

Demand, Supply and the Market Equilibrium

需求、供給與市場均衡

Joseph Tao-yi Wang
台大經濟系 王道一

Evidence-Based Economics Example

- ▶ How much more gasoline would people buy if its price were lower?

▶ 實證經濟學範例:

- ▶ 若汽油價格下跌
- ▶ 你會多消費多少汽油?



Evidence-Based Economics Example

- ▶ Why do organic eggs cost more?

- ▶ 實證經濟學範例:

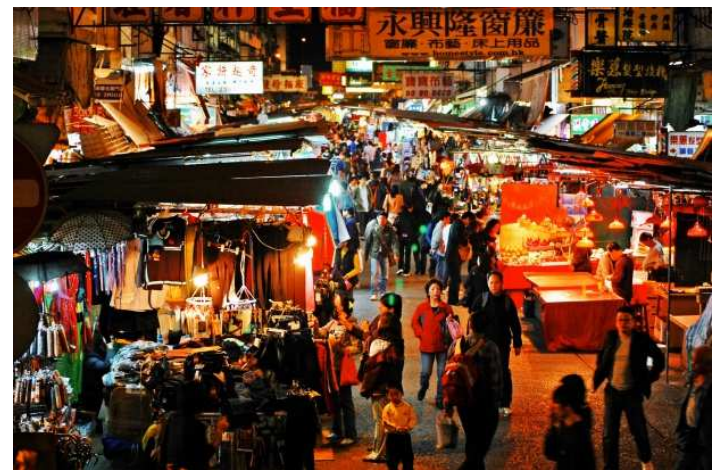
- ▶ 為什麼有機雞蛋

- ▶ 比白雞蛋貴?



Markets (市場)

- ▶ A **market** is a group of economic agents who are trading a good or service, and
 - ▶ the rules and arrangements for trading.
- ▶ **市場**就是一群交易特定商品或勞務的經濟決策者
 - ▶ 跟其所遵循的交易規則



Markets (市場)

- ▶ The **market price** is the price at which buyers and sellers conduct transactions
 - ▶ **市場價格**就是買賣雙方面對的(相同)交易價格



Competition (市場競爭)

- ▶ A market is **competitive** if buyers and sellers have little effect on market price
- ▶ (Since there are **substitutes** on both sides!)
 - ▶ 兩邊都有**代替品**讓**競爭市場**下幾乎沒有人能影響價格
- ▶ In a **perfectly competitive** market, **perfect substitutes** exists so one can always switch
 - ▶ 完全競爭市場下買賣雙方都有**完美代替品**可以隨時換
- ▶ All are **price takers** since others can switch
 - ▶ 所有人都是**價格接受者**，因為對方可以隨時把你換掉

In Perfectly Competitive Markets, 完全競爭下

- ▶ Sellers all sell identical products to buyers
- ▶ Traders pays/charge **same** market price
- ▶ No buyer/seller big enough to affect price

- ▶ 許多賣家販賣相同產品
給衆多買家
- ▶ 買賣雙方有相同交易價格
- ▶ 沒有人大到可以影響價格



How Do Buyers Behave? 買家如何做決策?

- ▶ How much would you be willing to pay for an "A+" in this course?
 - ▶ 在本課程中，你願意付出多少代價(金錢或時間)來拿A+?
 - ▶ 在國中會考(高中學測)拿5A++(滿級分)呢？為什麼？

A+



How Do Buyers Behave? 買家如何做決策?

- ▶ Quantity Demanded (需求數量)
 - ▶ The amount of a good that buyers are willing to purchase at a given price.
 - 在某個價格下，買方願意購買的數量。
- ▶ Demand Schedule (需求表)
 - ▶ A table that reports the quantity demanded at different prices, holding all else equal.
- ▶ Demand Curve (需求曲線)
 - ▶ Plots the quantity demanded at different prices
 - 價格和需求數量的函數關係作圖

How Do Buyers Behave? 買家如何做決策?

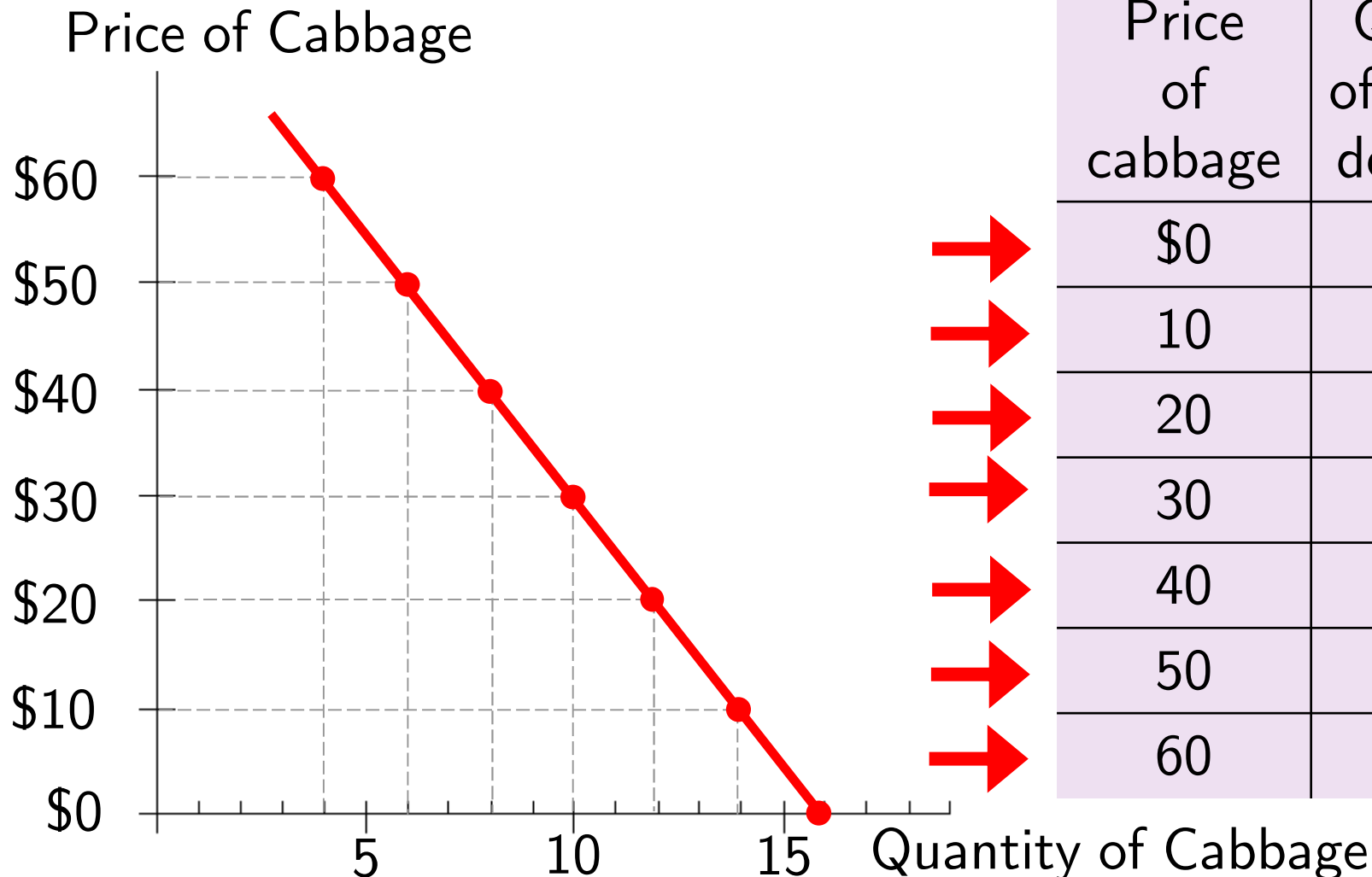
- ▶ Quantity Demanded (需求數量): Q^D
 - ▶ The amount of a good that buyers are willing to purchase at a given price.
 - 在某個價格下，買方願意購買的數量。
- ▶ Law of Demand (需求法則)
 - ▶ The claim that:
 - ▶ Quantity demanded of a good falls when the **price** of the good rises, other things equal
 - 其他條件不變時，價格上升會讓需求數量下降。

How Do Buyers Behave? 買家如何做決策?

- ▶ Demand Schedule (需求表)
 - ▶ A table that shows the relationship between the price of a good & quantity demanded
- ▶ Example: (王道一的白菜需求)
Joseph's demand for cabbage
- ▶ Notice that his preferences obey the law of demand.
 - ▶ 王道一的偏好符合需求法則!

Price of cabbage 白菜價格	Quantity of cabbage demanded 需求數量
\$0	16
10	14
20	12
30	10
40	8
50	6
60	4

Joseph's Demand Schedule & Curve



Price of cabbage	Quantity of cabbage demanded
\$0	16
10	14
20	12
30	10
40	8
50	6
60	4

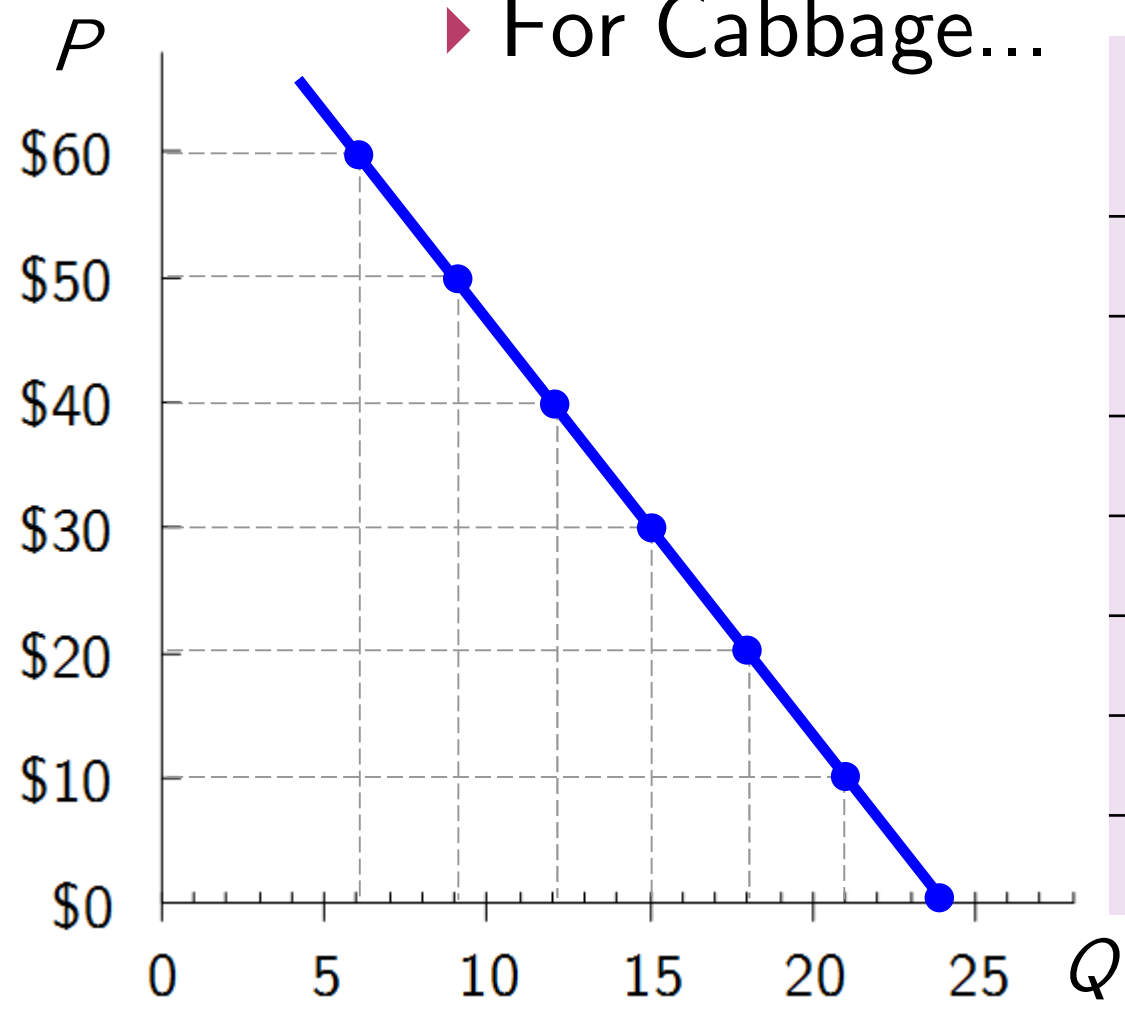
Market Demand (市場需求數量=個別需求數量加總)

- ▶ **Market Q^D** = sum of Q^D by all buyers at each price.
- ▶ Let Joseph & John be the only 2 buyers for cabbage.

Price	王道一's Q^D		王道二's Q^D		Market Q^D
\$0	16	+	8	=	24
10	14	+	7	=	21
20	12	+	6	=	18
30	10	+	5	=	15
40	8	+	4	=	12
50	6	+	3	=	9
60	4	+	2	=	6

Market Demand Curve 白菜市場需求曲線

► For Cabbage...



P	Q^d (Market)
\$0	24
10	21
20	18
30	15
40	12
50	9
60	6

Demand Curve Shifters 影響需求曲線的因素

- ▶ The demand curve shows how price affects quantity demanded, **other things being equal**.
 - ▶ 需求曲線假設「其他條件不變」(包括偏好、所得、替代品或互補品之價格、預期等), 這些會影響需求
- ▶ These "other things" are non-price determinants of demand (i.e., things that determine buyers' demand for a good, other than the good's price).
- ▶ Changes in them shift the D curve...

