

Econ 301: Managerial Economics

Topic 2: Market Forces

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Overview

- Demand and supply
- Consumer surplus (CS), Producer surplus (PS), Total surplus (TS), and Deadweight loss (DWL)
- Price and quantity determination in a competitive setting & comparative statics
- Taxes (both excise and ad valorem) and price controls (price ceilings and floors)

Demand

- **Demand:** maximum quantity consumers are willing and able to purchase at various prices.
- Demand can be represented as a table of data, a graph, or an equation (all of which can be thought of as **demand schedules**)
- Before in ECON 251, you represented demand as all of these, and the equation took the form $Q_x^d = f(P_x)$ or the inverse of that function, for example
 - $P = 100 - 2Q$ or
 - $Q_x^d = 50 - \frac{1}{2}P$.

Demand

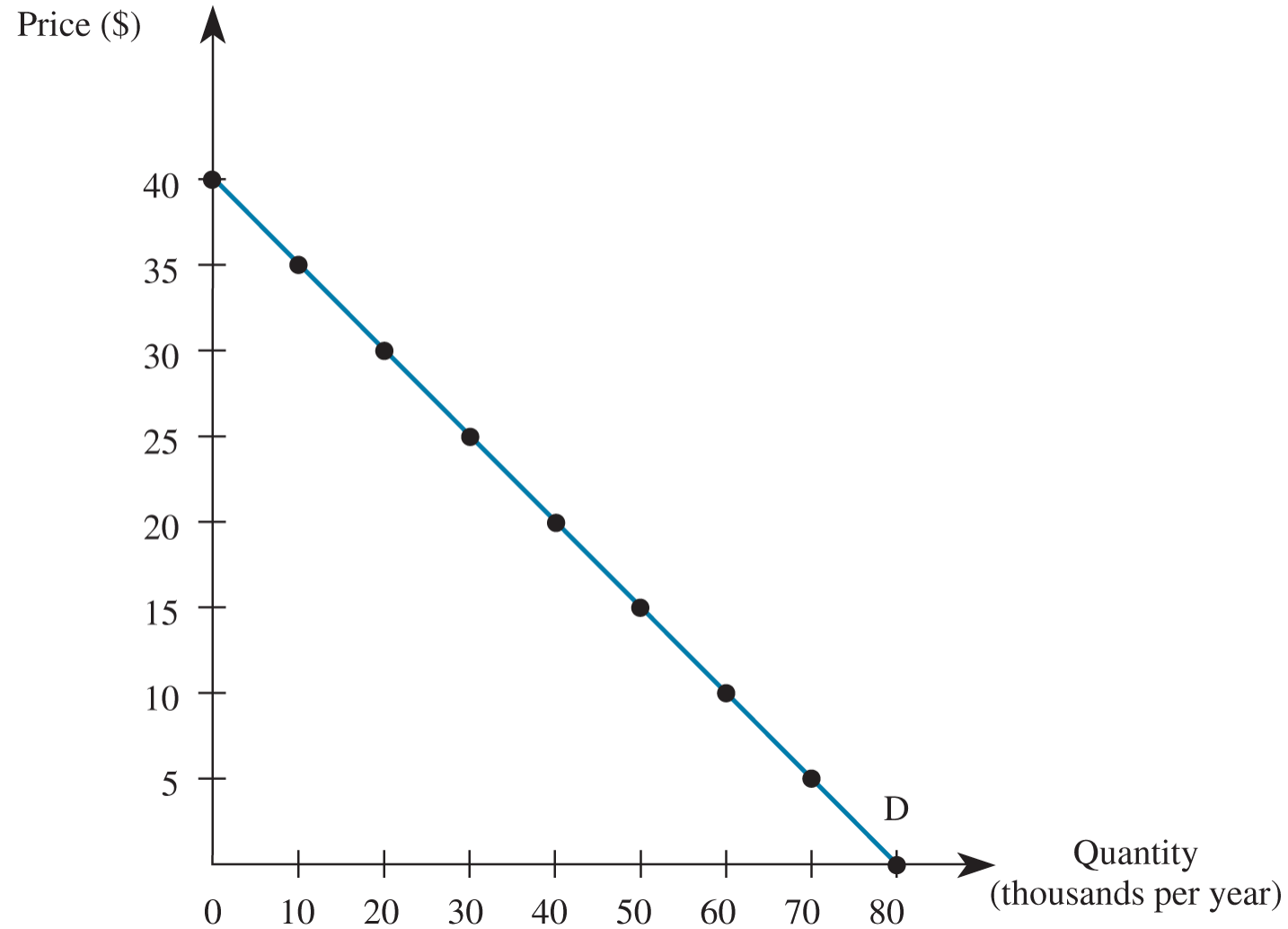
- **Law of demand**

- The quantity of a good consumers are *willing* and *able* to purchase increases (decreases) as the price falls (rises).
- Price and quantity demanded are inversely related.

- **Market demand curve**

- Illustrates the relationship between the total quantity and price per unit of a good all consumers are *willing* and *able* to purchase, holding other variables constant

