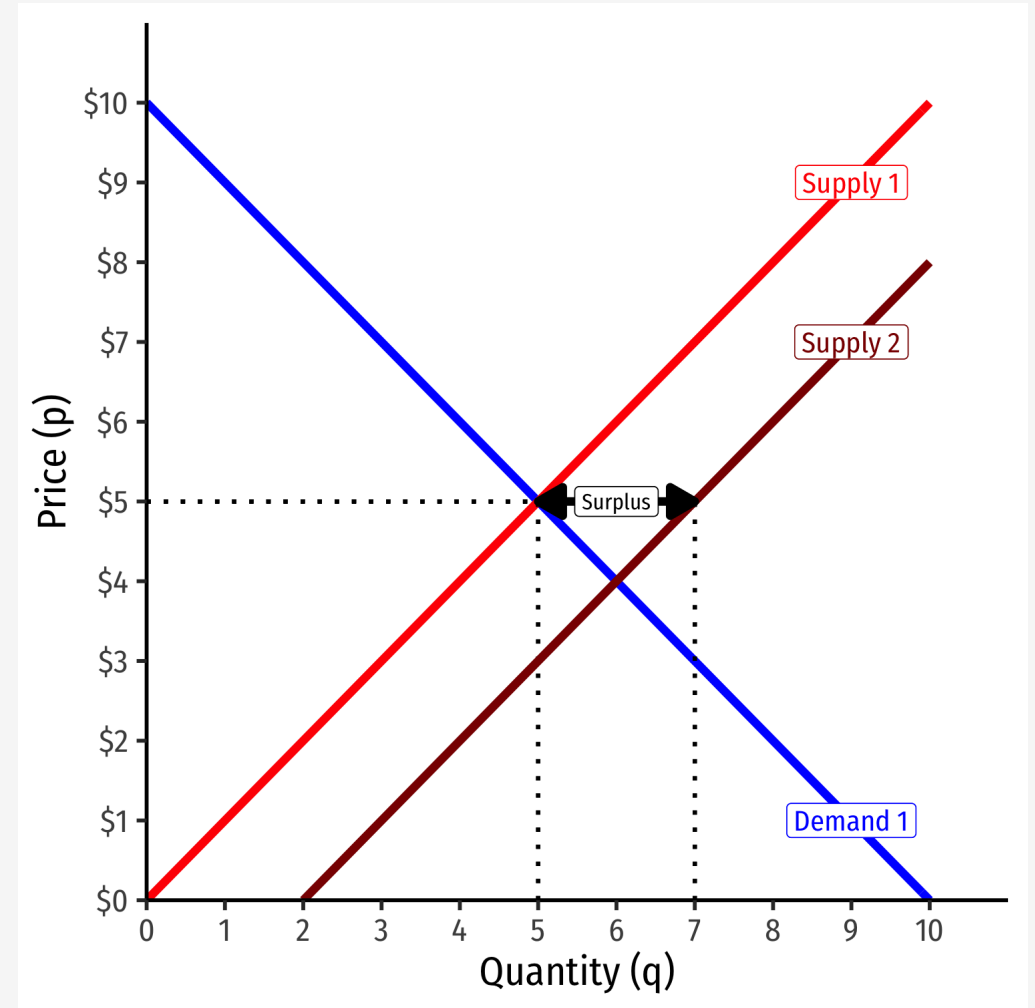
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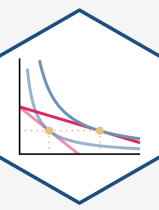  $(q_D < q_S)$
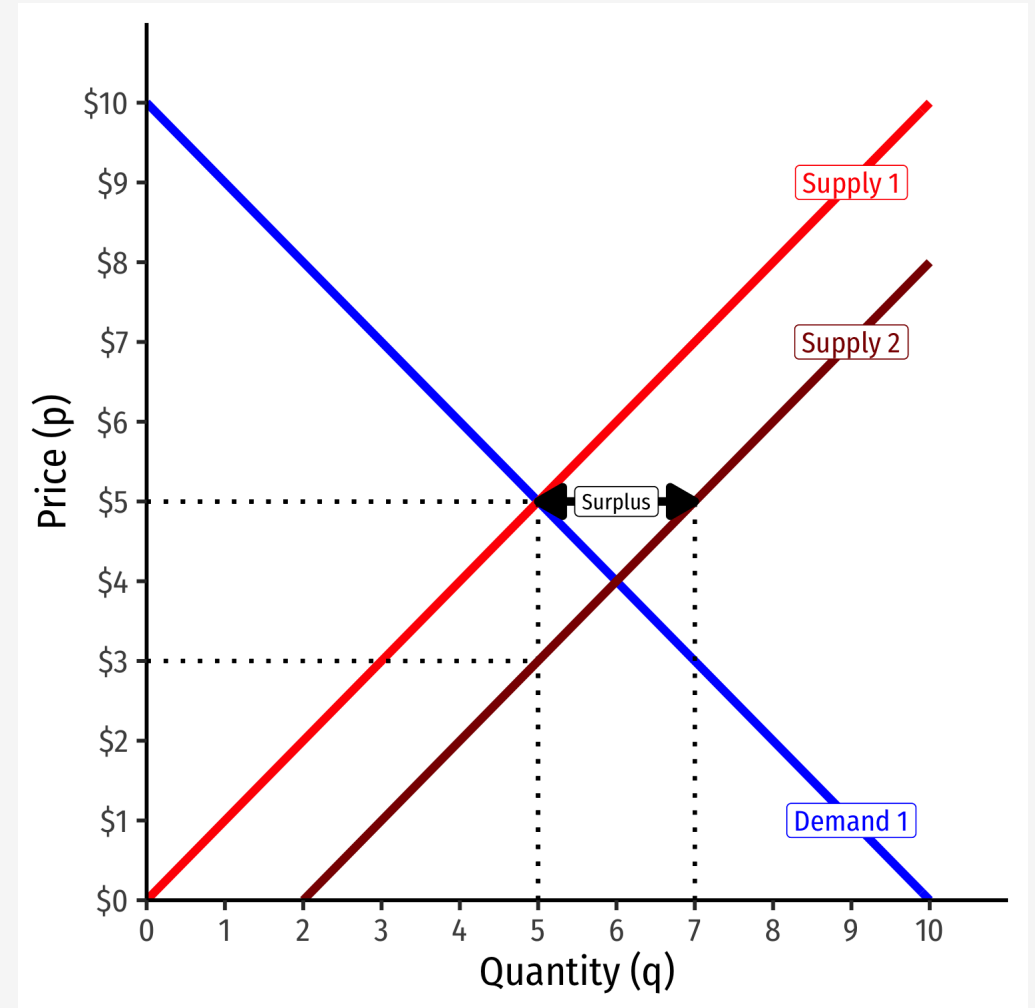
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