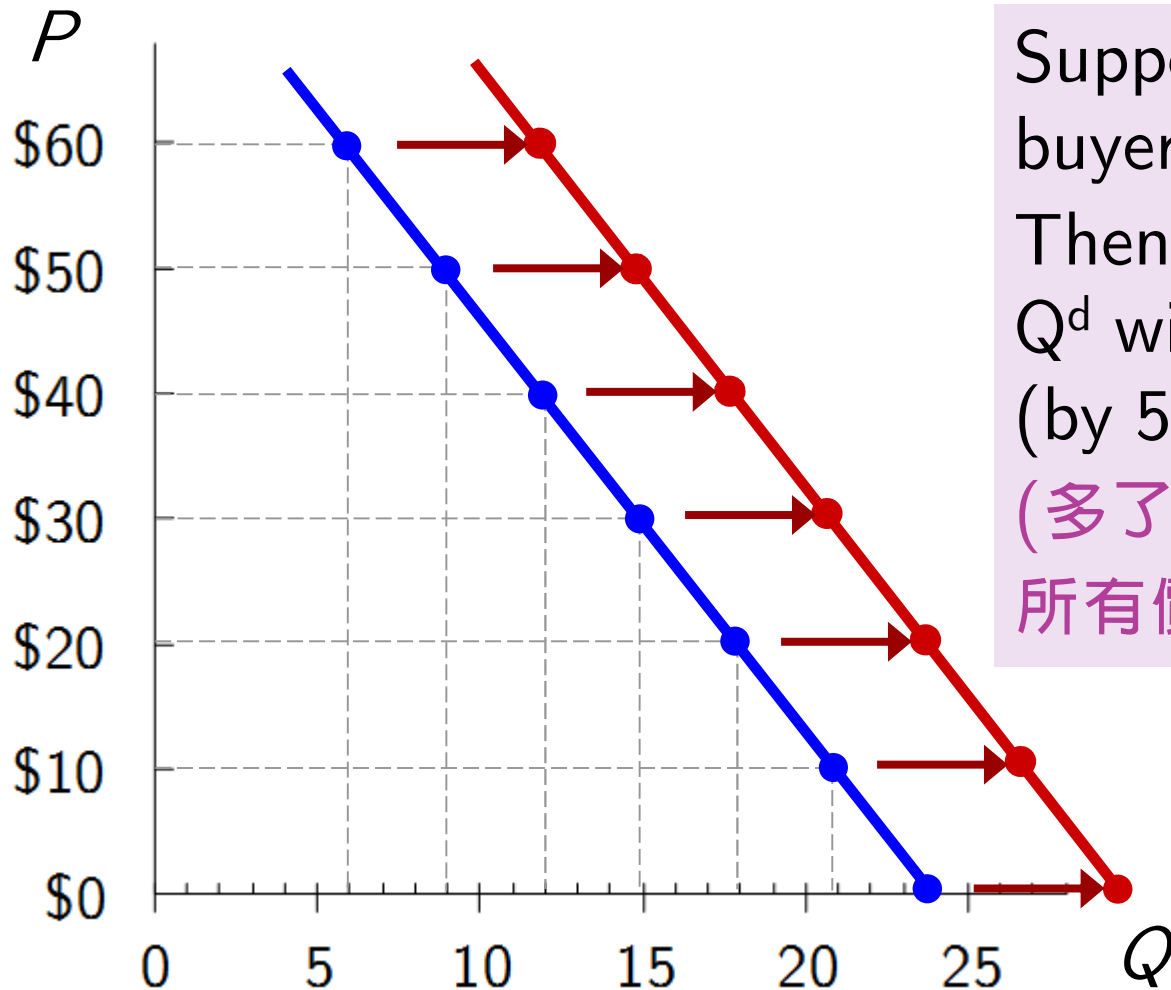
How Do Buyers Behave? 買家如何做決策?

Variable	A change in this variable...
Price (價格)	...movement along the D curve (在需求曲線上移動)
# of buyers (買家人數)	...shifts the D curve
Income (收入)	...shifts the D curve
Price of (相關產品價格) related goods	(整個需求曲線移動) ...shifts the D curve
Tastes (偏好口味)	...shifts the D curve
Expectations (預期心理)	...shifts the D curve

Demand Curve Shifters: # of Buyers 買家人數

- ▶ Increase in # of buyers increases quantity demanded at each price, shifts D curve to the right.
- ▶ 增加買家人數會增加每個價格下的總需求數量，也就是讓需求曲線右移

Demand Curve Shifters: # of Buyers 買家人數



Suppose the number of buyers increases. Then, at each P , Q^d will increase (by 5 in this example).
(多了買家王道三的話, 所有價格下 Q^d 都增加5)

Demand Curve Shifters: Income (所得)

- ▶ Demand for a **normal good** is positively related to income.
- ▶ Increase in income causes increase in Q^D at each price, shifts D curve to the right.
- ▶ 所得上升時需求會增加的商品為正常財(vs. 劣等財)

(Demand for an **inferior good** is negatively related to income. An increase in income shifts D curves for inferior goods to the left.)

Demand Curve Shifters: Prices of Related Goods

- ▶ Two goods are **substitutes** (替代品、代替品) if an increase in the price of one causes an increase in demand for the other.
- ▶ Example: Apple's iPad Pro vs. M\$ Surface Pro 4
 - ▶ iPad Pro價格上升時，需求數量下降；Surface Pro 4的需求增加
- ▶ Other examples: laptops and desktop computers, CDs and music downloads, fresh and frozen vegetables after a typhoon

Demand Curve Shifters: Prices of Related Goods

- ▶ Two goods are **complements** (互補品、相關配件) if an increase in the price of one causes a fall in demand for the other.
- ▶ Example: Apple Pencil vs. iPad Pro
 - ▶ Apple Pencil價格上升時，需求數量下降；iPad Pro的需求也減少
- ▶ Other examples: college tuition and textbooks, computers and software, gasoline and cars

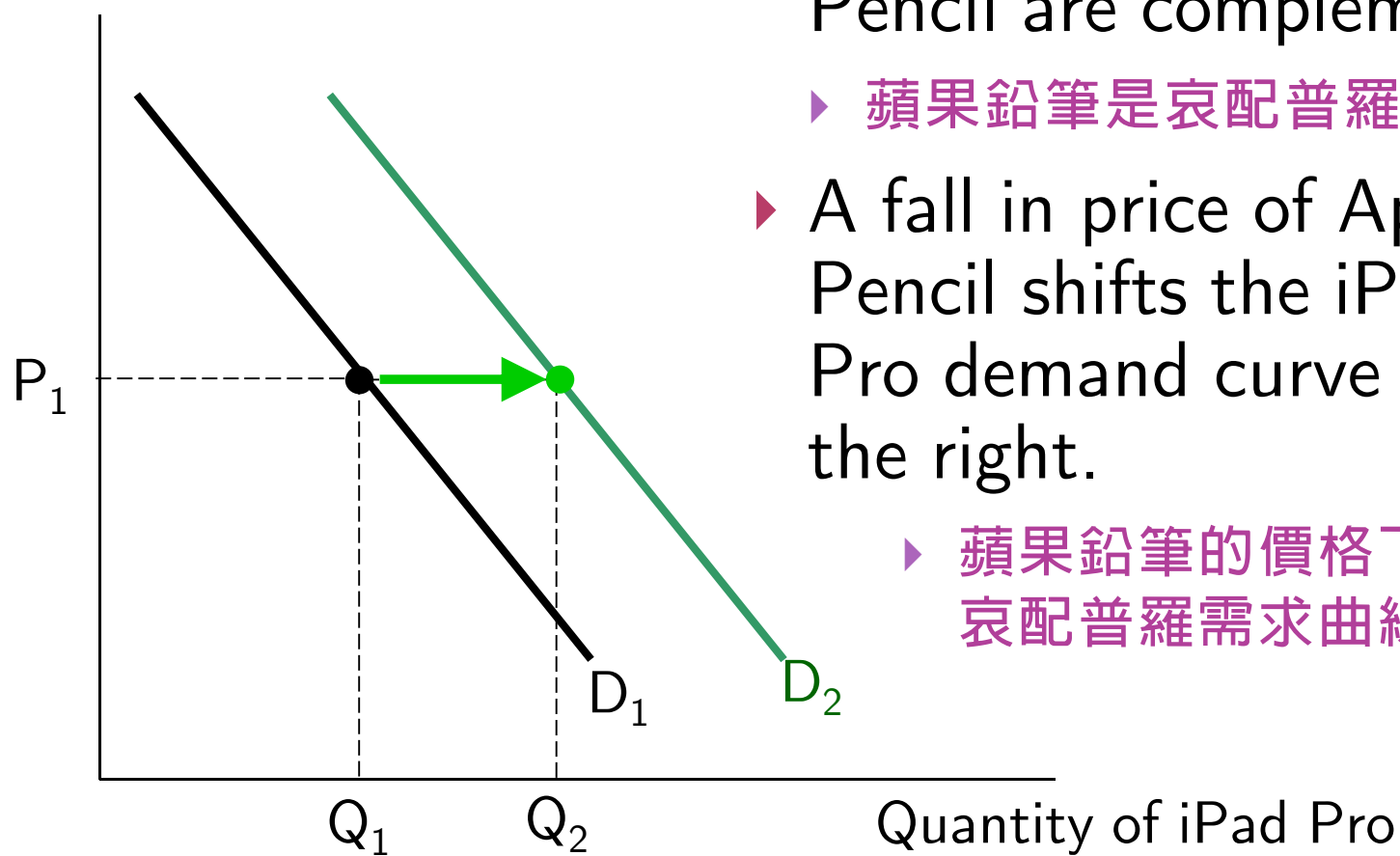
Example: iPad Pro Demand 範例: 哀配普羅的需求

- ▶ Draw a demand curve for iPad Pro to analyze what happens to it in the following scenarios?
- ▶ Price of Apple Pencil falls
- ▶ Price of iPad Pro falls
- ▶ Price of Surface Pro 4 falls
- ▶ 分析下列事件對需求的影響:
 - ▶ 蘋果鉛筆的價格下跌
 - ▶ 哀配普羅的價格下跌
 - ▶ 表面普羅四價格下跌



Price of Apple Pencil Falls (蘋果鉛筆的價格下跌)

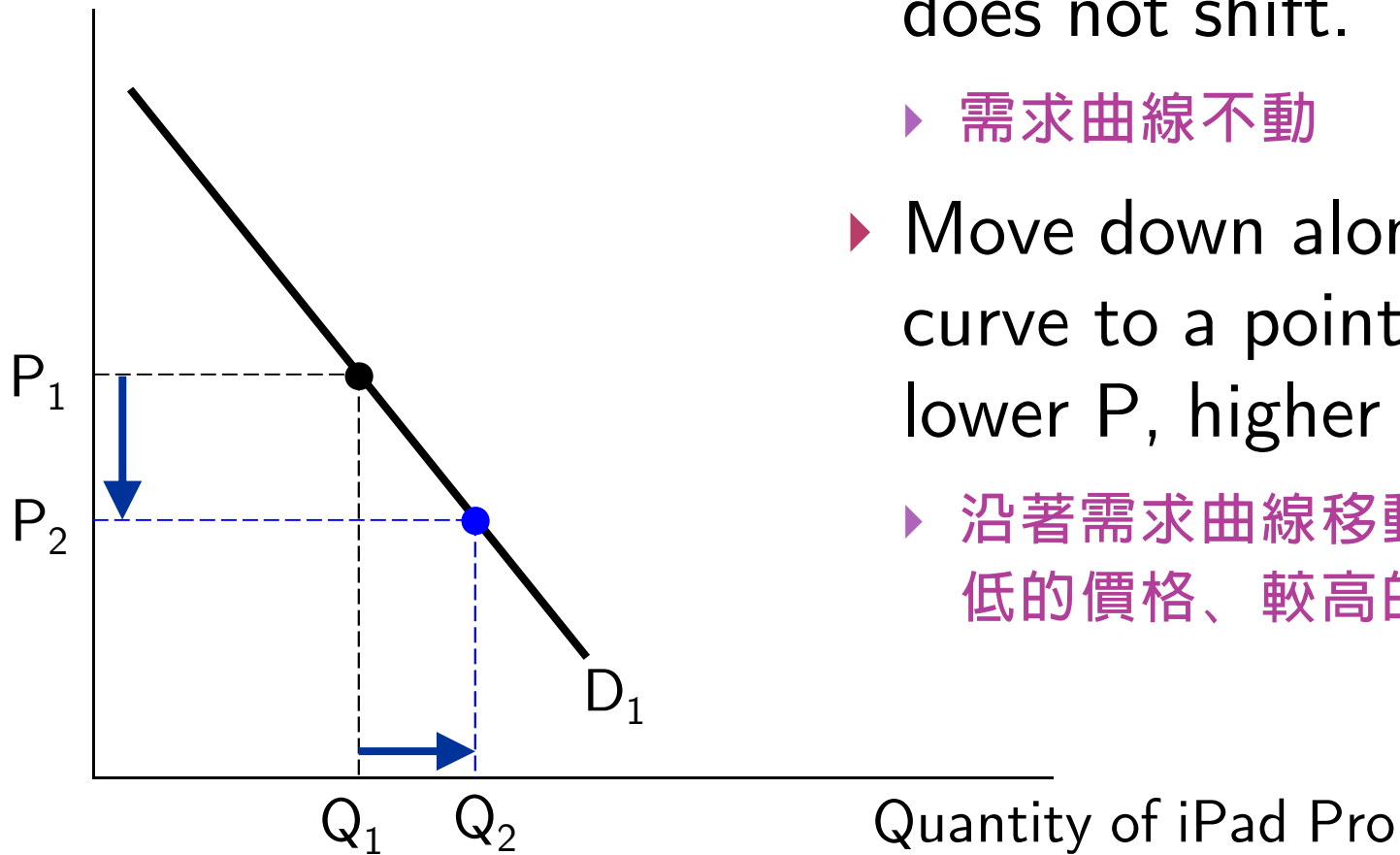
Price of iPad Pro



- ▶ iPad Pro and Apple Pencil are complements.
- ▶ 蘋果鉛筆是哀配普羅配件
- ▶ A fall in price of Apple Pencil shifts the iPad Pro demand curve to the right.
- ▶ 蘋果鉛筆的價格下跌讓哀配普羅需求曲線右移

Price of iPad Pro Falls (衰配普羅的價格下跌)

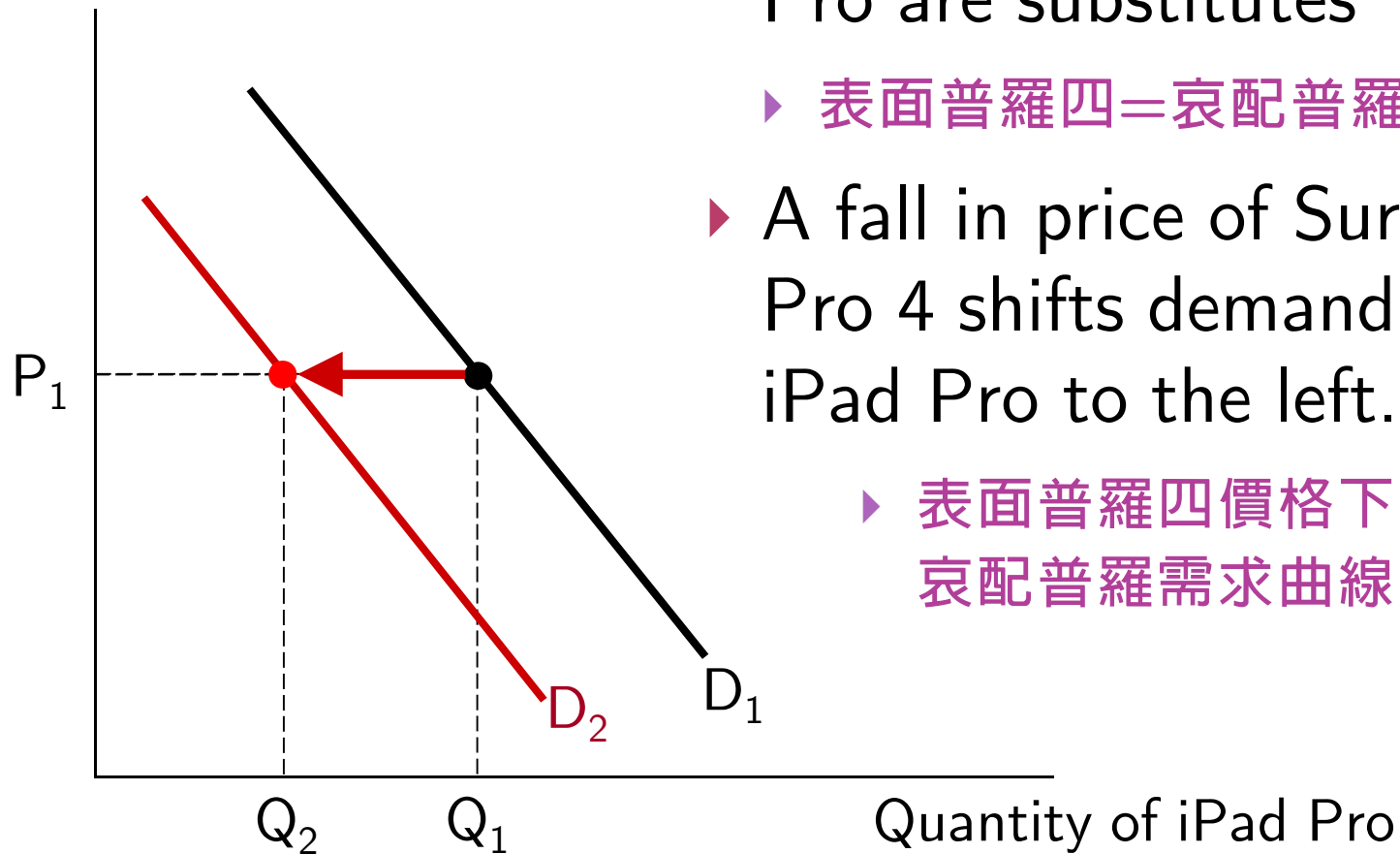
Price of iPad Pro



- ▶ The D curve does not shift.
 - ▶ 需求曲線不動
- ▶ Move down along curve to a point with lower P, higher Q.
 - ▶ 沿著需求曲線移動到較低的價格、較高的數量