The Demand Curve

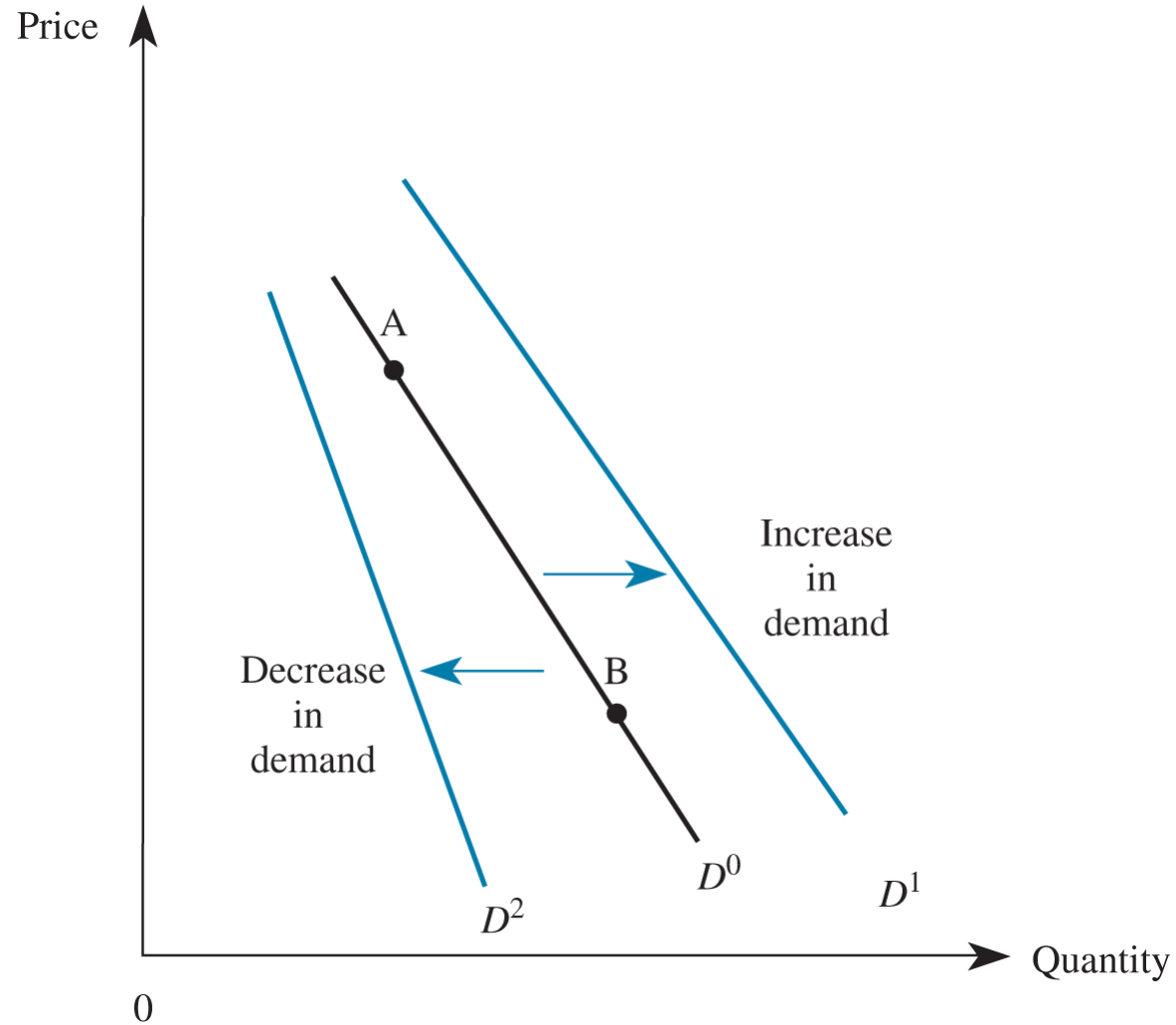


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Changes in Demand

- Changing *only* price leads to **changes in *quantity demanded***.
 - This type of change is graphically represented by a movement along a given demand curve, holding other factors that impact demand constant.
- Changing factors other than price leads to ***changes in demand***.
 - These types of changes are graphically represented by **a shift of the entire demand curve**.
 - In other words, at the same price there will be a new quantity demanded.

Changes in Demand



Changes in Demand (Shifts)

1. Income
 - Normal good
 - Inferior good
2. Prices of related goods
 - Substitutes
 - Complements
3. Advertising and consumer tastes
 - Informative advertising
 - Persuasive advertising
4. Population
5. Consumer expectations
6. Other factors

Income

Two types of goods

Normal Goods: Demand of normal goods increases as income rises.

- Steak
- Airline Travel
- Designer Clothes

Inferior Goods: Demand of Inferior goods falls as income rises.

- Instant Noodles/Potatoes
- Bus travel
- Generic clothes

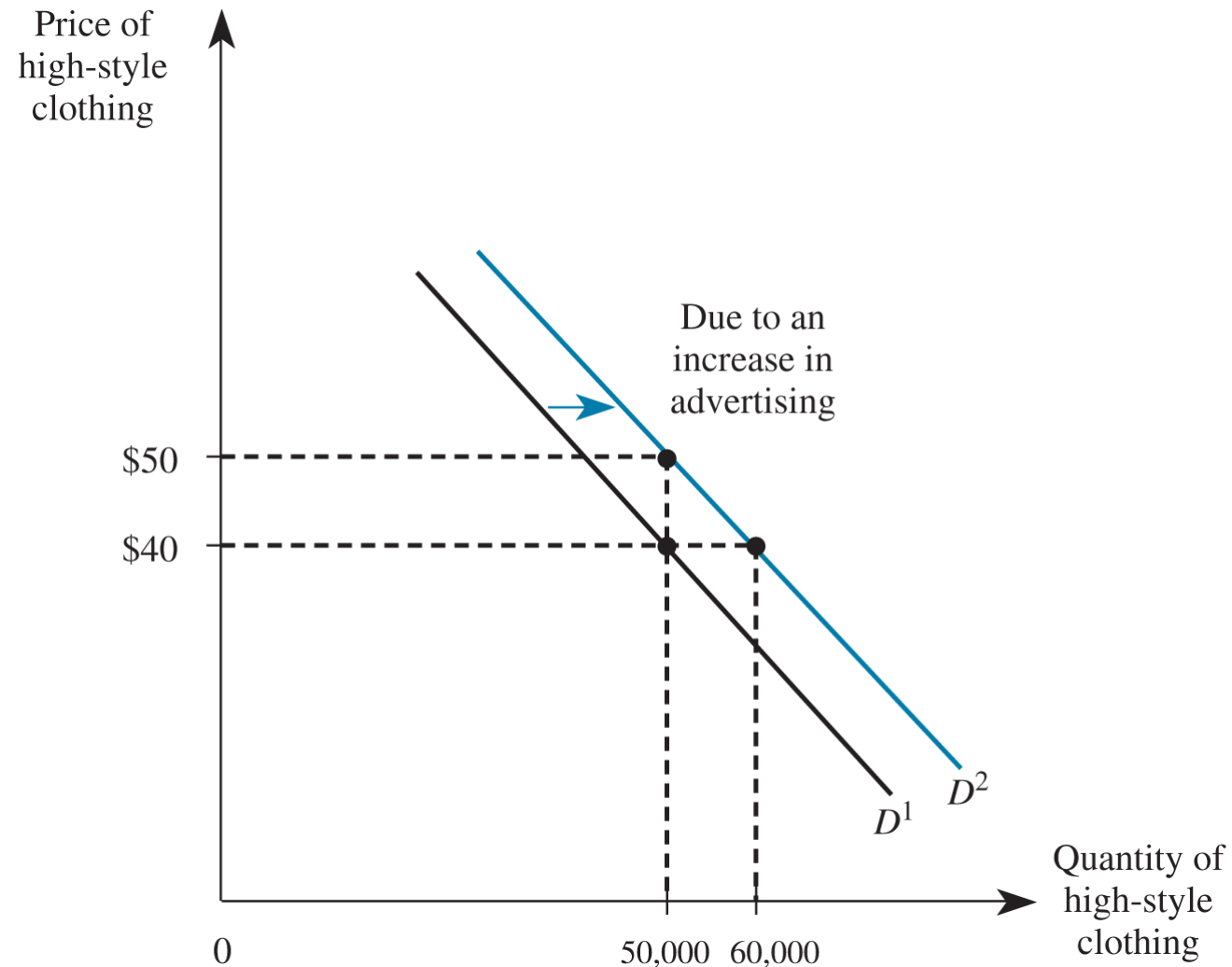
Prices of Related Goods

- Changes in prices of related goods generally shift the supply curve as the good of interest is either more or less attractive.
- A ‘similar’ type of good that people may consume instead of the good of interest is a **Substitute**.
 - As the prices of substitute falls (rises) the demand for a good decreases (increases)
- A good that is purchased (or used) with another good is a **complement**
 - As the prices of a complement falls (rises) the demand for a good increases (decreases)

Advertising & Consumer Tastes

- An increase in advertising can change demand for a few reasons:
 1. The 'noble' reason is that it provides consumers with information about the existence of a product.
 2. Can alter the underlying tastes of consumers (for better or worse).
 - Promoting fads
 - Appealing to identity
 - Subliminal Messaging?

