Introduction
Supply & Demand

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Discussion Section #1
January 20, 2023

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UGBA 101A, Spring 2023

Agenda

- Introduction
- Objectives
- Study Guidelines
- Starter: Supply and Demand

Readings

- **GLS 2.1 – 2.4**

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Who I am

Tianyu Han

- 5th year Quantitative Marketing PhD student at Haas
- Fields: industrial organization, behavioral economics, applied machine learning
- Background:
  - MS Econometrics @ London School of Economics
  - MS Economics @ University of Wisconsin-Madison
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  - tianyu_han@berkeley.edu
  - **Prefix [UGBA 101A] in the subject line**
  - Contact Professor Fitch directly about logistics (e.g., grading, deadline extension, exam reschedule)

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Objectives

- Review of the main concepts
- Solving any doubts from lecture
- Safe place to ask questions
- Practice problems!
- To nudge thinking and encourage active participation, I will ask questions aggressively, so be prepared!

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Study Guidelines

- **Intuition** goes first: understand concepts and how to solve problems.
- **Don't memorize** or get trapped in the technical details!
- Do **practice problems** (i.e., sections, textbook)
- Write your own questions as if you were an instructor.
- Ask questions in section and office hours – I'm here to help!

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What is Microeconomics?

- Economics studies the allocation of limited resources to satisfy unlimited human wants.
- Microeconomics focuses on individual economic decision makers, e.g., a consumer, worker, firm, or manager.
- Macroeconomics starts from the perspective of the entire economy, e.g., aggregate demand/supply, unemployment, money supply, inflation, or business cycles.

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Economic Models

An economic model is a

- theoretical construct
- that represents the economic processes
- by a set of variables and a set of logical/quantitative relationship between them.

Variables:

- **Endogenous**: determined within the model (by its relationship with other variables).
  - Endogenous variables are usually what the model tries to study.
- **Exogenous**: determined outside of the model.
  - An economic model usually takes the exogenous variables as given parameters.

Example

Why (seemly unrealistic) economic models?

Many reasons:

- We need to start somewhere simple
- If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details

Why (seemly unrealistic) economic models?

If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details

If you want to understand how the world works when technology is dynamic and endogenous:

- You need to first understand how it works when technology is fixed
- So you understand the incentives to develop a new technology in the first place

Same with preferences

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Why (seemly unrealistic) economic models?

If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details

If you want to understand whether people save enough for retirement:

- Maybe you don't need to model where their tastes for coffee come from
- And it's enough to have a simple model of consumer behavior within your bigger model of labor supply and investment decisions

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Why (seemly unrealistic) economic models?

If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details

Or if you want to model international trade:

- Maybe it's enough to imagine technology is static in each country in the short term
- But different across countries, which gives a reason to trade

Why (seemly unrealistic) economic models?

Many reasons:

- We need to start somewhere simple
- If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details
  - Even if the model isn't exactly right, it's the natural starting point, and we can potentially try to build up from there

Why (seemly unrealistic) economic models?

Many reasons:

- We need to start somewhere simple
- If you want to focus on “big” questions, it’s worthwhile to simplify many of the “small” details
- If you want to be able to communicate with economists, you need to know how they think about the world

Why (seemly unrealistic) economic models?

So, even though the real world is incredibly rich and complex and dynamic and intractable,

- we'll be assuming away a lot of the richness and complexity
- in order to focus on some very simplified, tractable models
- and understand, in the simplest possible cases, the basic implications of a couple of very basic premises

Credit to Daniel Quint @Wisconsin

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Tools

Constrained optimization.

- Consumer: utility maximization subject to a budget constraint;
- Producer: cost minimization subject to a technology constraint.
- Big question: **People optimize, and what are the implications?**

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Tools (cont.)

Equilibrium analysis.

Example

- Equilibrium is a **steady state** that will remain unchanged as long as exogenous factors remain unchanged.

Tools (cont.)

Comparative statics.

Example

- Analysis used to examine how a **change in some exogenous** variable will **affect some endogenous variable**
- Comparative statics allows us to do a **before-and-after analysis** by comparing two snapshots.
  - The first snapshot tells us the levels of the endogenous variables given a set of initial values of exogenous variables before change.
  - The second snapshot tells us how an endogenous variable we care about has changed in response to a change in the level of some exogenous variable.

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Starter Model: Supply & Demand

In this chapter, we introduce the **supply and demand** model. We will:

- Describe the basics of supply and demand.
- Use equations and graphs to represent supply and demand.
- Analyze markets for goods and services using the supply and demand model.

Markets and Models

What is the **supply** and **demand** for a good?

- **Supply:** The combined amount of a good that all producers in a market are willing to sell.
- **Demand:** The combined amount of a good that all consumers in a market are willing to buy.

Table 2.1 The Four Key Assumptions Underlying the Supply and Demand Model

1. We focus on supply and demand in a single market.
2. All goods sold in the market are identical.
3. All goods sold in the market sell for the same price, and everyone has the same information.
4. There are many producers and consumers in the market.

Demand

Factors that influence the demand for a good or service:

- Price
- Number of consumers
- Consumer income or wealth
- Consumer tastes
- Prices of other, related goods
  - Complements and substitutes
- …

Demand

Many factors influence demand for goods and services. Is there one factor that stands out?

- Focus on how the **price** of a good influences the **quantity demanded** by consumers.
- **Demand curve:** Describes the relationship between quantity of a good that consumers demand and the good's price, holding all other factors constant.

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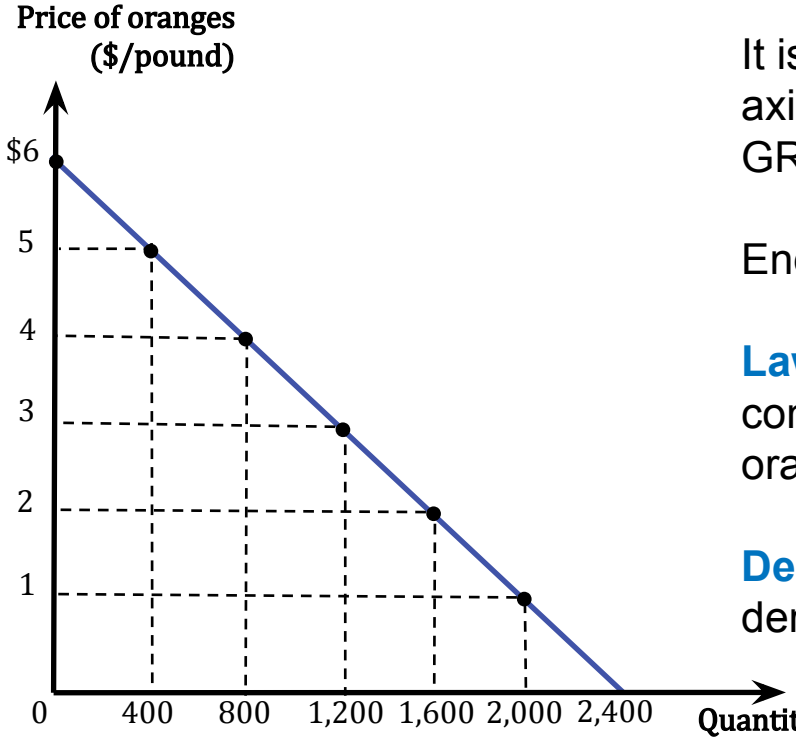
Demand

Consider the market for oranges. We want to map out the quantity (in pounds) demanded by local consumers at various prices ($/pound)



It is a convention to plot price on the vertical axis. REMEMBER TO ALWAYS LABEL GRAPHS!