Price of Surface Pro 4 Falls (表面普羅四價格下跌)

Price of iPad Pro



- ▶ Surface Pro 4 and iPad Pro are substitutes
 - ▶ 表面普羅四=哀配普羅代替品
- ▶ A fall in price of Surface Pro 4 shifts demand for iPad Pro to the left.
 - ▶ 表面普羅四價格下跌讓哀配普羅需求曲線左移

Demand Curve Shifters: Tastes (偏好口味)

- ▶ Anything that causes a shift in tastes **toward** a good will increase demand for that good and shift its D curve to the right.
- ▶ Example:
Fresh milk became popular recently after powder was hit by the Melamine (三聚氰胺) incident, caused an increase in demand for fresh milk, shifted the fresh milk demand curve to the right.
 - ▶ 三聚氰胺事件之後，台灣民衆對鮮奶的需求增加
 - ▶ 滅頂事件後，台灣民衆對林鳳營鮮奶的需求減少

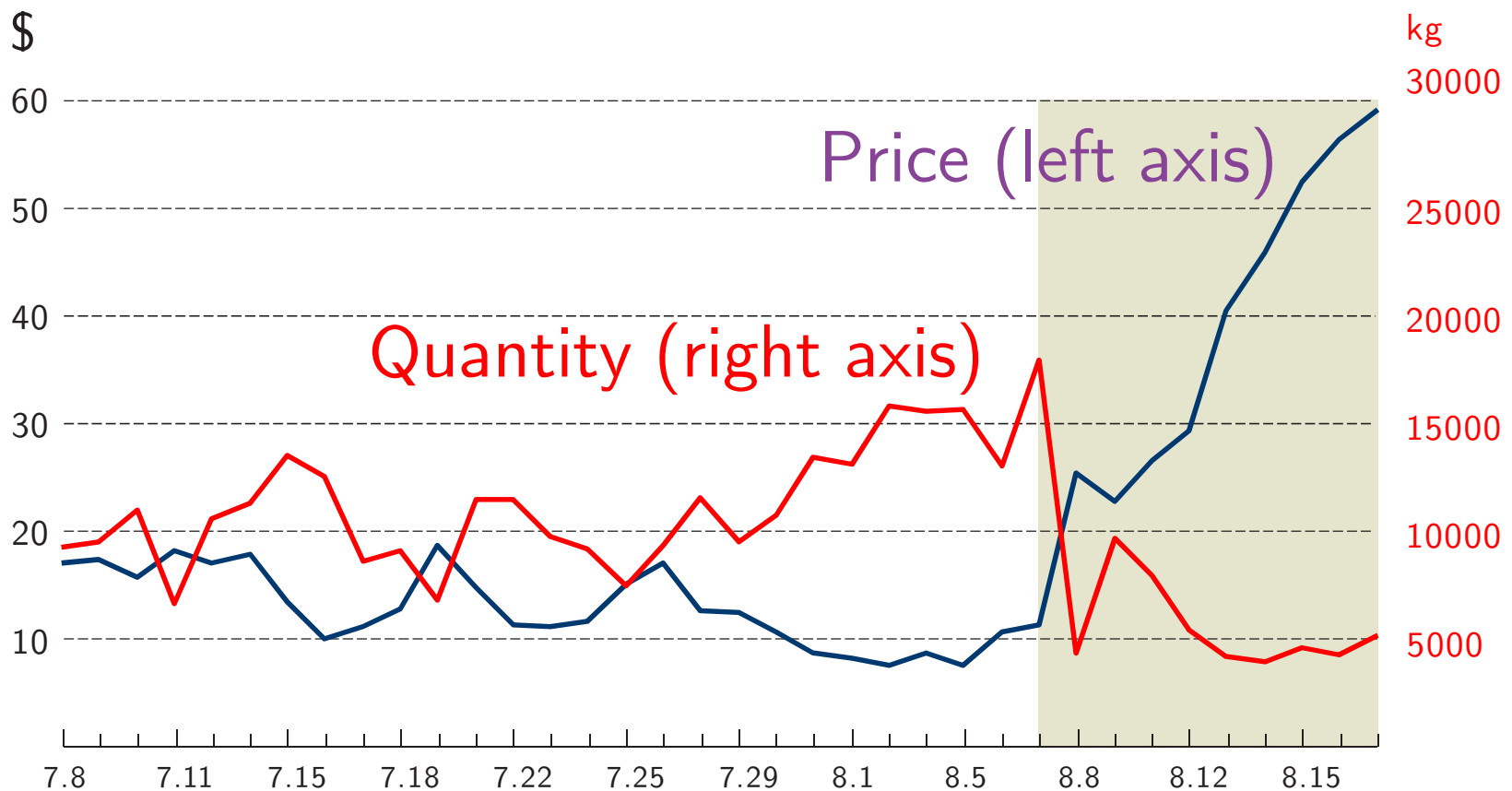
Demand Curve Shifters: Expectations (預期心理)

- ▶ Expectations affect consumers' buying decisions. 預期心理會影響消費者購買決策
- ▶ Examples:
 - ▶ If people expect their incomes to rise, their demand for meals at expensive restaurants may increase now. (若預期會加薪...)
 - ▶ If the **typhoons** is coming and people worry about a vegetable price surge, demand for vegetables may rise now. (颱風來之前菜價就...)

Price and Quantity for Bok Choy 白菜價格與數量

Taipei 1st Wholesale Fruit & Vegetable Market (台北市第一果菜批發市場)

What happened on 2009.8.7-8.8? **Typhoon Morakot!**



How Do Buyers Behave? 買家如何做決策?

Variable	A change in this variable...
Price (價格)	...movement along the D curve (在需求曲線上移動)
# of buyers (買家人數)	...shifts the D curve
Income (收入)	...shifts the D curve
Price of (相關產品價格) related goods	(整個需求曲線移動) ...shifts the D curve
Tastes (偏好口味)	...shifts the D curve
Expectations (預期心理)	...shifts the D curve

Evidence-Based Economics Example

- ▶ How much more gasoline would people buy if its price were lower?

- ▶ 實證經濟學範例:

- ▶ 若汽油價格下跌

- ▶ 你會多消費多少汽油?

- ▶ 取決於需求曲線!



- ▶ Depends on the Demand Curve!!

Evidence-Based Economics Example

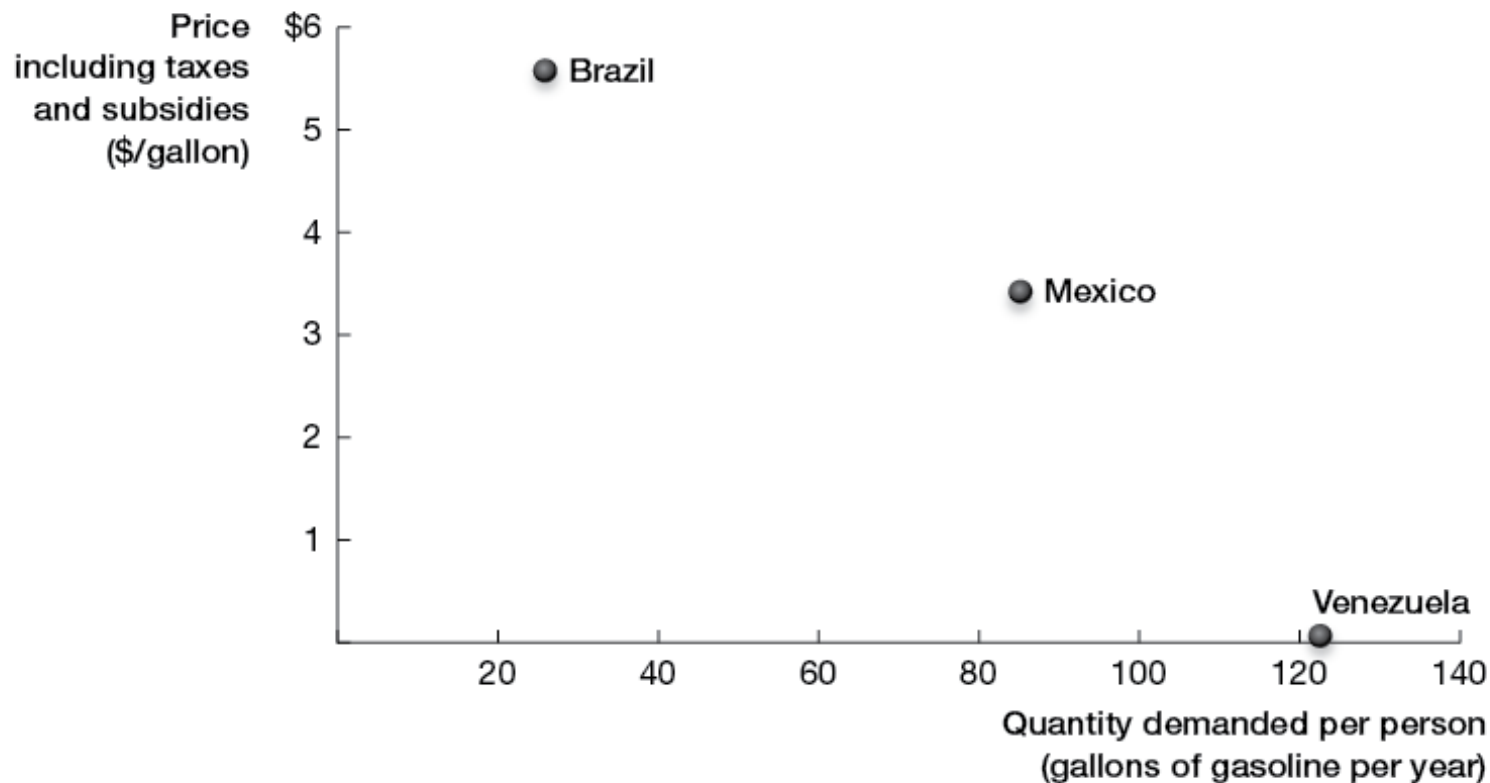
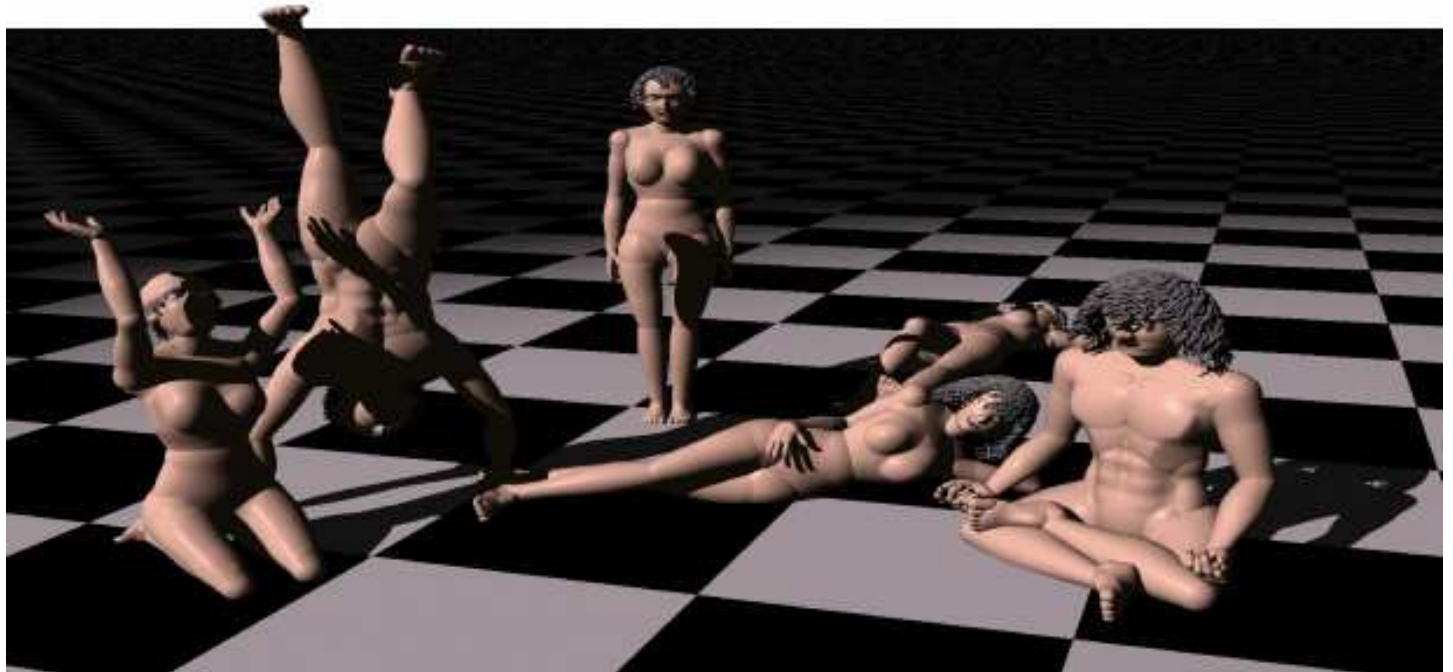


Exhibit 4.5 The Quantity of Gasoline Demanded (per person) and the Price of Gasoline in Brazil, Mexico, and Venezuela

How Do Sellers Behave? 賣家如何做決策?

