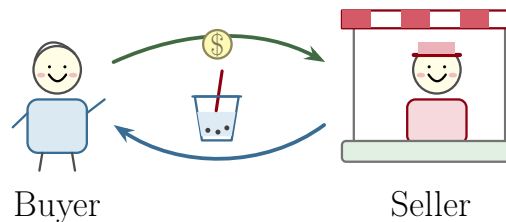


Chapter 4

The Market Forces of Supply and Demand



Markets and Competition

Definition. A **market** is a group of buyers and sellers of a particular good or service. The buyers as a group determine the **demand** for the product, and the sellers as a group determine the **supply** of the product.

Some markets are highly organized, like an auction where buyers and sellers meet at a set time and place.

Most markets are far less organized than that, like the market for bubble tea in a college neighborhood, where dozens of shops each post their own price without ever meeting their competitors. Yet the buyers and sellers are still closely connected by the prices they all watch.

Competitive Markets

Definition. A **competitive market** is a market with so many buyers and sellers that each one has a negligible impact on the market price.

A **perfectly competitive** market has two features. Every seller offers an identical product, and buyers and sellers are so numerous that no single one can influence the price. Everyone is a **price taker**.

Real bubble-tea shops differ in flavor, location, and toppings, so each shop has some control over its price. Our model uses an idealized market with identical cups and price-taking buyers and sellers.

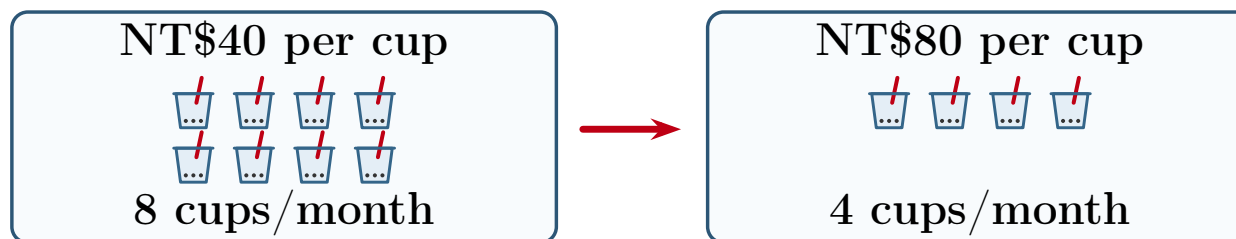
Not every market is like this. A **monopoly** has a single seller with market power, though demand and regulation can constrain its price. The supply-and-demand model assumes perfect competition.

Demand

Definition. The **quantity demanded** of a good is the amount that buyers are willing and able to purchase at a given price during a specified period.

The good's own price is one determinant of quantity demanded. Below, Yu-Ting chooses fewer cups at a higher price. These hypothetical choices hold her income, tastes, and other demand determinants fixed.

Definition. The **law of demand** states that, other things being equal, the quantity demanded of a good falls when the price of the good rises, and rises when the price falls.



The Demand Schedule

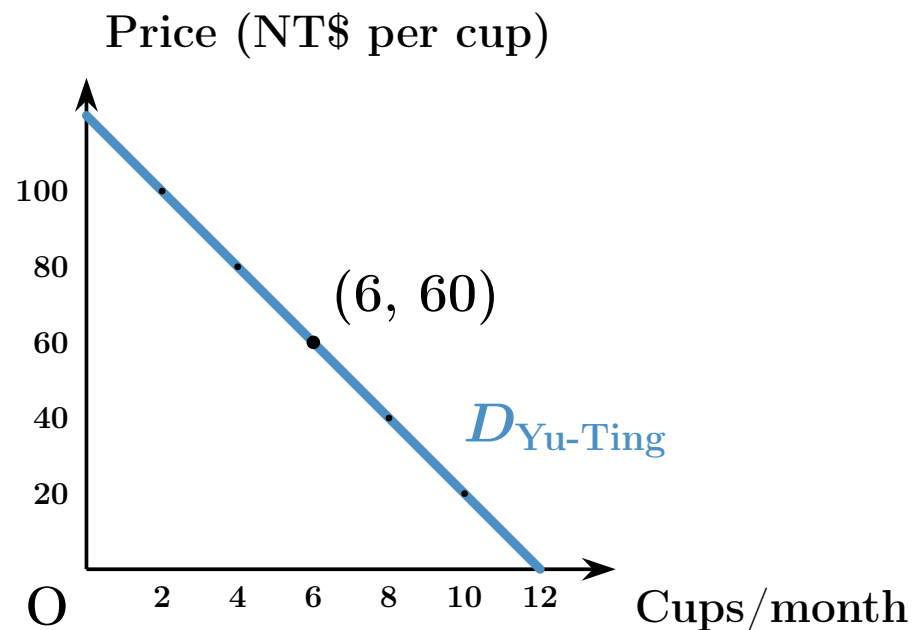
Definition. A **demand schedule** is a table showing the relationship between the price of a good and the quantity demanded, holding everything else constant.

Here is a hypothetical monthly demand schedule for one student, Yu-Ting:

Price of a cup (NT\$)	0	20	40	60	80	100
Quantity demanded (cups/month)	12	10	8	6	4	2

If bubble tea were free, Yu-Ting would drink 12 cups a month. As the price rises, she buys fewer and fewer cups, exactly as the law of demand says.

The Demand Curve



Definition. A **demand curve** is a graph of the relationship between the price of a good and the quantity demanded.

Price is on the vertical axis and quantity on the horizontal axis. Holding other things constant, a lower price raises quantity demanded.