Endogenous variables: Price and quantity

Law of demand: As the price drops, consumers demand a greater quantity of oranges.

Demand choke price: At $6, consumers demand no oranges

Demand

We can also describe the demand curve mathematically:

The **demand function** on the previous slide is given as

$$Q^D = 2{,}400 - 400P$$

where Q^D is the quantity of oranges demanded (in pounds) and P is the price of oranges ($/pound).

It is often useful to represent price as a function of quantity demanded, i.e., **inverse demand function**

$$P = 6 - 0.0025Q^D$$

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Demand

Changes in price vs. in other factors

- A price change (**endogenous**) creates a ***movement along*** the demand curve
  - **Change in quantity demanded**: Keeping all other factors fixed (*ceteris parabus*), the relationship between price and quantity is exactly explained by the demand curve
- If another factor changes (**exogenous**), the demand curve will ***shift***.
  - **Change in demand:** The current price-quantity relationship no longer holds after exogenous changes, so we need a new demand curve
  - Exogenous changes are usually called **shocks**

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Example

Mad Cow Disease and the Demand for Beef

Bovine spongiform encephalopathy (Mad Cow Disease), is a potentially fatal disease contracted through the consumption of infected beef products

Schlenker and Villas-Boas (2009) investigate the impact of the announcement of the first confirmed case of MCD in the US (December 23, 2003) on daily beef sales for a national supermarket chain.

The authors find a significant drop in the quantity of beef purchased following the announcement.

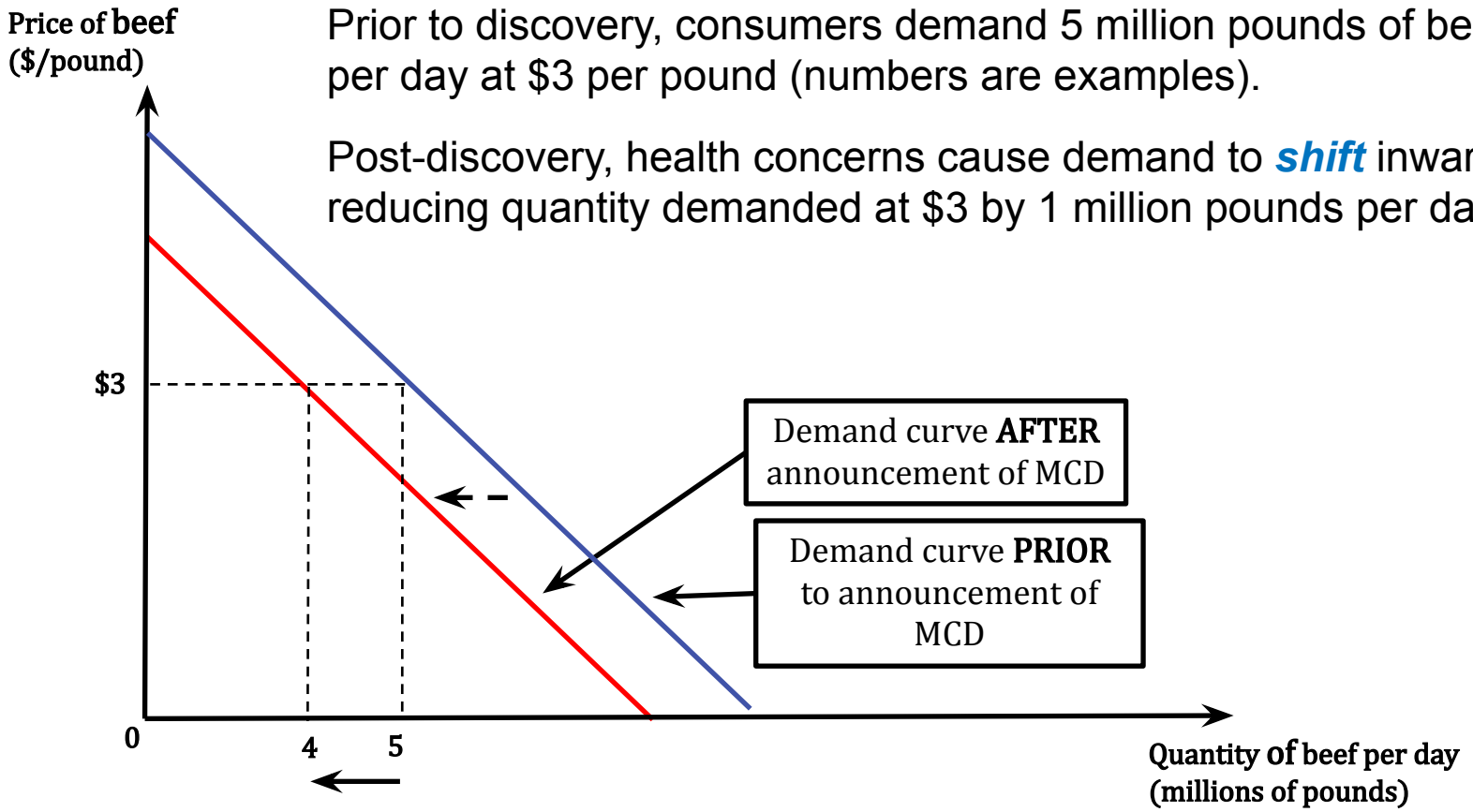
– Approximately 21% less beef was purchased in the following 35 days.

How do we represent this "shock" using demand curves?

Image: FreeDigitalPhotos.net

Citation: Wolfram Schlenker and Sofia B. Vilas-Boas. 2009. Consumer and Market Responses to Mad Cow Disease. *American Journal of Agricultural Economics* 91(4):1140–1152.

Example



Prior to discovery, consumers demand 5 million pounds of beef per day at $3 per pound (numbers are examples).

Post-discovery, health concerns cause demand to ***shift*** inward, reducing quantity demanded at $3 by 1 million pounds per day.

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Exercise

Which of the following will result in a shift of the demand curve to the right (increase in demand)?

A. A decrease in the price of the good.
B. An increase in consumer income.
C. A decrease in input prices.
D. A decrease in the price of a substitute good.

Exercise

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Demand

Why do we treat price differently?

- The “market” (trade) works if and only if there exists a unanimously agreeable price.
- Price is usually the most direct factor influencing demand.
- Price is the one factor of demand that is most likely to also measurably impact the *supply* of a good.
    - Therefore, price ties together the two sides of the market.

Now to the supply side of the model.