Demand Increase Due to Advertising



Population

- How many people exist will affect the demand for products.
 - More people exist (ceteris paribus), demand should increase
 - Less people exist (ceteris paribus), demand should decrease
- The demographics of the population also matter
 - More people in 20s (more demand for beer)
 - More people in 30-40s (more demand for real estate)
 - More people in 80s (more demand for hip replacements).

Consumer Expectations

- Humans are smart (most of the time)!
- If they expect that prices will fall for a product in the future, they will hold off from buying it now (decreasing demand today)
- If they expect that prices will rise in the future, they will be more likely to 'rush' to buy the product today (increase demand).

Examples:

- Black Friday Sales
- Expectations of EV taxes/subsidies
- Price of bananas in climates where hurricanes/floods can happen.

Other Factors

- Covering all bases
- There may be other reasons that the demand curve shifts.
 - Health scares affect the demand of certain products (cigarettes)
 - The birth of a baby affects the demand of diapers
 - Purdue making the final 4 of March Madness affects the sales of Purdue final four merch.

Demand All Grown Up

- Let Q_x^d represent the quantity that people are willing to buy of good X.

Then demand is

$$Q_x^d = f\{P_x; P_y; M; H\}$$

- Where:
- P_x is the price of good X
- P_y is the price of good Y (or perhaps an index of other goods)
- M is income
- H is other variables that affect demand.

Estimating a Linear Demand Function

- One simple, but useful, representation of a demand function is the *linear demand function*:

$$Q_x^d = \alpha_0 + \alpha_x P_x + \alpha_y P_y + \alpha_M M + \alpha_H H$$

- where:
- Q_x^d • is the number of units of good X demanded;
- P_x • is the price of good X ;
- P_y • is the price of a related good Y ;
- M is income;
- H is the value of any other variable affecting demand.

Understanding a Linear Demand Function

- The signs and magnitude of the α coefficients determine the impact of each variable on the number of units of X demanded.

$$Q_x^d = \alpha_0 + \alpha_x P_x + \alpha_y P_y + \alpha_M M$$

- For example:
 - $\alpha_x < 0$ by the law of demand;
 - $\alpha_y > 0$ if good Y is a substitute for good X ;
 - $\alpha_M < 0$ if good X is an inferior good.

The Linear Demand Function in Action

- Suppose that an economic consultant for X Corp. recently provided the firm's marketing manager with this estimate of the demand function for the firm's product:

$$Q_x^d = 12,000 - 3P_x + 4P_y - 1M + 2A_x$$

- Question: How many of good X will consumers purchase when $P_x = \$200$ per unit, $P_y = \$15$ per unit, $M = \$10,000$ and $A_x = 2,000$?
- Are goods X and Y substitutes or complements? Is good X a normal or an inferior good?

The Inverse Demand Function

By setting $P_y = \$15$ and $M = \$10,000$ and $A_x = 2,000$ the demand function is

