

3.1 — The Supply and Demand Model

ECON 306 • Microeconomic Analysis • Spring 2021

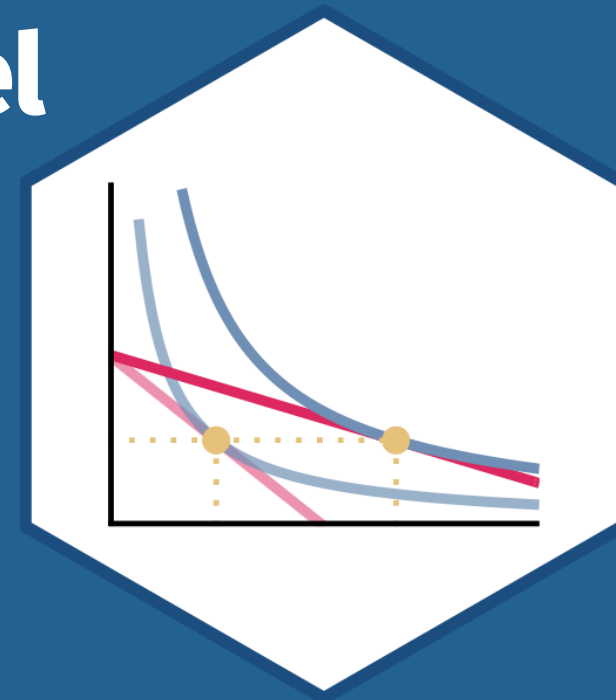
Ryan Safner

Assistant Professor of Economics

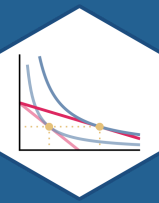
[✉ safner@hood.edu](mailto:safner@hood.edu)

[🔗 ryansafner/microS21](https://github.com/ryansafner/microS21)

[🌐 microS21.classes.ryansafner.com](https://microS21.classes.ryansafner.com)



Outline



Equilibrium

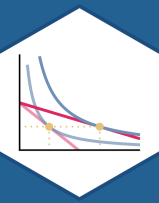
Recall: Demand

Recall: Supply

Market Equilibrium

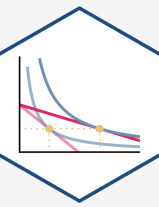
Why Markets Tend to Equilibrate

Comparative Statics



Equilibrium

Recall: 2 Major Models of Economics as a “Science”



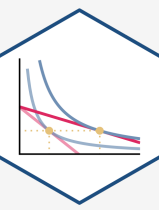
Optimization

- Agents have **objectives** they value
- Agents face **constraints**
- Make **tradeoffs** to maximize objectives within constraints

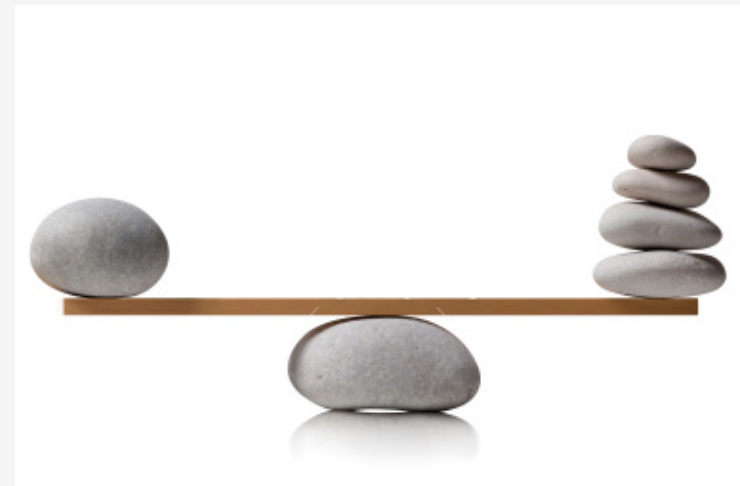
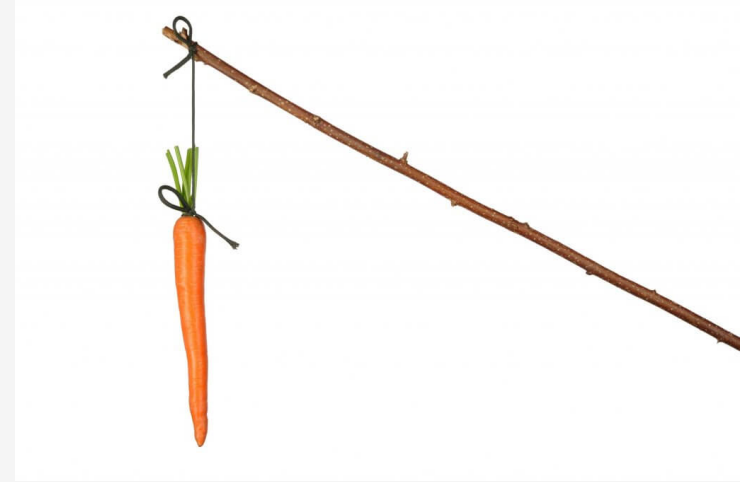
Equilibrium

- Agents **compete** with others over **scarce** resources
- Agents **adjust** behaviors based on prices
- **Stable outcomes** when adjustments stop

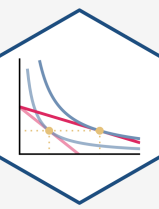
Recall: Optimization and Equilibrium



- 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*



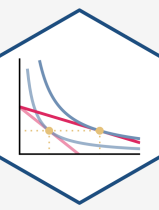
Equilibrium Analysis & Price Theory



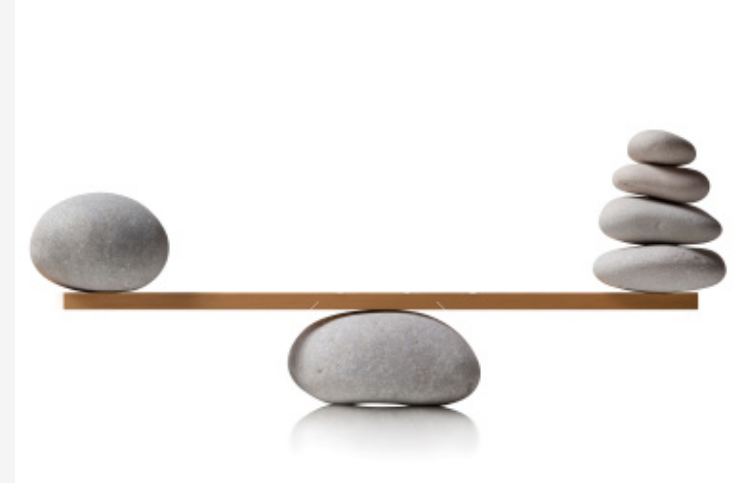
- Where do prices come from?
- *How do they change?*
- How consumers and producers to *respond* to changes?
- What *predictions* can we make about what we will see in the world?



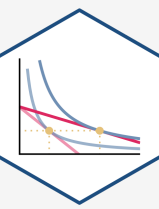
Equilibrium Analysis



- 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

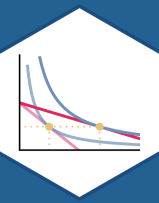


Partial Equilibrium Analysis



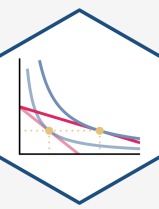
- We will only look at “*partial equilibrium*” for a single market
- Changes in *one* market often affect *other* markets, affecting the “*general equilibrium*”
 - **Example:** change in price of *corn* will affect the market for wheat, soybeans, flax, cereal, sugar, candy, ethanol, gasoline, automobiles, etc...
 - think of all of the *complements, substitutes*, upstream and downstream goods in production...
 - General equilibrium is too complicated for undergraduate courses...





Recall: Demand

Demand Function

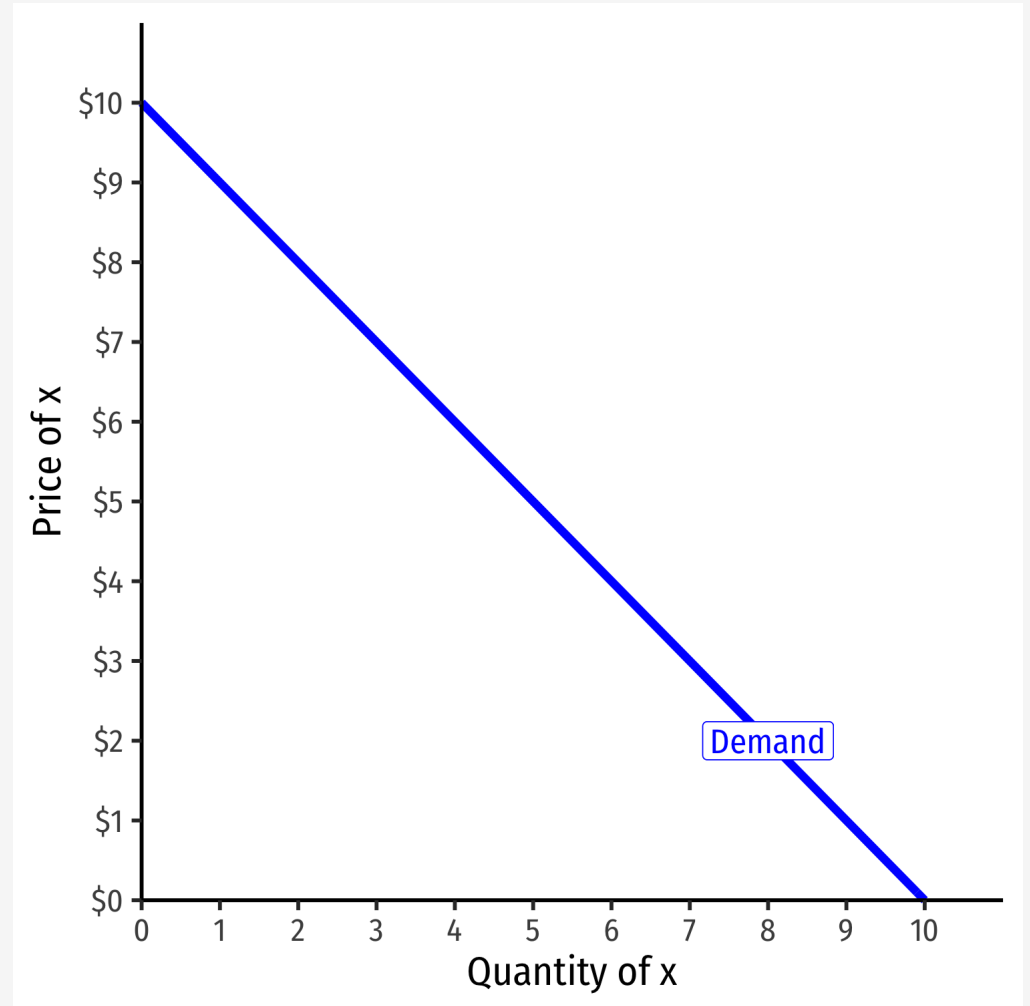


- **Demand function** relates quantity to price

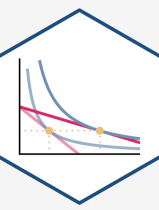
Example:

$$q = 10 - p$$

- Not graphable (wrong axes)!



Inverse Demand Function



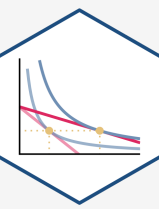
- **Inverse demand function** relates price to quantity
 - Take demand function and solve for p

Example:

$$p = 10 - q$$

- Graphable (price on vertical axis)!

Inverse Demand Function

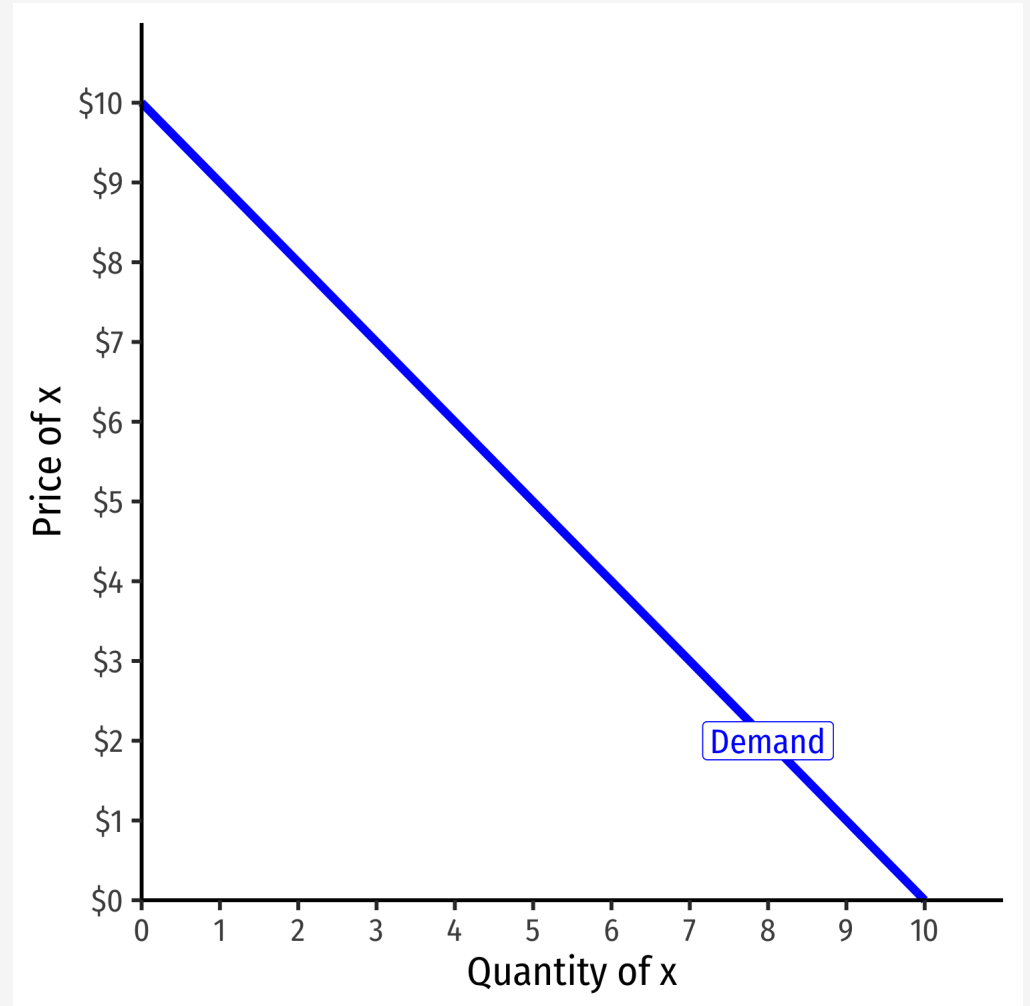


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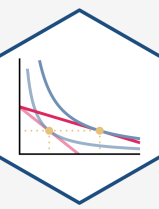
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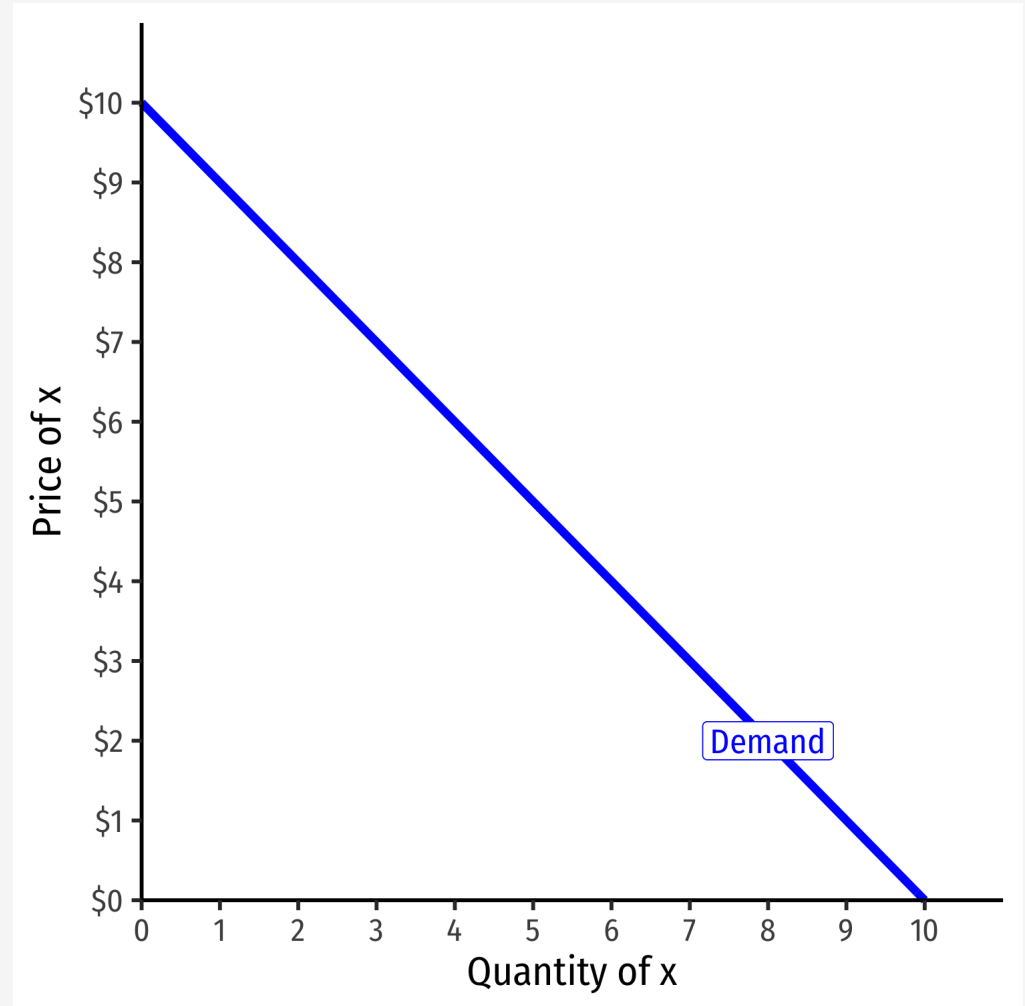
- Vertical intercept ("**Choke price**"): price where $q_D = 0$ (\$10), just high enough to discourage *any* purchases