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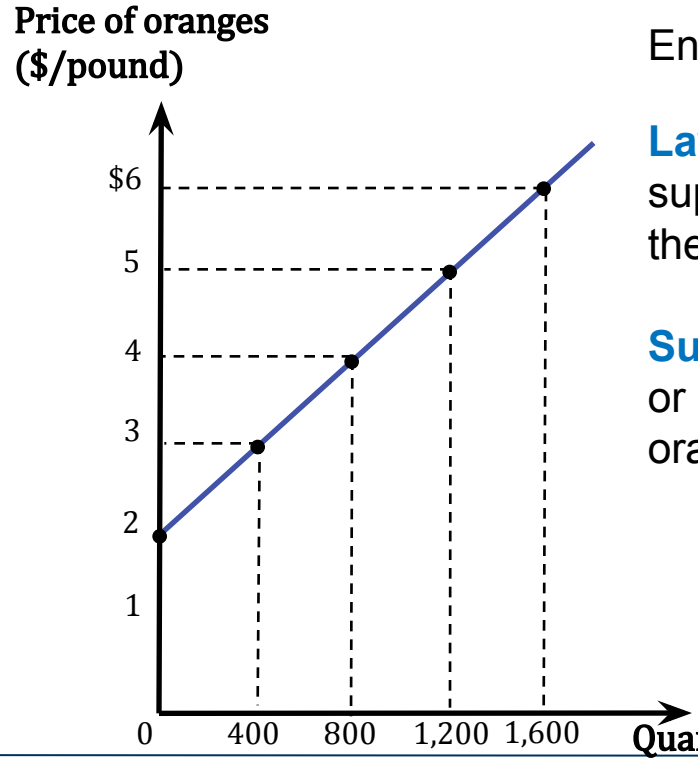
Supply

Factors that influence the supply of a good or service?

- Price
- Production costs
  - Includes the processes used to make, distribute, and sell a good (production technology)
- Number of sellers
- Sellers' outside options
  - Price of good in other markets and prices of other, related goods
- …

Supply

We can describe the relationship between the quantity of oranges supplied (in pounds) and the price ($/pound) with a **supply curve**.



Endogenous variables: price and quantity

Law of supply: As the price increases beyond $2, suppliers will provide more and more oranges to the market.

Supply choke price: At the price of $2 per pound or less, suppliers find it unprofitable to sell any oranges so they are unwilling to supply any

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Supply

We can also describe the supply curve mathematically:

The **supply function** on the previous slide is given as

$$Q^S = 400\mathrm{P} - 800$$

where Q^S is the quantity of oranges supplied (in pounds) and P is the price of oranges ($/pound).

Since we plot price on the vertical axis, it is useful to specify the **inverse supply function**

$$P = 2 + 0.0025Q^S$$

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Supply

What about the other factors that influence supply?

- The supply curve is also graphed in two dimensions; all other factors are assumed constant.
  - **Change in quantity supplied**: A movement *along* the supply curve that occurs as a result of a change in the good's price.

- If another factor changes, the supply curve will *shift.*
  - **Change in supply**: A shift of the entire supply curve caused by a change in a non-price factor that affects supply.

Exercise

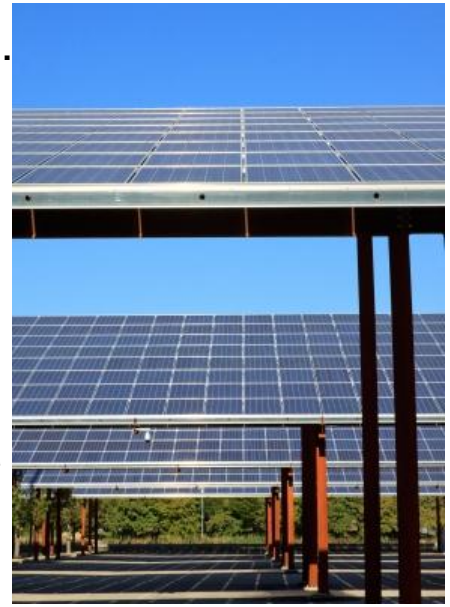
Solar Panels and Polysilicon

Solar energy is often touted as a key ingredient in the future of energy, but has historically been cost-prohibitive.

Recently, prices for solar modules have fallen rapidly, pushing the cost of solar power closer to "grid parity."

– Grid parity means solar can compete with other sources of energy on a cost basis.

One of the key reasons has to do with the cost of production. The price of polysilicon, a semiconductor that is the basis for most solar systems, dropped more than 90% between 2008 and 2011.



How can we describe this phenomenon using supply curves?

Citation: Roca, M. and B. Sills. November 10, 2011. "Solar Glut Worsens as Supply Surge Cuts Prices 93%: Commodities." *Bloomberg News, www.bloomberg.com*

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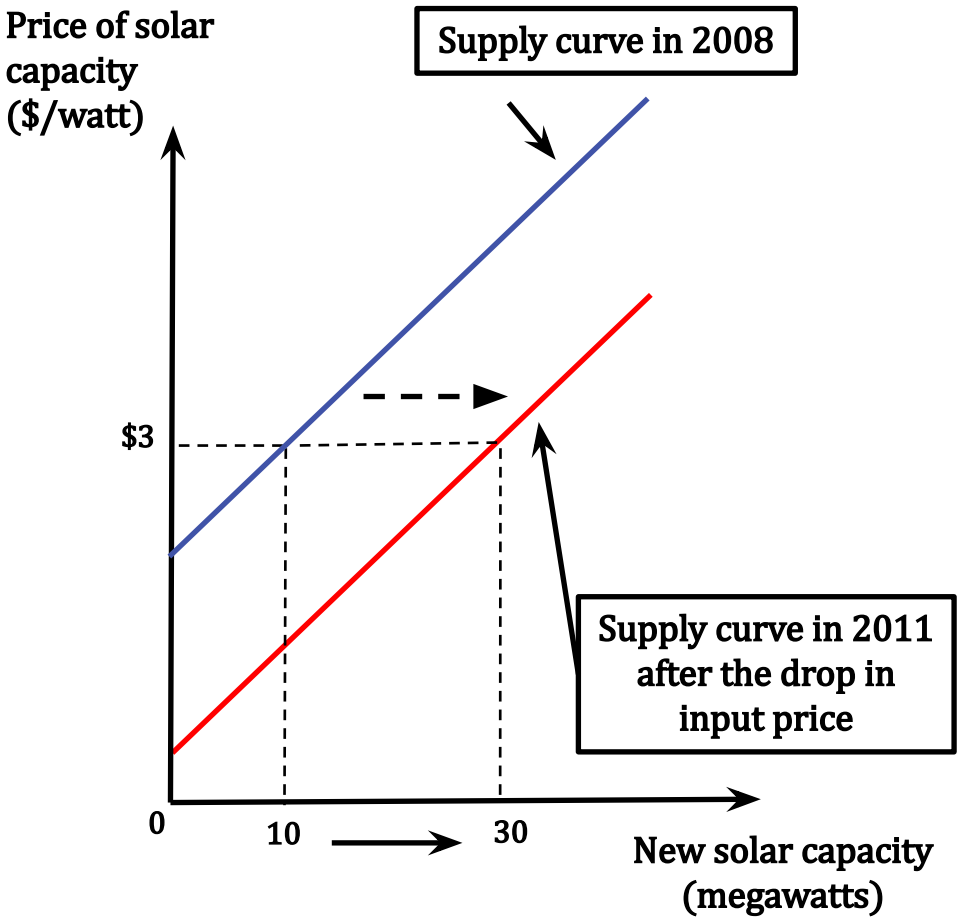
Exercise



In 2008, the cost of solar installation averaged $3 per watt, at this price producers were willing to supply 10 megawatts (MW) (numbers are examples)

As suppliers of polysilicon expand capacity, the cost of this key input drops. As the price of the input drops, the supply of solar energy ***shifts*** outward

Producers are now willing to supply 30 MW in 2011 at a price of $3 per watt

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Exercise

Consider the market for burritos. Which of the following will result in an increase in the equilibrium price of burritos?