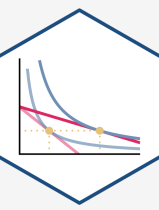- Some sellers willing to accept less at this quantity
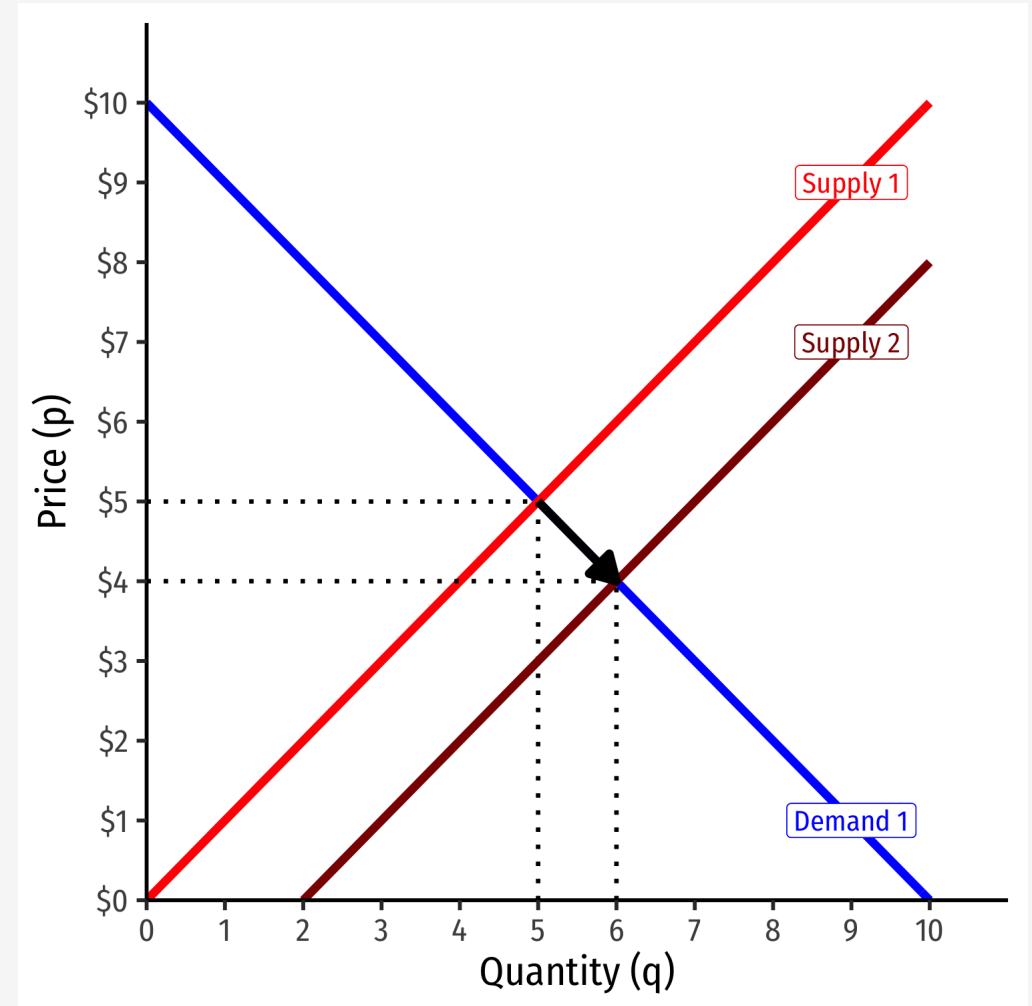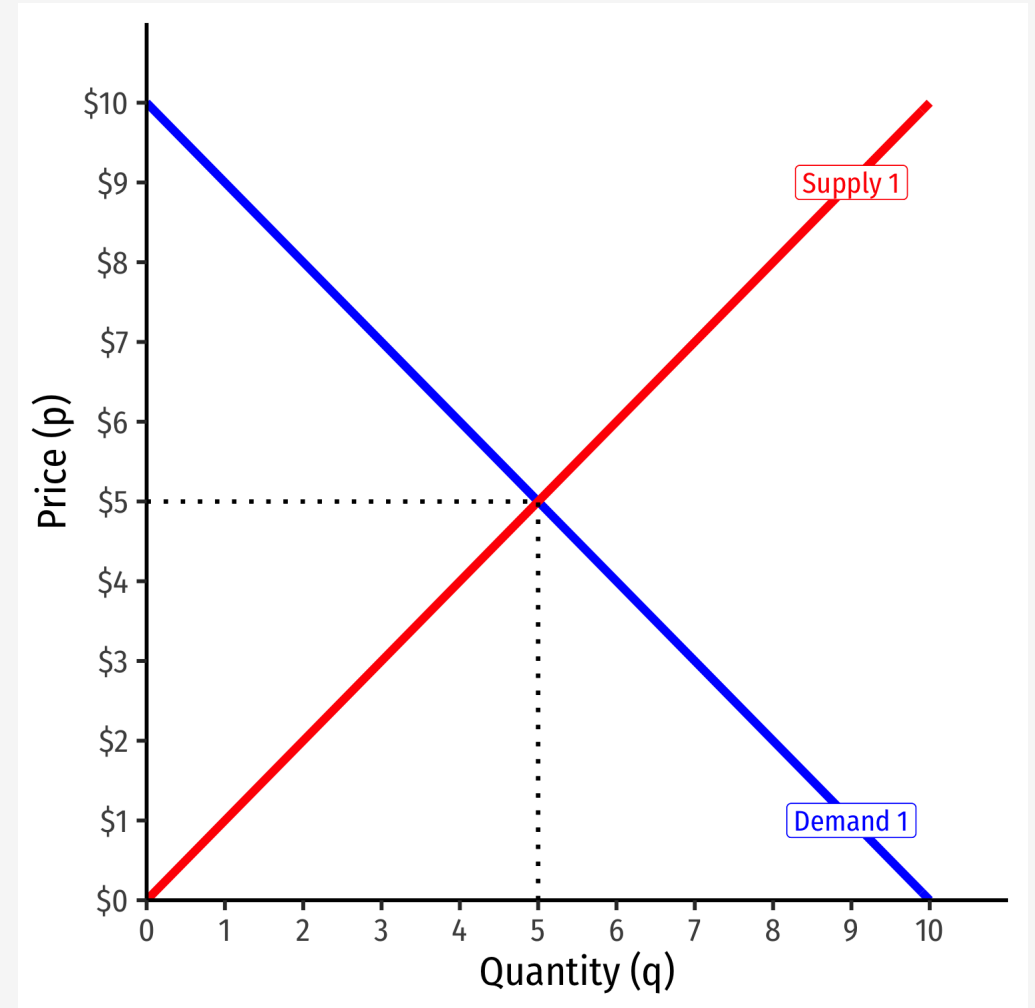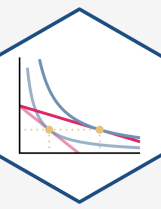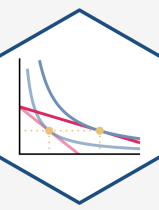