Market Demand versus Individual Demand

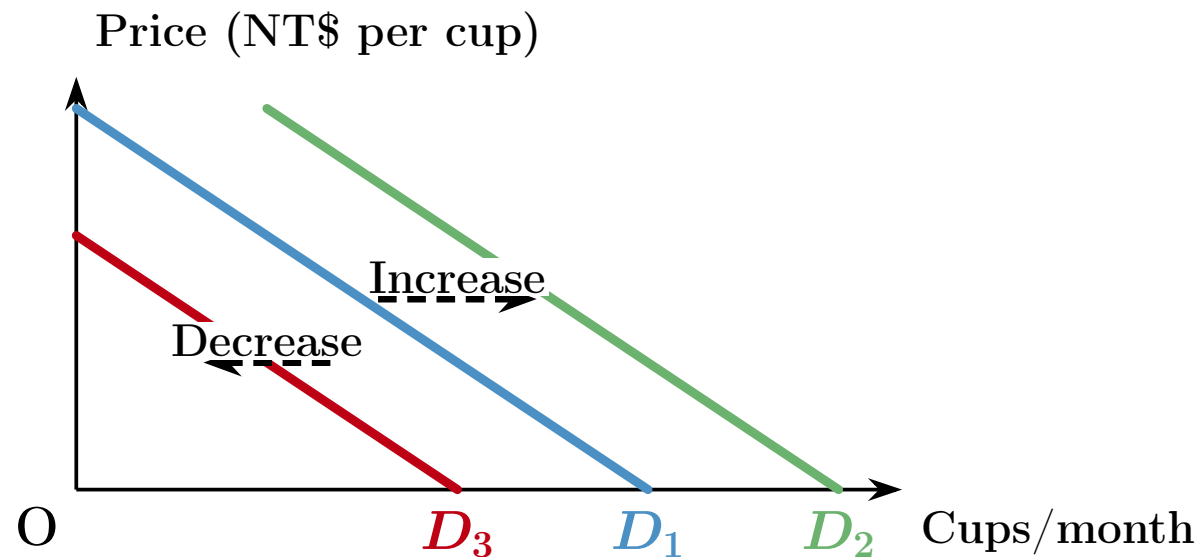
The curve on the previous page is one student's demand. To analyze how a market works, we need the **market demand**, the sum of all the individual demands for the good.

Suppose Yu-Ting and Chia-Hao are the only two buyers in the market. At each price, the market quantity demanded is the sum of the two individual quantities:

Price of a cup (NT\$)	0	20	40	60	80	100
Yu-Ting's quantity demanded	12	10	8	6	4	2
Chia-Hao's quantity demanded	6	5	4	3	2	1
Market quantity demanded	18	15	12	9	6	3

We add quantities at each price, so we add individual demand curves **horizontally**. Quantities in the table are cups per month.

Shifts in the Demand Curve



The demand curve holds other things constant, so it need not stay put over time. Any change that raises the quantity demanded at every price shifts the curve to the right, from D_1 to D_2 , an **increase in demand**. Any change that lowers it at every price shifts the curve to the left, from D_1 to D_3 , a **decrease in demand**.

What Shifts the Demand Curve?

- **Income:** for a *normal* good, higher income raises demand; for an *inferior* good, higher income lowers demand.
- **Prices of related goods:** a higher price for a *substitute* raises demand for the good; a higher price for a *complement* lowers it.
- **Tastes:** anything that makes a good more appealing raises demand, and anything that makes it less appealing lowers demand.
- **Expectations:** expecting higher income or a higher price in the future can raise demand today.
- **Number of buyers:** more buyers in the market raises demand at every price.

Income: Normal and Inferior Goods

Definition. A **normal good** is one for which, other things being equal, an increase in income leads to an increase in demand.

Definition. An **inferior good** is one for which, other things being equal, an increase in income leads to a decrease in demand.

Many goods are normal. If higher income leads a student to buy more bubble tea at each price, bubble tea is a normal good for that student.

An inferior good is the exception. As a student's income rises, they may ride the bus less and take a taxi or a scooter instead, so demand for bus rides can fall as income rises.

Prices of Related Goods: Substitutes and Complements

Definition. Two goods are **substitutes** if an increase in the price of one leads to an increase in the demand for the other.

Definition. Two goods are **complements** if an increase in the price of one leads to a decrease in the demand for the other.

Bubble tea and coffee are substitutes. When the price of coffee rises, some coffee drinkers switch to bubble tea instead, so the demand curve for bubble tea shifts to the right.

Scooters and gasoline are complements. When the price of gasoline rises, riding a scooter becomes more expensive, so the demand curve for scooters shifts to the left.

Shift or Movement? A Rule of Thumb

A curve shifts when there is a change in a relevant variable that is **not measured on either axis**. Price is on the vertical axis, so a change in price is a movement along the demand curve. A change in another determinant of demand shifts it.