A. An increase in the price of beans (an input).
B. New advancements in burrito-making technology.
C. News report on the negative health risks of burritos.
D. An increase in the price of tortilla chips (a complement).

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Exercise

Consider the market for burritos. Which of the following will result in an increase in the equilibrium price of burritos?

A. An increase in the price of beans (an input).
B. New advancements in burrito-making technology.
C. News report on the negative health risks of burritos.
D. An increase in the price of tortilla chips (a complement).

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Summary

REMEMBER:

A change in a good's own-price (i.e. the price of the good) creates a movement along the curve. This reflects an endogenous change.

Only exogenous variable changes (a.k.a., shocks) will shift the curve.

Back

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Market Equilibrium

Combining the descriptions of market supply and market demand completes the model.

- Remember, both the supply and demand curves relate the **price** of a good to the **quantity** demanded or supplied.

The point at which the supply and demand curves cross is called the **market equilibrium.**

- **Market equilibrium:** Occurs when the price of a good results in the quantity demanded equaling the quantity supplied (Q_e).
  - Q_e → Quantity where $Q^S = Q^D$
- **Equilibrium price:** The only price at which the quantity demanded equals the quantity supplied (P_e)

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Market Equilibrium

The market equilibrium can be identified mathematically.

Returning to the orange example:

$$Q^D = 2{,}400 - 400P \quad \text{and} \quad Q^S = 400P - 800$$

We solve for the ***equilibrium price***, P_e, by setting demand equal to supply ($Q^D = Q^S$)

$$2{,}400 - 400P_e = 400P_e - 800$$

Combining terms containing P_e yields:

$$3{,}200 = 800P_e, \; \mathbf{P_e = \$4}$$

To find the ***equilibrium quantity***, Q_e, substitute $P_e = 4$ into either equation, both should yield:

$$\mathbf{Q_e = 800}$$

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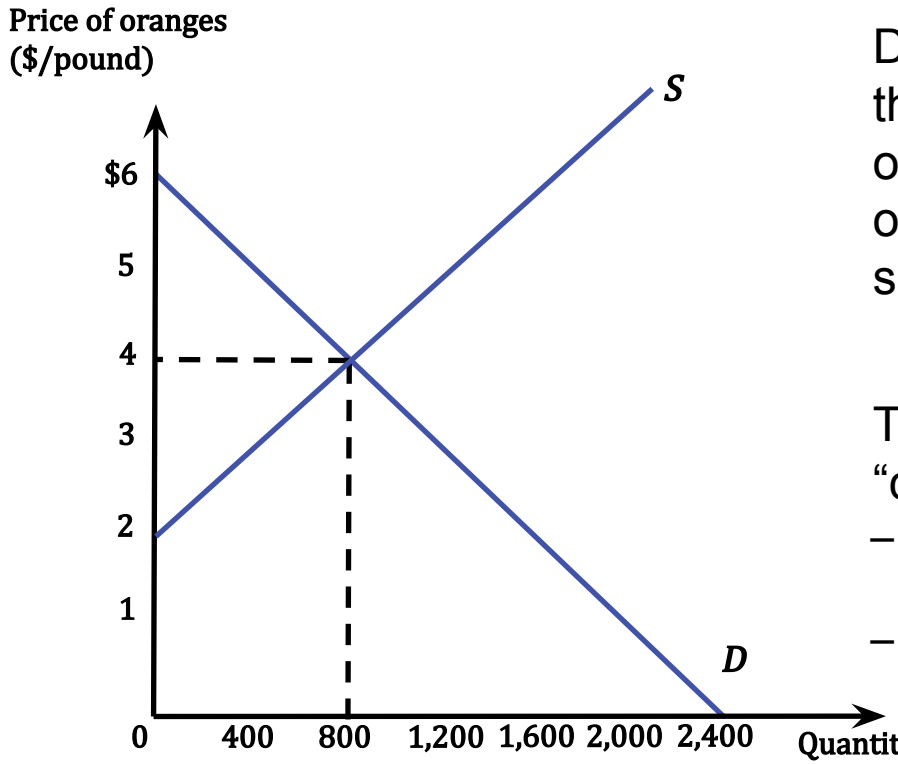
Market Equilibrium

Graphically, the equilibrium can be found by plotting the supply and demand curves together.



Demand and supply intersect at the price of $4.00 per pound of oranges, resulting in 800 pounds of oranges being demanded and supplied in the market.

This is the only price that can "clear" the market.

- Higher prices: Quantity supplied exceeds quantity demanded.
- Lower prices: Quantity demanded exceeds quantity supplied.

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Market Equilibrium

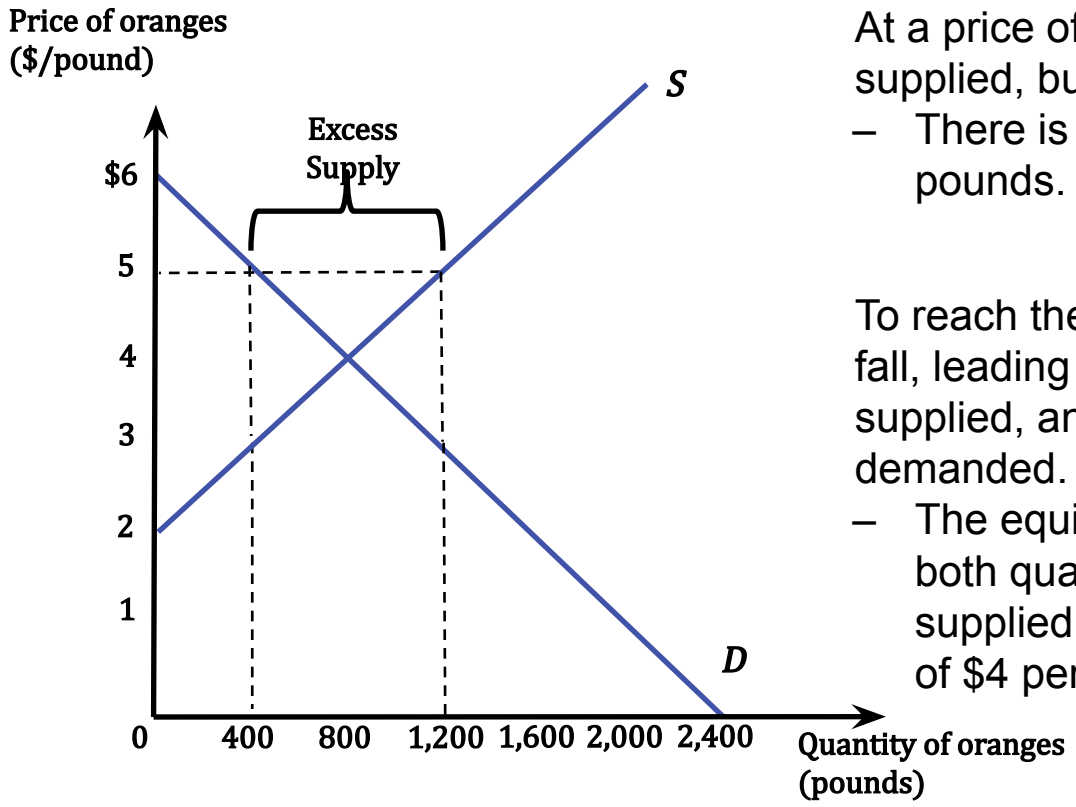
Why markets move toward equilibrium

First, if $P > P_e$, quantity supplied will exceed quantity demanded, resulting in **excess supply**.