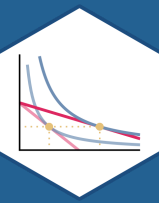


Inverse Demand Function



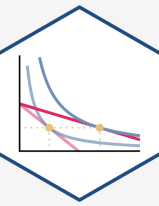
- Read two ways:
- Horizontally: at any given price, how many units person wants to buy
- Vertically: at any given quantity, the **maximum willingness to pay (WTP)** for that quantity
 - This way will be very useful later





Recall: Supply

Supply Function

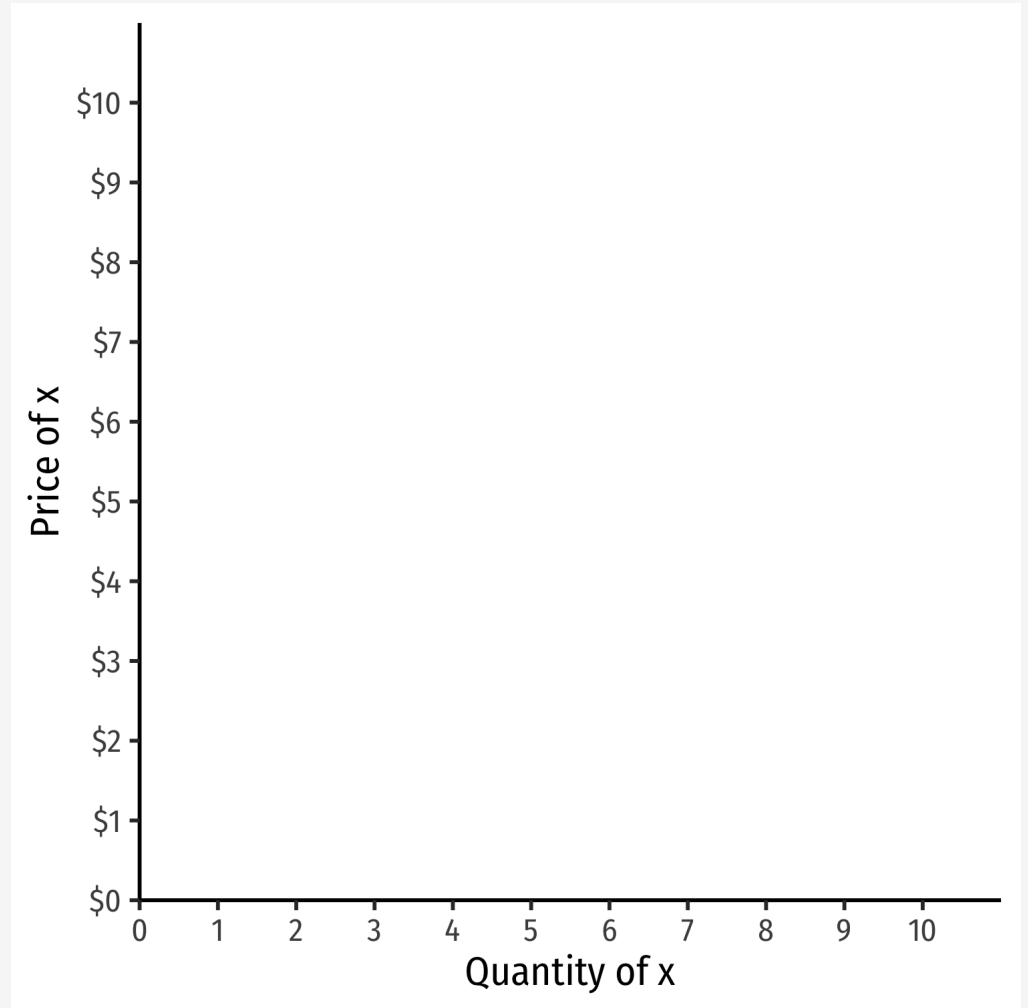


- **Supply function** relates quantity to price

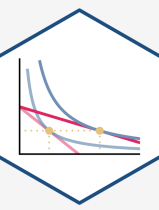
Example:

$$q = 2p - 4$$

- Not graphable (wrong axes)!



Inverse Supply Function

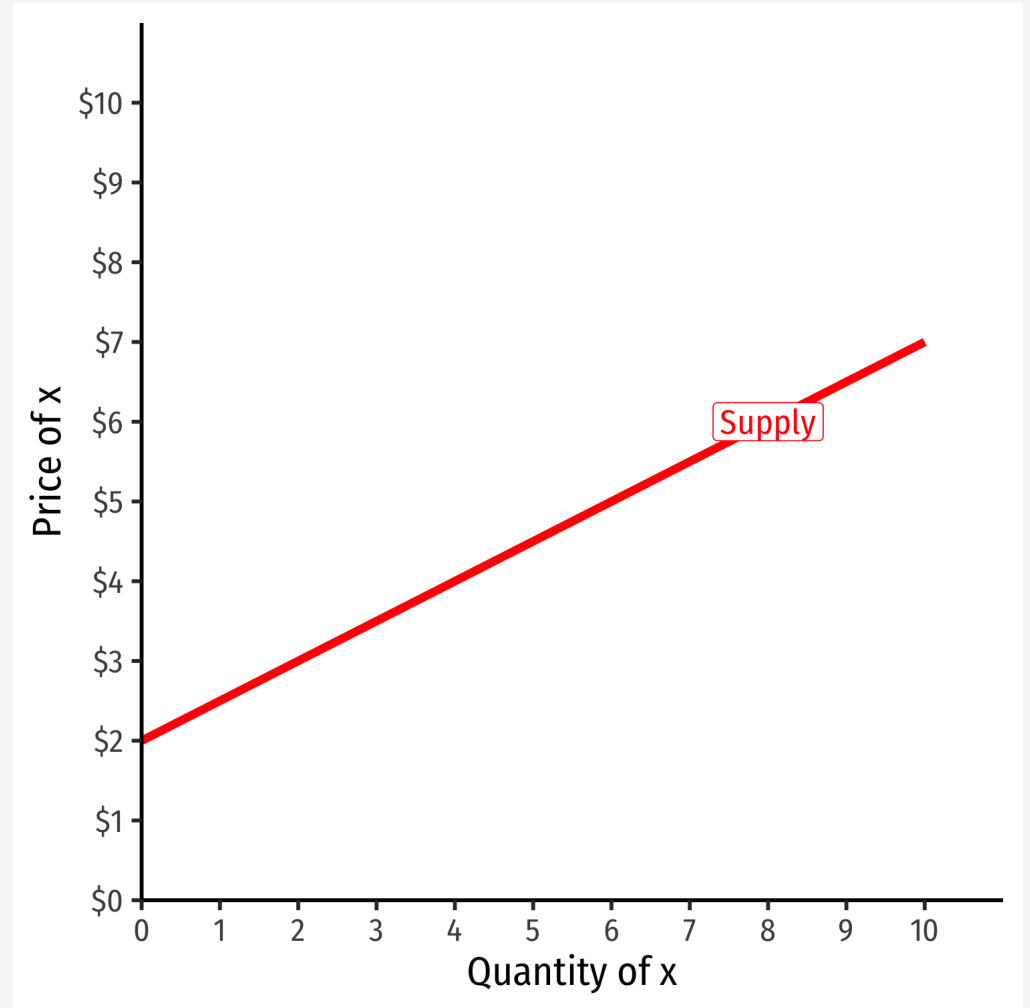


- **Inverse supply function** relates price to quantity
 - Take supply function, solve for p

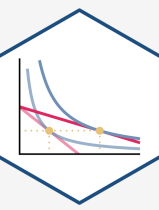
Example:

$$p = 2 + 0.5q$$

- Graphable (price on vertical axis)!



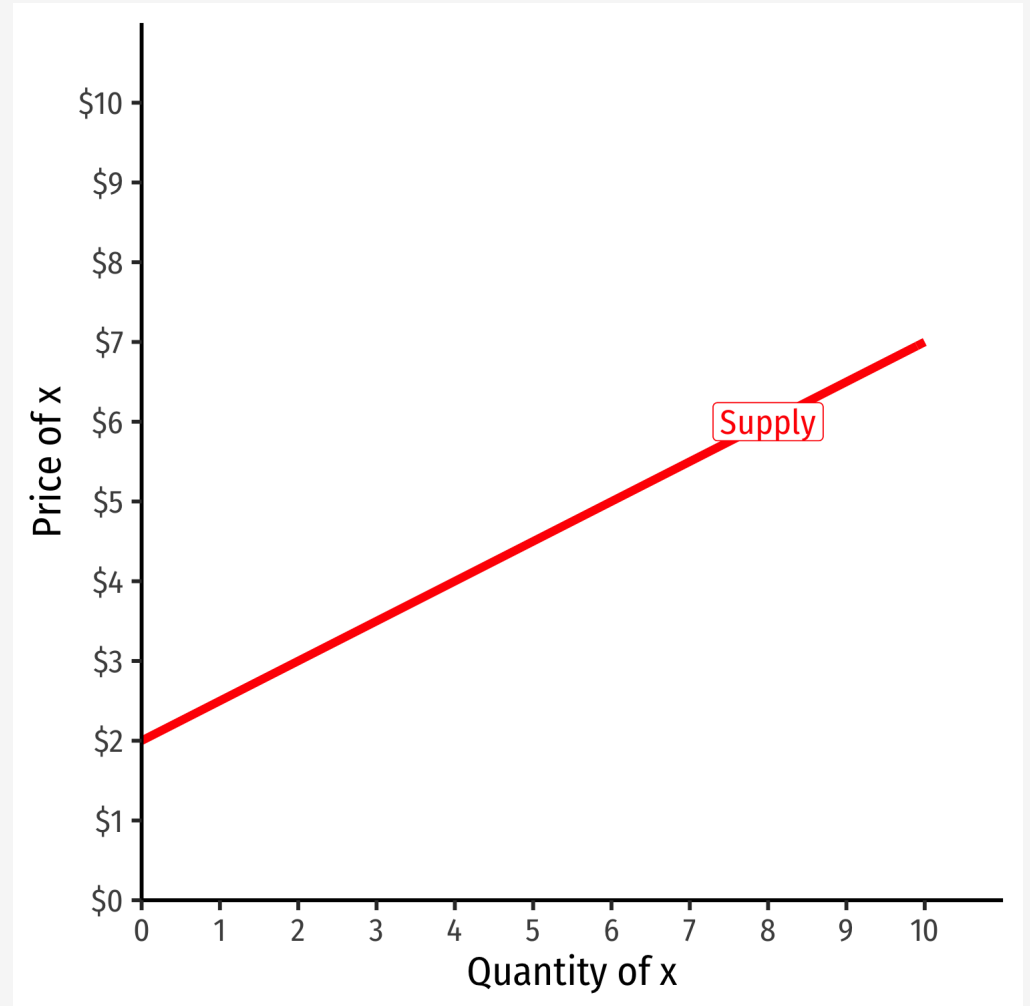
Inverse Supply Function



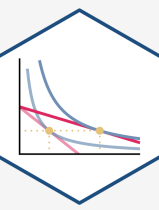
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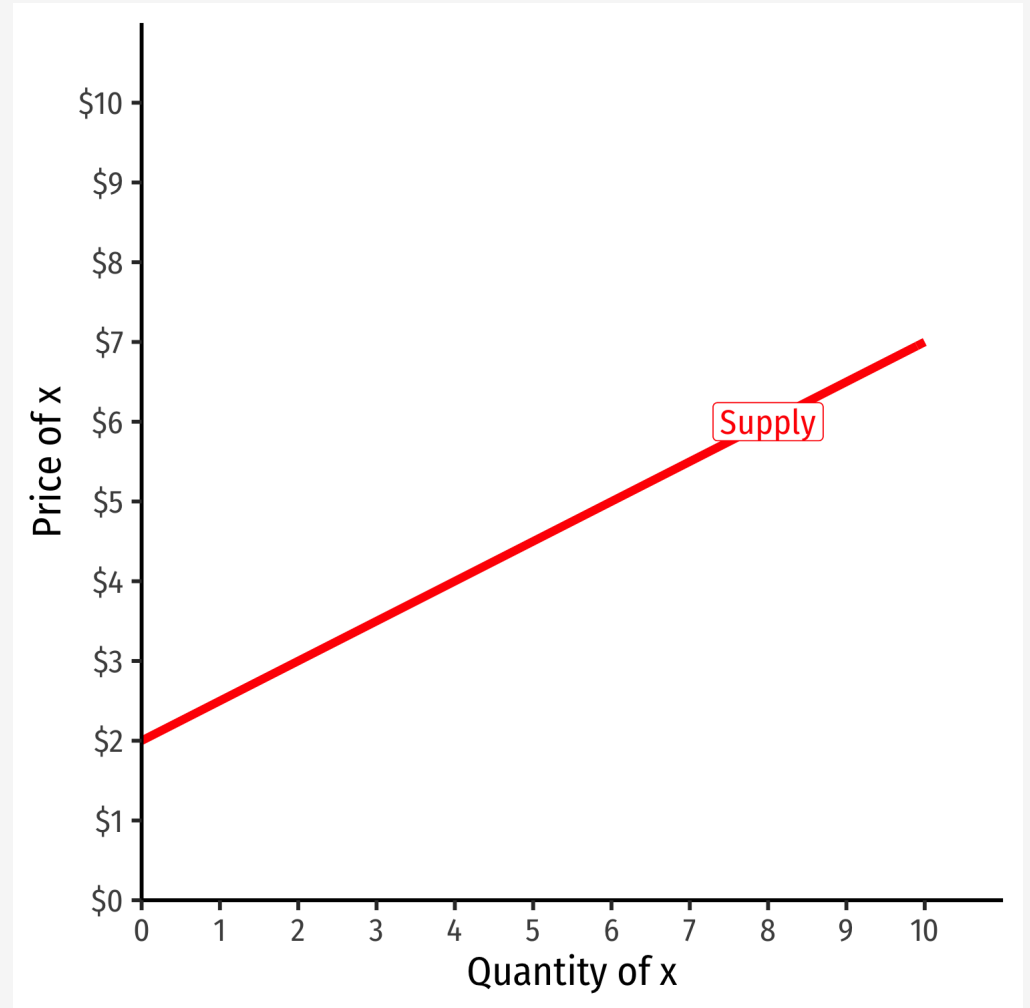
- Slope: 0.5
- Vertical intercept called the "**Choke price**": price where $q_S = 0$ (\$2), just low enough to discourage *any* sales

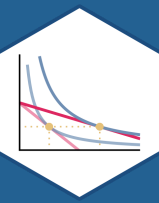


Inverse Supply Function



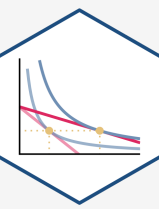
- Read two ways:
- Horizontally: at any given price, how many units firm wants to sell
- Vertically: at any given quantity, the **minimum willingness to accept (WTA)** for that quantity