- ▶ How much would you have to be paid to take your clothes off in class?
- ▶ 要付給你多少錢，你才願意在課堂中全裸演出？



How Do Sellers Behave? 賣家如何做決策?

- ▶ **Quantity Supplied** (供給數量)
 - ▶ The amount of a good that **sellers** are willing to **sell** at a given price.
 - 在某個價格下，賣方願意出售的數量。
- ▶ **Supply Schedule** (供給表)
 - ▶ A table that reports the quantity **supplied** at different prices, holding all else equal.
- ▶ **Supply Curve** (供給曲線)
 - ▶ Plots the quantity **supplied** at different prices
 - 價格和供給數量的函數關係作圖

How Do Sellers Behave? 賣家如何做決策?

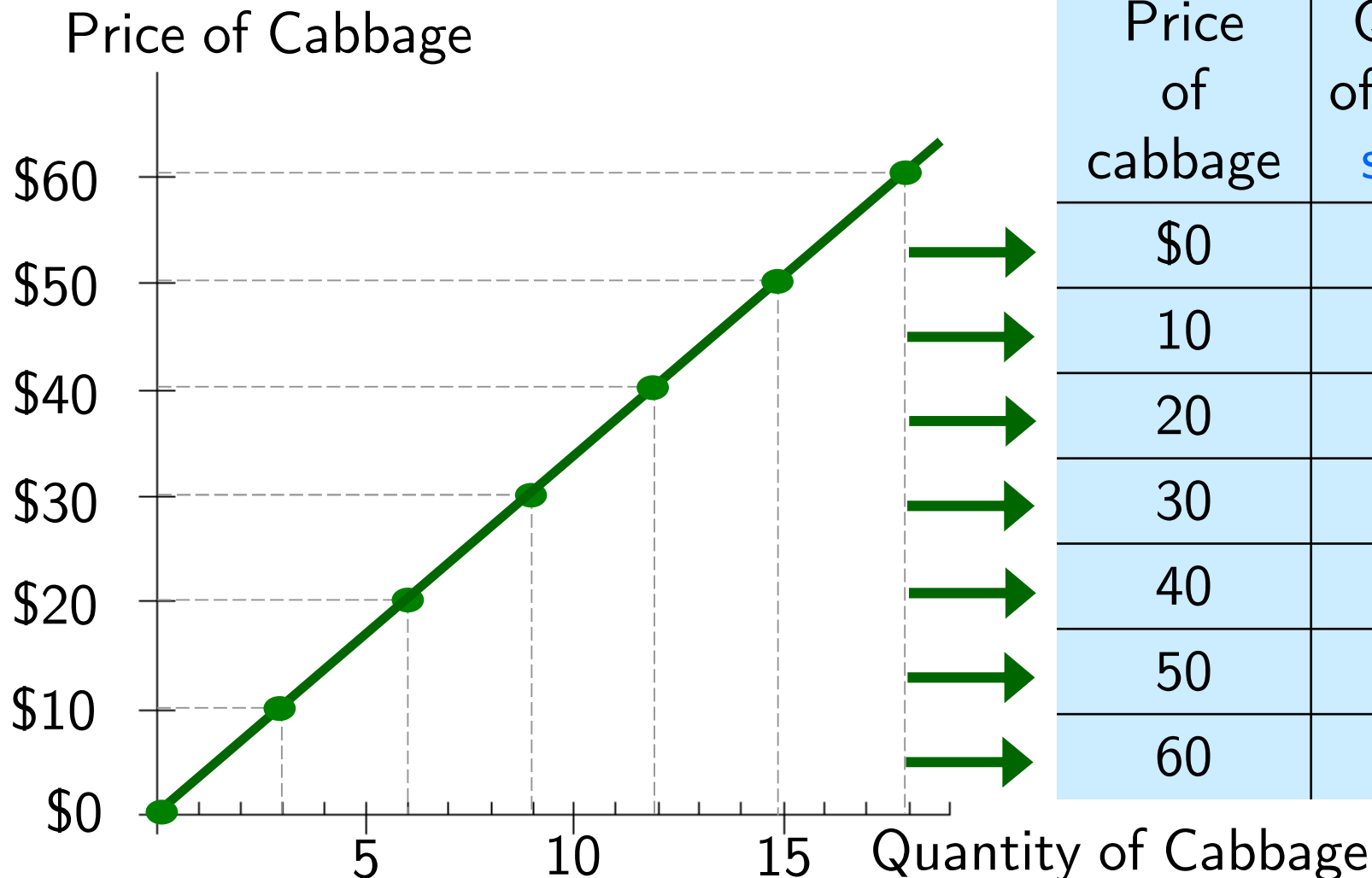
- ▶ Quantity Supplied (供給需求數量): Q^S
 - ▶ The amount of a good that sellers are willing to sell at a given price.
 - 在某個價格下，賣方願意賣出的數量。
- ▶ Law of Supply (供給法則)
 - ▶ The claim that:
 - ▶ Quantity supplied of a good rises when the price of the good rises, other things equal
 - 其他條件不變時，價格上升會讓供給數量上升。

How Do Sellers Behave? 賣家如何做決策?

- ▶ Supply Schedule (供給表)
 - ▶ A table that shows the relationship between the price of a good & quantity supplied
- ▶ Example: (蔡奇亞的白菜供給)
Marco's supply for cabbage
- ▶ Notice that his preferences obey the law of supply.
 - ▶ 蔡奇亞的供給表符合供給法則!

Price of cabbage	Quantity of cabbage supplied
\$0	0
10	3
20	6
30	9
40	12
50	15
60	18

Marco's Supply Schedule & Curve



Price of cabbage	Quantity of cabbage supplied
\$0	0
10	3
20	6
30	9
40	12
50	15
60	18

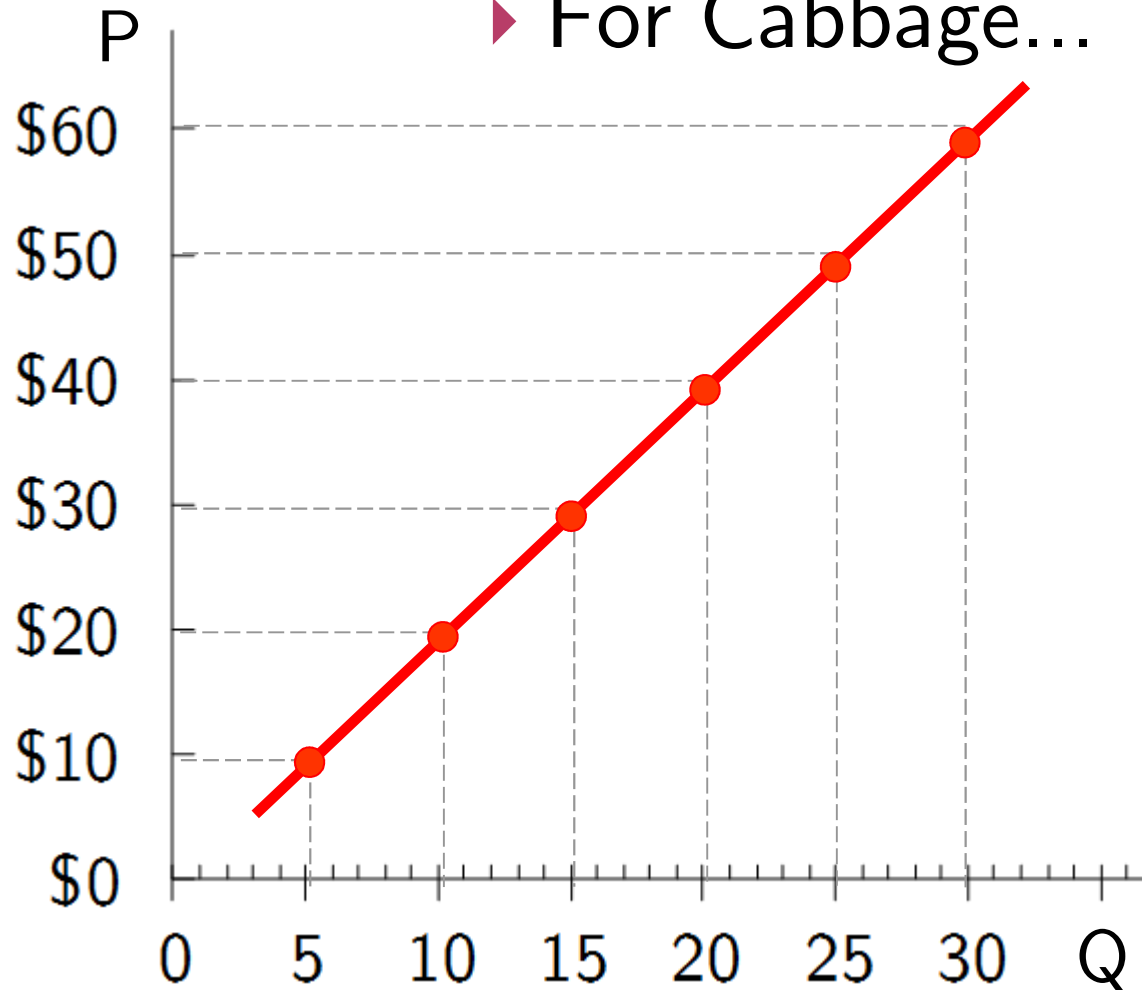
Market Supply (市場供給數量=個別供給數量加總)

- ▶ **Market Q^S** = sum of Q^S by all **sellers** at each price.
- ▶ Let Marco & Michael be the only 2 sellers of cabbage

Price	蔡奇亞's Q^S		蔡偶亞's Q^S		Market Q^S
\$0	0	+	0	=	0
10	3	+	2	=	5
20	6	+	4	=	10
30	9	+	6	=	15
40	12	+	8	=	20
50	15	+	10	=	25
60	18	+	12	=	30

Market Supply Curve 白菜市場需求曲線

► For Cabbage...



P	Q ^s (Market)
\$0	0
10	5
20	10
30	15
40	20
50	25
60	30

Supply Curve Shifters 影響供給曲線的因素

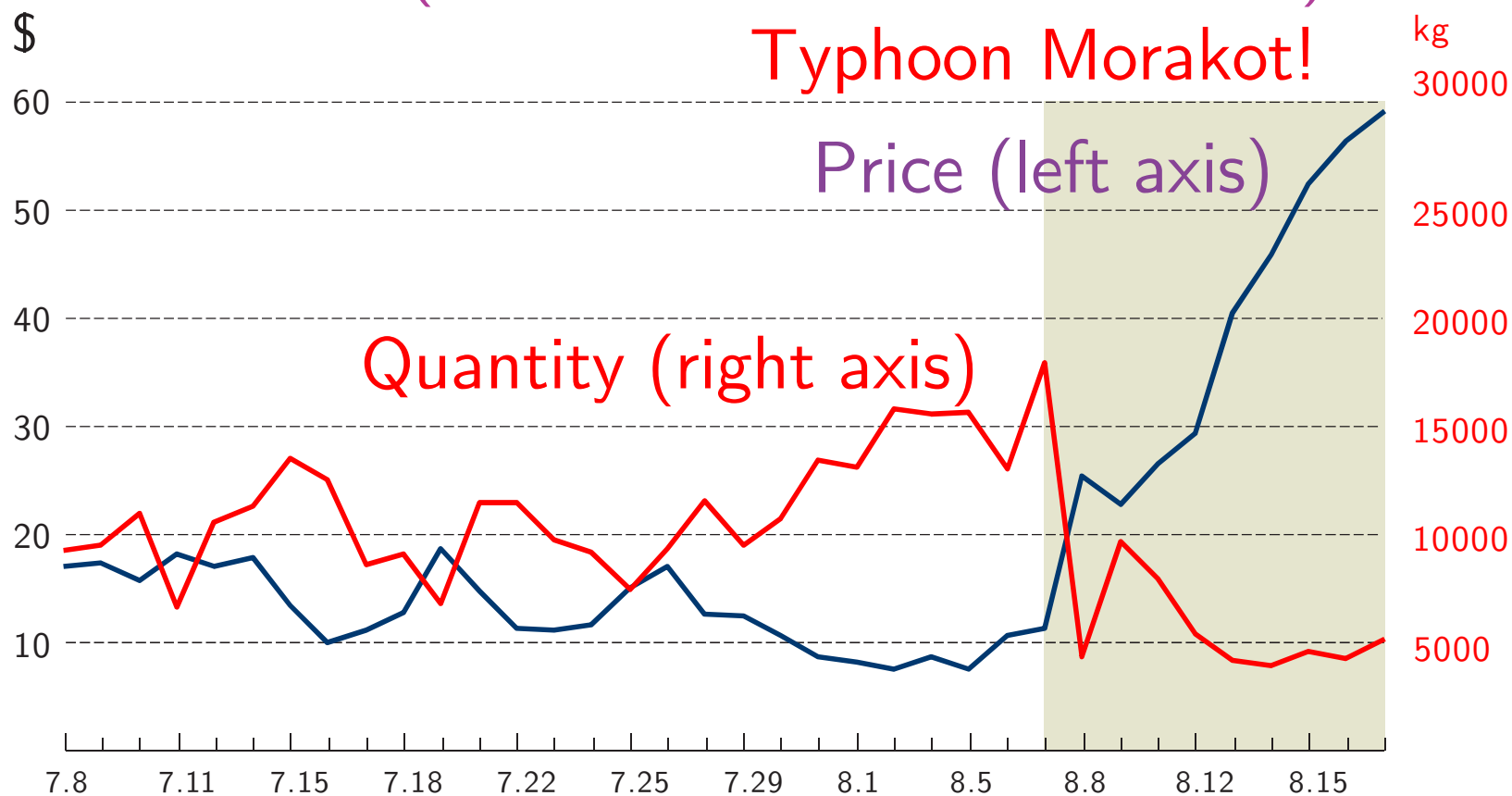
- ▶ The **supply** curve shows how price affects quantity **supplied**, **other things being equal**.
 - ▶ 需求曲線假設「其他條件不變」(包括偏好、所得、替代品或互補品之價格、預期等), 這些會影響需求
- ▶ These "other things" are non-price determinants of **supply**.
- ▶ Changes in them shift the *S* curve...

How do sellers behave? 賣家如何做決策?