- $Q^S > Q^D$
- Excess supply is also referred to as a **surplus**.
- To sell their products, producers must lower prices.
  - As *prices* fall, quantity demanded increases and quantity supplied decreases until the market reaches an equilibrium at a lower price.

Market Equilibrium

Describing **excess supply** graphically



At a price of $5 1,200 pounds are supplied, but only 400 are demanded.

– There is an **excess supply** of 800 pounds.

To reach the equilibrium, prices must fall, leading to a decrease in the quantity supplied, and an increase in the quantity demanded.

– The equilibrium is reached where both quantity demanded and quantity supplied equal 800 pounds at a price of $4 per pound.

Market Equilibrium

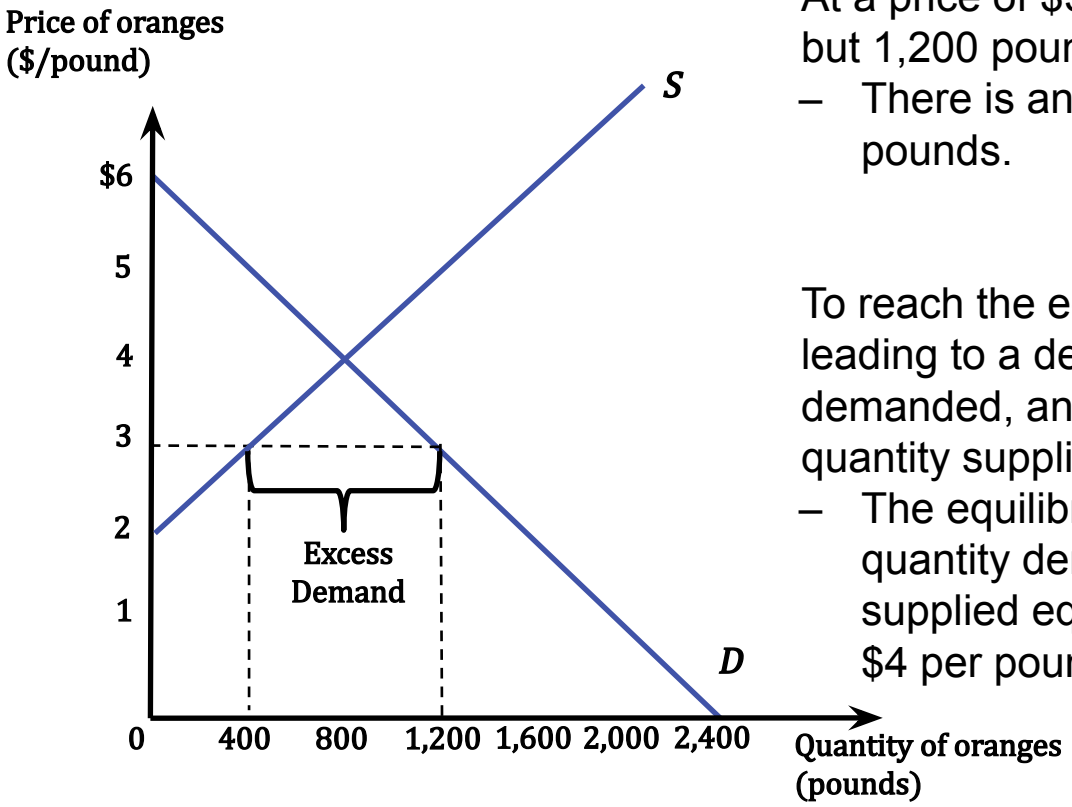
Why markets move toward equilibrium

Likewise, if $P < P_e$, quantity demanded will exceed quantity supplied, resulting in **excess demand**.

- $Q^D > Q^S$
- Excess demand is also referred to as a **shortage**.
- The shortage will induce buyers to bid up the price.
  - As prices rise, quantity demanded will fall and quantity supplied will rise until the market reaches equilibrium at a higher price.

Market Equilibrium

Describing **excess demand** graphically



At a price of $3 400 pounds are supplied, but 1,200 pounds are demanded.

– There is an **excess demand** of 800 pounds.

To reach the equilibrium, prices must rise, leading to a decrease in the quantity demanded, and an increase in the quantity supplied.

– The equilibrium is reached where both quantity demanded and quantity supplied equal 800 pounds at a price of $4 per pound

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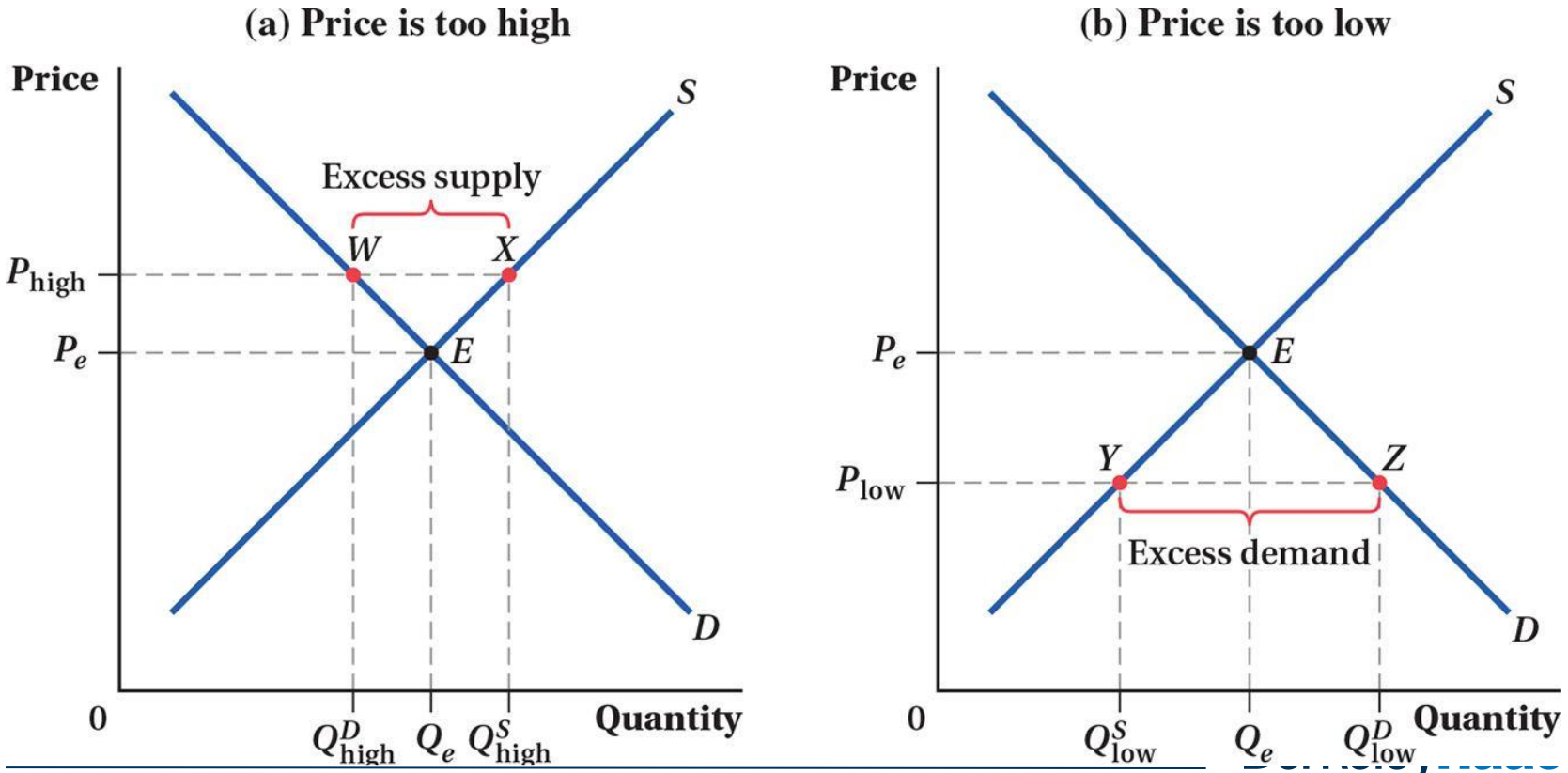
Market Equilibrium