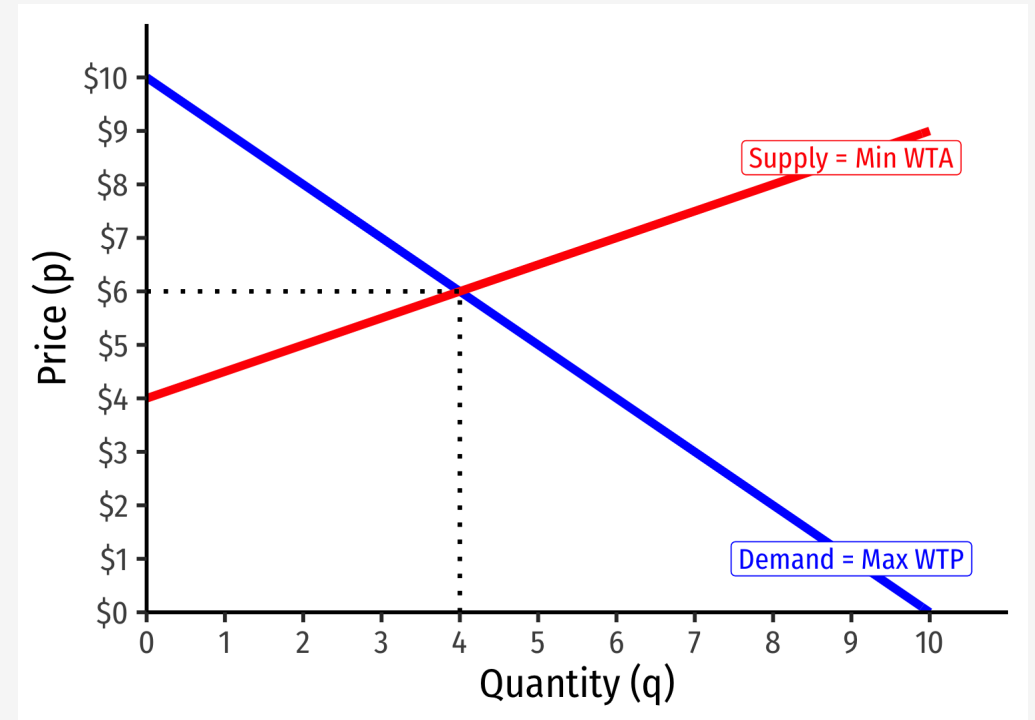


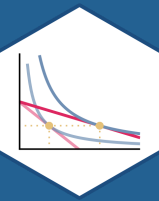
Market Equilibrium

Market Equilibrium



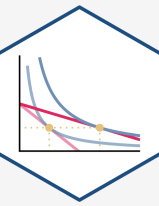
- Market-clearing (equilibrium) price (p^*): \$6.00
- Market-clearing (equilibrium) quantity exchanged (q^*): 4 units





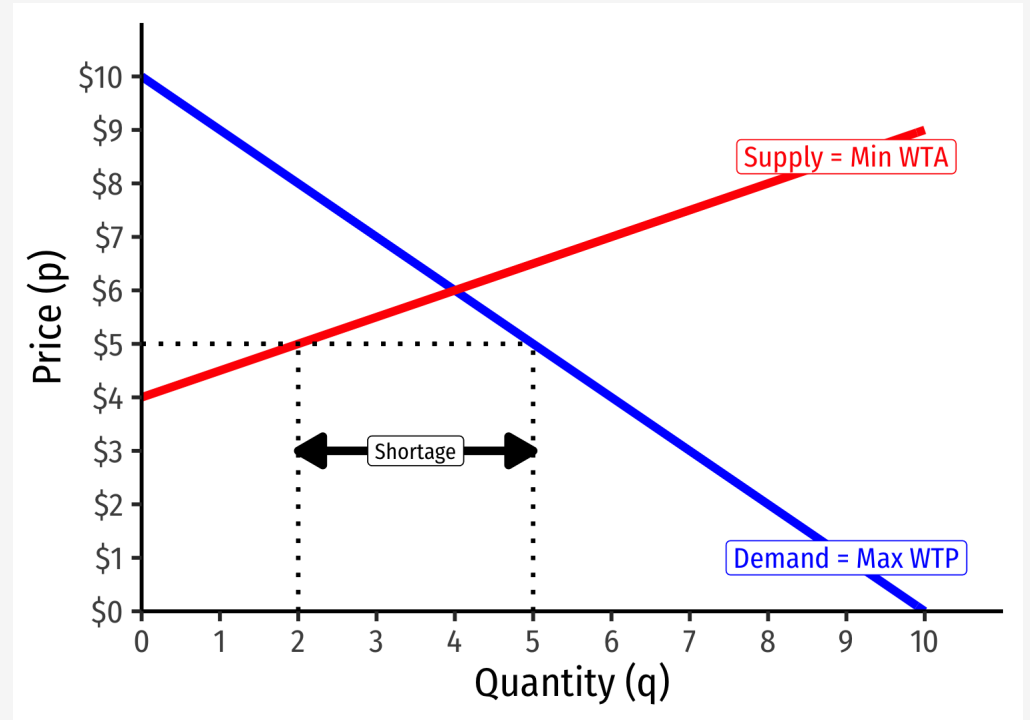
Why Markets Tend to Equilibrate

Excess Demand I

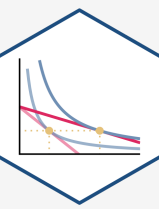


Example: Consider *any* price below \$6, such as \$5:

- $Q_d = 5$ $Q_s = 2$
- $Q_d > Q_s$: **excess demand**
- A **shortage** of 3 units

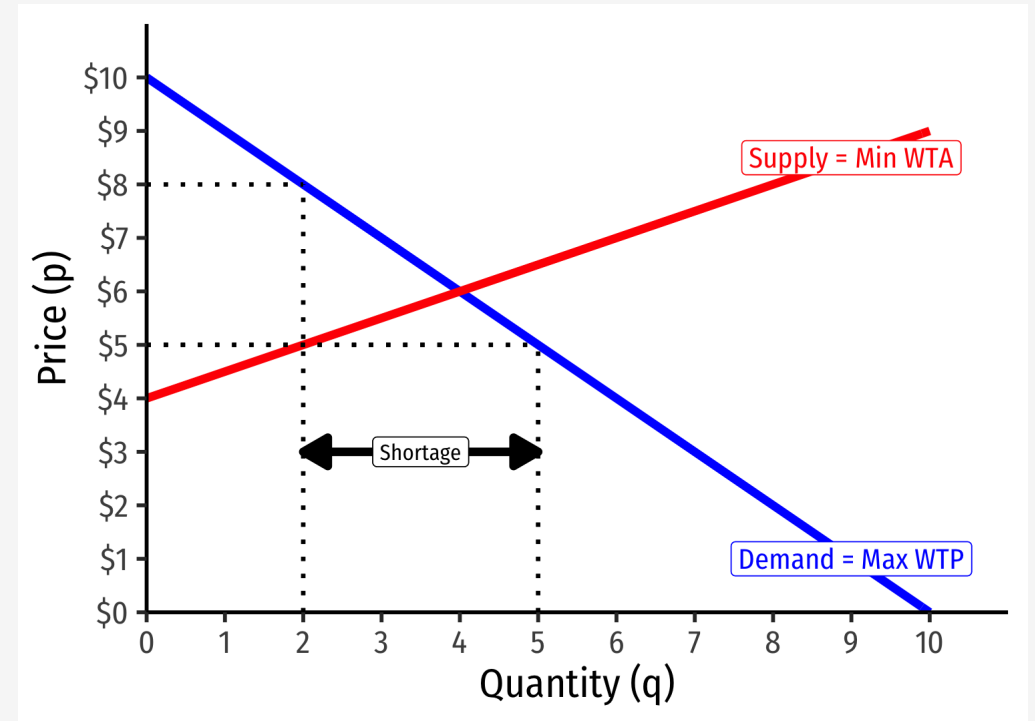


Excess Demand II



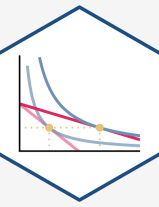
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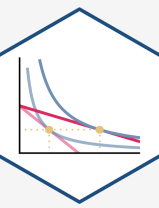


- Sellers will not supply more than 2 units
- For 2 units, some buyers are willing to pay more than \$5

Excess Demand II



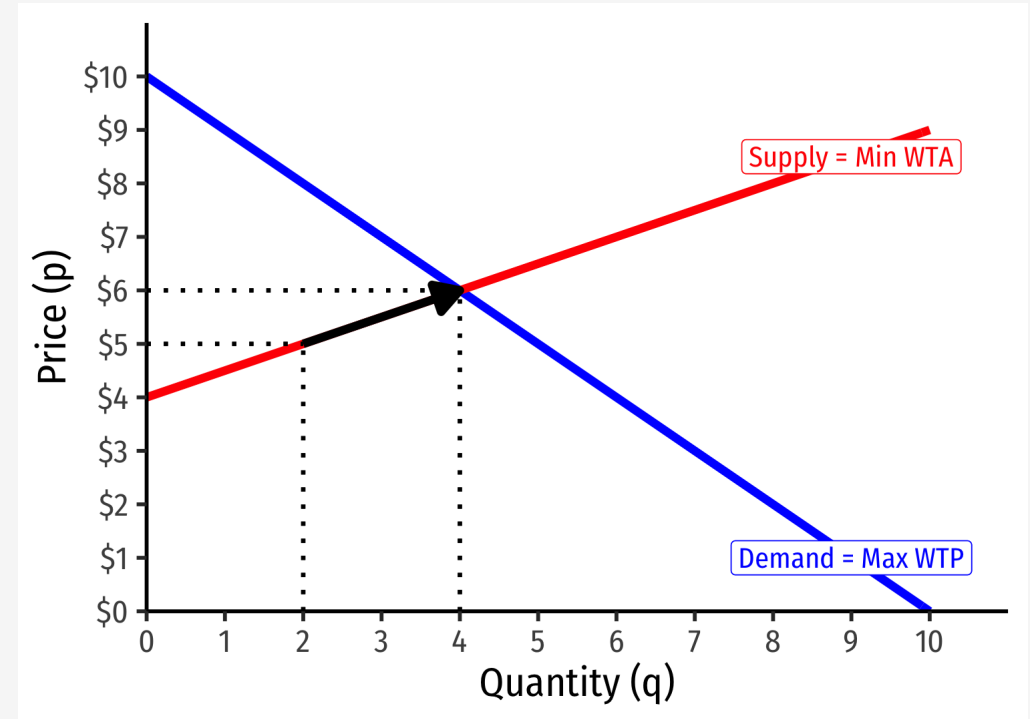
Excess Demand III



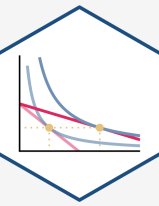
Example: Consider *any* price below \$6, such as \$5:

- $Q_d = 5$ $Q_s = 2$
- $Q_d > Q_s$: **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!

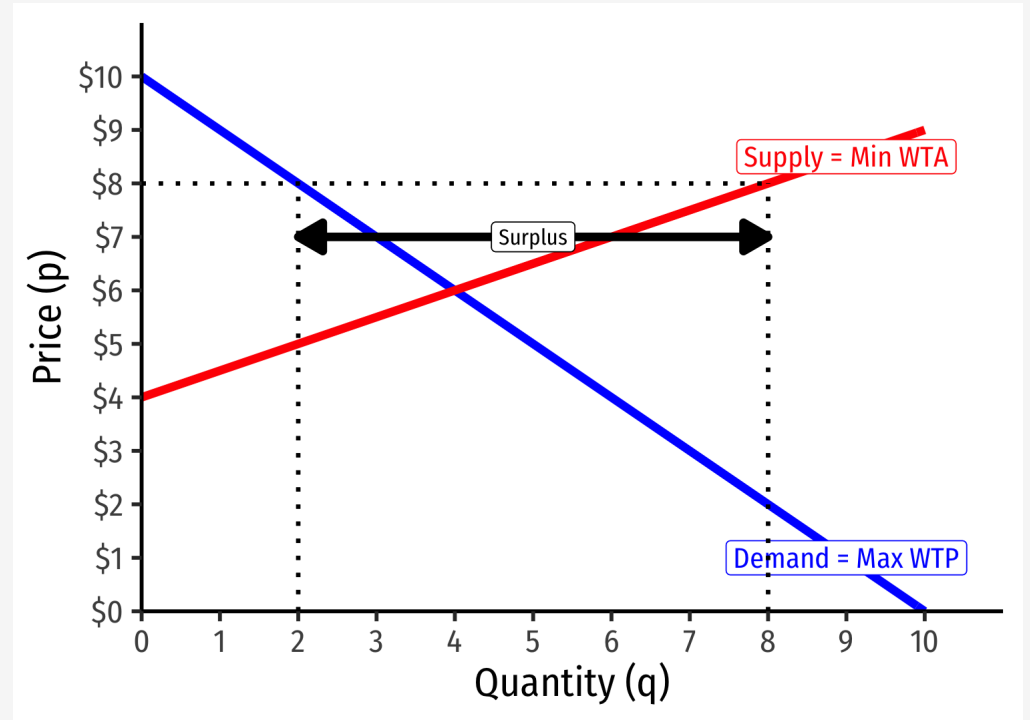


Excess Supply I

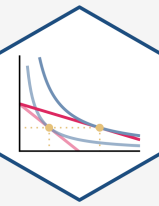


Example: Consider *any* price above \$6, such as \$7:

- $Q_d = 2$ $Q_s = 8$
- $Q_d < Q_s$: **excess supply**
- A **surplus** of 6 units

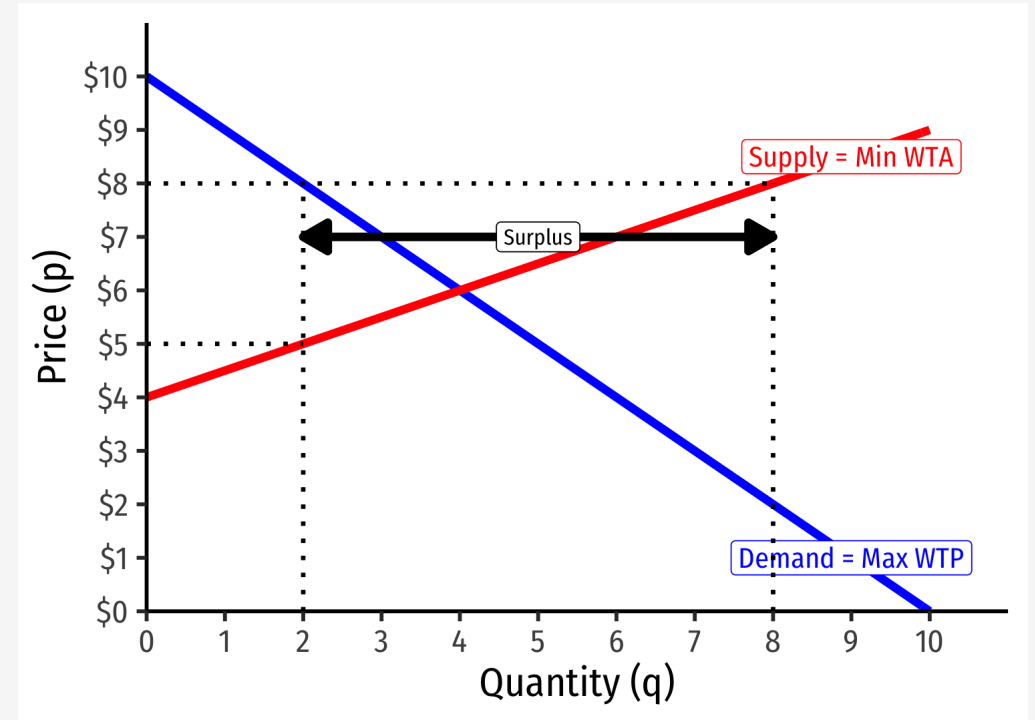


Excess Supply II



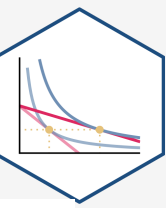
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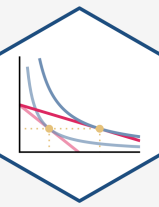


- Buyers will not buy more than 2 units
- For 2 units, some sellers willing to accept less than \$8