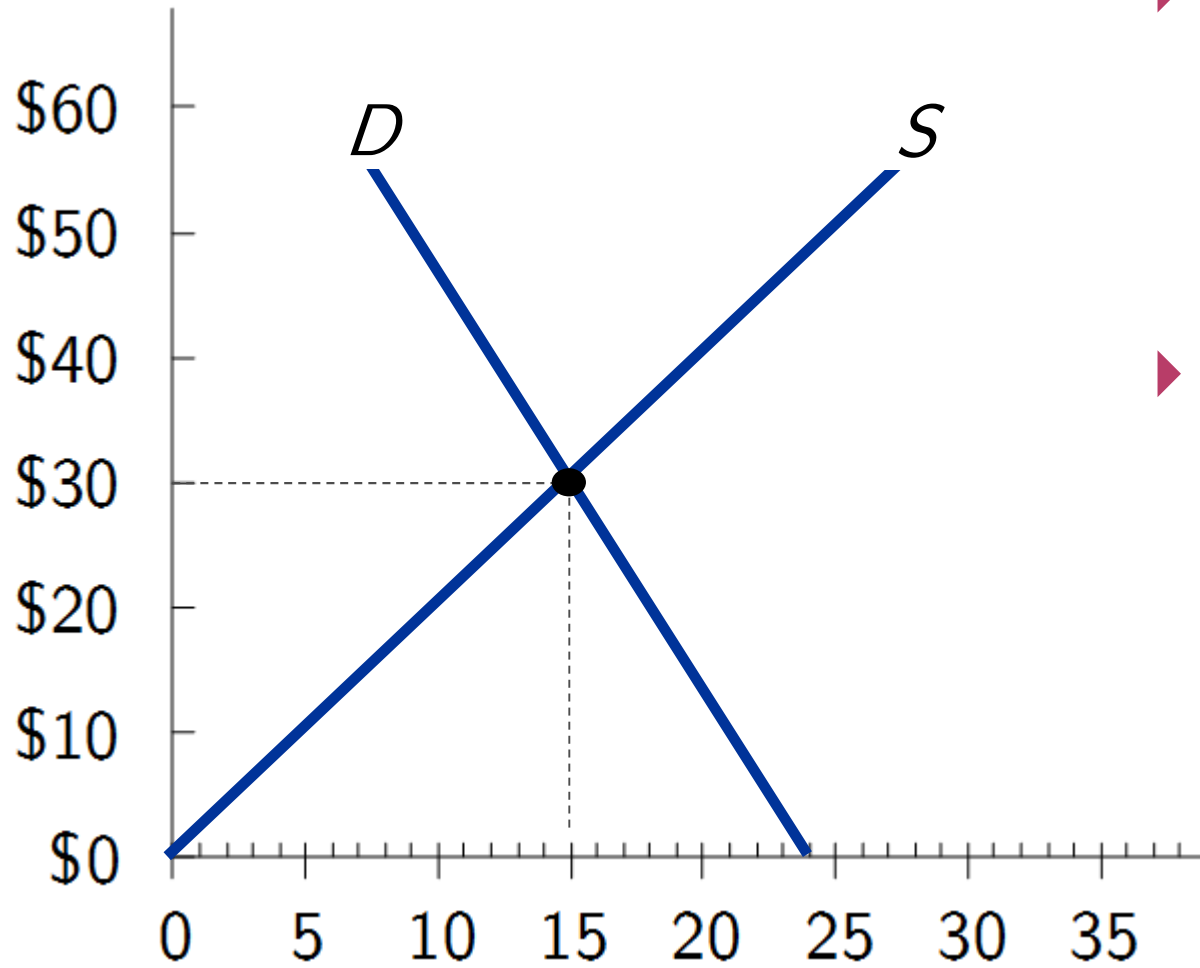
Variable	A change in this variable...
Price (價格)	...movement along the S curve (在供給曲線上移動)
Input Prices (投入價格)	...shifts the S curve
Technology (科技進步)	...shifts the S curve (整個供給曲線移動)
# of Sellers (買家人數)	...shifts the S curve
Expectations (預期心理)	...shifts the S curve

Is Bok Choy Perishable or Not? 白菜能貯存嗎?

- ▶ Which change is driven by expectation of supply or demand? (哪些價量改變來自預期心理?)



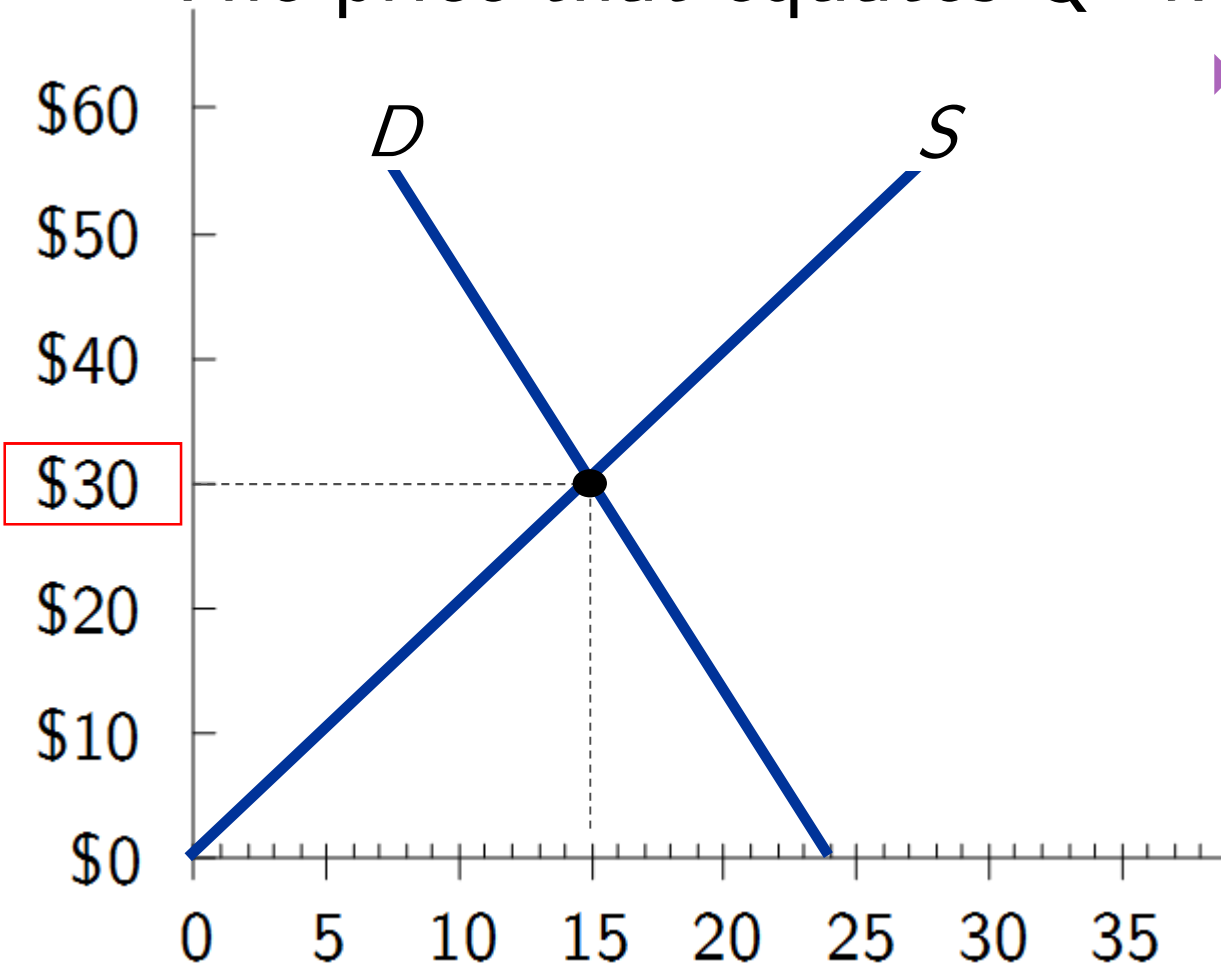
Supply + Demand = ? (供給+需求=?)



- ▶ **Equilibrium:**
P has reached the level where Q^S equals Q^D
- ▶ **均衡:**
讓 $Q^S = Q^D$ 的價格

Equilibrium Price 均衡價格

▶ The price that equates Q^S with Q^D

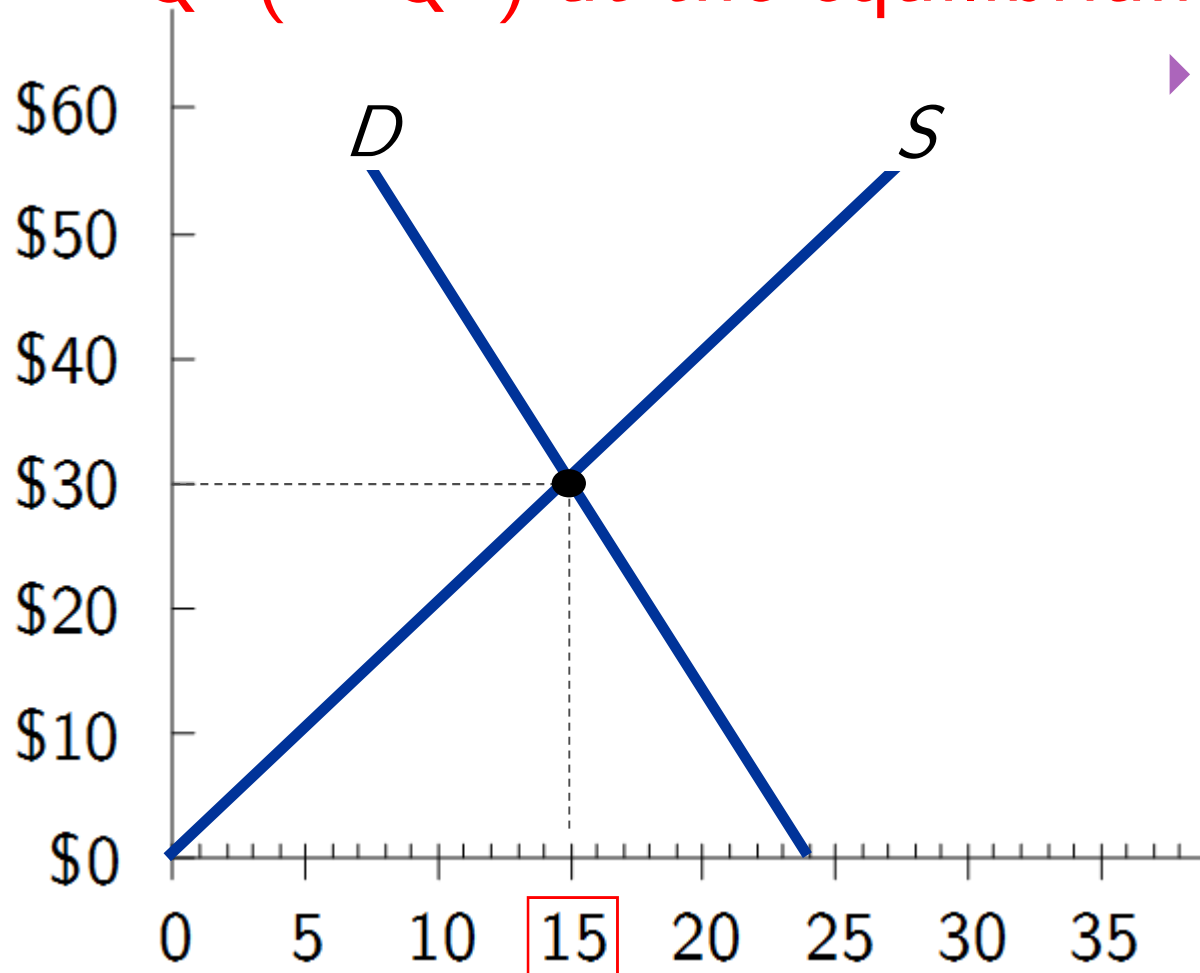


▶ 讓 $Q^S = Q^D$ 的價格

P	Q^D	Q^S
\$0	24	0
1	21	5
2	18	10
3	15	15
4	12	20
5	9	25
6	6	30

Equilibrium Quantity 均衡數量(均衡交易量)

▶ $Q^S (= Q^D)$ at the equilibrium price

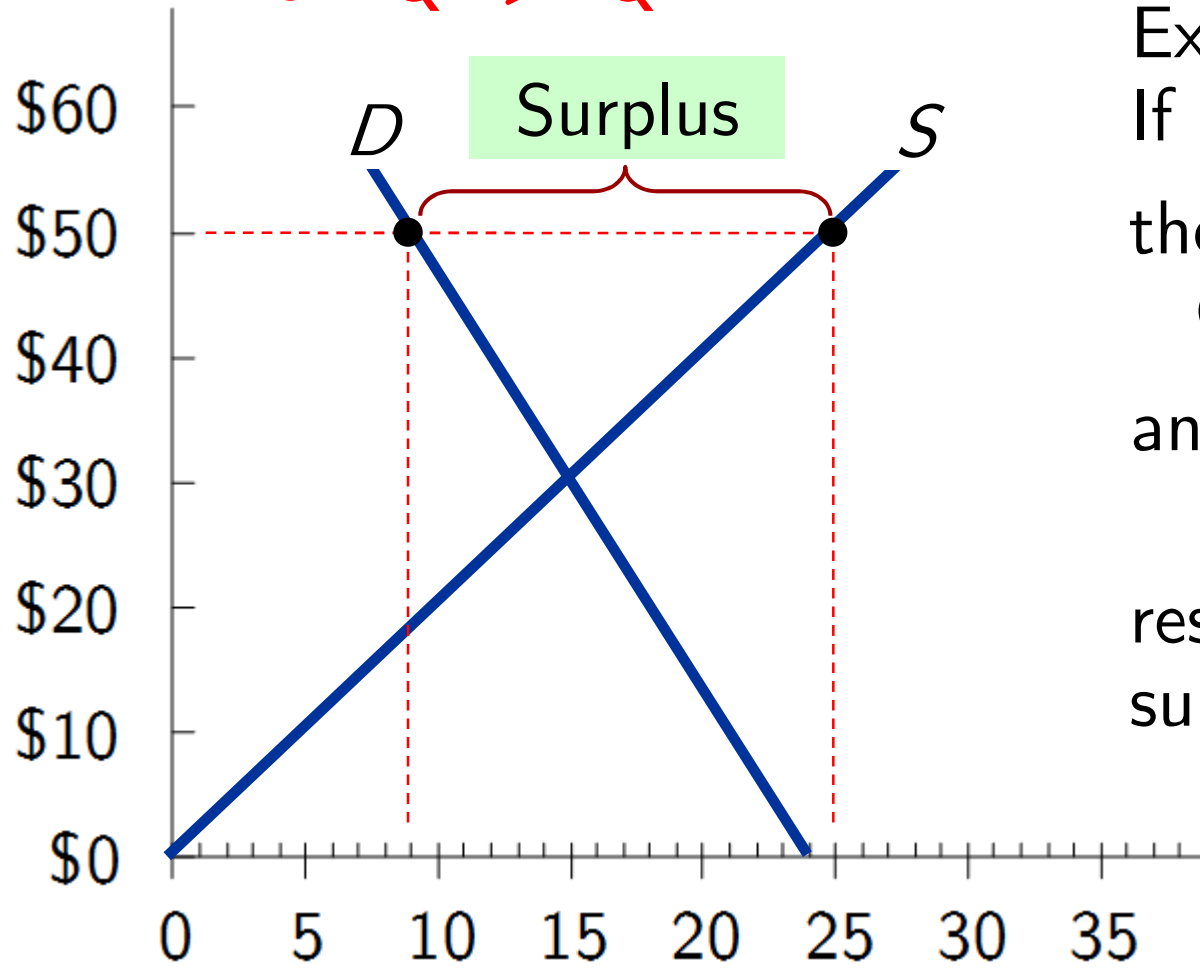


▶ 在此價格 $Q^S = Q^D$

P	Q^D	Q^S
\$0	24	0
1	21	5
2	18	10
3	15	15
4	12	20
5	9	25
6	6	30

Surplus (a.k.a. excess supply): 供過於求

▶ When $Q^S > Q^D$



Example:

If $P = \$50$,

then

$$Q^D = 9 \text{ kg}$$

and

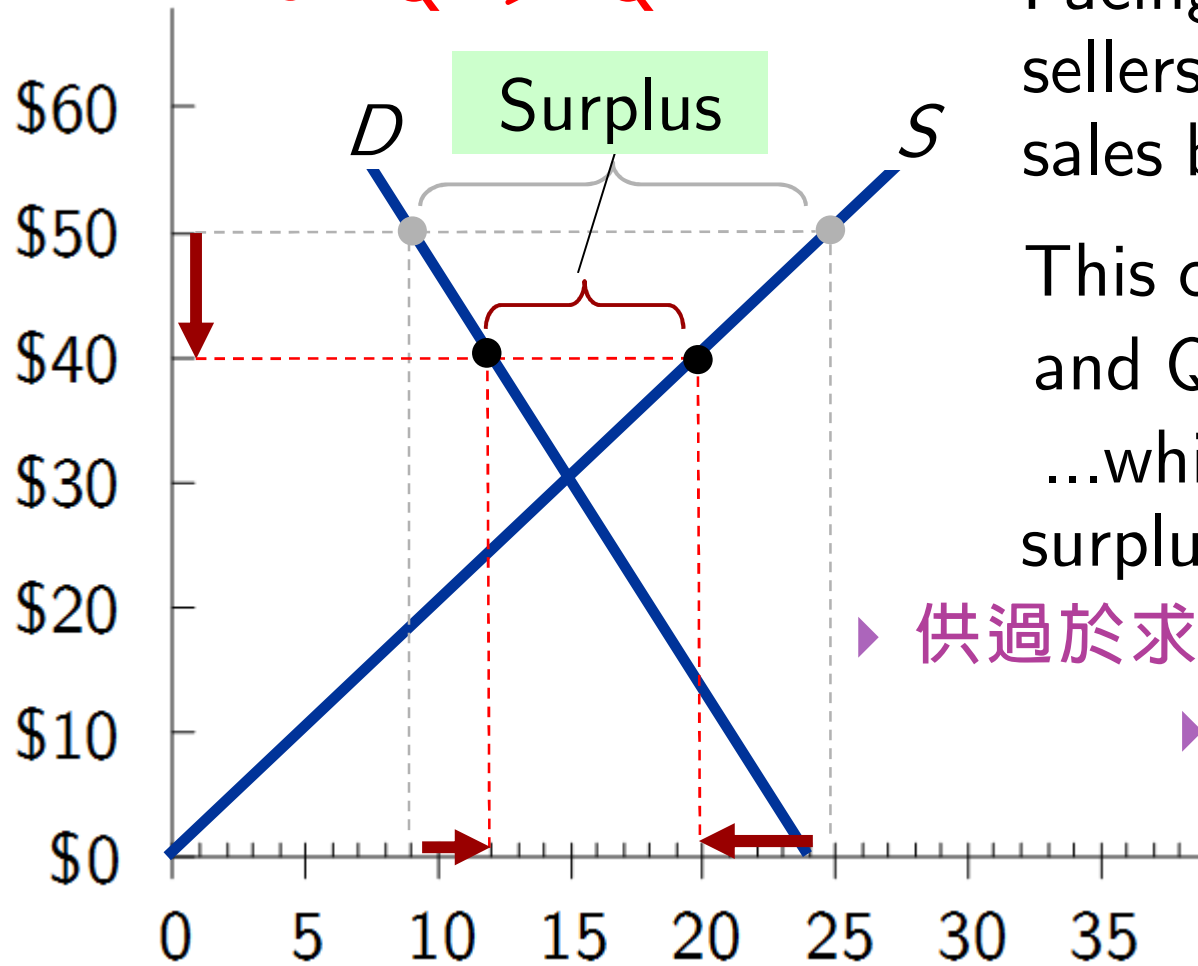
$$Q^S = 25 \text{ kg}$$

resulting in a

surplus of 16 kg

Surplus (a.k.a. excess supply): 供過於求

▶ When $Q^S > Q^D$



Facing a surplus, sellers try to increase sales by cutting price.

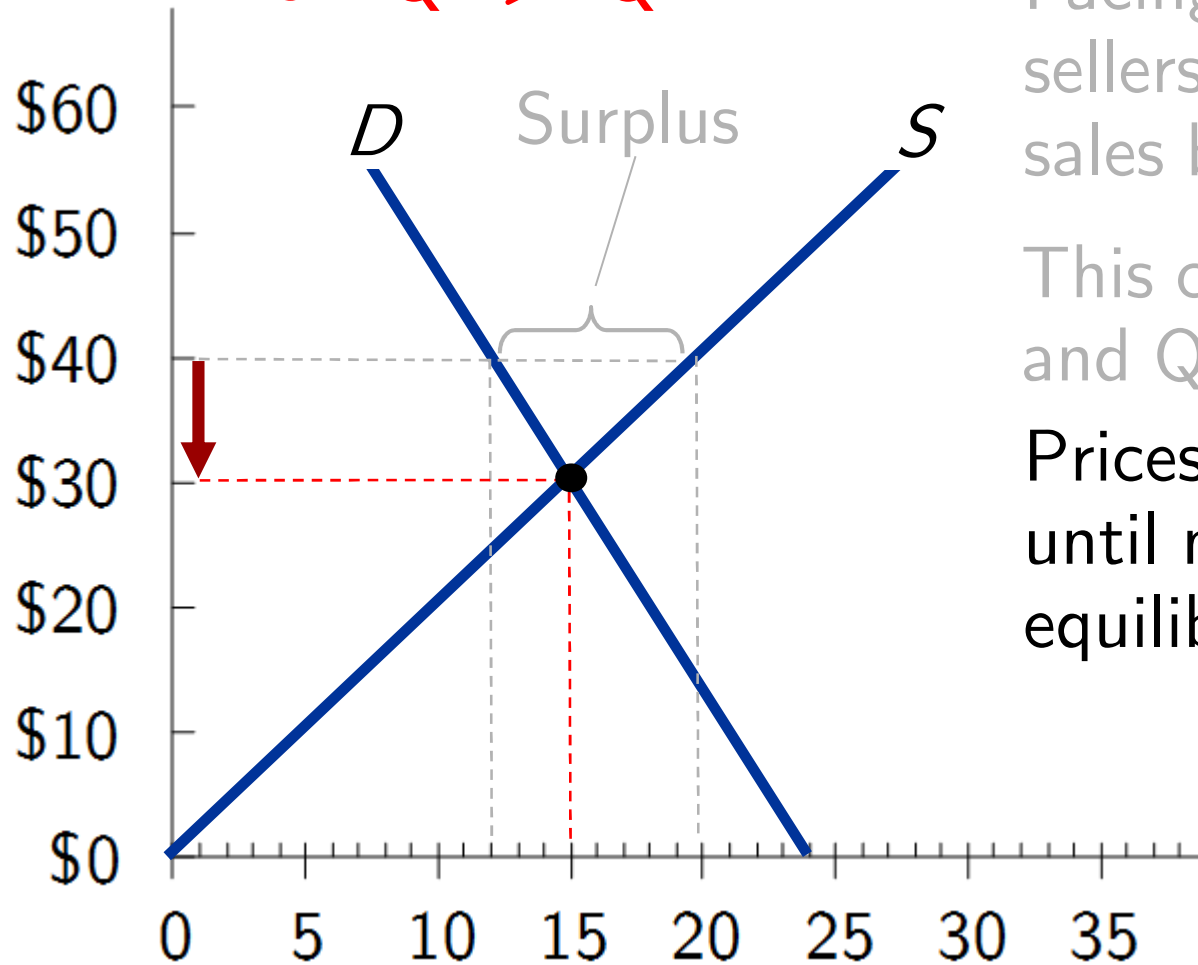
This causes Q^D to rise and Q^S to fall, ...which reduces the surplus.

▶ 供過於求時賣家會降價促銷

▶ Q^D 增加、 Q^S 減少
減緩供過於求

Surplus (a.k.a. excess supply): 供過於求

▶ When $Q^S > Q^D$



Facing a surplus, sellers try to increase sales by cutting price.

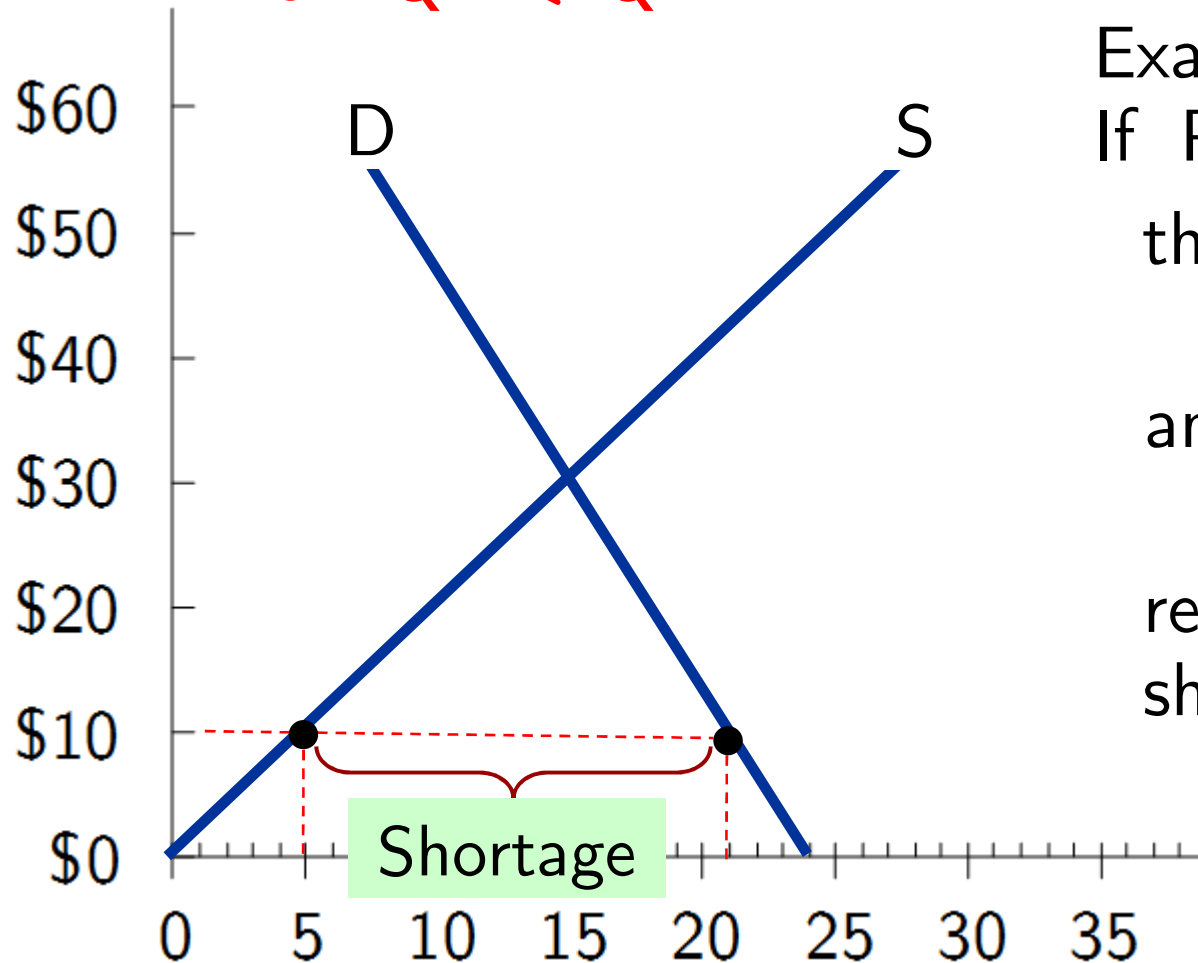
This causes Q^D to rise and Q^S to fall.

Prices continue to fall until market reaches equilibrium.

- ▶ 價格會一直下跌
- ▶ 直到回到均衡

Shortage (a.k.a. excess demand): 供不應求

▶ When $Q^S < Q^D$



Example:

If $P = \$10$,

then

$$Q^D = 21 \text{ kg}$$

and

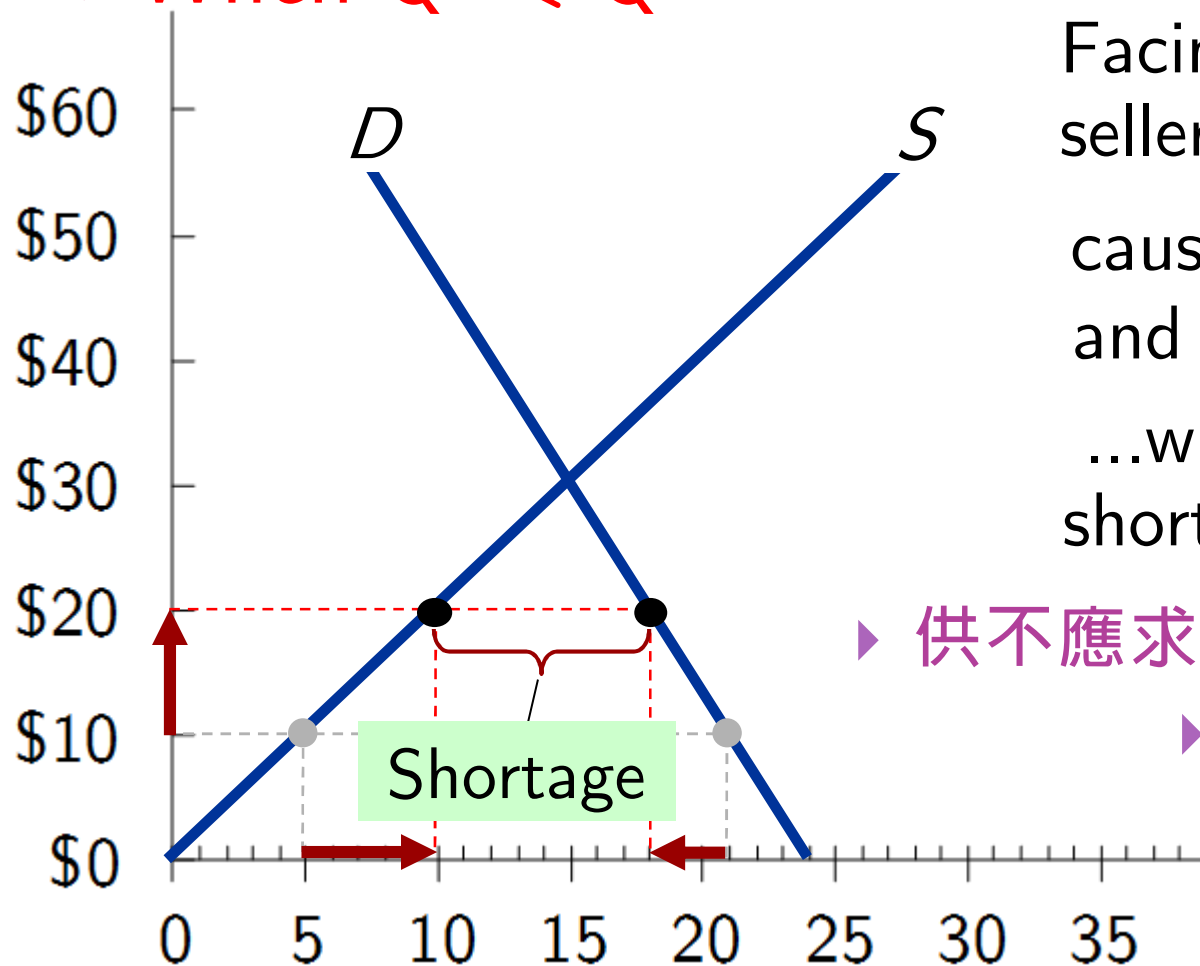
$$Q^S = 5 \text{ kg}$$

resulting in a

shortage of 16 kg

Shortage (a.k.a. excess demand): 供不應求

▶ When $Q^S < Q^D$

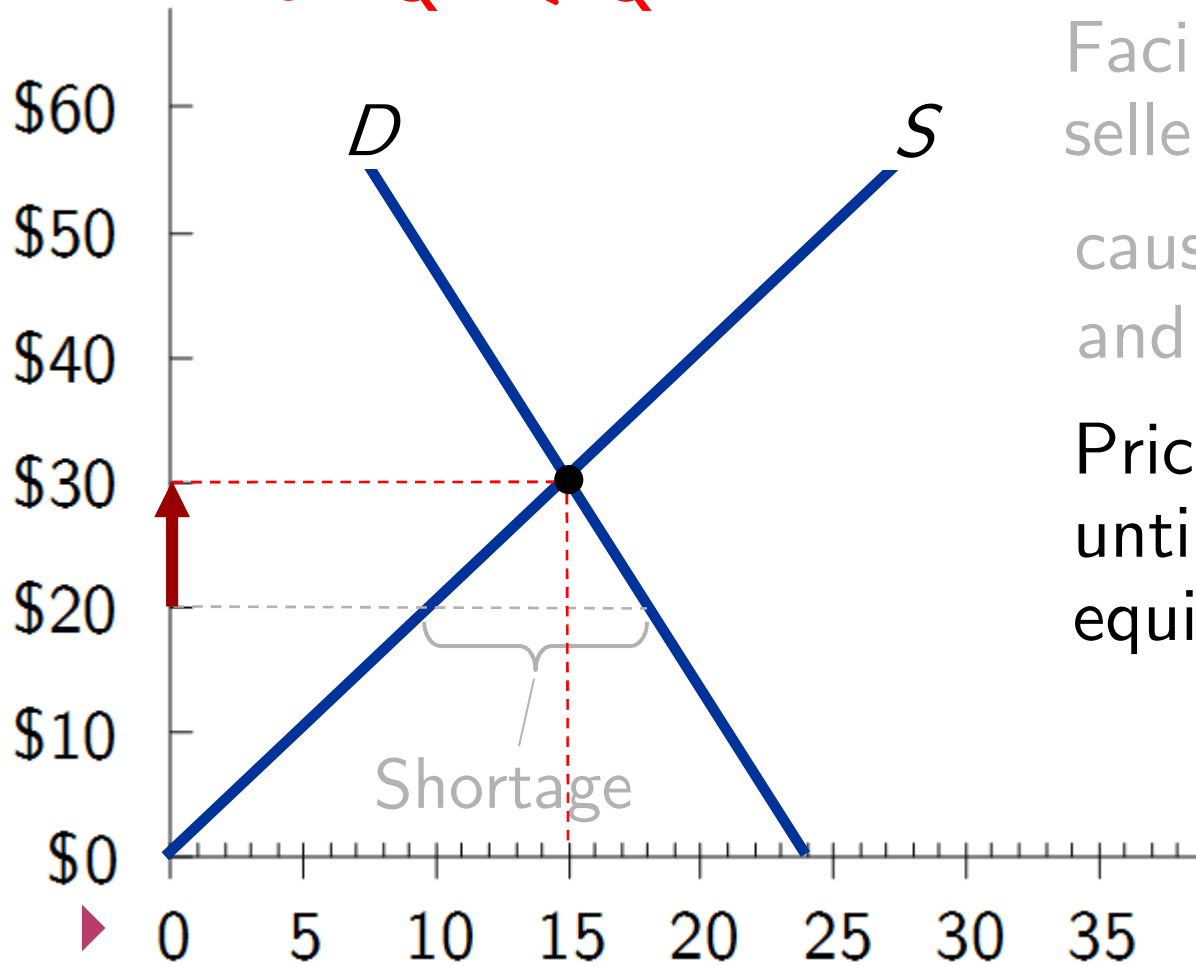


Facing a shortage, sellers raise the price, causing Q^D to fall and Q^S to rise, ...which reduces the shortage.

- ▶ 供不應求時賣家會提高價格
- ▶ Q^D 減少、 Q^S 增加
- ▶ 減緩供不應求

Shortage (a.k.a. excess demand):

▶ When $Q^S < Q^D$



Facing a shortage, sellers raise the price, causing Q^D to fall and Q^S to rise.

Prices continue to rise until market reaches equilibrium.

- ▶ 價格會一直上升
- ▶ 直到回到均衡

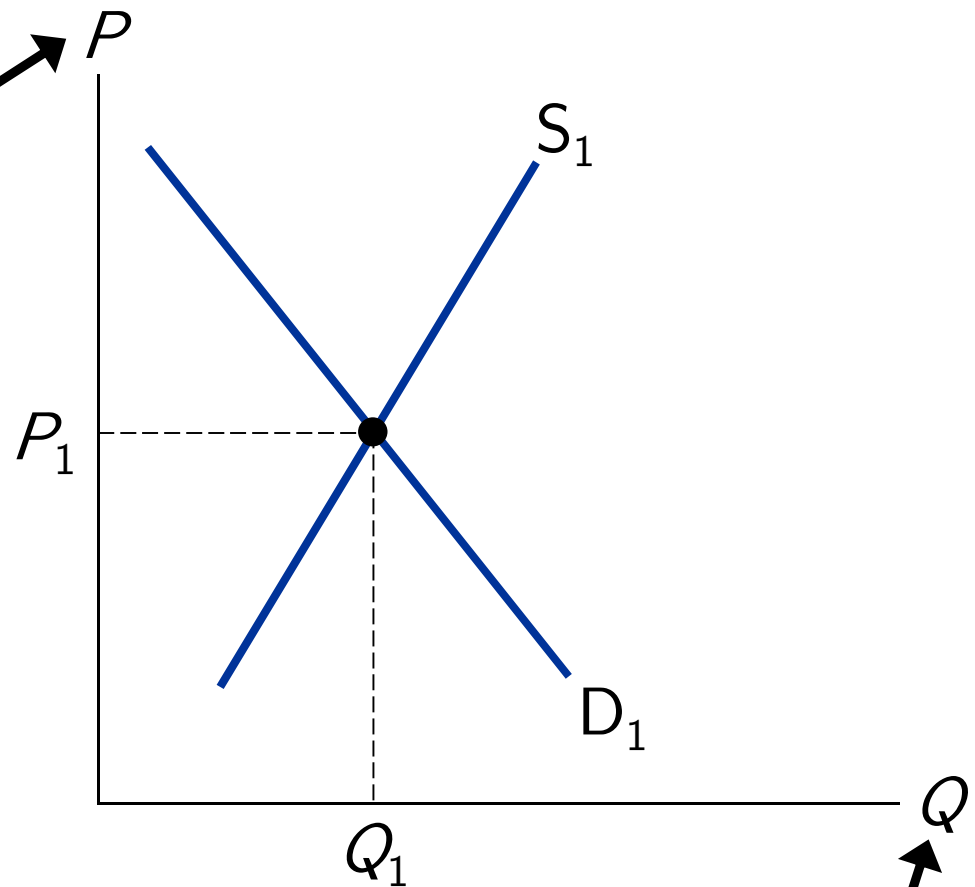
Three Steps to Analyzing Changes in Eq'm

- ▶ To determine the effects of any event,
 1. Decide whether the event shifts S curve, D curve, or both.
 2. Decide in which direction curve shifts.
 3. Use supply—demand diagram to see how the shift changes equilibrium P and Q.
- ▶ 分析某個事件對均衡的影響的三步驟：
 1. 該事件是影響供給曲線、需求曲線，還是都有？
 2. 這個影響讓曲線左移還是右移？
 3. 畫出供需圖來看均衡價格和均衡數量如何改變。

EXAMPLE: The Market for Hybrid Cars

price of hybrid cars

- ▶ 舉例來說，油電混合車市場如右：



quantity of hybrid cars

EXAMPLE 1: A Shift in Demand 需求增加

EVENT TO BE ANALYZED:

Increase in gas price 油價上漲

STEP 1:

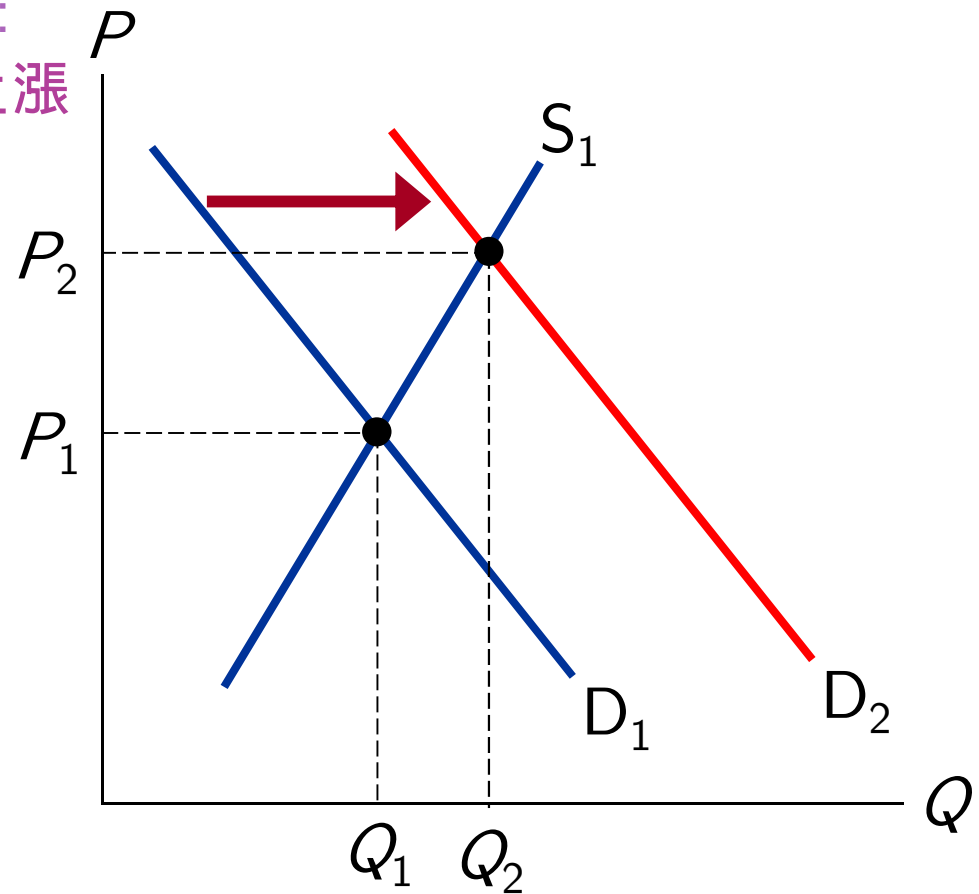
D curve shifts 需求移動

STEP 2:

D shifts right 需求右移

STEP 3:

The shift causes an increase in price and quantity of hybrid cars.
(均衡價格和數量均上升)

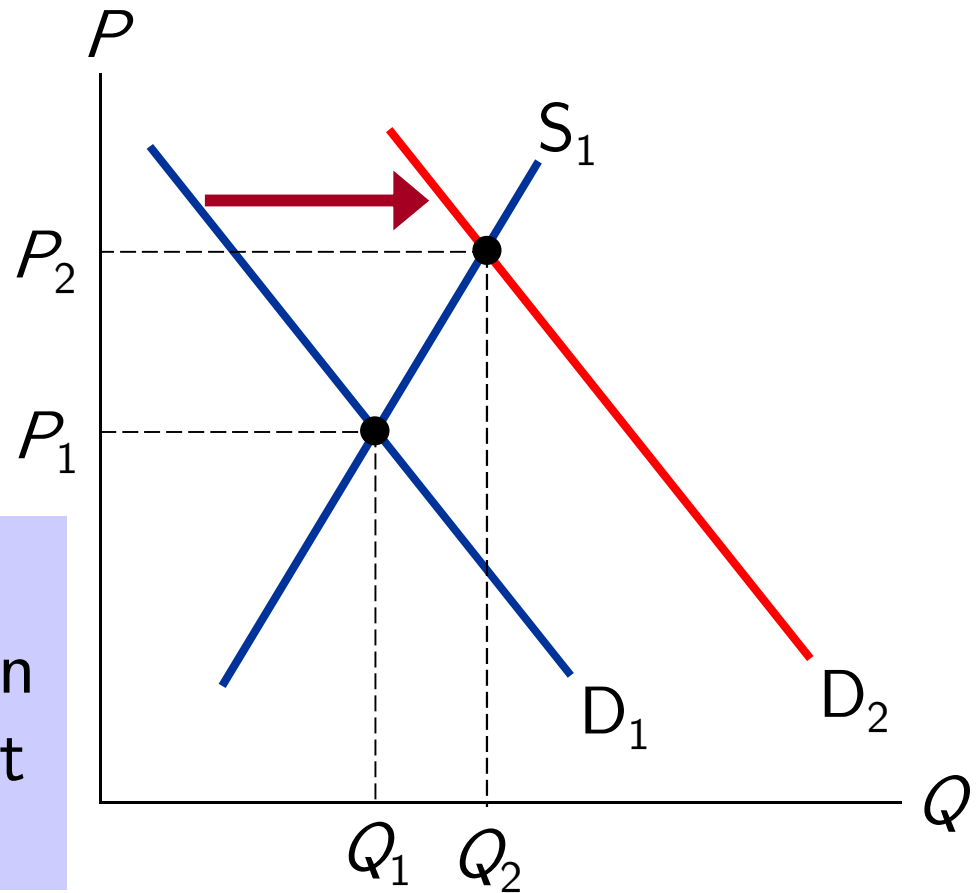


EXAMPLE 1: A Shift in Demand 需求增加

Notice:

When P rises, producers supply a larger quantity of hybrids, even though S curve has not shifted.