Variable	A change in this variable ...
Price of the good itself	moves us along the demand curve
Income	shifts the demand curve
Prices of related goods	shifts the demand curve
Tastes	shifts the demand curve
Expectations	shifts the demand curve
Number of buyers	shifts the demand curve

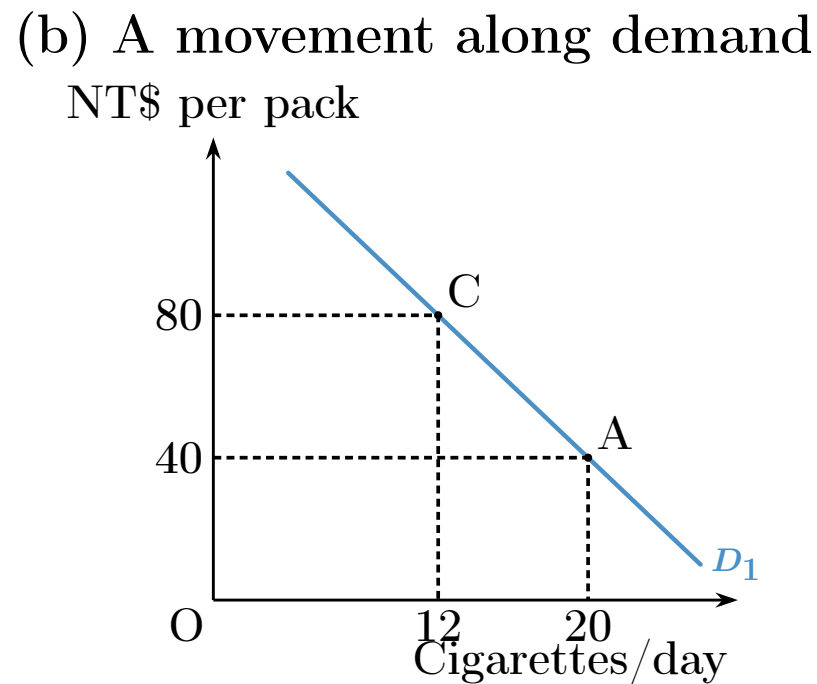
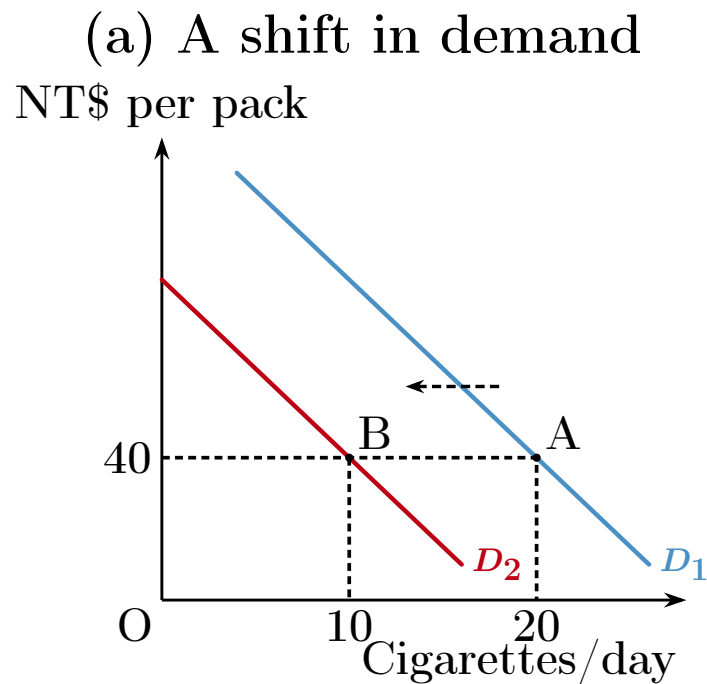
Case Study: Two Ways to Reduce Smoking

Because smoking causes illness, governments often want people to smoke less. The model gives us two ways to do it.

One way is to **shift the demand curve** for cigarettes to the left. Graphic health warnings on packs, bans on tobacco advertising, and public health campaigns all aim to reduce the quantity demanded at any given price.

The other way is to **raise the price**. In June 2017, Taiwan raised its tobacco tax by NT\$20 per pack. To the extent that a tax raises the price buyers pay, it reduces quantity demanded through a movement along the demand curve, holding other demand determinants fixed.

Two Ways to Reduce Smoking, Illustrated



These are hypothetical examples, not estimates of the 2017 tax effect. In panel (a), a health campaign shifts demand left. At NT\$40 per pack, quantity demanded falls from 20 to 10 cigarettes a day (A to B). In panel (b), price rises to NT\$80 while other demand determinants stay fixed. Quantity demanded falls to 12 cigarettes a day along D_1 (A to C).

Discussion: Shift or Movement?

For each event, say whether the demand curve for bubble tea shifts, and if so, in which direction, or whether we instead move along a fixed demand curve.

- The price of bubble tea itself falls.
- A heat wave makes cold drinks more appealing to everyone.
- Coffee shops raise their prices.
- More students move into the neighborhood, increasing the number of potential bubble tea buyers.

Answer: Shift or Movement?

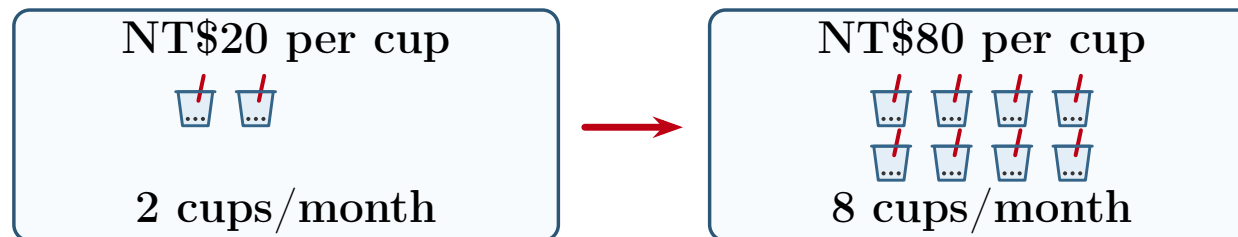
- A change in the price of bubble tea itself is a movement along the existing demand curve, not a shift.
- The heat wave is a change in tastes, so it shifts demand to the right.
- A higher price for coffee, a substitute, also shifts demand for bubble tea to the right.
- More students in the neighborhood means more buyers, which shifts market demand to the right.