Excess Supply II

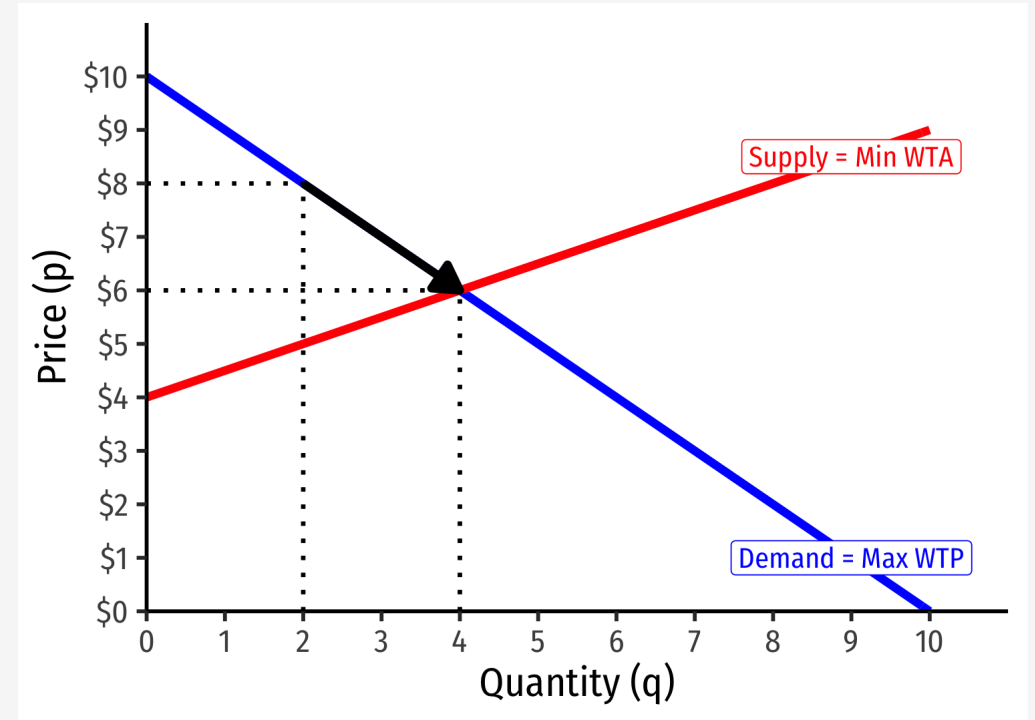


Excess Supply III



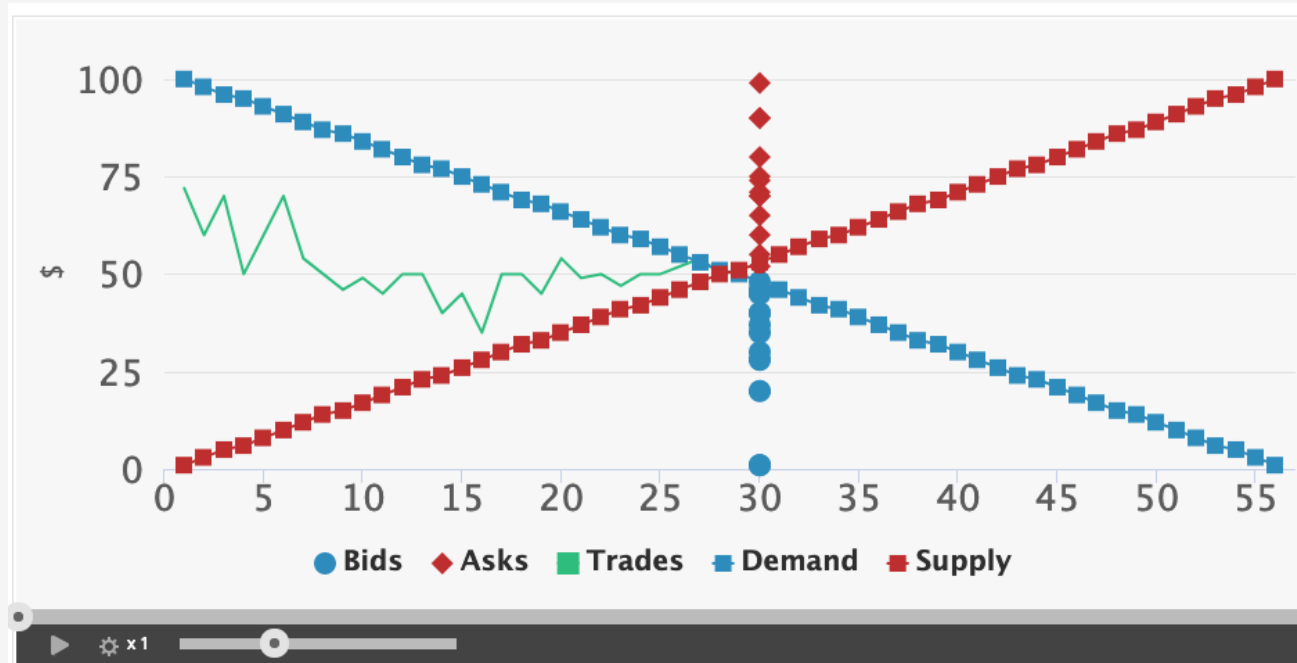
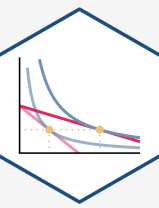
Example: Consider *any* price above \$6, such as \$7:

- $Q_d = 2$ $Q_s = 8$
- $Q_d < Q_s$: **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!

Why Markets Tend to Equilibrate



STATS

TOTAL EARNINGS:

\$ 1243

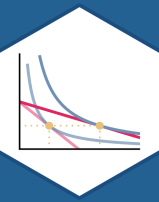
POSSIBLE EARNINGS:

\$ 1410

EFFICIENCY

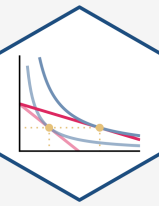
88.16%





Comparative Statics

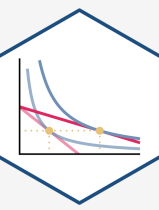
Ceterus Paribus I



- Supply function and demand function *only* relate **quantity** (supplied or demanded) to **price**
 - 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, costs, expectations, etc.
- A supply or demand function (or graph) requires “**ceterus paribus**” (all else equal)

KEEP
CALM
AND
CETERIS
PARIBUS

Recall (for example), Demand I



- A consumer's **demand** (for good x) depends on current prices & income:

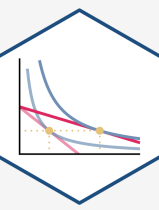
$$q_x^D = q_x^D(m, p_x, p_y)$$

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

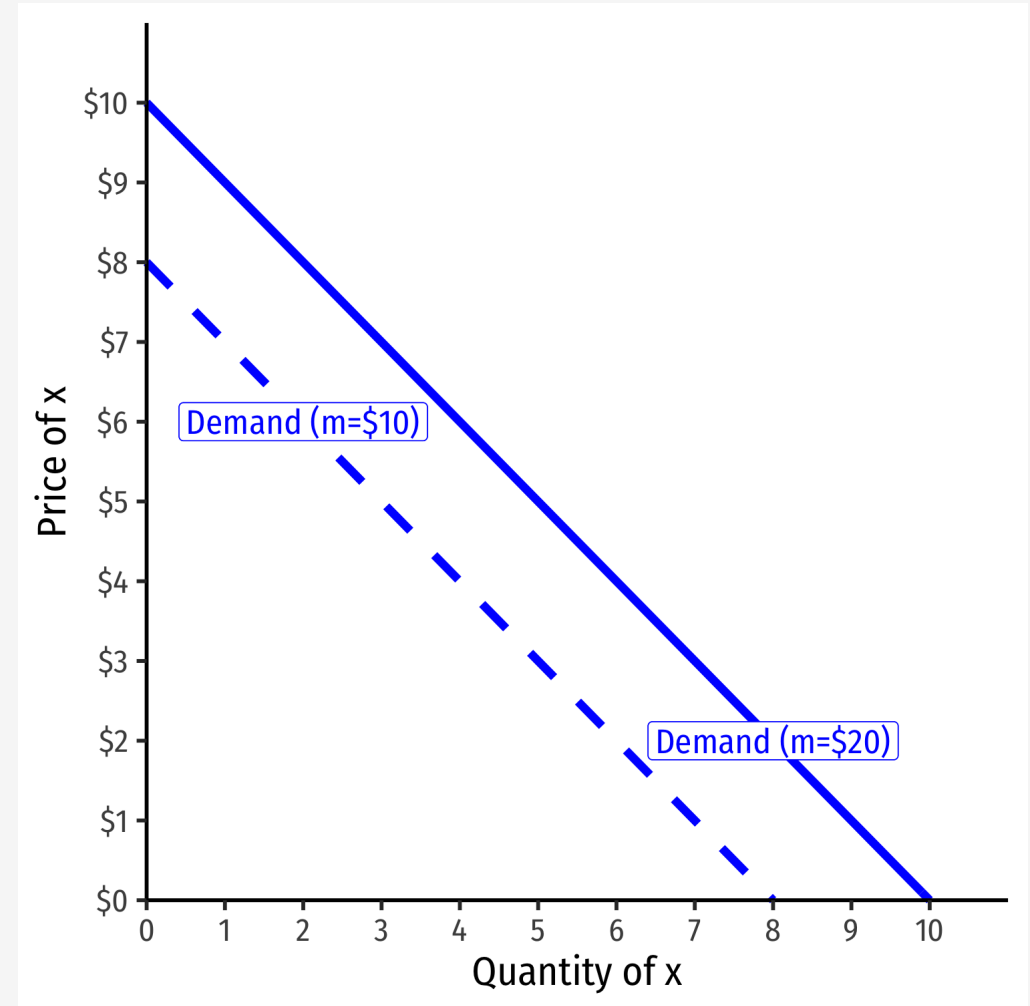
1. **Income effects** $\left(\frac{\Delta q_x^D}{\Delta m} \right)$: how q_x^D changes with changes in income
2. **Cross-price effects** $\left(\frac{\Delta q_x^D}{\Delta p_y} \right)$: how q_x^D changes with changes in prices of *other* goods (e.g. y)
3. **(Own) Price effects** $\left(\frac{\Delta q_x^D}{\Delta p_x} \right)$: how q_x^D changes with changes in price (of x)



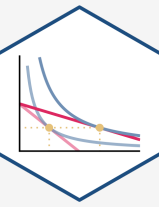
Recall (for example), Demand II



- 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](#)



Ceterus Paribus II



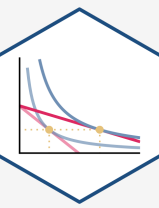
- Consider our demand function:

$$q_D = 10 - p$$

- If the **market price changes** (perhaps because supply changes), that results in a **change in *quantity demanded***
 - We move **along** the existing demand curve
- *Ceterus paribus* has not been violated

KEEP
CALM
AND
CETERIS
PARIBUS

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**

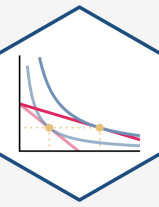
- A whole *new* demand function/graph:

$$q_D = 12 - p$$

- *Ceterus paribus* has been violated



Ceterus Paribus IV



- There is a big difference between a change in "quantity demanded" and a change in "demand"!



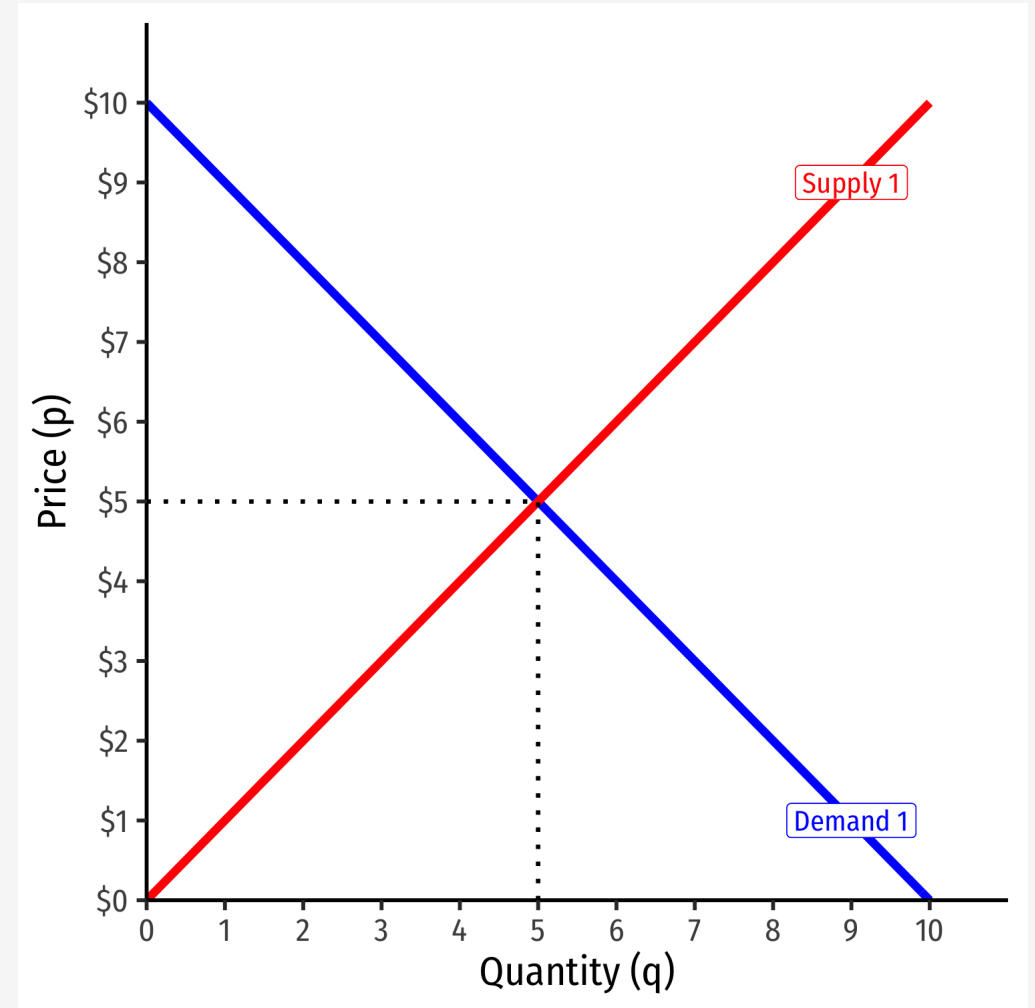
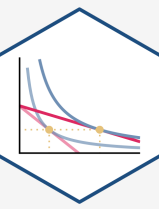
A fall
in price
causes demand
to increase



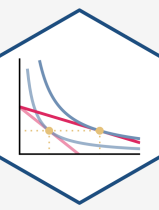
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imgflip.com