Always be careful to distinguish b/w a shift in a curve and a movement along the curve.



雖然供給曲線不變，價格上漲仍使車商增產(在曲線上移動)!

Terms for Shift vs. Movement Along Curve

- ▶ **Change in supply:** (供給(曲線的)改變)
 - ▶ a shift in the S curve (當「其他條件」改變)
 - ▶ occurs when a non-price determinant of supply changes (like technology or costs)
- ▶ **Change in quantity supplied:** (供給數量改變)
 - ▶ a movement along a fixed S curve
 - ▶ occurs when P changes (產品本身「價格」改變)

Terms for Shift vs. Movement Along Curve

- ▶ **Change in demand:** (需求(曲線的)改變)
 - ▶ a shift in the D curve (當「其他條件」改變)
 - ▶ occurs when a non-price determinant of demand changes (like income or # of buyers)
- ▶ **Change in quantity demanded:** (需求數量改變)
 - ▶ a movement along a fixed D curve
 - ▶ occurs when P changes (產品本身「價格」改變)

EXAMPLE 2: A Shift in Supply 供給增加

EVENT: New technology reduces cost of producing hybrid cars. (科技進步)

降低成本)

STEP 1:

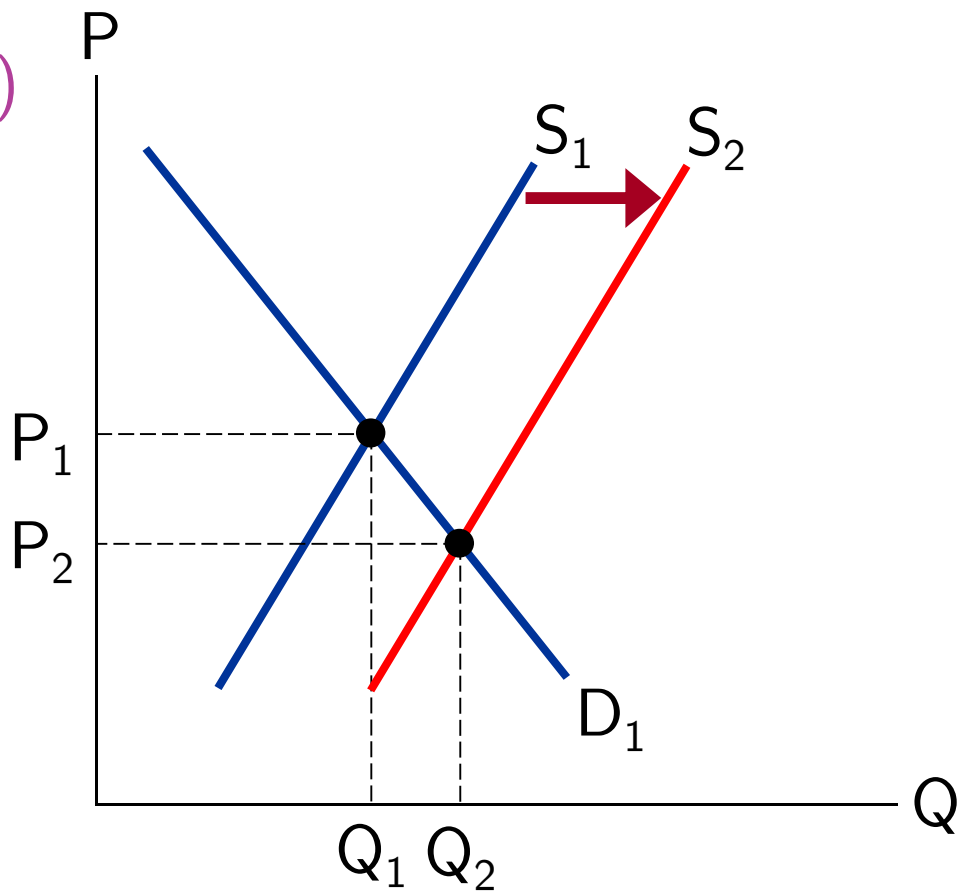
S curve shifts 供給移動

STEP 2:

S shifts right 供給右移

STEP 3:

The shift causes price to fall and quantity to rise. (均衡價格下降, 但均衡數量上升)



EXAMPLE 3: A Shift in Both Supply & Demand

EVENTS: Price of gas rises AND new technology reduces production costs. P (油價上漲+科技進步)

STEP 1:

Both curves shift 都移動

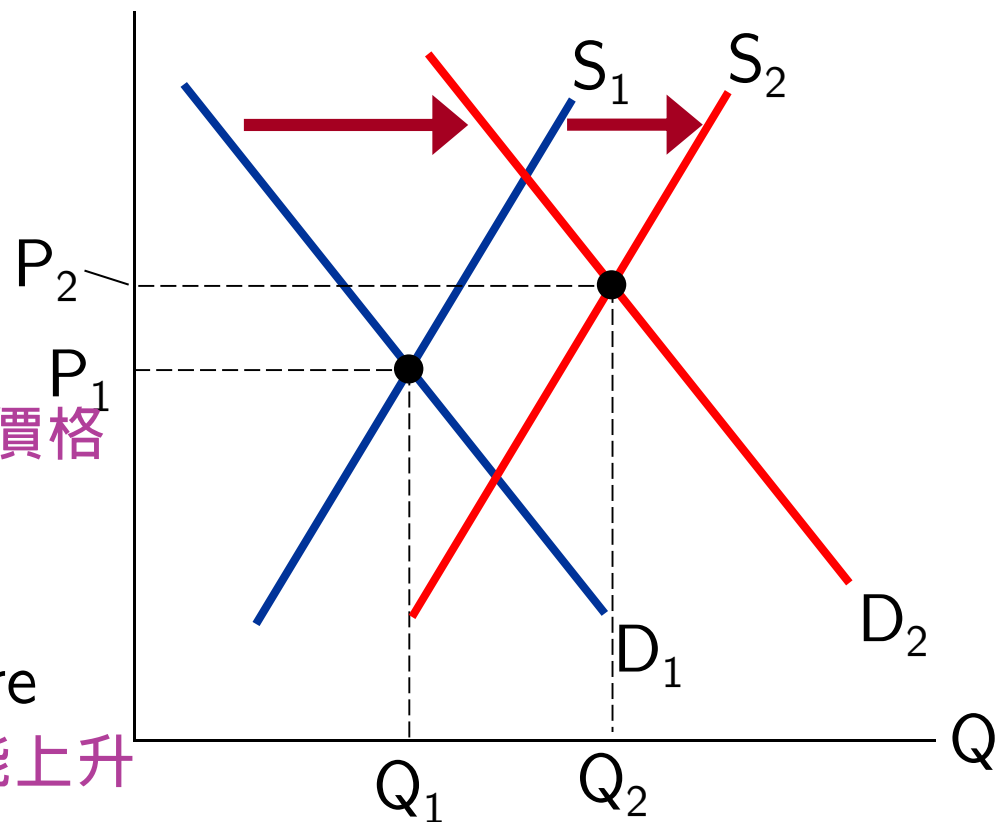
STEP 2: 都右移

Both shift to the right.

STEP 3: 均衡數量上升但價格

Q rises, but effect on P is ambiguous:

If demand increases more than supply, P rises. 可能上升



EXAMPLE 3: A Shift in Both Supply & Demand

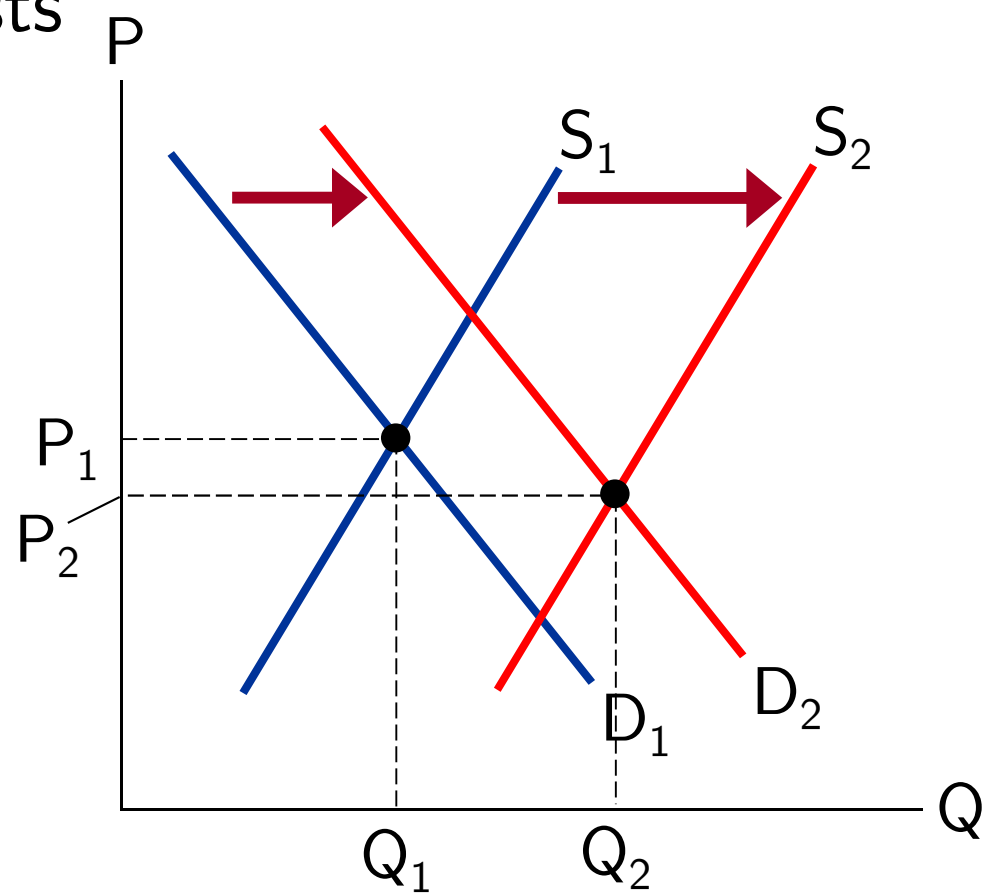
EVENTS: Price of gas rises AND new technology reduces production costs

STEP 3, cont.

But if supply increases more than demand, P falls.

也可能下降

取決於哪條右移較多



Evidence-Based Economics Example

- ▶ Why do the price of roses increase right before Valentine's Day?

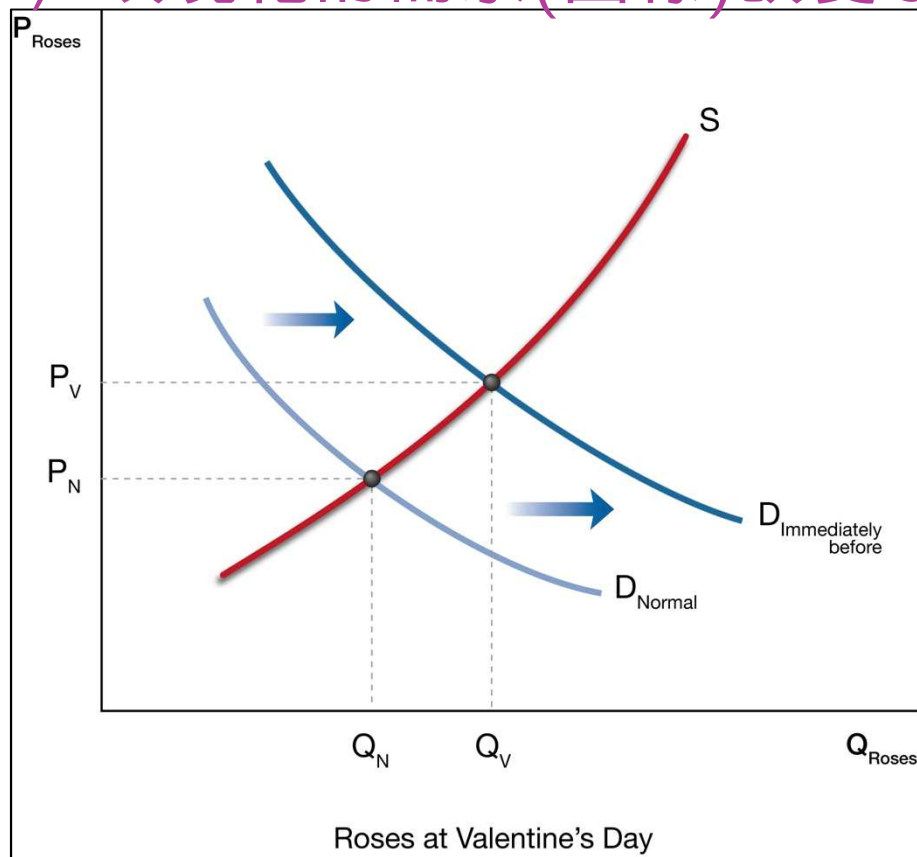
- ▶ 實證經濟學範例:
- ▶ 為什麼每到情人節玫瑰花就會漲價?



Evidence-Based Economics Example

► Change in Demand for Roses

► 在情人節，玫瑰花的需求(曲線)改變了!



Evidence-Based Economics Example

- ▶ Why can't you find a Ubike?
 - ▶ 實證經濟學範例:
 - ▶ 為什麼傍晚下課時你老是租不到Ubike?

104年4月1日起 YouBike會員於 **臺北市** 借車，
前 30分鐘 **自付5**元，超過30分鐘借車費用維持與現況相同。

*There will be an NT\$ 5 charge for the first 30 minutes in Taipei city starting April 1, 2015.
For rentals over 30 minutes, charges remain unchanged.*



Conclusion 結論

- ▶ In a perfectly competitive market,
 - ▶ (1) sellers all sell an identical good or service
 - ▶ (2) any individual buyer/seller isn't powerful enough on their own to affect the market price
 - ▶ 完全競爭市場：衆多賣家販賣相同產品，沒有人大到可以影響價格(因為兩邊都有完美替代品)。
- ▶ The demand curve plots the relationship between the market price and the quantity of a good demanded by buyers.
 - ▶ 需求曲線：市場價格跟買方需求數量的關係

Conclusion 結論

- ▶ The supply curve plots the relationship between the market price and the quantity of a good supplied by sellers.
 - ▶ 供給曲線：市場價格跟賣方供給數量的關係
- ▶ The competitive equilibrium price equates the quantity demanded and the quantity supplied. (競爭均衡價格 P 會使 $Q^D=Q^S$)
- ▶ When prices are not free to fluctuate, markets fail to equate quantity demanded and quantity supplied. (P 不能自由調整讓 $Q^D \neq Q^S$)

Conclusion 結論

- ▶ Supply, Demand, and Equilibrium
 - ▶ 供給 + 需求 = 均衡
 - ▶ Step 1: Identify which curve shifts (both?)
 - ▶ Step 2: Identify what direction did it shift
 - ▶ Step 3: Use the S/D graph to find how equilibrium price and quantity change
1. 哪條曲線移動，還是都有？
 2. 曲線是左移，還是右移？
 3. 用供需圖分析均衡價格和均衡數量如何改變。