Supply

Definition. The **quantity supplied** of a good is the amount that sellers are willing and able to sell at a given price during a specified period.

A higher price makes additional cups more profitable to supply. Below is a hypothetical small-scale example for Mr. Lin, holding input costs and technology fixed. He offers more cups at the higher price.

Definition. The **law of supply** states that, other things being equal, the quantity supplied of a good rises when the price of the good rises, and falls when the price falls.



The Supply Schedule

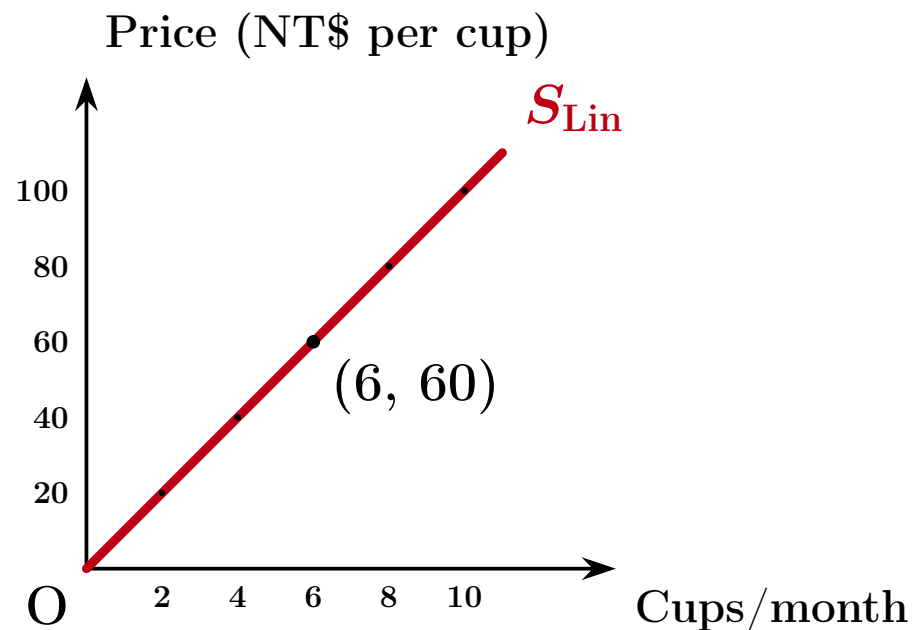
Definition. A **supply schedule** is a table showing the relationship between the price of a good and the quantity supplied, holding everything else constant.

For simple arithmetic, suppose Mr. Lin offers the following small quantities. This is a hypothetical schedule, not a typical shop's monthly sales.

Price of a cup (NT\$)	0	20	40	60	80	100
Quantity supplied (cups/month)	0	2	4	6	8	10

At a price of zero, Mr. Lin sells nothing. As the price rises, he supplies a greater and greater quantity, as the law of supply says.

The Supply Curve



Definition. A **supply curve** is a graph of the relationship between the price of a good and the quantity supplied.

The supply curve slopes upward because, other things being equal, a higher price means a greater quantity supplied.

Market Supply versus Individual Supply

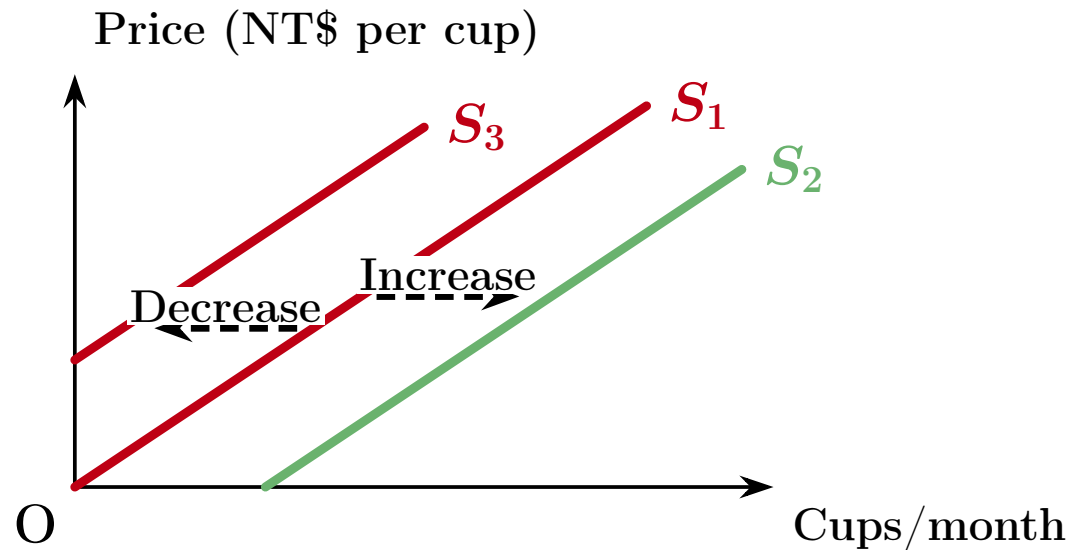
Just as market demand is the sum of the demands of all buyers, **market supply** is the sum of the supplies of all sellers.

Suppose Mr. Lin's shop and Ms. Chen's shop are the only two sellers in the market. At each price, the market quantity supplied is the sum of the two:

Price of a cup (NT\$)	0	20	40	60	80	100
Mr. Lin's quantity supplied	0	2	4	6	8	10
Ms. Chen's quantity supplied	0	1	2	3	4	5
Market quantity supplied	0	3	6	9	12	15

As with demand, we add quantities at each price. Quantities are cups per month. These two-seller schedules illustrate aggregation; sellers in our competitive model take the price as given.