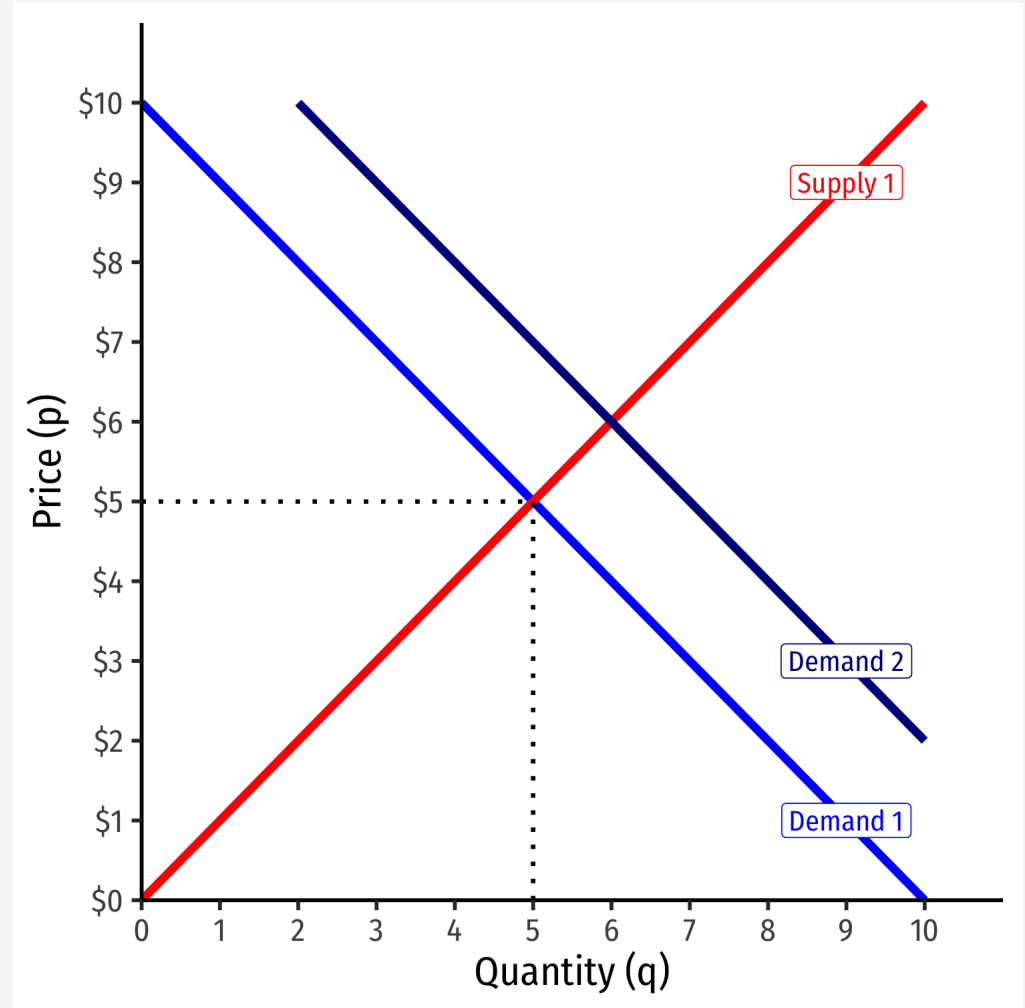
Increase in Demand



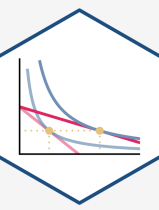
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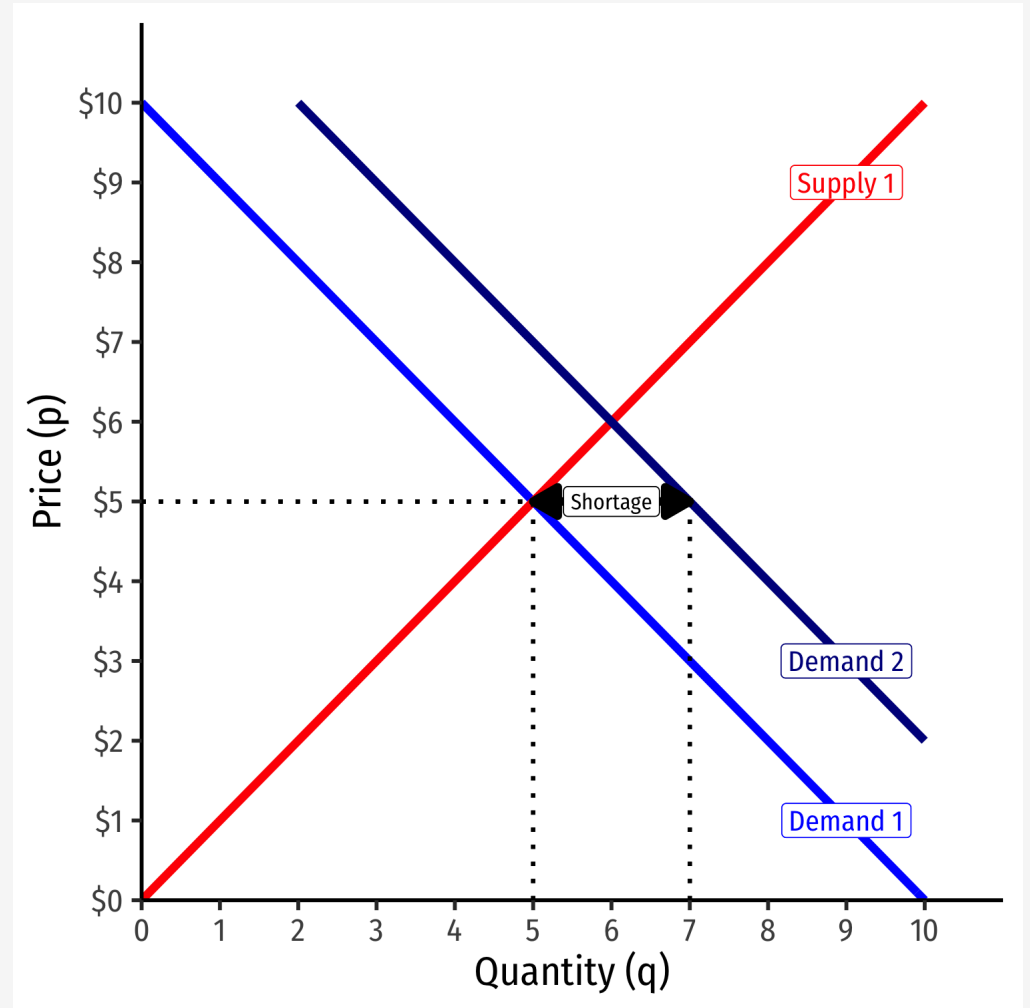
- More individuals want to buy more of the good at *every* price
- Entire demand curve shifts to the *right*



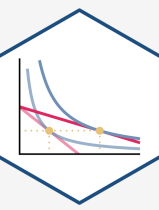
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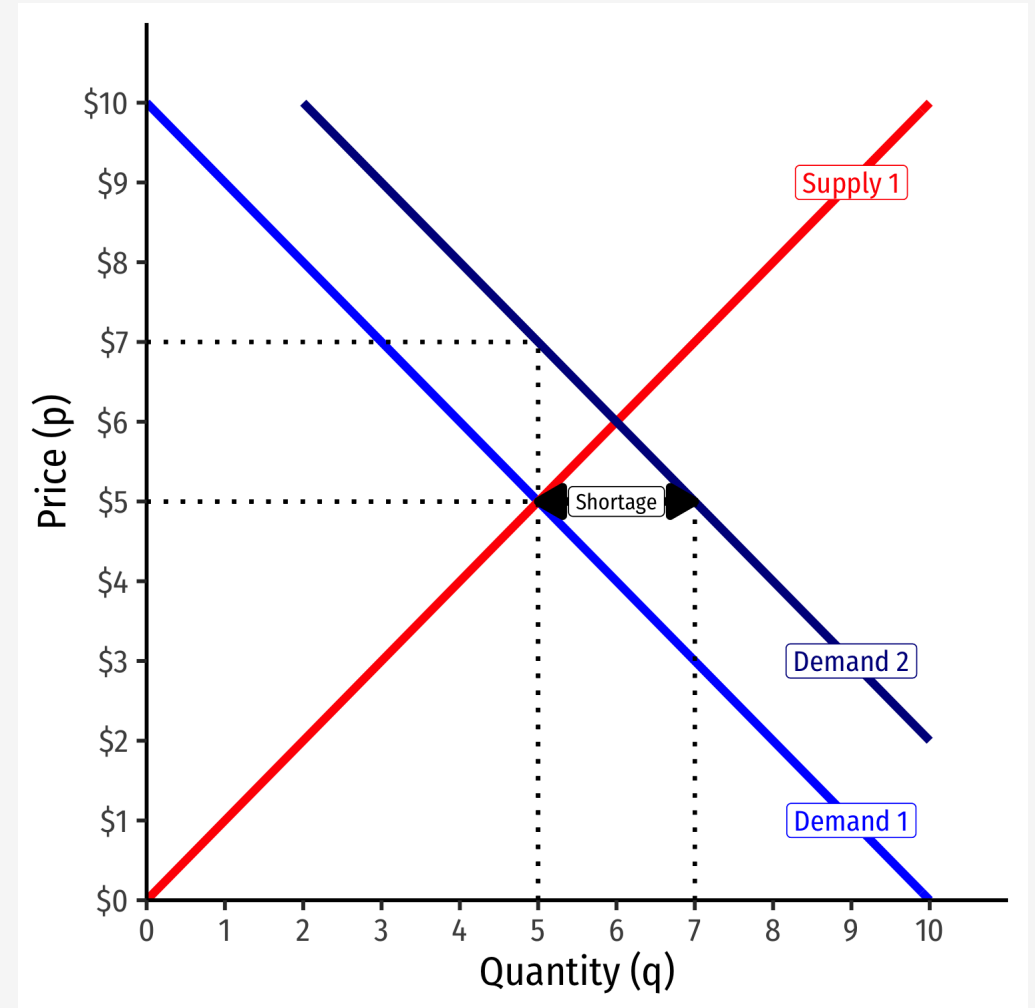
- More individuals want to buy more of the good at *every* price
- Entire demand curve shifts to the *right*
- At the original market price, a **shortage!**
($q_D > q_S$)



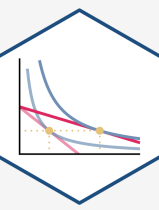
Increase in Demand



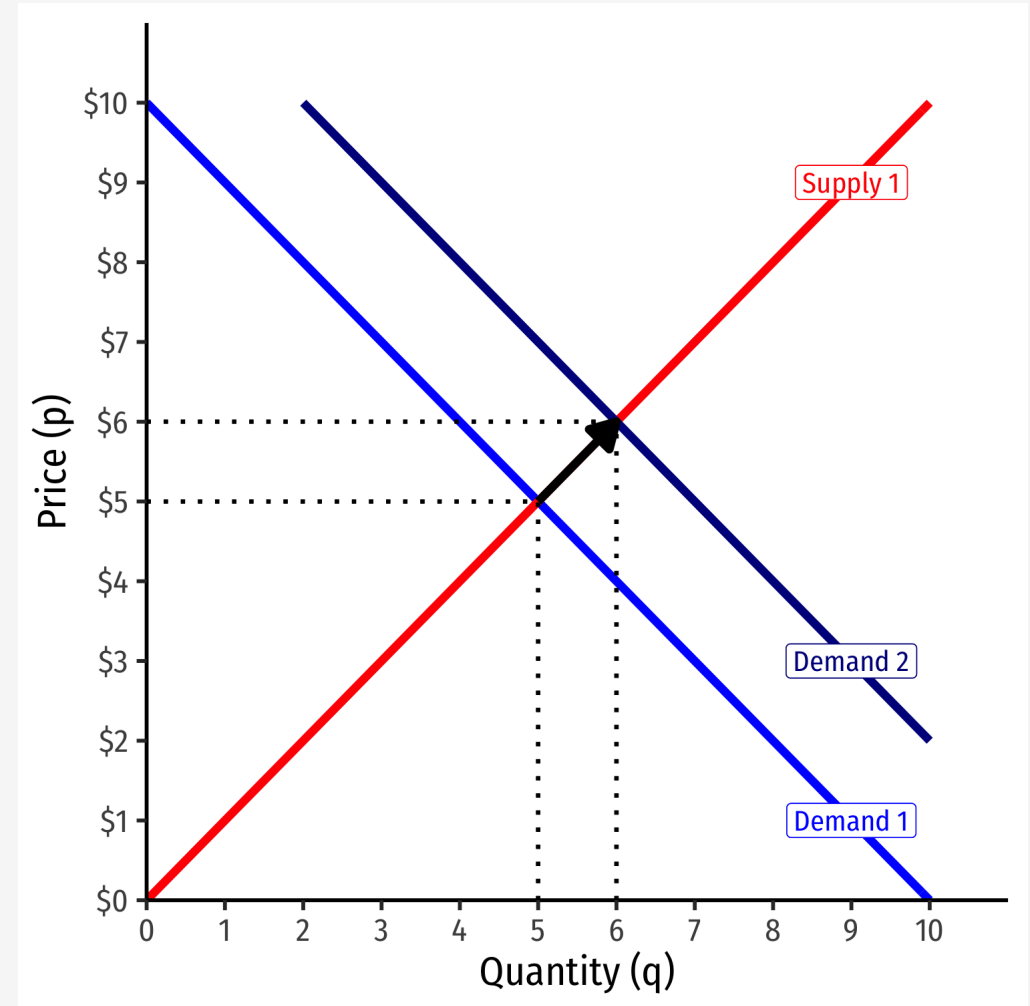
- More individuals want to buy more of the good at *every* price
- Entire demand curve shifts to the *right*
- At the original market price, a **shortage!** ($q_D > q_S$)
- Some buyers willing to pay more at this quantity



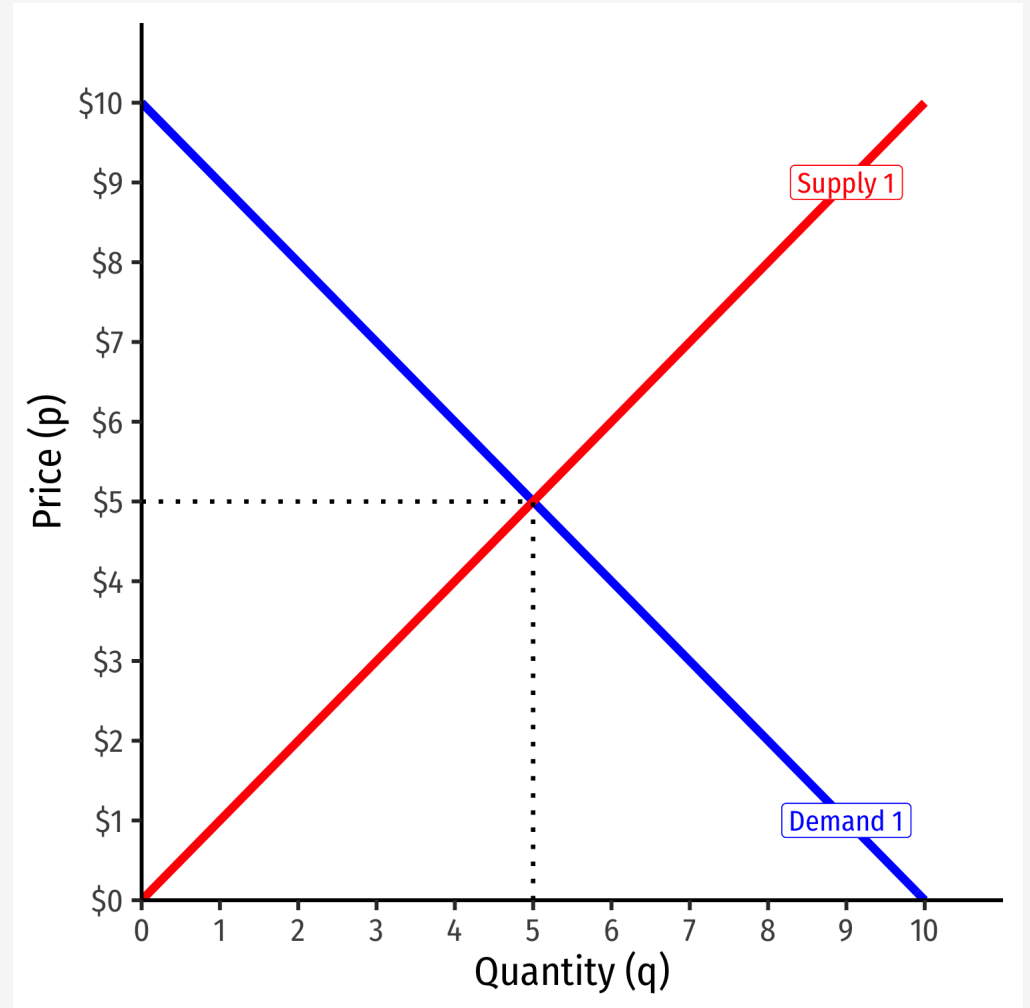
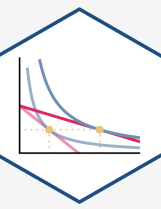
Increase in Demand



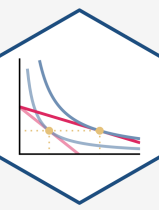
- More individuals want to buy more of the good at *every* price
- Entire demand curve shifts to the *right*
- At the original market price, a **shortage!** ($q_D > q_S$)
- Some buyers willing to pay more at this quantity
- Buyers raise bids, inducing sellers to sell more
- Reach new equilibrium with:
 - **higher market-clearing price**
 - **larger market-clearing quantity exchanged**