$$Q_x^d = 12,000 - 3P_x + 4(15) - 1(10,000) + 2(2,000)$$

the linear demand function simplifies to

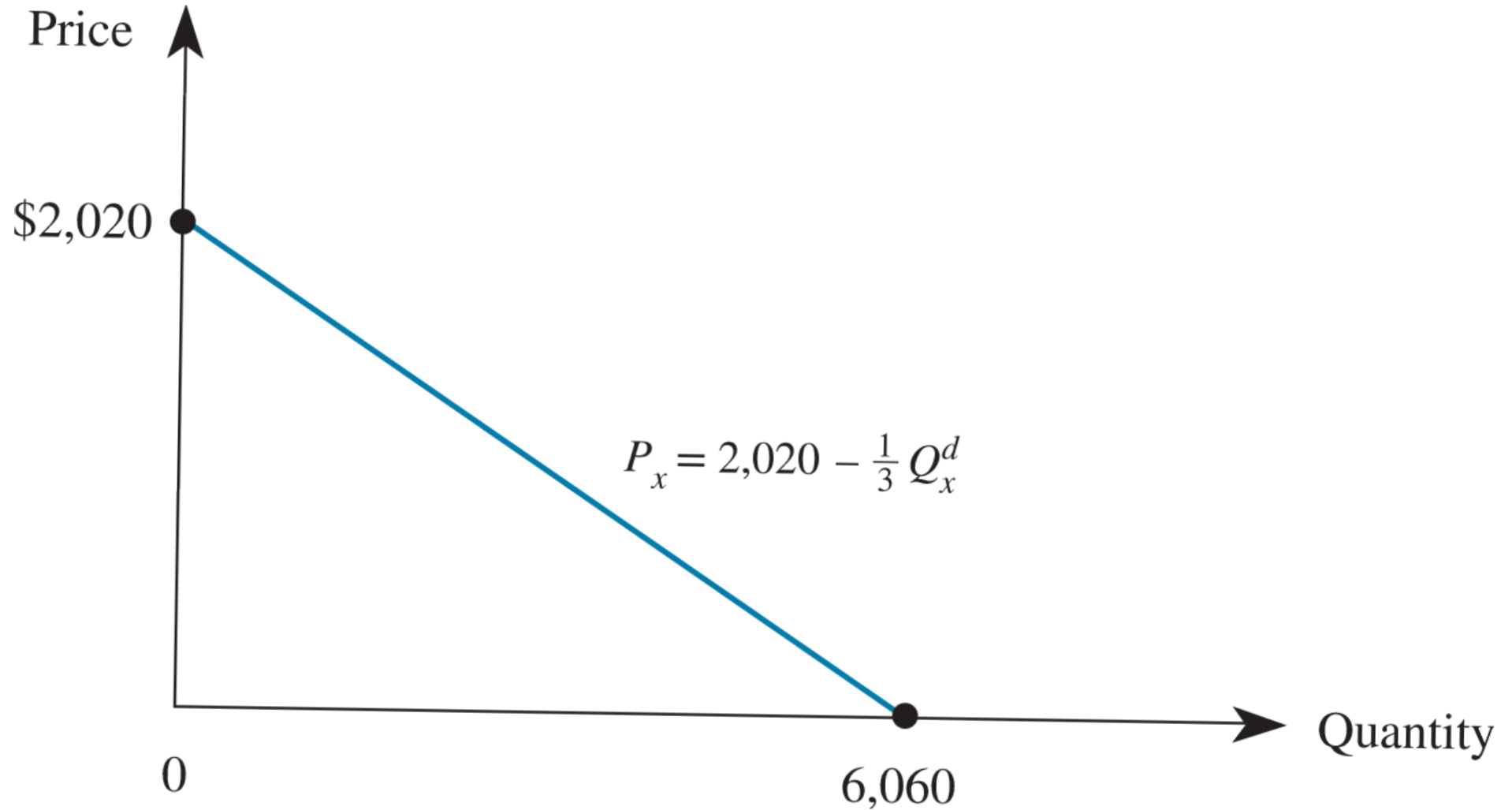
$$Q_x^d = 6,060 - 3P_x$$

Solving this for P_x in terms of Q_x^d results in

$$P_x = 2,020 - \frac{1}{3}Q_x^d$$

which is called the ***inverse demand function***. This function is used to construct a *market demand curve*.

Graphing the Inverse Demand Function



Consumer Surplus

Consumer surplus: the value consumers get from a good that they don't have to pay for (the textbook's definition)

- In other words, how much do you value a good?
 - Example: What is your marginal benefit from having a 6th slice of pizza? If you value it at \$2, you would not be willing to pay more than \$2 for it ($MC > MB$).
 - If you bought it for \$0.5, your consumer surplus is your Willingness to Pay for it (\$2) minus the amount you actually paid (50 cents).
 - $CS = \$2 - 0.5 = \1.5
- What is your WTP?
 - Think about the coffee game we did in class. When you sat down that was higher than your WTP
 - While you remained standing your $WTP > Price$, so you would have received consumer surplus at that price.

Consumer Surplus

Another Example: Assume a price of coffee is \$2 for all cups.

For your first cup of coffee, you derive \$10 of benefit from it (WTP).

- $CS = \$10 - \$2 = \$8$

For your second cup of coffee, you derive \$7 of benefit from it (WTP).

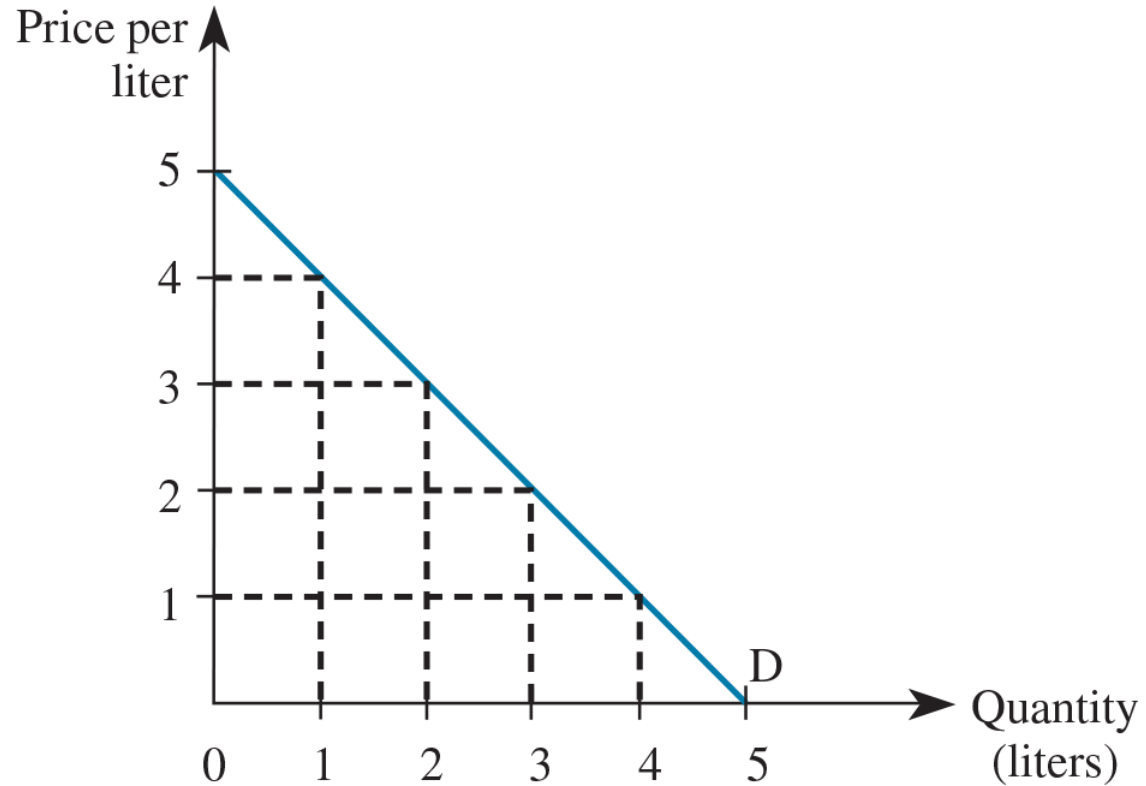
- $CS = \$7 - \$2 = \$5$

For your fourth cup of coffee, you derive \$2.01 of benefit from it (WTP).