Shifts in the Supply Curve



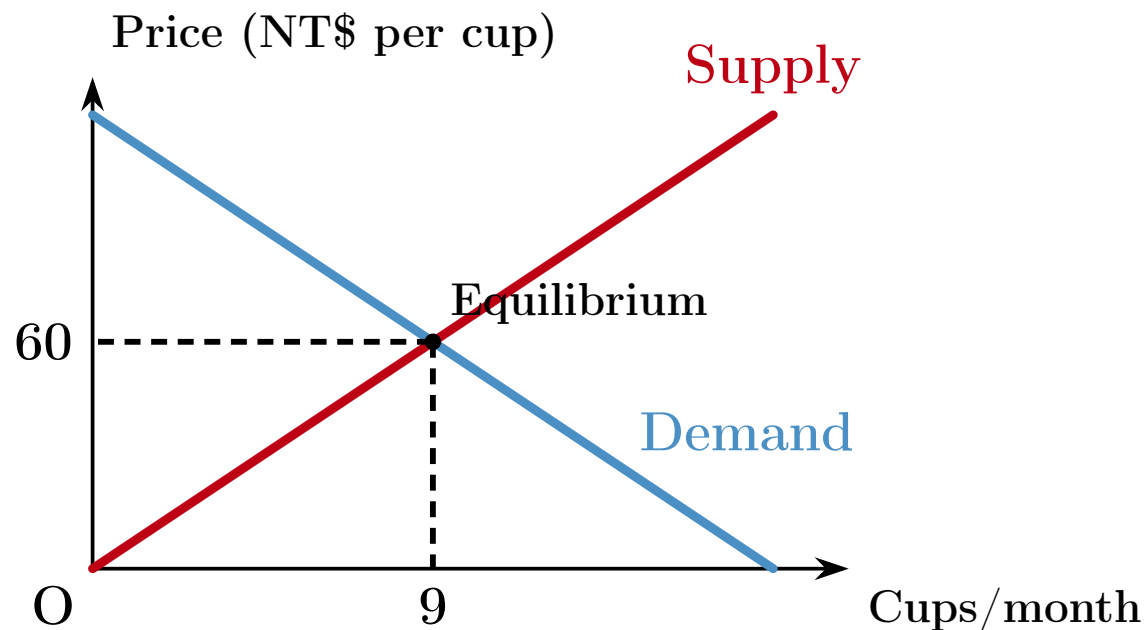
Any change that raises the quantity supplied at every price, like a fall in the price of tapioca, shifts the curve to the right, from S_1 to S_2 , an **increase in supply**. Any change that lowers it at every price shifts the curve to the left, from S_1 to S_3 , a **decrease in supply**.

What Shifts the Supply Curve?

- **Input prices:** a higher price for an input, like tea leaves, tapioca, milk, or labor, makes production less profitable and shifts supply to the left.
- **Technology:** an improvement that lowers production costs, like an automatic tea-shaking machine, shifts supply to the right.
- **Expectations:** expecting a higher price tomorrow can lower supply today, as sellers of storable goods hold back inventory.
- **Number of sellers:** more sellers in the market raises supply at every price, and sellers leaving the market lowers it.

As with demand, a change in the good's own price moves us along the supply curve, while a change in any of these shifts it.

Supply and Demand Together



Definition. The market's **equilibrium** is the point where the supply and demand curves intersect. The price there is the **equilibrium price** and the quantity is the **equilibrium quantity**. Here they are NT\$60 and 9 cups.

Equilibrium in the Schedules

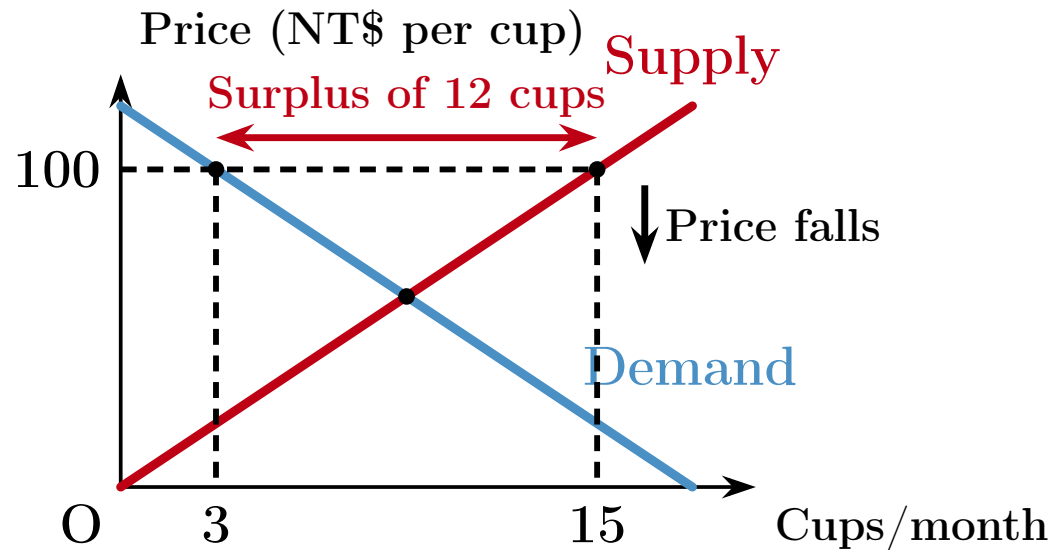
We can find the same equilibrium without a graph, by putting the market demand and market supply schedules side by side and looking for the price at which the two quantities match.