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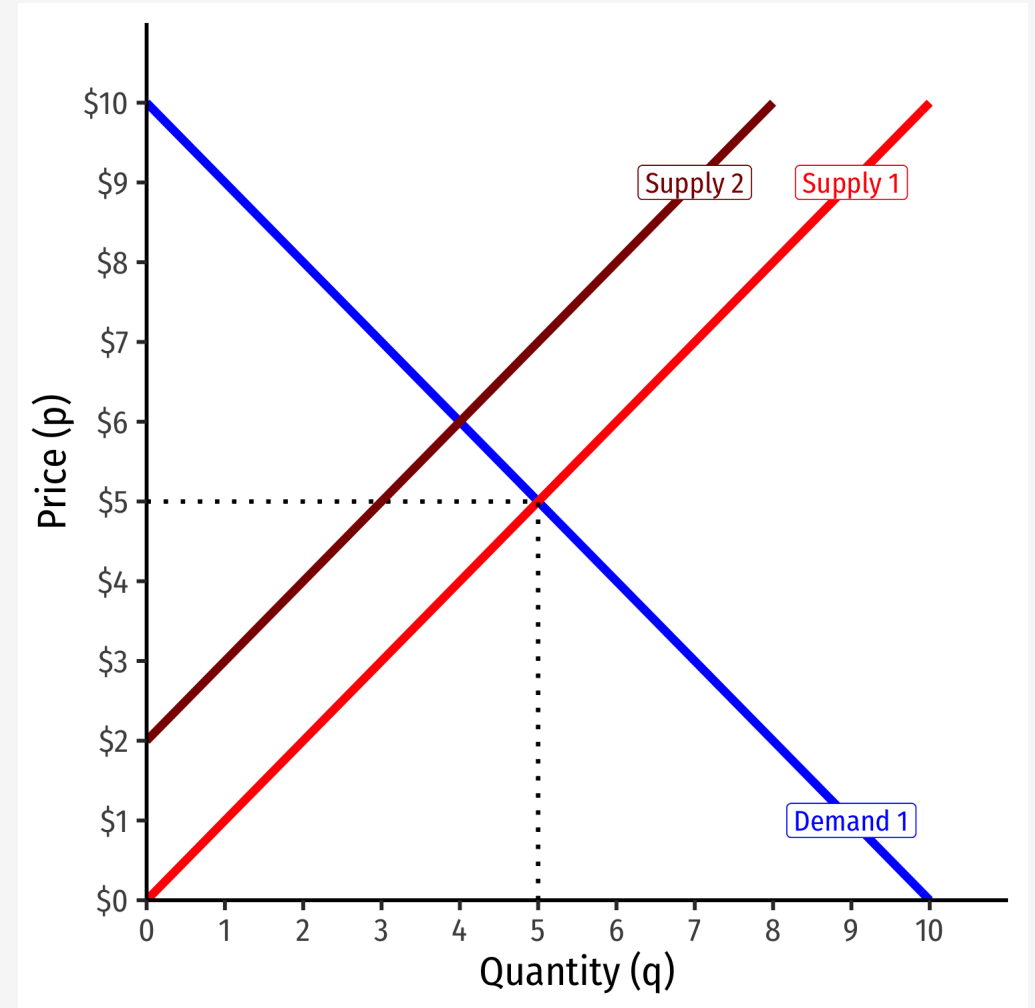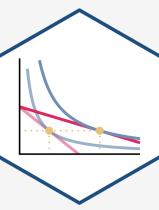    - **larger market-clearing quantity exchanged**
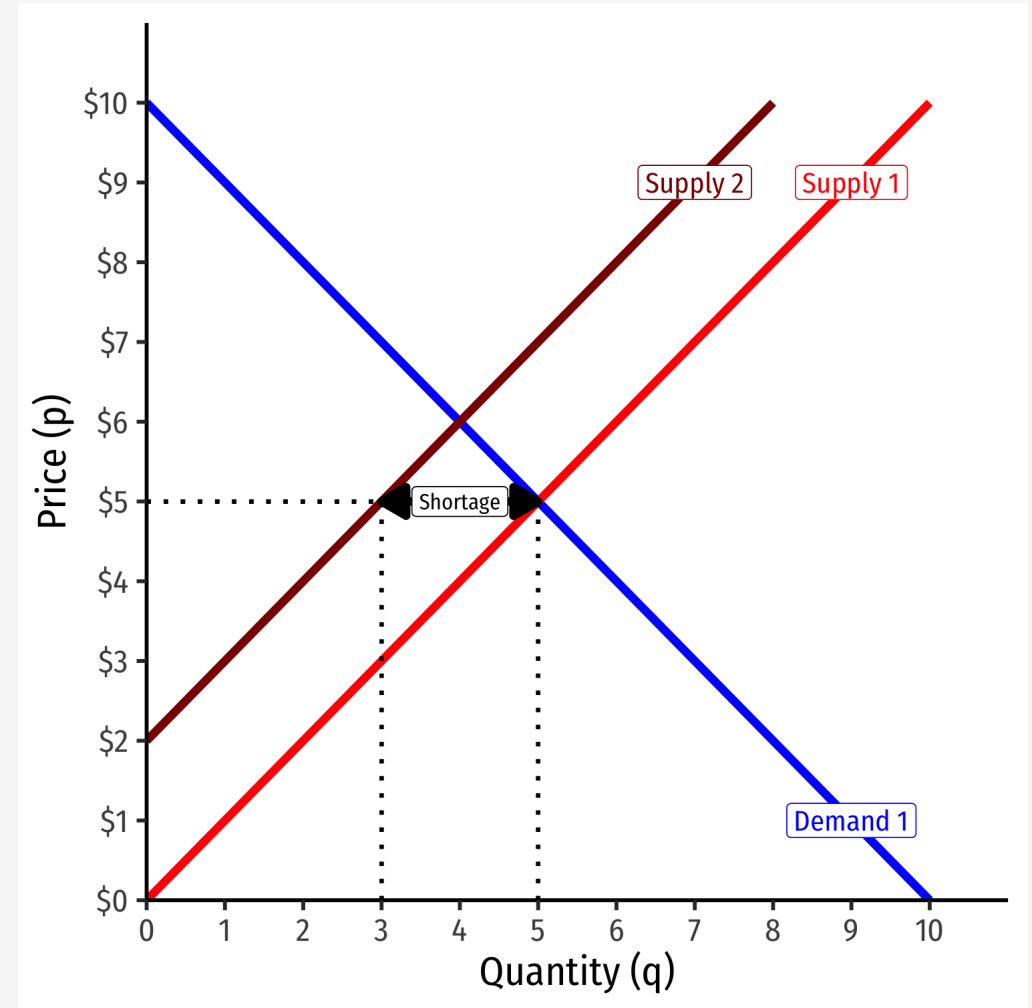