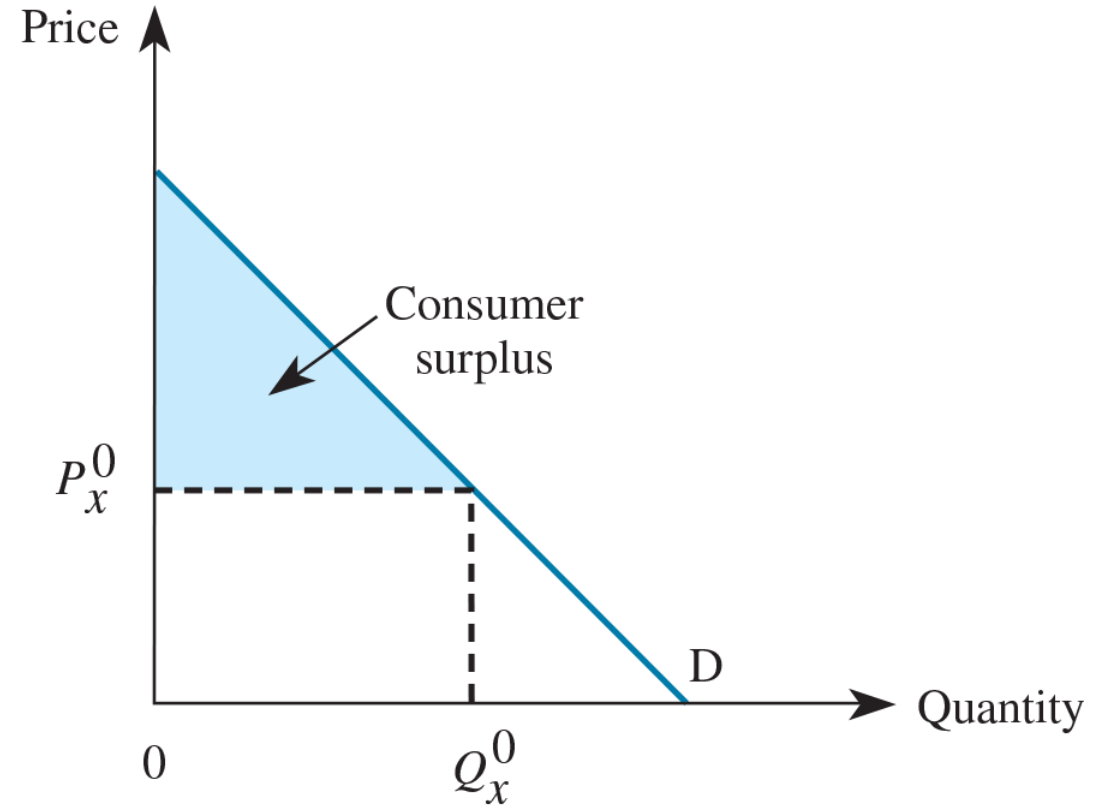
- $CS = \$2.01 - \$2 = \$0.01$

- You can do this for all possible cups of coffee, then add up the difference between what you were willing to pay for each cup and the price you paid, up to the last cup of coffee you end up buying (the quantity actually sold)
 - This allows you to determine for each individual, how much quantity they demand at that price.

Consumer Surplus



(a)



(b)

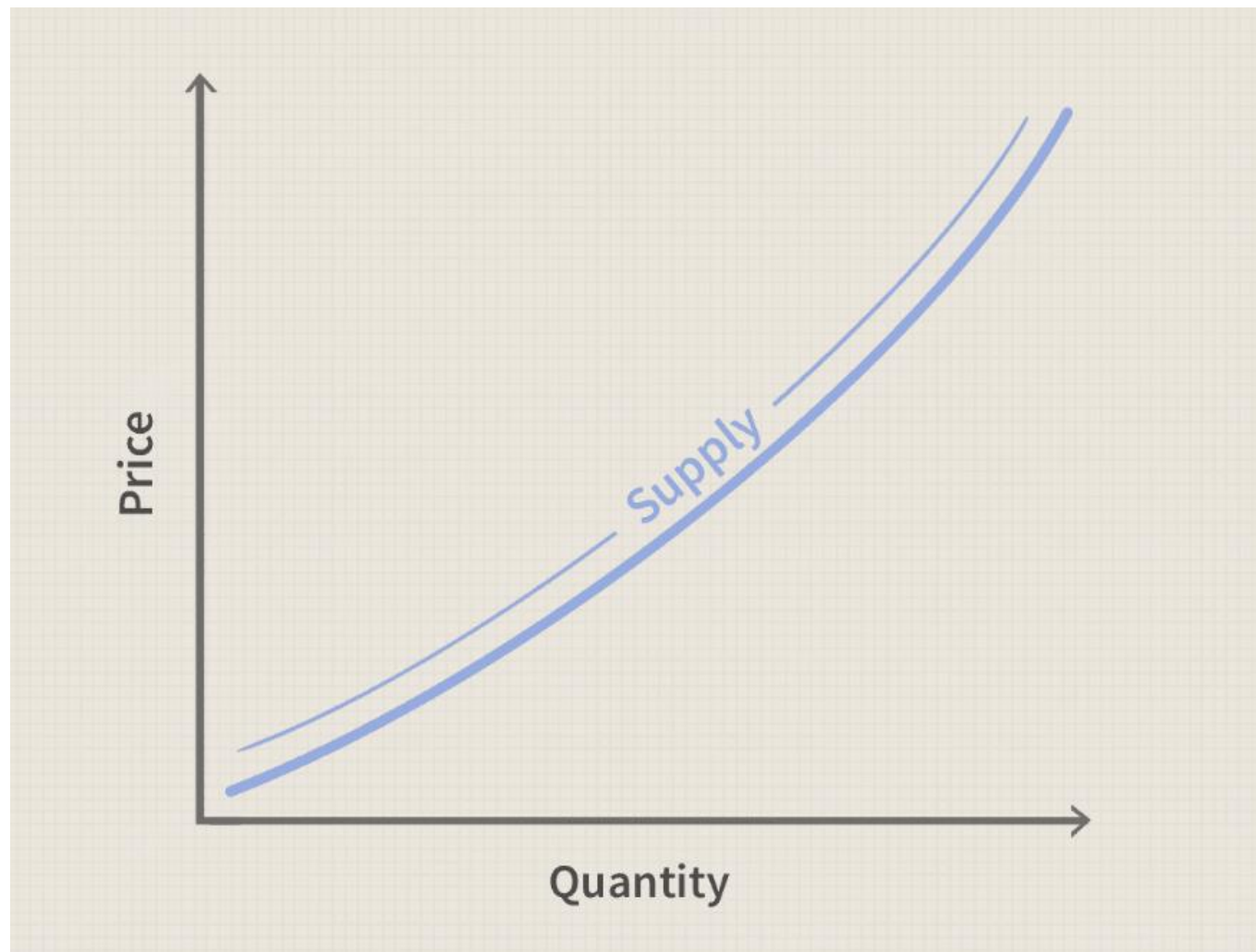
Supply

- **Supply:** Supply: the maximum quantity a seller is willing and able to sell at various prices.
 - Supply can be represented as a table of data, a graph, or an equation.

Market supply curve

- A curve indicating the total quantity of a good that all producers in a competitive market would produce at each price, holding input prices, technology, and other variables affecting supply constant
- **Law of supply**
- As the price of a good rises (falls), the quantity supplied of the good rises (falls), holding other factors affecting supply constant.

Supply



Supply

- Supply: the maximum quantity a seller is willing and able to sell at various prices
- Supply can be represented as a table of data, a graph, or an equation.