Figure 2.6 Why P_e is the Equilibrium Price



Exercise

The demand and supply for a monthly cell phone plan with unlimited texts can be represented by

$$Q^D = 50 - 0.5P$$
$$Q^S = -25 + P$$

where P is the monthly price, in dollars.

Answer the following questions:

a. If the current price for a contract is $40 per month, is the market in equilibrium?

b. Would you expect the price to rise, fall, or be unchanged?

c. If so, by how much? Explain.

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Exercise

a. Two ways to solve the problem:

1. Compute quantity supplied and demanded at a price of $40, or
2. Solve for the equilibrium price, and compare with $40.

Using the first method

$$Q^D = 50 - 0.5P = 50 - 0.5(40) = 30$$

$$Q^S = -25 + P = -25 + 40 = 15$$

$Q^D > Q^S$, so the market is not in equilibrium as there is excess demand (shortage).

b. What must happen to price?

Price needs to rise… but by how much?

c. Solve for equilibrium price and quantity (second method)

$Q^S = Q^D = Q^* \Rightarrow -25 + P^* = 50 - 0.5P^* \Rightarrow$ **$P^* = \$50$, $Q^* = 25$**

Price must rise by **$10**, and **10** more contracts will be sold

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Market Equilibrium

What happens to the market equilibrium when there is a *shift* in demand or supply?

Remember the factors that can shift the *demand curve*:

- Number of consumers
- Wealth or income
- Consumer tastes
- Prices of related goods (complements or substitutes)

and those that shift the *supply curve*:

- Number of producers
- Costs of production
- Producer outside options

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Exercise

Draw a standard supply and demand diagram of the market for generators in Tampa, Florida.

Answer the following questions:

a. Suppose a hurricane watch is issued, and some residents expect to lose power. Using the supply and demand diagram, show what will happen to the equilibrium price and quantity in the Tampa market for generators.

b. Does this change reflect a change in demand or a change in the quantity demanded?

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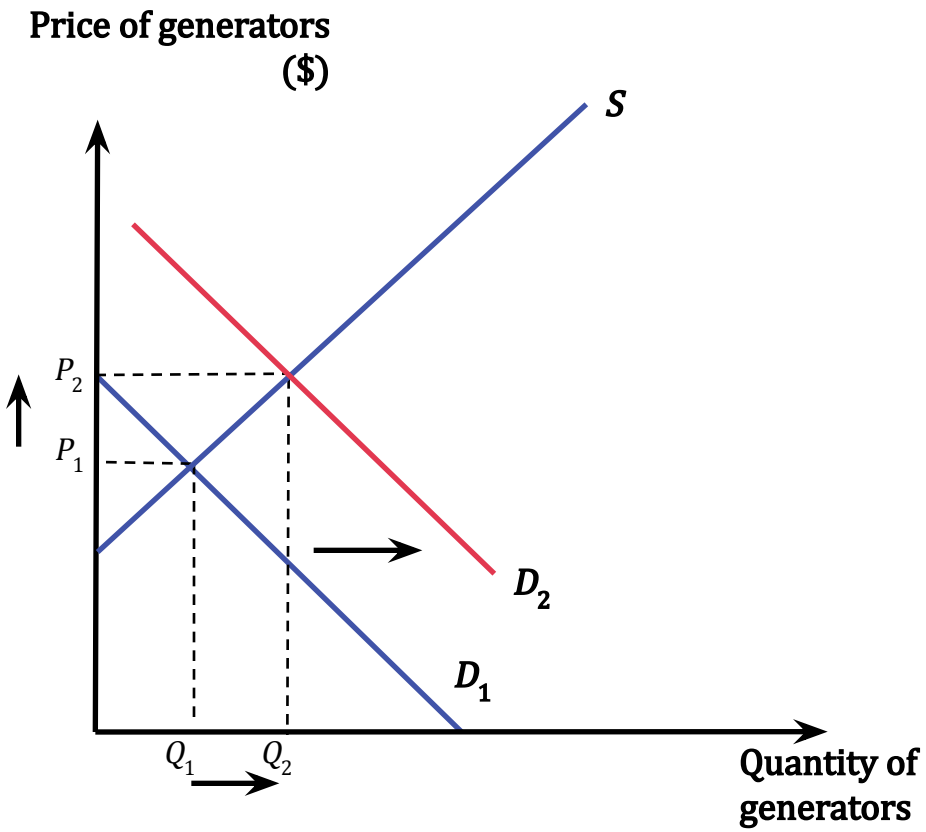
Exercise



a. The initial equilibrium occurs at a price of P_1 and quantity Q_1.

When the hurricane watch is issued, the demand for generators shifts outward.

The new equilibrium price is P_2, and the new quantity is Q_2.

– So, price and quantity have both increased.

b. This represents a **change (or shift) in demand**.

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Market Equilibrium

Summary of the effect of a shift in supply or demand on market equilibrium (DON'T MEMORIZE – UNDERSTAND IT)

Table 2.2 Effect of Shifts in Demand and Supply Curves in Isolation

Curve that Shifts	Direction of Shift	Impact on Equilibrium: Price	Impact on Equilibrium: Quantity
Demand Curve	Out (increase in D)	↑	↑
	In (decrease in D)	↓	↓
Supply Curve	Out (increase in S)	↓	↑
	In (decrease in S)	↑	↓