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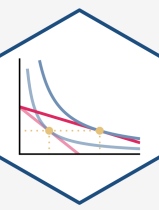- At the original market price, a **shortage!** $(q_D > q_S)$

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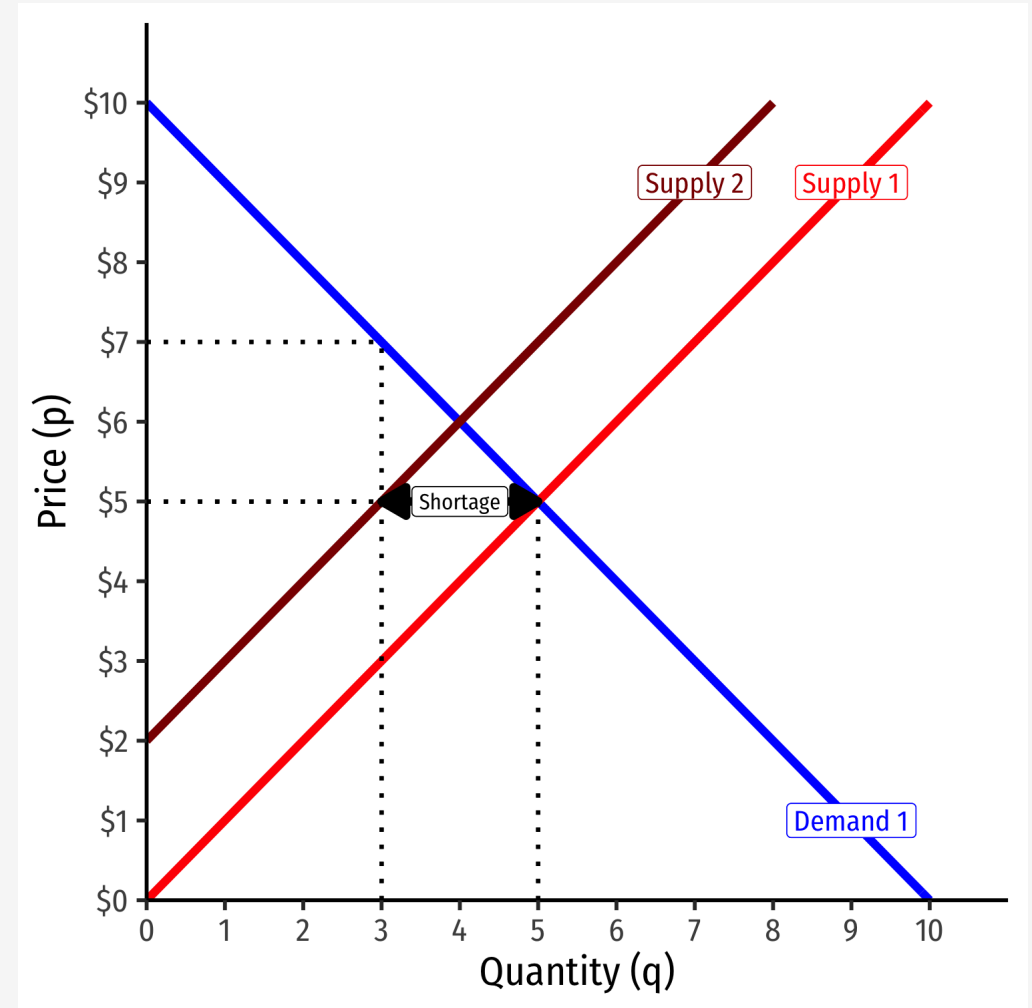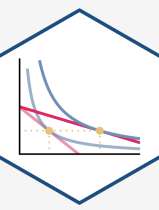