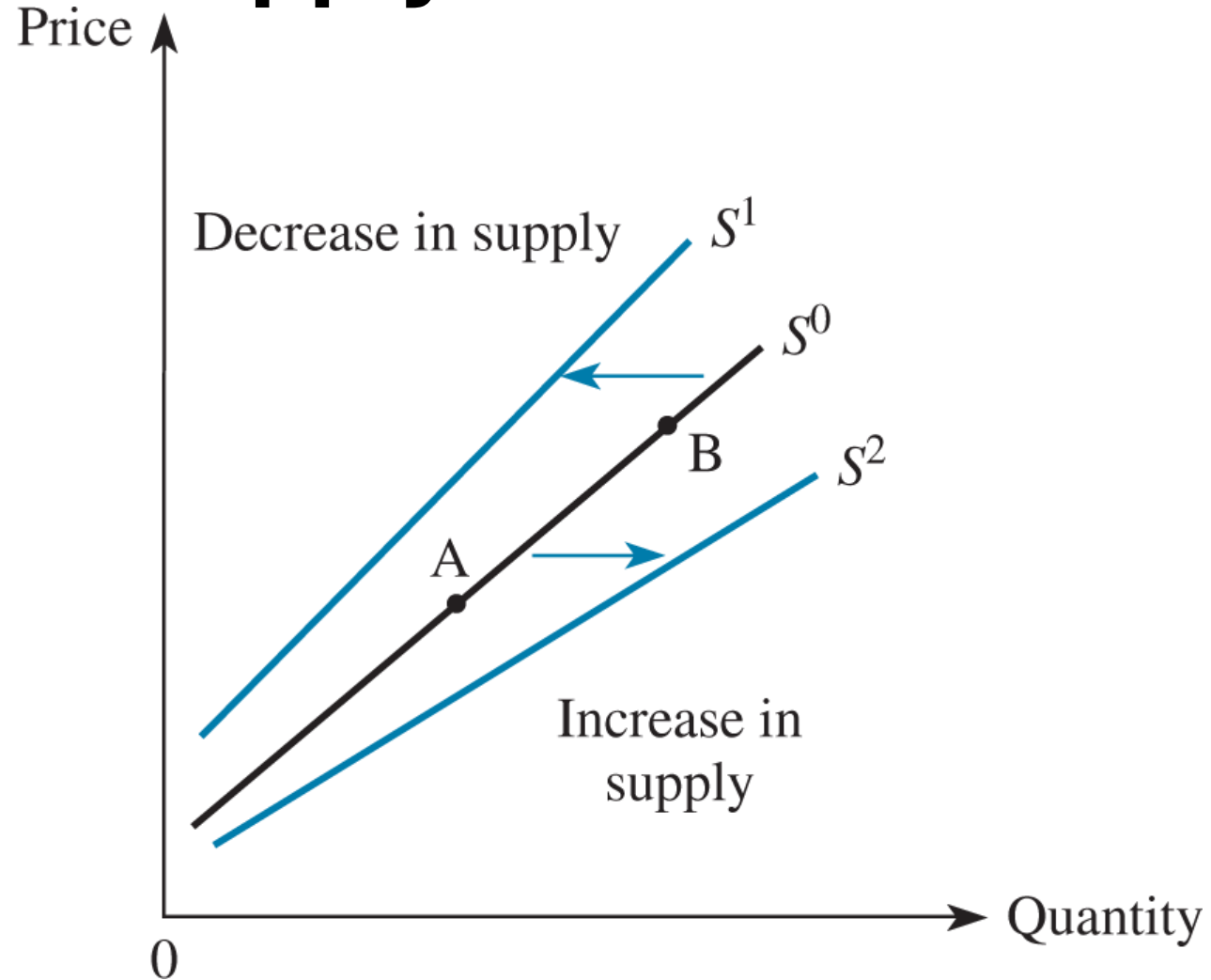
Let the supply curve be represented by $Q_x^S = f\{P_x; P; W; H\}$

- Where:
 - P_x is the price of good X
 - P_z is the price of good Z (or perhaps an index of other goods)
 - W is wages paid for inputs to production
 - H is other variables that affect supply.

Changes in Supply

- Changing only price leads to **changes in *quantity supplied***.
 - This type of change is graphically represented by a movement along a given supply curve, holding other factors that impact supply constant.
- Changing factors other than price leads to ***changes in supply***.
 - These types of changes are graphically represented by a shift of the entire supply curve.

Changes in Supply



Changes in Supply (Shifts)

1. Input prices
2. Technology or government regulation
3. Number of firms
 - Entry
 - Exit
4. Substitutes in production
5. Taxes
 - **Excise tax**: a tax on each unit of output sold, where tax revenue is collected from the supplier
 - **Ad valorem tax**: percentage tax
6. Producer expectations

Input Prices

- As production costs increase (decrease), each unit of the product is now more (less) expensive to create.
- This means the minimum amount of money you are Willing to Accept for each unit increases (decreases).
- This shifts supply up and to the left (down and to the right).

Technology or Government Regulation

- Government policies can affect the cost of production. Same with technologies.
- For example the policies of NAFTA (North American Free Trade Agreement), lowered the input prices for many firms in America, shifting the supply curve down and to the right.
- New technologies that are more efficient (cheaper) can also make it cheaper to produce a product. Shifting supply down and to the right.
- Conversely, natural disasters that destroy existing technologies and government regulations such as quotas on carbon emissions can have adverse effects on businesses
 - Shifting supply up and to the left.

Number of Firms

- As more firms enter the industry, competition increases-> more output is available at the same price -> this shifts supply down and to the right.
- Similarly, if firms leave the industry, competition decreases -> less output is available at the same price -> this shifts supply up and to the right.