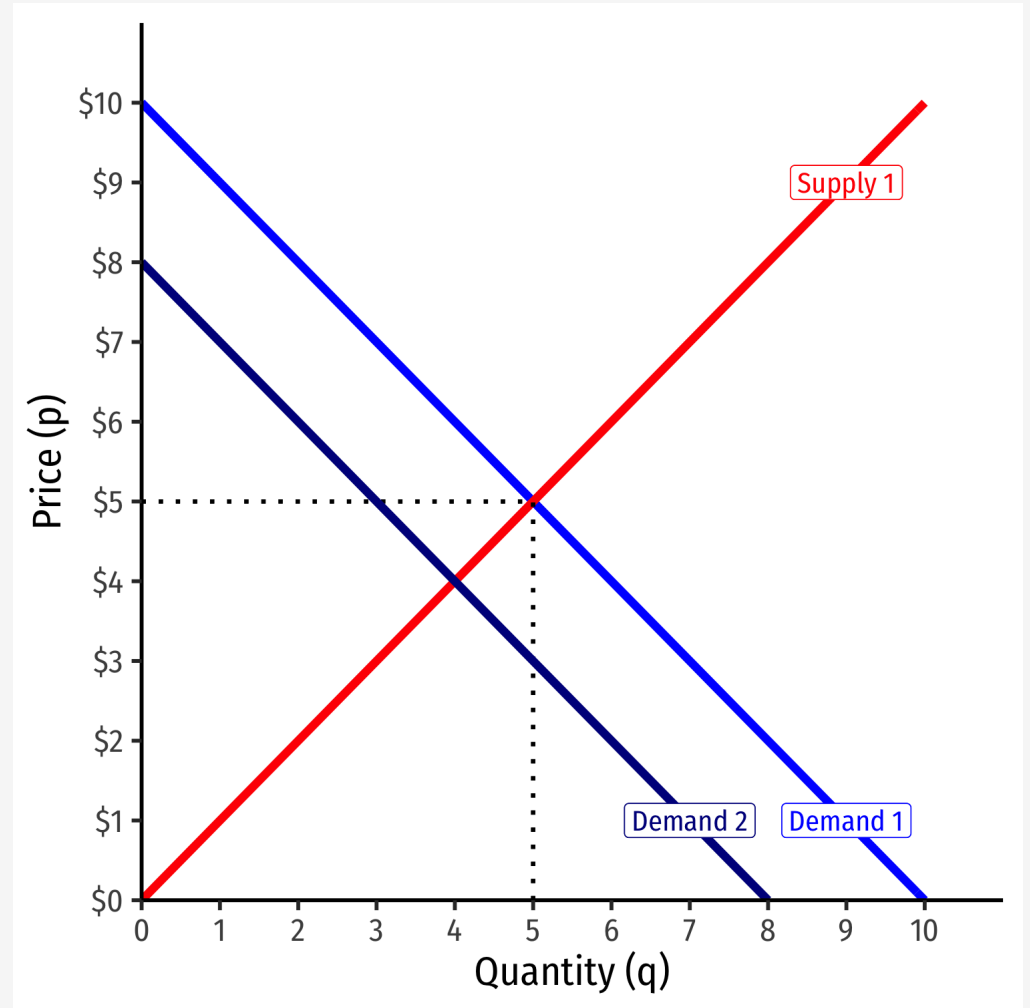
Decrease in Demand



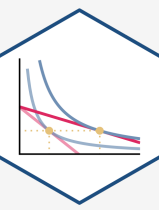
Decrease in Demand



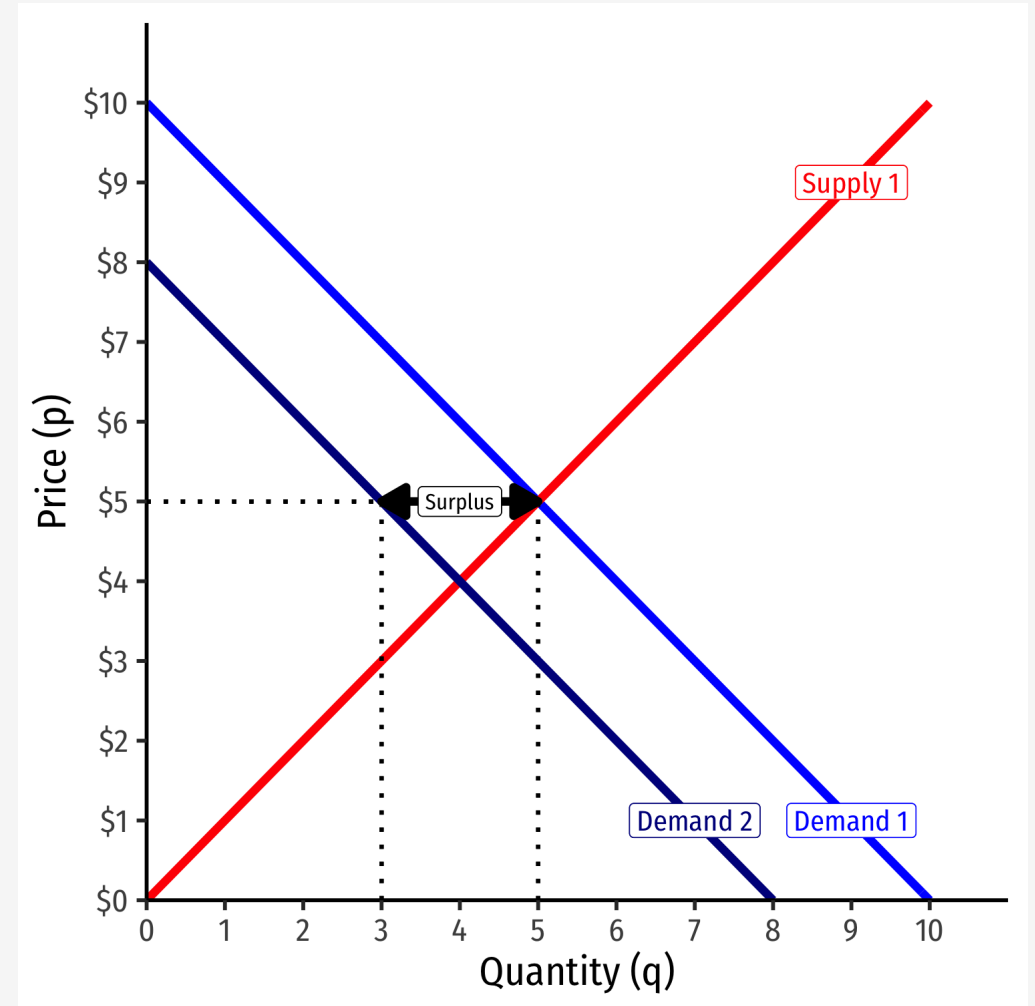
- Fewer individuals want to buy less of the good at *every* price
- Entire demand curve shifts to the *left*



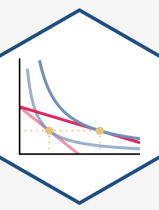
Decrease in Demand



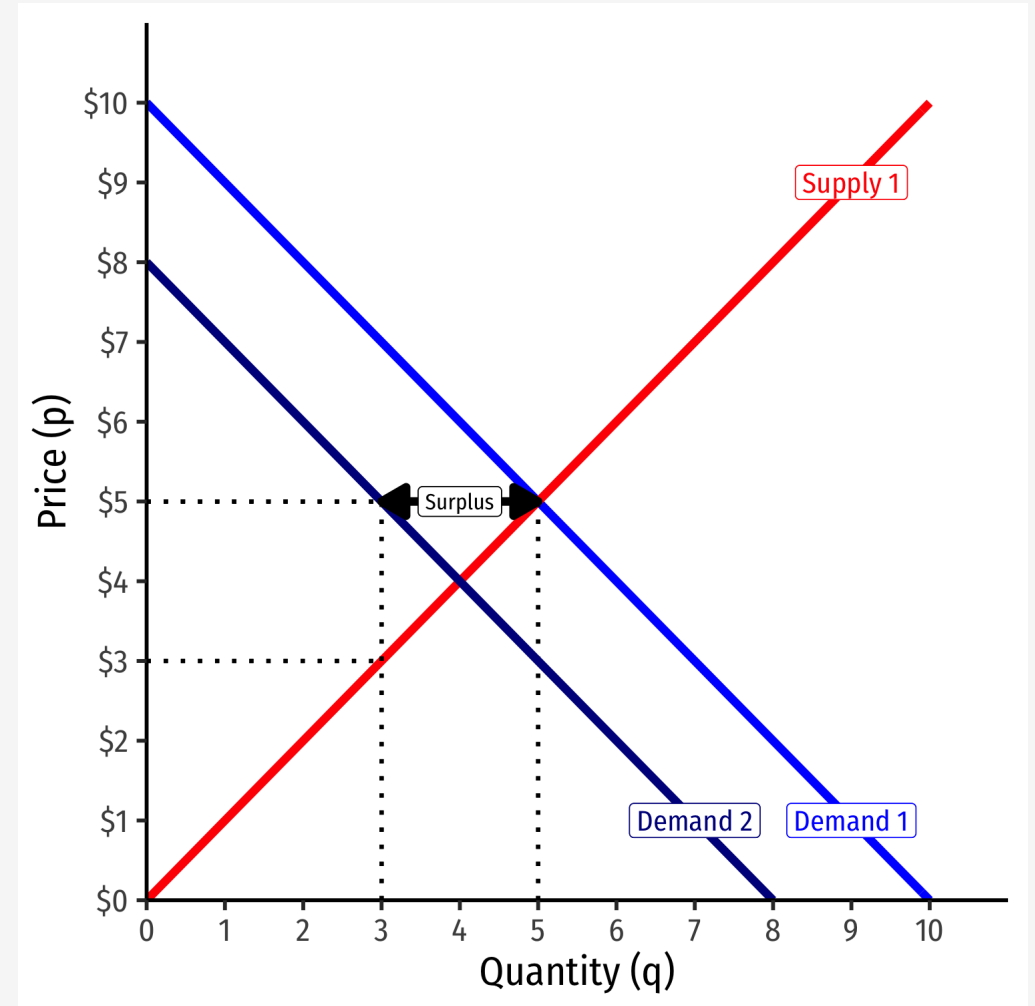
- Fewer individuals want to buy less of the good at *every* price
- Entire demand curve shifts to the *left*
- At the original market price, a **surplus!**
($q_D < q_S$)



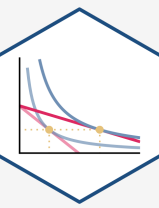
Decrease in Demand



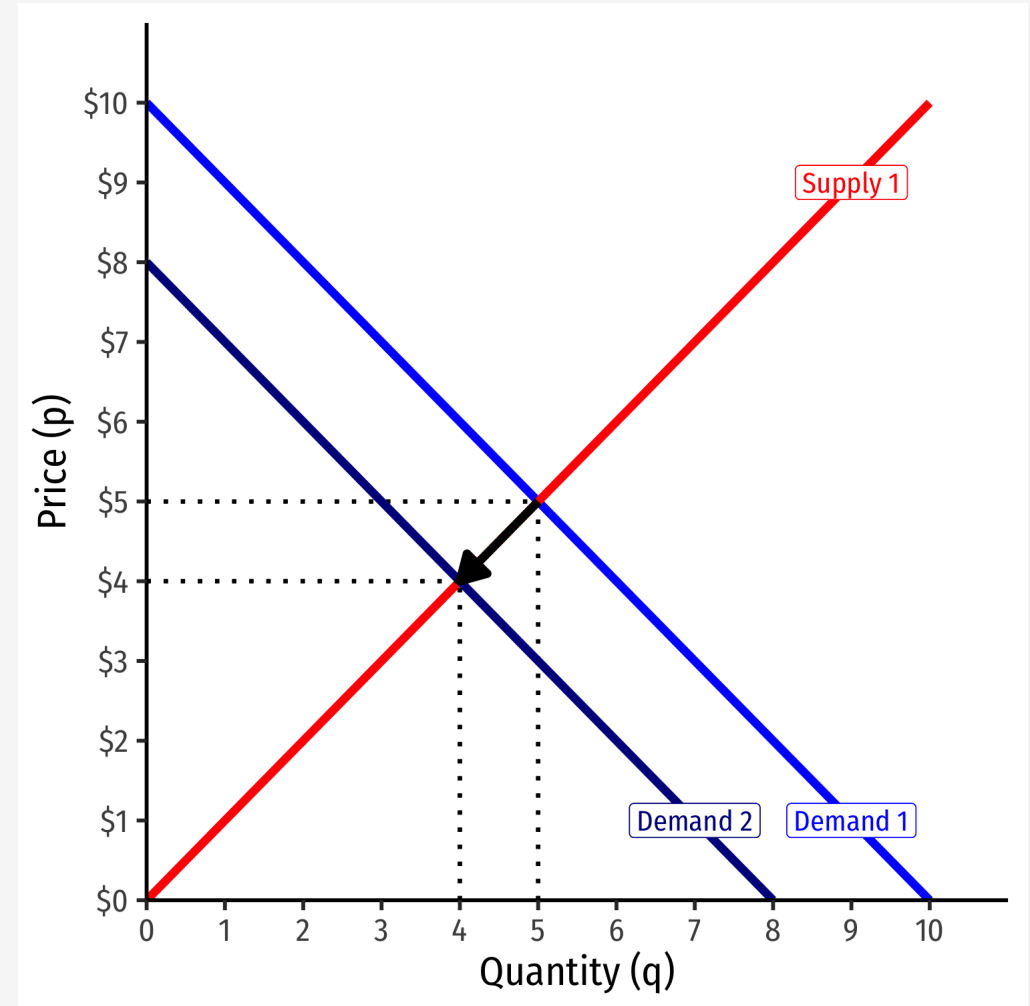
- Fewer individuals want to buy less of the good at *every* price
- Entire demand curve shifts to the *left*
- At the original market price, a **surplus!** ($q_D < q_S$)
- Some sellers willing to accept less at this quantity



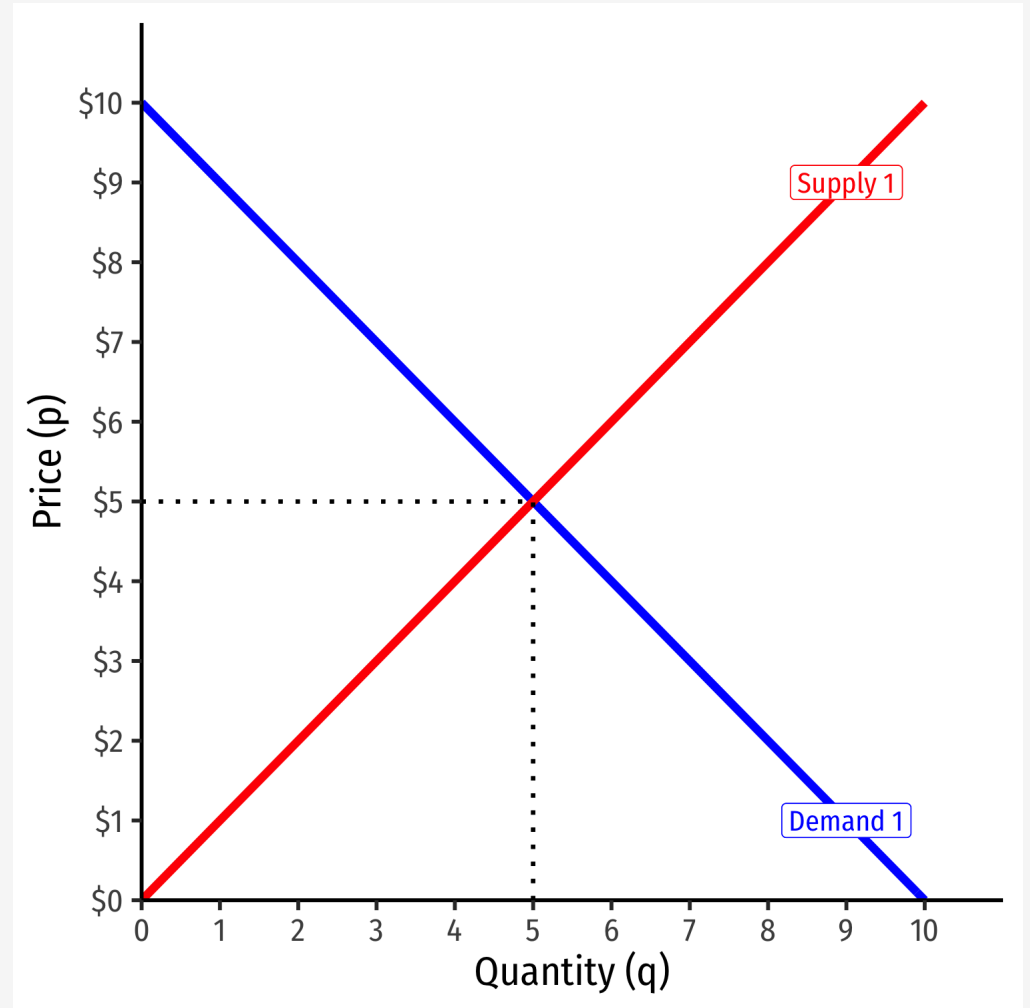
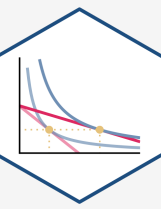
Decrease in Demand