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- Buyers raise bids, inducing sellers to sell more

- Reach new equilibrium with:
  - **higher market-clearing price**
  - **smaller market-clearing quantity exchanged**
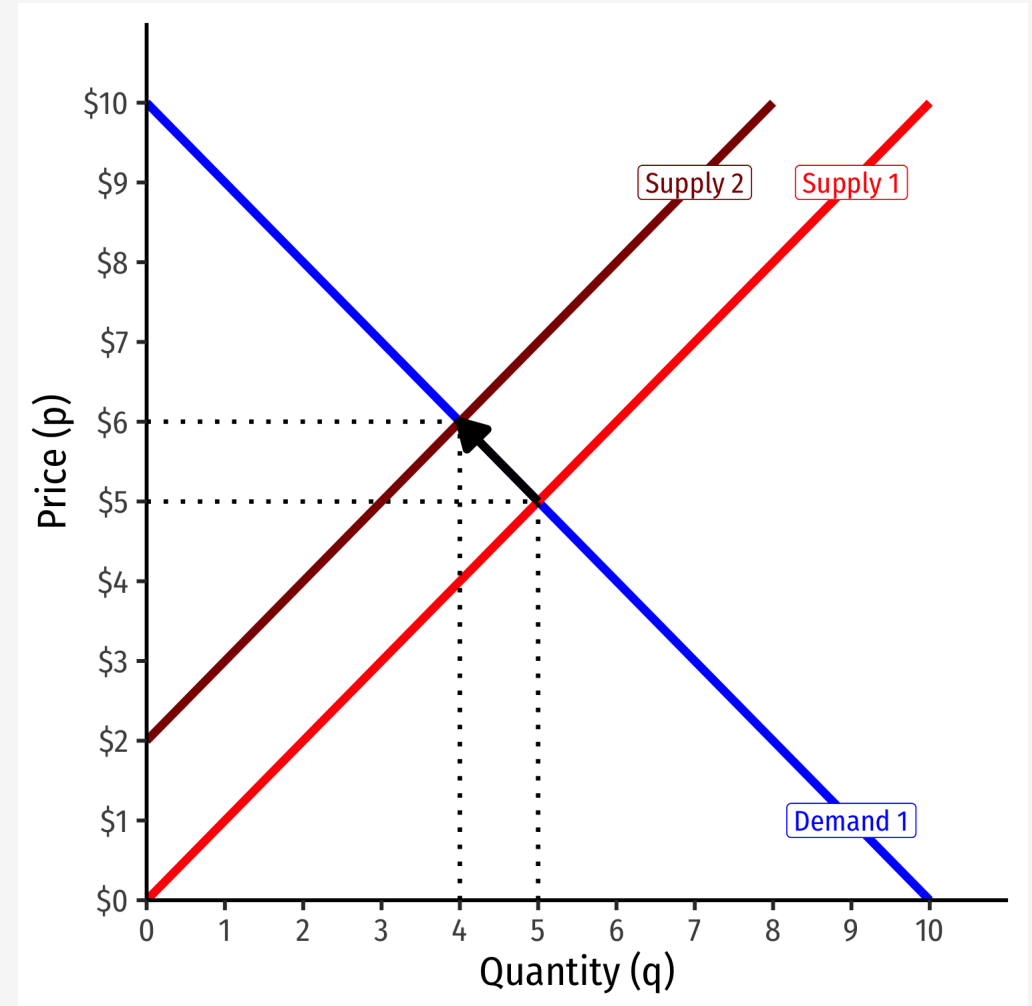
# Equilibrium Tendencies
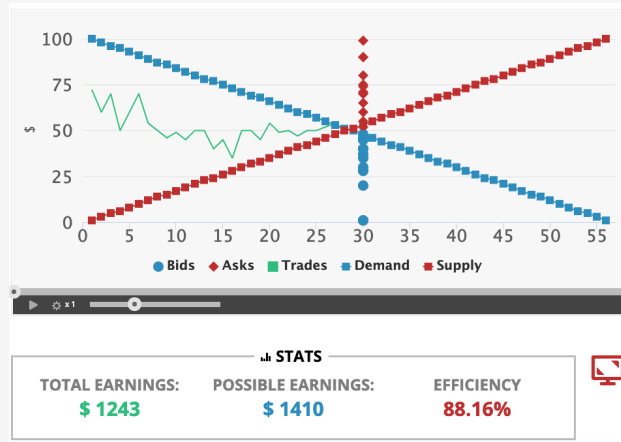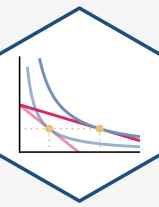


- Equilibrium is a *tendency* we can *predict* with our models

- Buyers and sellers raise and lower their bids and asks to adjust to competition from other buyers and sellers, moving the market price

- *Ceterus paribus*, market prices will settle on an equilibrium given existing conditions

- But conditions are always changing (and so are prices)!