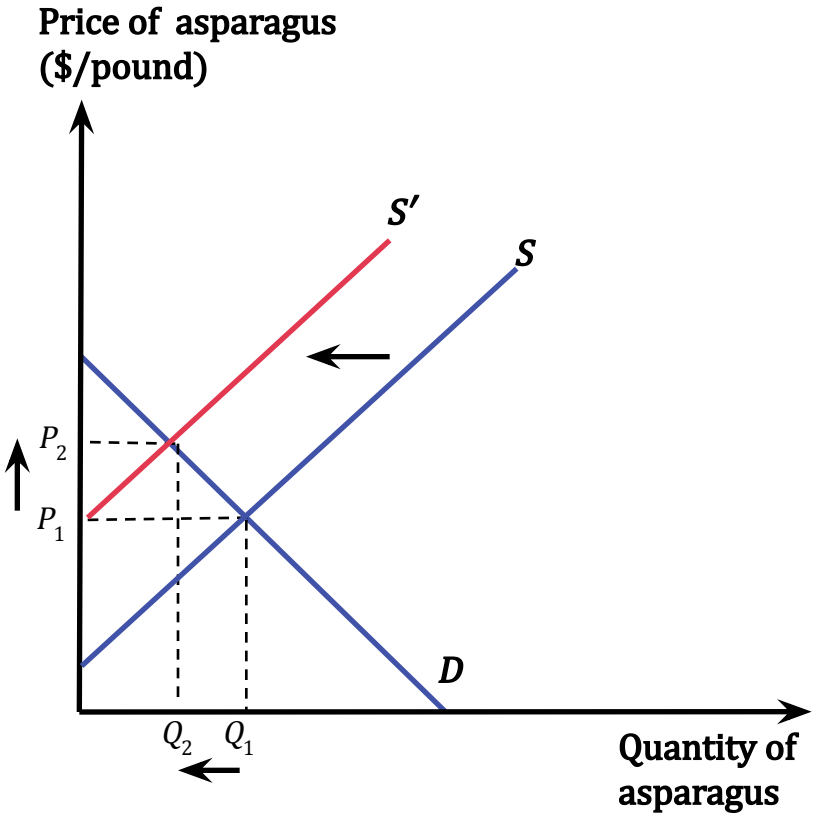
Exercise

Last month, you noticed the price of asparagus rising, and you also noted that there was less asparagus being sold than in the prior month.

Answer the following question:

Using a supply and demand diagram, what can you infer about the behavior of the supply and demand for asparagus?

Exercise



The initial equilibrium occurs at a price of P_1 and quantity Q_1.

What change in supply or demand would result in prices rising *and* quantity exchanged falling?

A negative shift in supply!

– The new price is P_2, and the new quantity is Q_2.

This represents a **change (or shift) in supply** followed by a change in the **quantity demanded**.

– Both Decrease

Exercise

Suppose that the supply of lemonade is represented by:

$$Q^S = 40P$$

where Q is measured in pints and P is measured in cents per pint.

Answer the following questions:

a. If the demand for lemonade is $Q^D = 5{,}000 - 10P$, what is the current equilibrium price and quantity?

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Exercise

a. To solve for the equilibrium price and quantity, we need to equate quantity demanded and supplied.

$Q^D = Q^S \rightarrow 5{,}000 - 10P = 40P$

$50P = 5{,}000 \rightarrow \boldsymbol{P^* = 100}$ **cents**

$Q^{\boldsymbol{D}} = 5{,}000 - 10(100) = \boldsymbol{4{,}000}$ **pints**

$Q^{\boldsymbol{S}} = 40(100) = \boldsymbol{4{,}000}$ **pints**

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Exercise

Suppose that the supply of lemonade is represented by:

$$Q^S = 40P$$

where Q is measured in pints and P is measured in cents per pint.

Answer the following questions:

a. If the demand for lemonade is $Q^D = 5{,}000 - 10P$, what is the current equilibrium price and quantity?

b. Suppose that a severe frost in Florida raises the price of lemons, and thus the cost of making lemonade. In response to the increase in cost, producers reduce the quantity supplied of lemonade by 400 pints at every price. What is the new equation for the supply of lemonade?

Compute the new equilibrium price and quantity of lemonade after the frost.

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Exercise

a. To solve for the equilibrium price and quantity, we need to equate quantity demanded and supplied.

$Q^D = Q^S \rightarrow 5{,}000 - 10P = 40P$

$50P = 5{,}000 \rightarrow \boldsymbol{P^* = 100 \text{ cents}}$

$\boldsymbol{Q^D} = 5{,}000 - 10(100) = \boldsymbol{4{,}000 \text{ pints}}$

$\boldsymbol{Q^S} = 40(100) = \boldsymbol{4{,}000 \text{ pints}}$

b. Quantity supplied has fallen by 400 pints at every price, so the supply curve is shifting left

$Q_2^S = Q^S - 400 \rightarrow \boldsymbol{Q_2^S = 40P - 400}$

To solve for the new equilibrium price and quantity, we set $\boldsymbol{Q^D = Q_2^S}$:

$5{,}000 - 10P_2 = 40P - 400$

$50P_2 = 5{,}400 \rightarrow \boldsymbol{P_2 = 108 \text{ cents}}$

$\boldsymbol{Q^D} = 5{,}000 - 10(108) = \boldsymbol{3{,}920 \text{ pints}}$

$Q_2^S = 40(108) - 400 = \boldsymbol{3{,}920 \text{ pints}}$

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Exercise

Consider the market for burritos. Which of the following will result in an increase in the equilibrium quantity of burritos?

A. An increase in the price of beans (an input).
B. An increase in the price of tortilla chips (a complement).
C. New advancements in burrito-making technology.
D. News report on the negative health risks of burritos.

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Exercise

Consider the market for burritos. Which of the following will result in an increase in the equilibrium price of burritos?

A. An increase in the price of beans (an input).
B. New advancements in burrito-making technology.
C. News report on the negative health risks of burritos.
D. An increase in the price of tortilla chips (a complement).

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Market Equilibrium

What determines the ***magnitude*** of the change in equilibrium price and quantity?

Two important parameters:

1. **Size of the shift**
2. **Slope of the curves**
   - If demand shifts, the slope of the *supply curve* determines the size of the change in equilibrium price and quantity, and vice versa.
   - The size of the change in price is *inversely* related to the size of the change in quantity.

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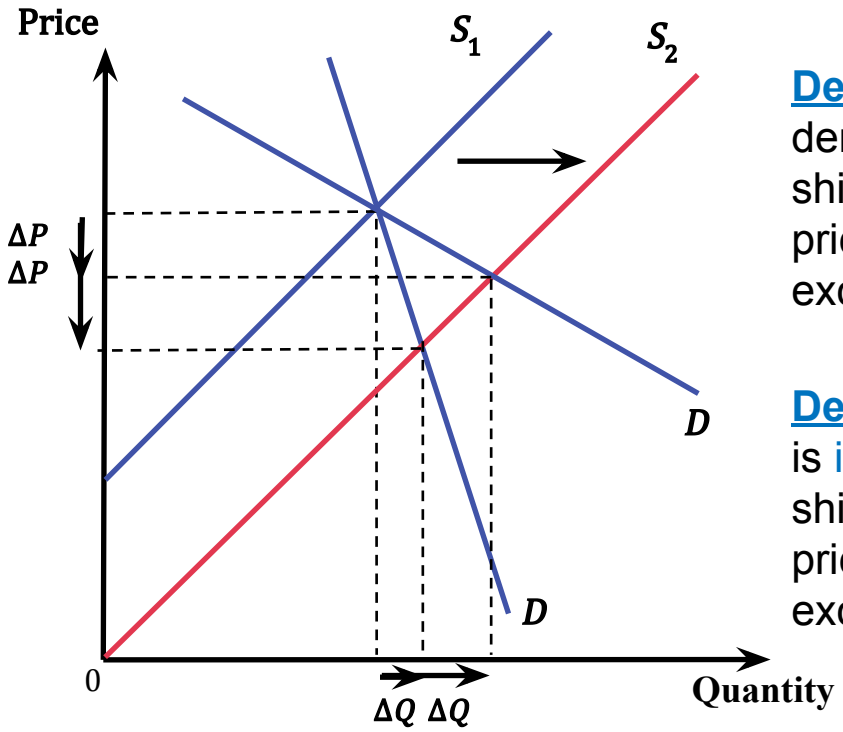
Market Equilibrium

Consider an outward shift in supply (increase)



Demand has relatively steep slope: demand is sensitive to price change, and a shift in supply results in *large* change in price and *small* change in quantity exchanged.