Price of a cup (NT\$)	0	20	40	60	80	100
Market quantity demanded	18	15	12	9	6	3
Market quantity supplied	0	3	6	9	12	15

At NT\$60, buyers want 9 cups per month and sellers offer 9 cups per month. Quantity demanded equals quantity supplied.

The equilibrium price is sometimes called the **market-clearing price**, because buyers can buy and sellers can sell the quantities they choose at that price.

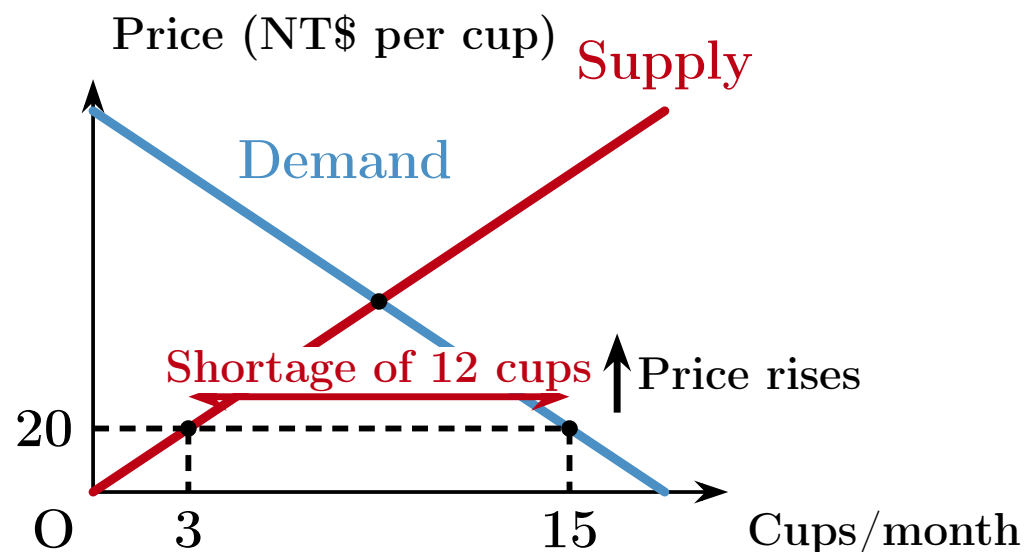
Surplus



Definition. A **surplus** (or **excess supply**) is a situation in which the quantity supplied exceeds the quantity demanded.

At NT\$100, quantity supplied is 15 cups but quantity demanded is only 3. Shops with unsold bubble tea cut their price, which raises quantity demanded and lowers quantity supplied, until the price reaches NT\$60.

Shortage



Definition. A **shortage** (or **excess demand**) is a situation in which the quantity demanded exceeds the quantity supplied.

At NT\$20, buyers want 15 cups but sellers offer only 3. Shops raise the price, reducing quantity demanded and raising quantity supplied until the market clears at NT\$60.

The Law of Supply and Demand

When prices can adjust and the curves stay fixed, a surplus puts downward pressure on the price, and a shortage puts upward pressure on it.

Definition. The **law of supply and demand** describes the tendency of prices to adjust until quantity supplied equals quantity demanded.

At equilibrium, there is no excess demand or supply pushing the price to change. A new shock can shift a curve and change the equilibrium.

Adjustment takes time. A binding price control can prevent the price from clearing the market, so a shortage or surplus may persist.

Example: Price Gouging and Taiwan's Mask Rationing

During a crisis, prices for scarce goods often rise sharply, a pattern critics call **price gouging**. Governments sometimes respond with a legal maximum price to stop sellers from charging more.

In February 2020, Taiwan distributed masks requisitioned by the government through pharmacies using National Health Insurance cards. Initially, adults could buy two masks every seven days for NT\$5 each.

Rationing allocated scarce masks without relying only on willingness to pay. A low administered price does not itself expand supply. Taiwan also increased production to ease scarcity; this was more than a price ceiling alone.

How Prices Allocate Resources

Market prices coordinate decisions about how scarce resources are used.

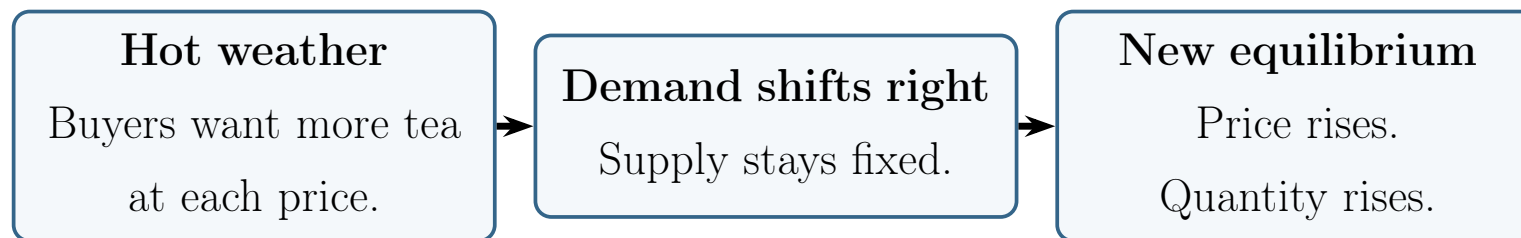
Consider apartments within walking distance of campus. There are only so many, so not everyone who wants one can have one. Who gets them? Whoever is willing and able to pay the rent, which adjusts until the quantity demanded matches the quantity supplied. In market economies, prices are the mechanism for rationing scarce resources.