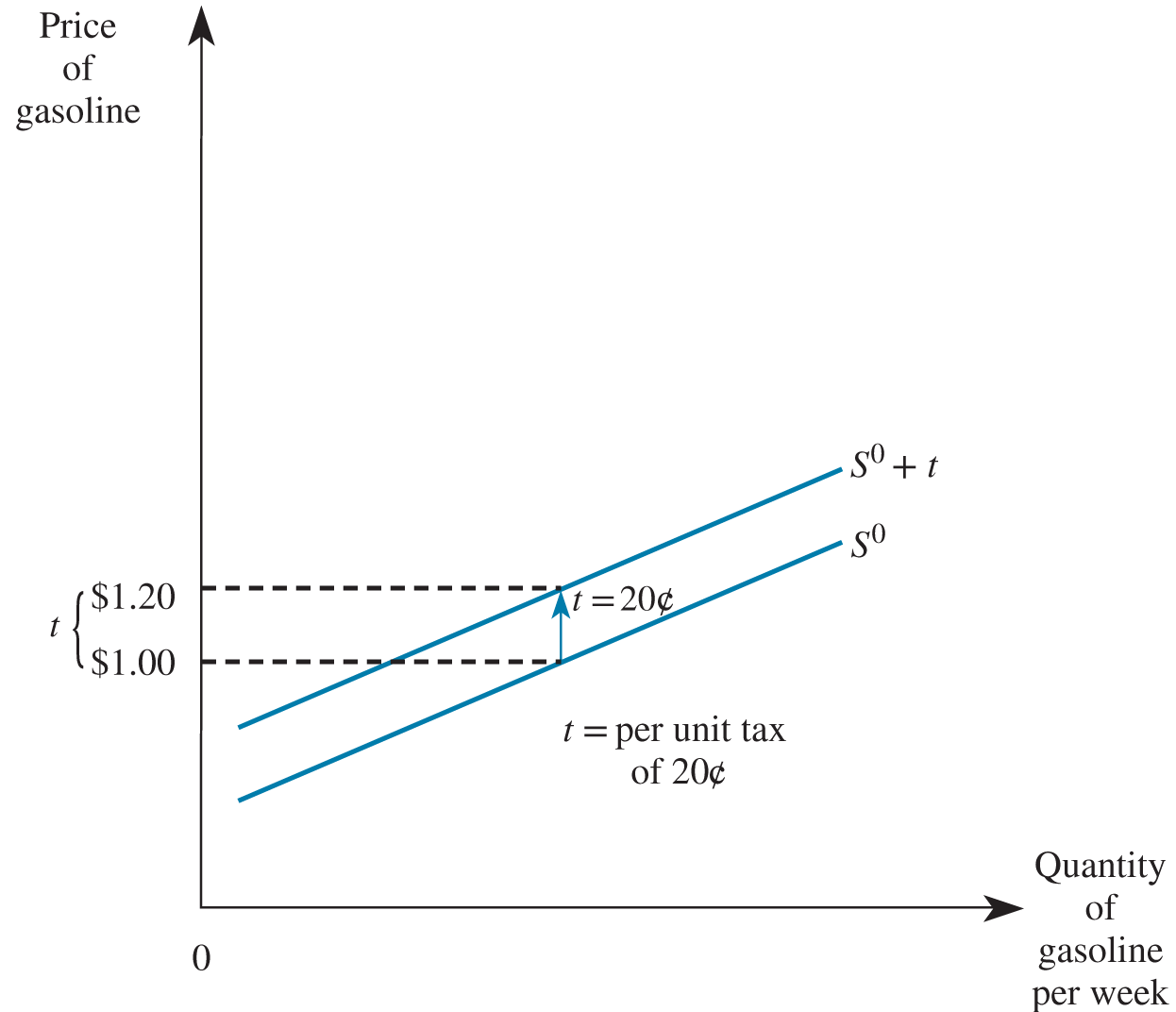
Substitutes in Production

- Many firms have technologies (or processes) that are adaptable to several products.
- For Example; Automakers can use assembly lines to make trucks or cars.
- If the prices of cars rise, automakers will convert truck assembly lines to car assembly lines (as they can make more profit).
- This will decrease the number of trucks produced at a specific price point, shifting the supply curve of trucks up and to the left

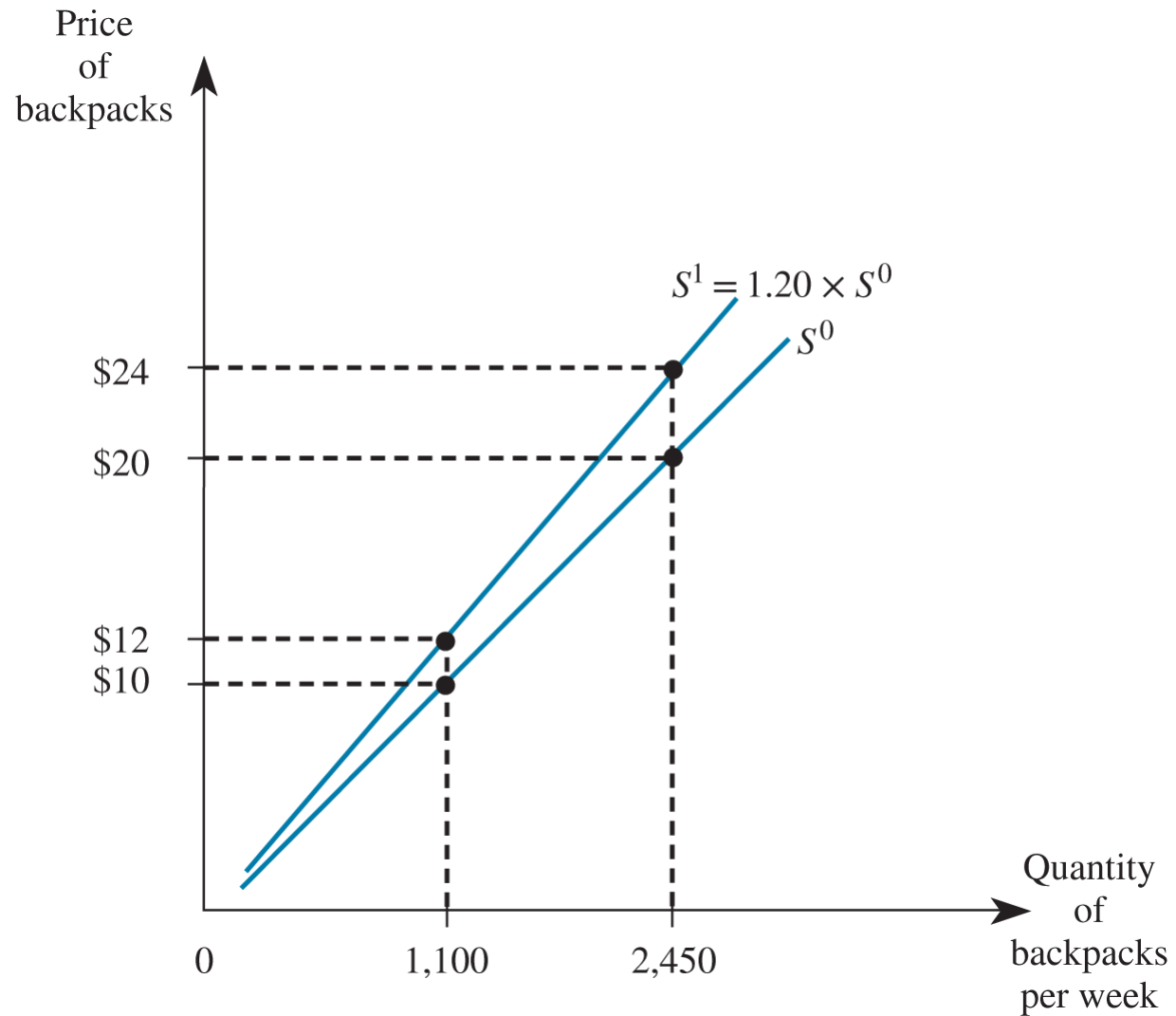
Taxes

- *Shifts the supply curve up and to the left (decreasing supply at the same price).*
- **Excise tax:** a tax on each unit of output sold, where tax revenue is collected from the supplier.
 - Flat rate
- **Ad valorem tax:** A percentage tax
 - According to value

Excise Tax (Price per unit)



Ad Valorem Tax



The Linear Supply Function

- One simple, but useful, representation of a supply function is the **linear supply function**:

$$Q_x^s = \beta_0 + \beta_x P_x + \beta_r P_r + \beta_w W + \beta_H H$$

- Q_x^s is the number of units of good X produced;
- P_x is the price of good X ;
- W is the price of an input;
- P_r is price of technologically related goods;
- H is the value of any other variable affecting supply.