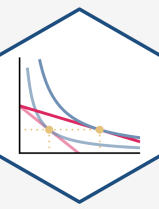
- Fewer individuals want to buy less of the good at *every* price
- Entire demand curve shifts to the *left*
- At the original market price, a **surplus!** ($q_D < q_S$)
- Some sellers willing to accept less at this quantity
- Sellers lower asks, inducing buyers to buy more
- Reach new equilibrium with:
 - **lower market-clearing price**



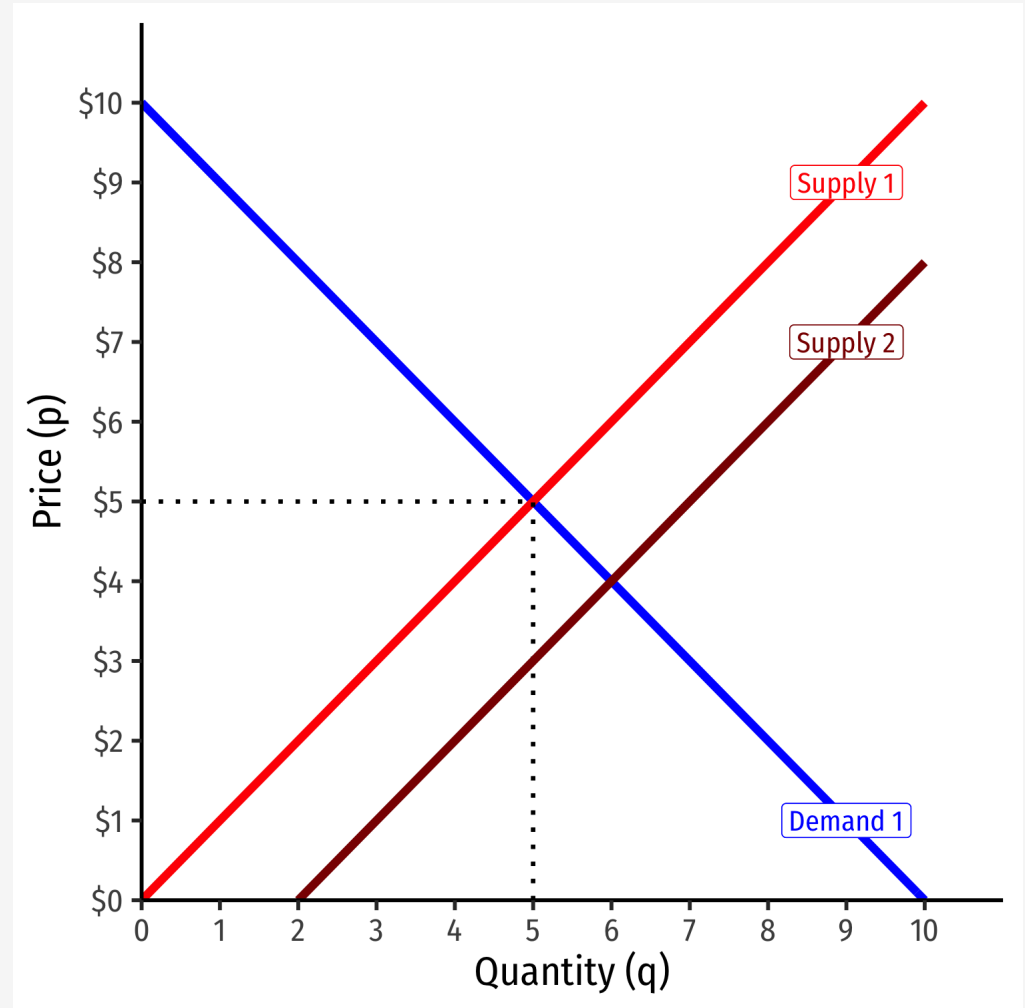
Increase in Supply



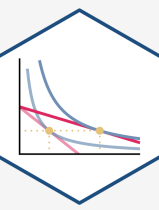
Increase in Supply



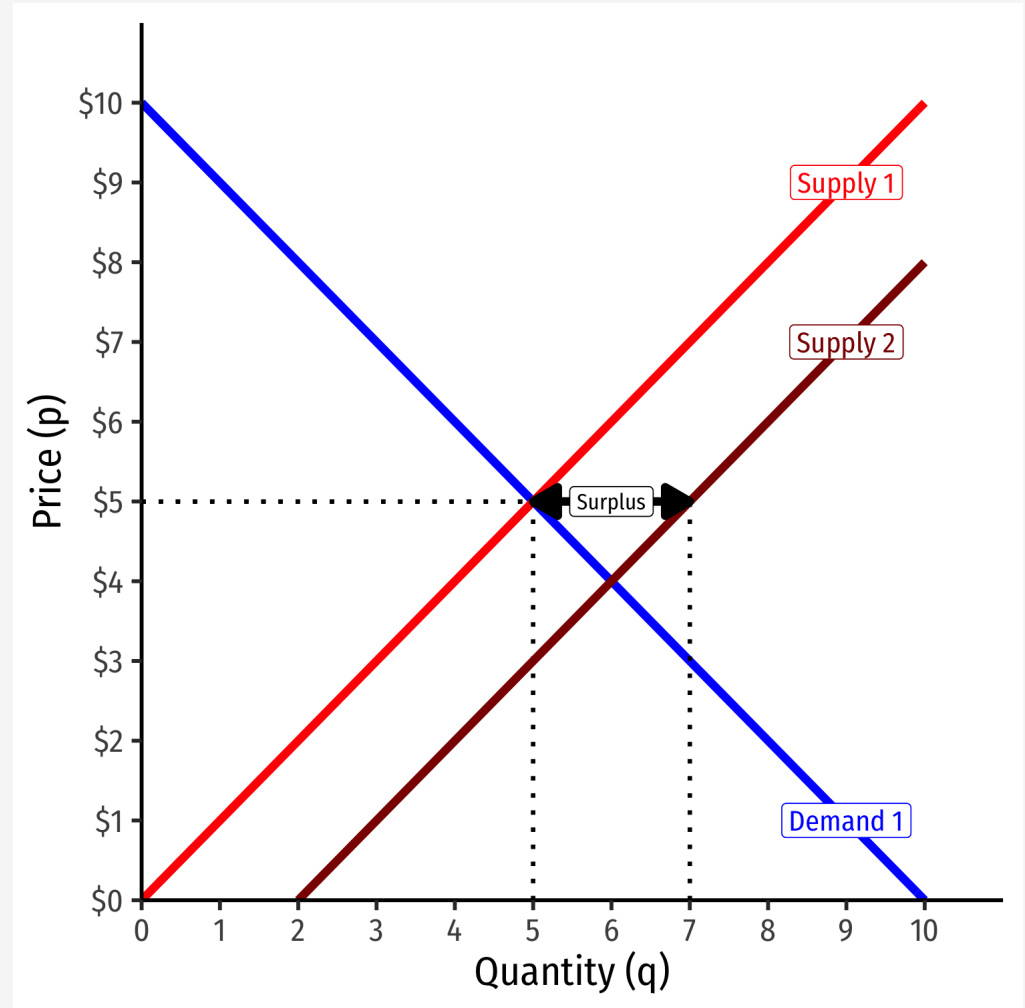
- More individuals want to sell more of the good at *every* price
- Entire supply curve shifts to the *right*



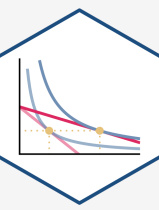
Increase in Supply



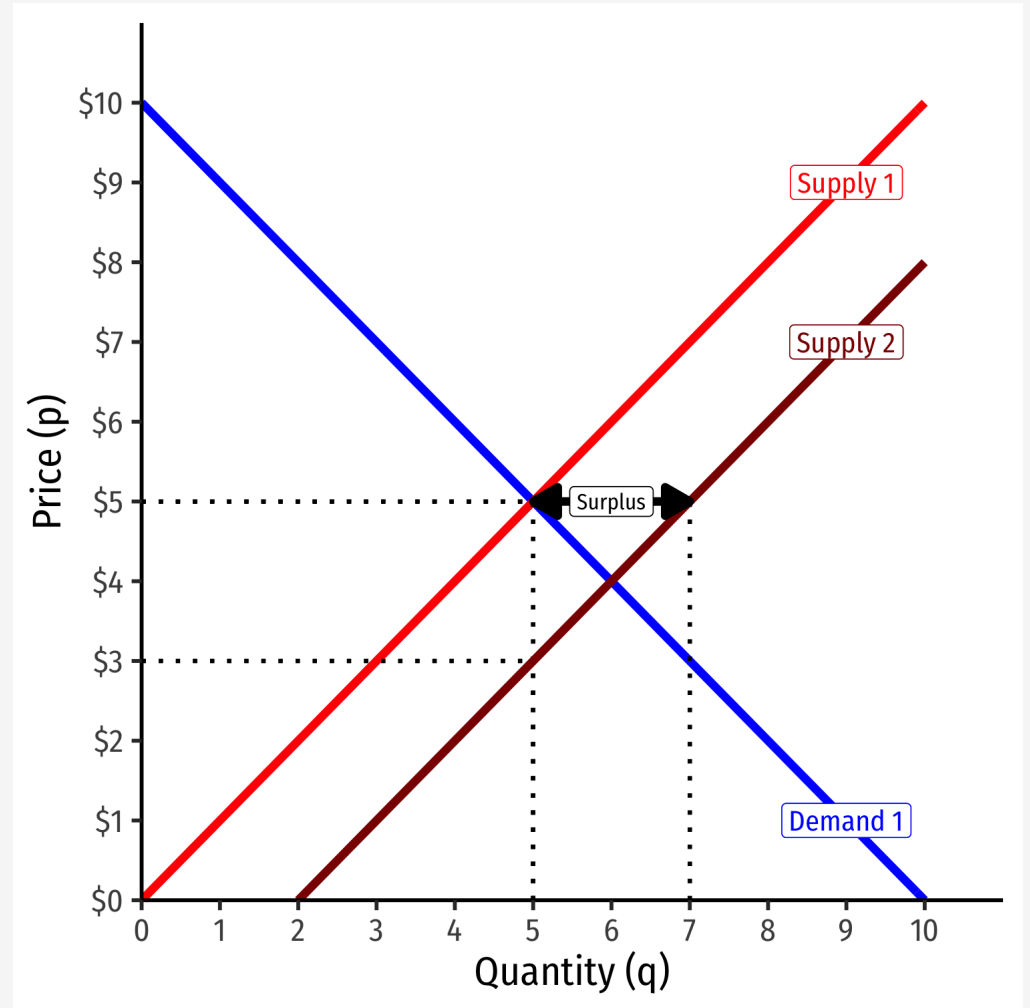
- More individuals want to sell more of the good at *every* price
- Entire supply curve shifts to the *right*
- At the original market price, a **surplus!**
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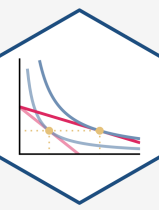
Increase in Supply



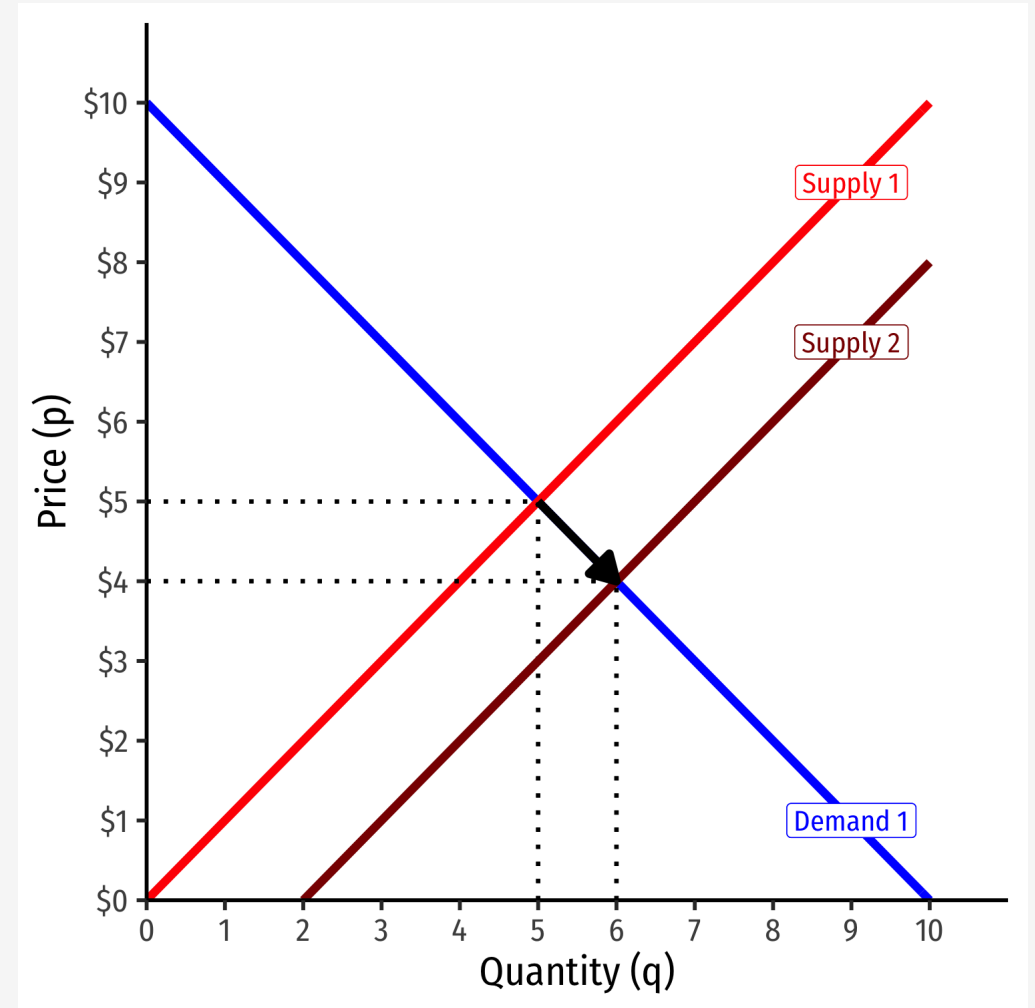
- More individuals want to sell more of the good at *every* price
- Entire supply curve shifts to the *right*
- At the original market price, a **surplus!** ($q_D < q_S$)
- Some sellers willing to accept less at this quantity



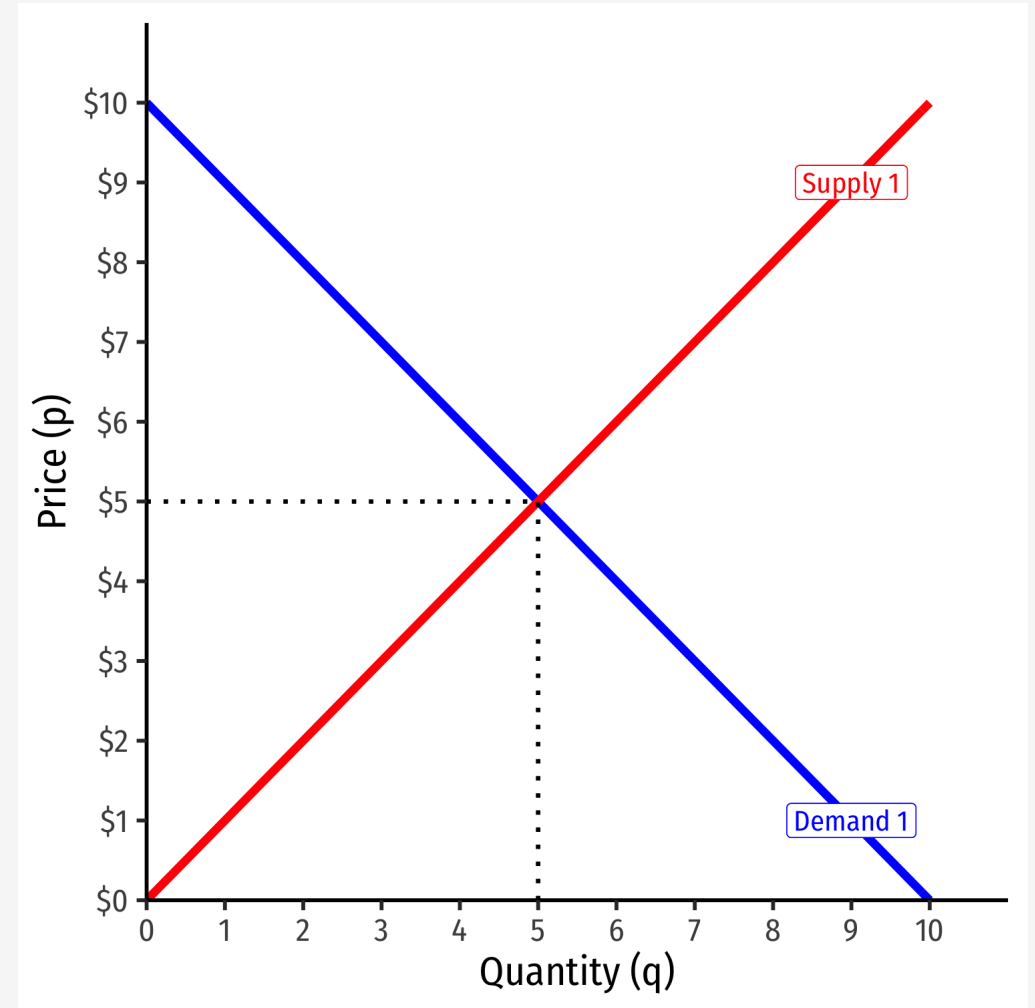
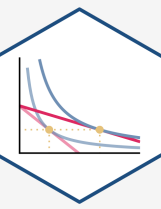
Increase in Supply