Prices also decide who produces what. Nobody assigns workers to farms, yet enough people farm because food prices and farm wages adjust until they do. If an invisible hand guides market economies, as Adam Smith suggested, the price system is the baton with which it conducts the orchestra.

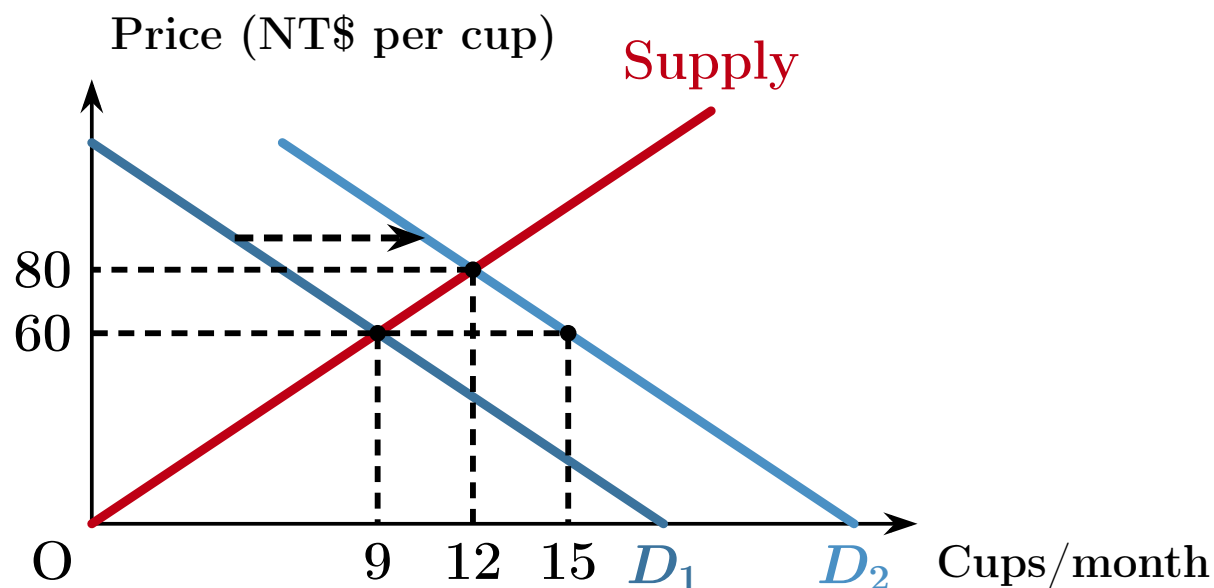
Three Steps for Analyzing a Change

When some event affects a market, the equilibrium changes, and we get a new price and a new quantity. We work through it in three steps.

1. Decide whether the event shifts the supply curve, the demand curve, or both.
2. Decide which direction each affected curve shifts.
3. Compare the new equilibrium to the old one using the supply-and-demand diagram.



Example: A Heat Wave Hits Taipei



Step 1: hot weather changes tastes, so it shifts the demand curve, while supply is unchanged. **Step 2:** demand shifts right, from D_1 to D_2 . **Step 3:** at the old price of NT\$60, quantity demanded is 15 cups and quantity supplied is 9 cups, a **shortage of 6 cups**. The price rises to NT\$80, and the quantity sold rises from 9 to 12 cups.

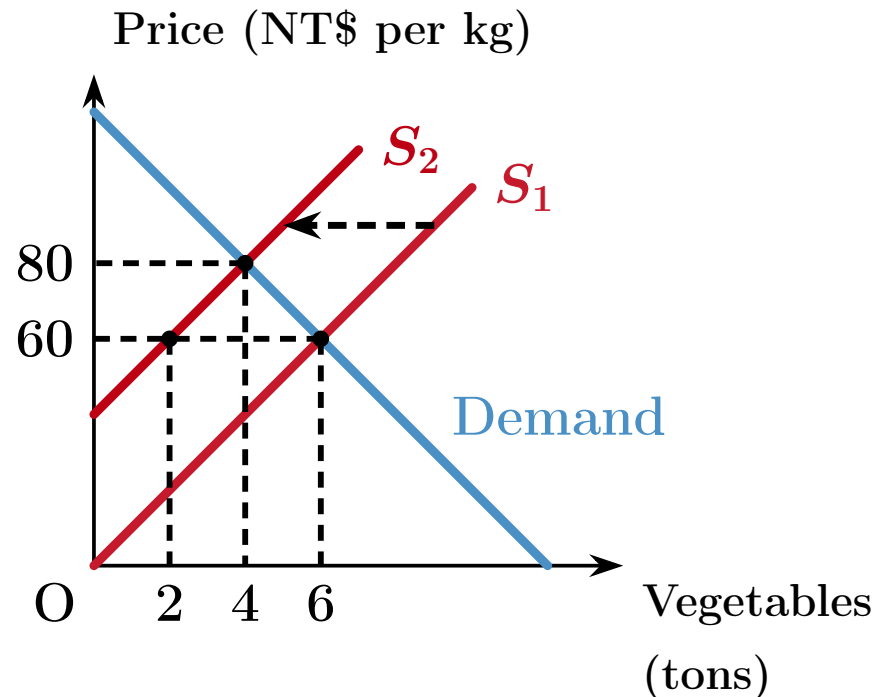
Change in Supply versus Change in Quantity Supplied

In the heat-wave example, the quantity that shops supplied rose from 9 to 12 cups, even though the supply curve never moved. Economists say there was an increase in **quantity supplied** but no change in **supply**.

- **Supply** refers to the position of the supply curve. It changes only when a supply shifter, like an input price, changes.
- **Quantity supplied** refers to the amount sellers wish to sell at a particular price. A price change moves us along a fixed supply curve; a supply shift can also change the quantity supplied at a given price.