Demand has relatively flat slope: demand is insensitive to price change, and the same shift in supply results in *small* change in price and *large* change in quantity exchanged.

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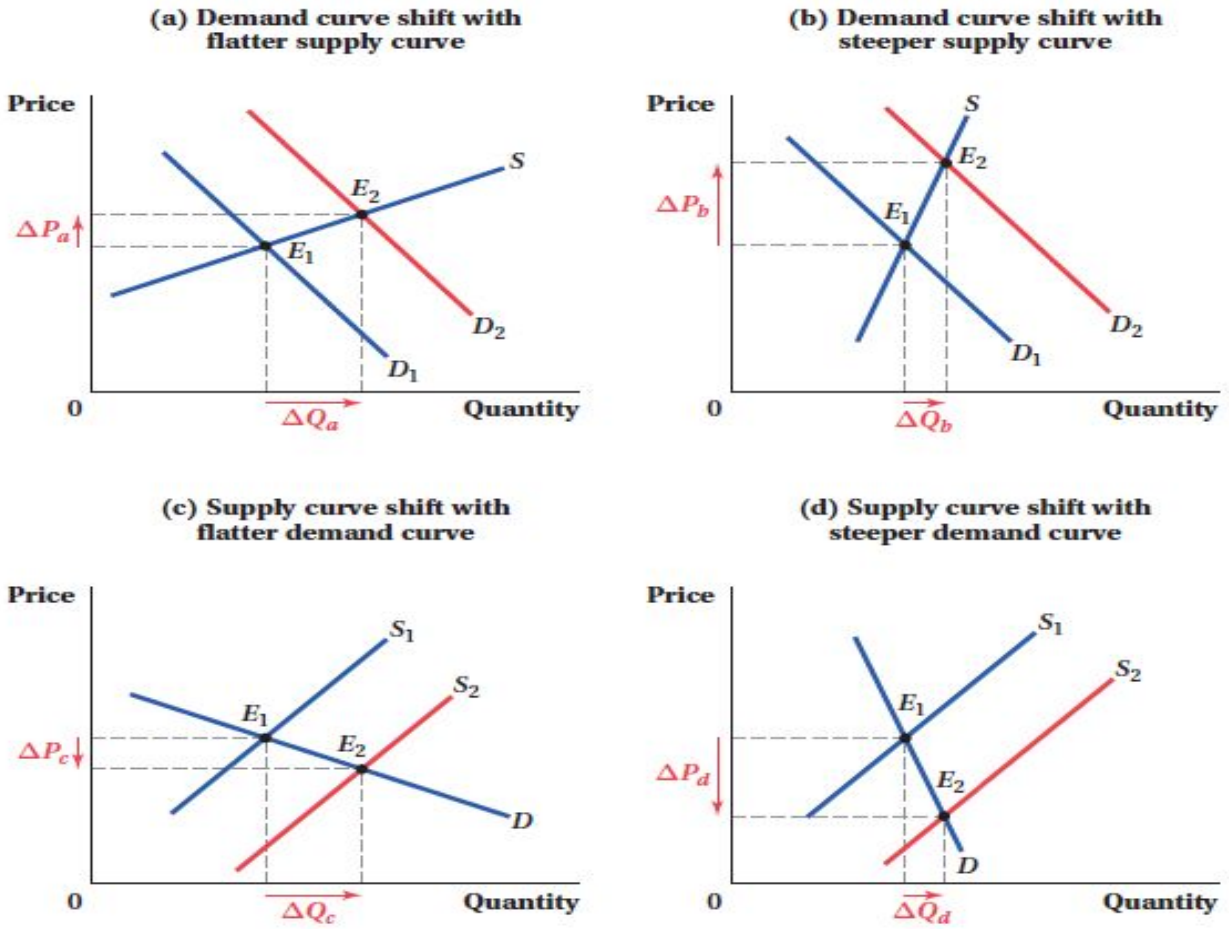
Market Equilibrium

Figure 2.10 Size of Equilibrium Price and Quantity Changes, and the Slopes of the Demand and Supply Curves



Market Equilibrium

Sometimes, supply and demand shift simultaneously!

Example: Hurricane the housing market

- Hurricane destroys many homes. What happens to supply?
- Hurricane displaces thousands of residents, many of which have not returned. What happens to demand?

How will these shifts affect the housing market equilibrium?

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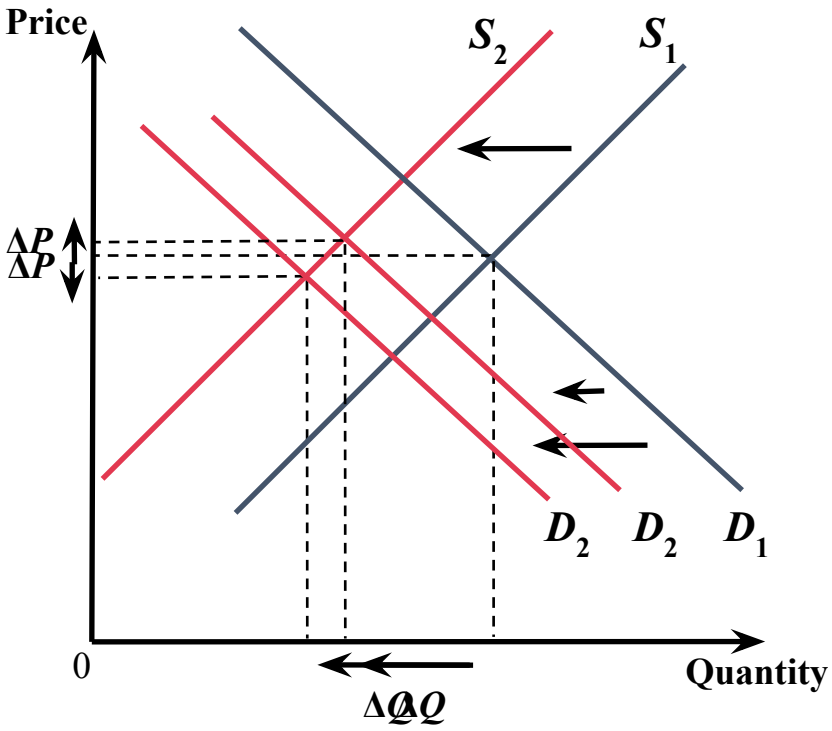
Market Equilibrium

Hurricane and the housing market



The hurricane shifts both supply and demand inward.

- Per this graph, the result is a large drop in quantity, and a small drop in price.

However, without specific information on shifts and slopes of supply and demand, we cannot know for sure what happens to price.

- Both shifts result in a decrease in quantity.

Example: Consider the same supply shift, but a smaller demand shift;

- **Quantity still falls, but price has now risen slightly!**

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Takeaways

- What's microeconomics
- What's an economic model (and why useful)
- Endogenous vs. exogenous variables
- Tools we'll use all the time
  - Constrained optimization
  - Equilibrium analysis
  - Comparative statics
- Demand and supply model
  - Curves and interpretation
  - Equilibrium analysis
  - Comparative statics

Sit back, relax, and enjoy Micro!

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