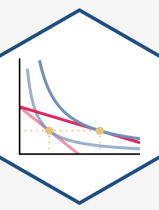
- More individuals want to sell more of the good at *every* price
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- At the original market price, a **surplus!** ($q_D < q_S$)
- Some sellers willing to accept less at this quantity
- Sellers lower asks, inducing buyers to buy more
- Reach new equilibrium with:
 - **lower market-clearing price**
 - **larger market-clearing quantity exchanged**



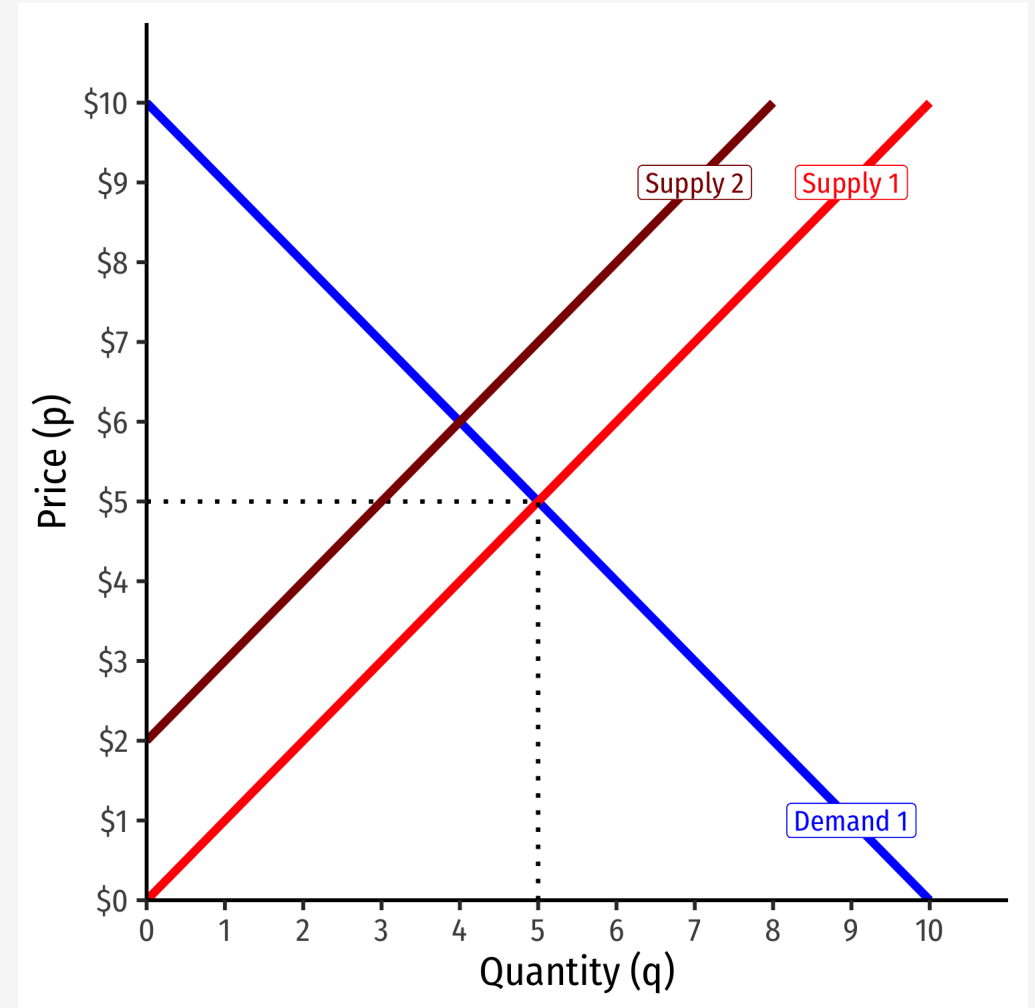
Decrease in Supply



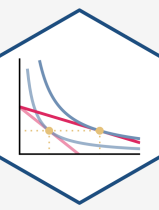
Decrease in Supply



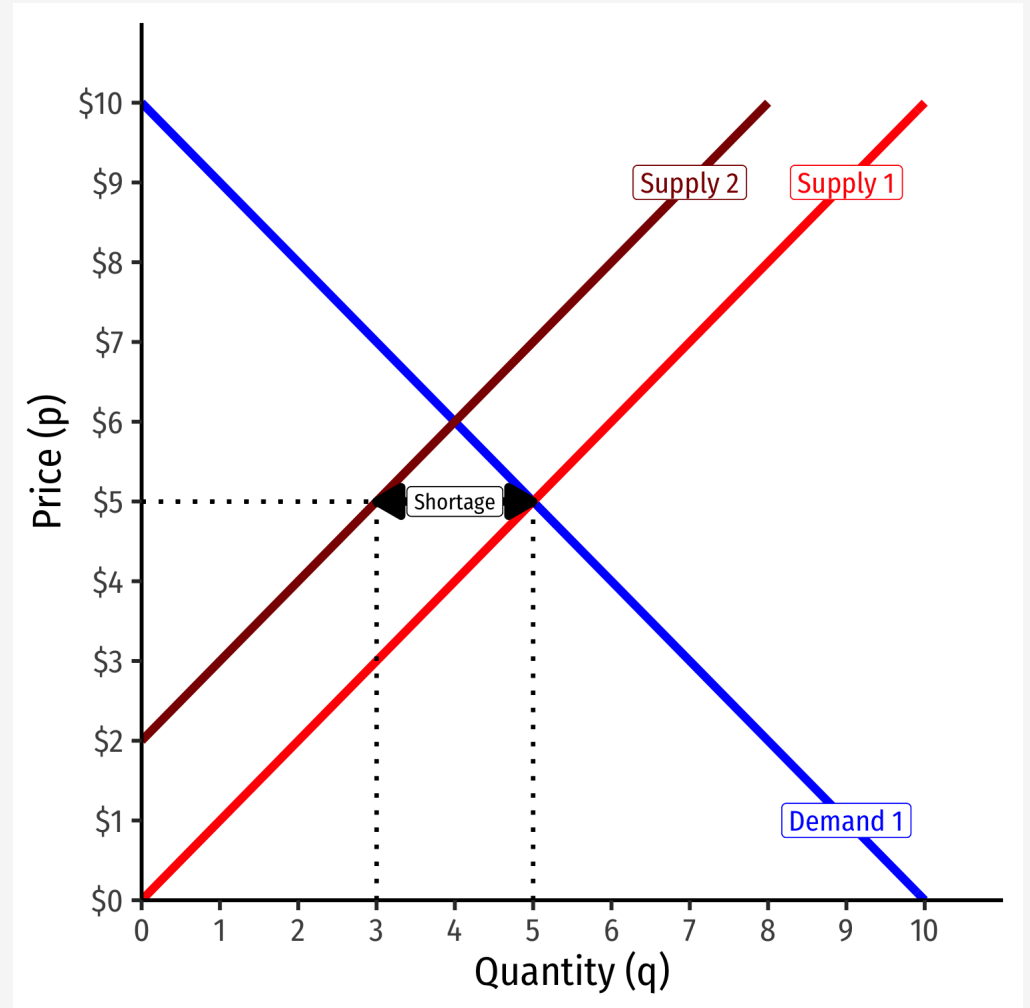
- Fewer individuals want to sell less of the good at *every* price
- Entire supply curve shifts to the *left*



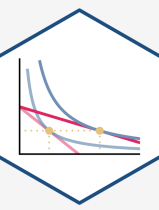
Decrease in Supply



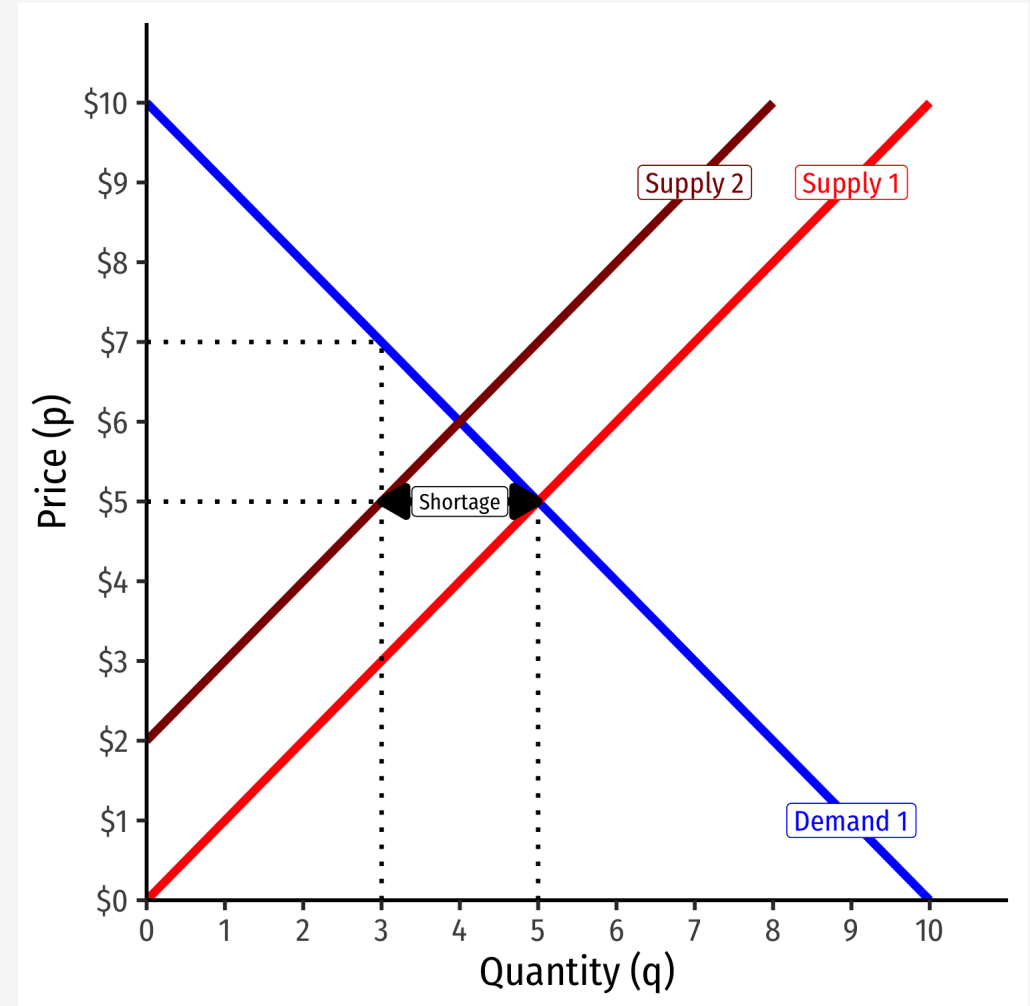
- Fewer individuals want to sell less of the good at *every* price
- Entire supply curve shifts to the *left*
- At the original market price, a **shortage!**
($q_D > q_S$)



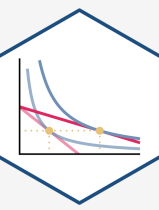
Decrease in Supply



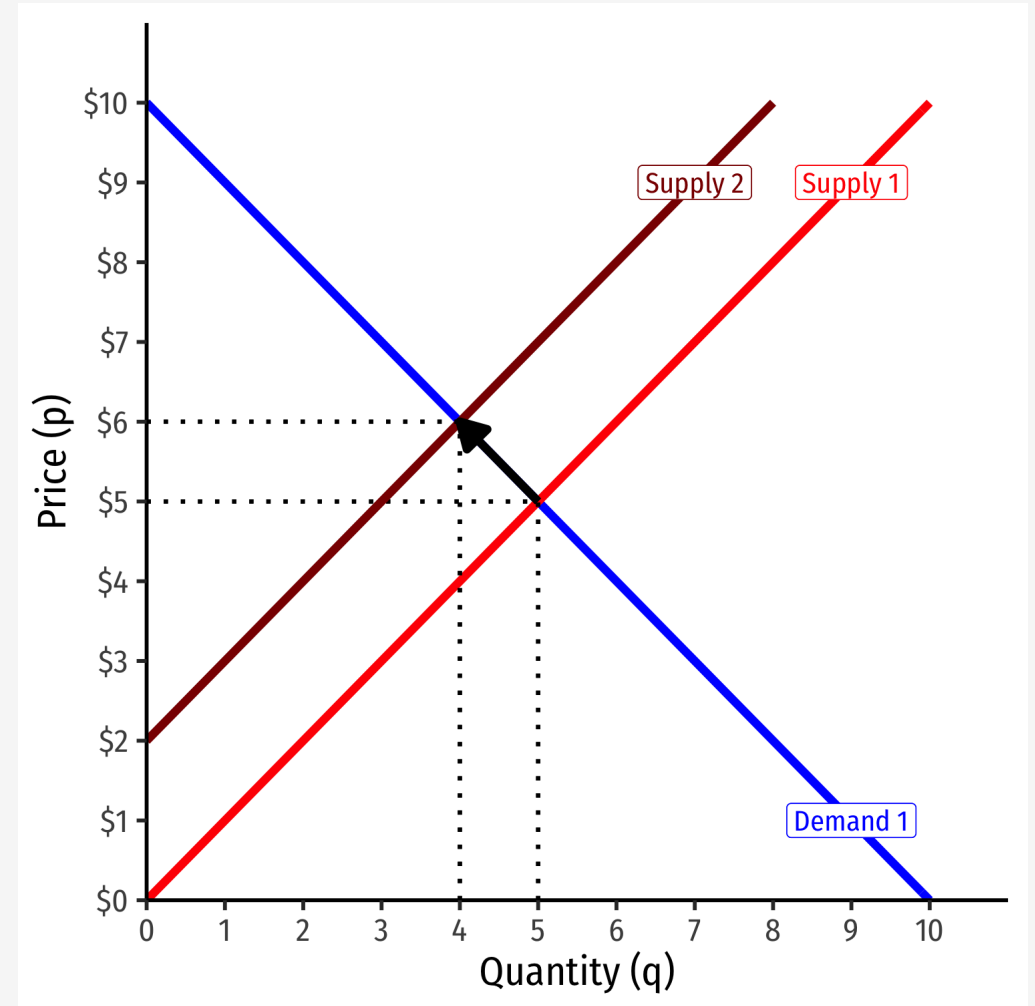
- Fewer individuals want to sell less of the good at *every* price
- Entire supply curve shifts to the *left*
- At the original market price, a **shortage!**
($q_D > q_S$)
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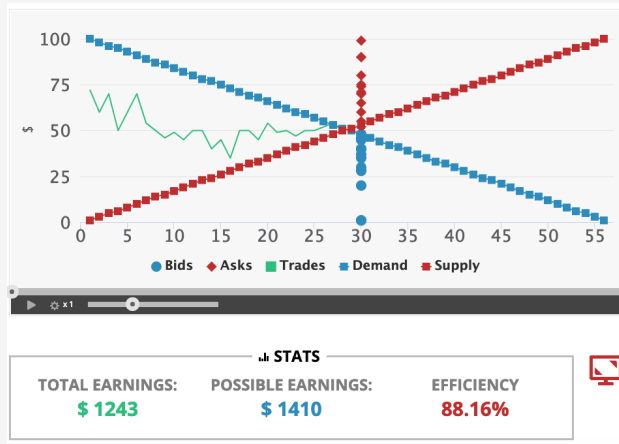
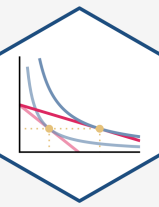
Decrease in Supply



- Fewer individuals want to sell less of the good at *every* price
- Entire supply curve shifts to the *left*
- 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**
 - **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)!