The same distinction applies to **demand** (the position of the demand curve) and **quantity demanded** (a point on it).

Example: The Typhoon Hits Vegetable Farms



Step 1: the typhoon reduces supply; demand is unchanged. **Step 2:** supply shifts left, from S_1 to S_2 . **Step 3:** at NT\$60 per kilogram, quantity supplied is 2 tons and quantity demanded is 6 tons: a **shortage of 4 tons**. The price rises to NT\$80, and the quantity sold falls from 6 to 4 tons.

Comparing the Two Examples

In both the heat wave and the typhoon, the equilibrium price rose from 60 to 80.

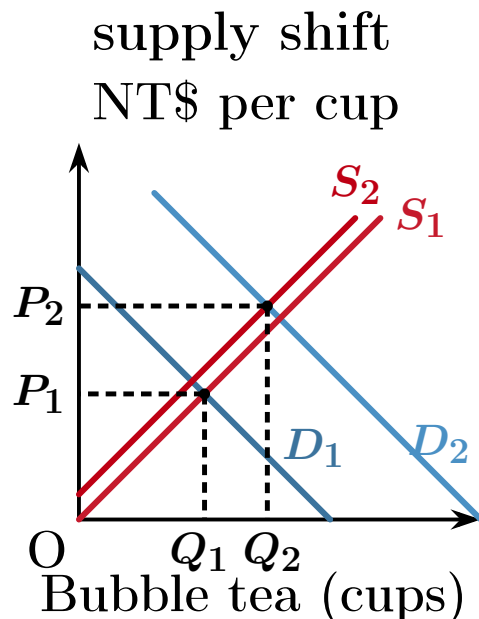
But the equilibrium quantity moved in opposite directions. It rose in the heat-wave example and fell in the typhoon example.

The price moved the same way in both cases because both events made the good relatively scarcer at the old price. The quantity result depends entirely on whether demand or supply changed.

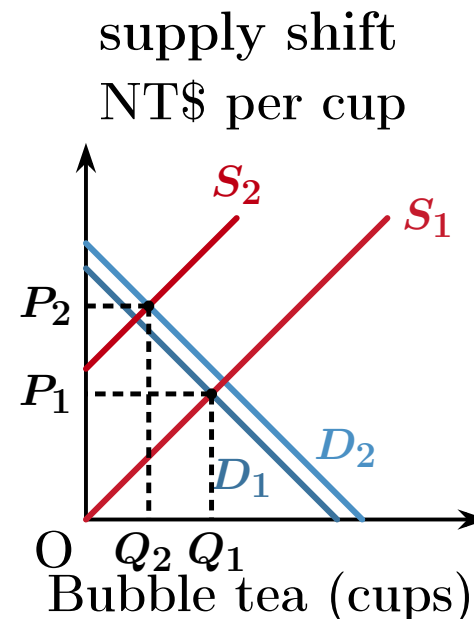
Remark. A price rise alone does not identify what caused the change. If only one curve shifts, the quantity change helps distinguish a demand increase from a supply decrease. If both curves shift, price and quantity changes alone generally do not identify the underlying changes in supply and demand.

Both Curves Shift, Illustrated

(a) Big demand shift, small



(b) Small demand shift, big



Suppose a heat wave raises bubble-tea demand while a typhoon raises tea-leaf costs and reduces bubble-tea supply. Hold other determinants fixed. Both shifts push the price up, so in both panels it rises from P_1 to P_2 . Their effects on quantity conflict, so the result is **ambiguous**: quantity rises in panel (a) and falls in panel (b), depending on which shift is larger.

Summary: Shifts and Equilibrium

	Supply unchanged	Supply increases	Supply decreases
Demand unchanged	P same Q same	P down Q up	P up Q down
Demand increases	P up Q up	P ambiguous Q up	P up Q ambiguous
Demand decreases	P down Q down	P down Q ambiguous	P ambiguous Q down

The first row and first column each hold one curve fixed and shift the other. The lower-right four cells combine two shifts. An effect that agrees across both shifts is certain, and one that conflicts is ambiguous.

We should be able to explain every cell in this table with a diagram.

Discussion: When Both Curves Shift

Use the three steps to analyze the equilibrium price and quantity of bubble tea. Treat coffee as a substitute and hold other determinants fixed.

- A. Coffee shops cut the price of coffee.
- B. An abundant tea harvest lowers the price of tea leaves.
- C. Events A and B happen at the same time.

Answer: When Both Curves Shift

- A. Coffee is a substitute, so cheaper coffee shifts the demand curve for bubble tea to the left. Both the price and the quantity of bubble tea fall.
- B. Tea leaves are an input, so cheaper tea leaves shift the supply curve to the right. The price falls and the quantity rises.
- C. Demand shifts left and supply shifts right. Both shifts push the price down, so the price certainly falls. The two shifts push the quantity in opposite directions, so the effect on quantity is ambiguous.

Takeaways

Supply and demand determine equilibrium prices and quantities.

- In a perfectly competitive market, buyers and sellers are **price takers**. Demand slopes down and supply slopes up, holding other determinants fixed.
- A change in the good's own price changes **quantity demanded** or **quantity supplied**. Other determinants shift the curves.
- At **equilibrium**, quantity demanded equals quantity supplied. A **surplus** pushes the price down; a **shortage** pushes it up.
- To analyze a change, identify which curve shifts and in which direction, then compare equilibria. If both curves shift, one outcome may be ambiguous.
- Prices coordinate decisions and allocate scarce resources.