Understanding the Linear Supply Function

- The signs and magnitude of the β coefficients determine the impact of each variable on the number of units of X produced.

$$Q_x^s = \beta_0 + \beta_x P_x + \beta_w W + \beta_r P_r$$

- For example:
- $\beta_x > 0$ by the law of supply.
- $\beta_w < 0$ increasing input price.
- $\beta_r > 0$ technology lowers the cost of producing good X .

The Linear Supply Function in Action

- Your research department estimates that the supply function for high definition televisions (HDTVs) is given by:

$$Q_x^s = 2,000 + 3P_x - 4P_t - 1P_w$$

- Question: How many televisions are produced when $P_x = \$400$, $P_t = \$250$ per unit, and $P_w = \$1,400$?

Inverse Supply Function

By setting $P_w = \$1,400$ and $P_t = \$250$ in

$$Q_x^s = 2,000 + 3P_x - 4(250) - 1(1,400)$$

the linear supply function simplifies to

$$Q_x^s = 3P_x - 400$$

Solving this for P_x in terms of Q_x^s results in

$$P_x = \frac{400}{3} + \frac{1}{3}Q_x^s$$

- which is called the ***inverse supply function***. This function is used to construct a *market supply curve*.

Producer Surplus

- **Producer surplus:** The amount producers receive in excess of the amount necessary to induce them to produce the good.
 - Producers want the price to be as low as possible. If the price is higher than the cost of making an extra unit, then they will produce that extra unit.
- What is your WTA?
 - Think about the vegemite game we did in class. When you sat down the price was lower than your WTA.
 - While you remained standing the $\text{Price} > \text{WTA}$, so you would have received producer surplus at that price.

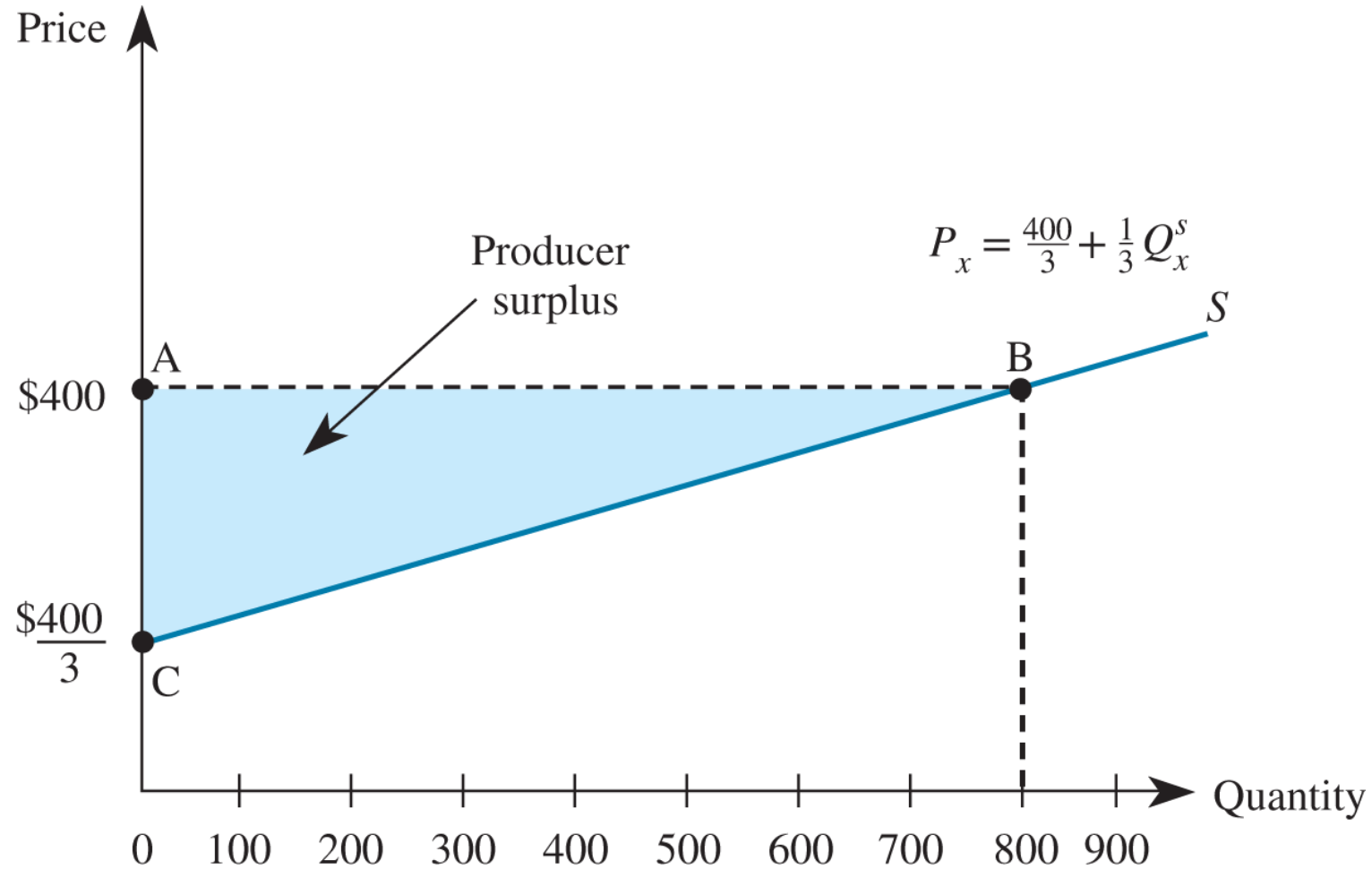
Producer Surplus

- Suppose a seller's supply curve is $P = 44 + 2Q$
- In order to be willing to sell $Q=20$ units, what price must they receive?
- Suppose this firm operates in a perfectly competitive market, and they know they can sell this good for \$100. How much do they get in excess of that price they were willing to sell that 20th unit for?

Producer Surplus

- Suppose a seller's supply curve is $P = 44 + 2Q$
- In order to be willing to sell $Q=20$ units, what price must they receive?
- At $Q=20$, their Marginal Cost of Producing the 20th unit is $44 + 2 \cdot 20 = \$84$
- If they can receive \$100 for selling this 20th unit, they receive
 - $100 - 84 = \$16$ producer surplus.

Producer Surplus

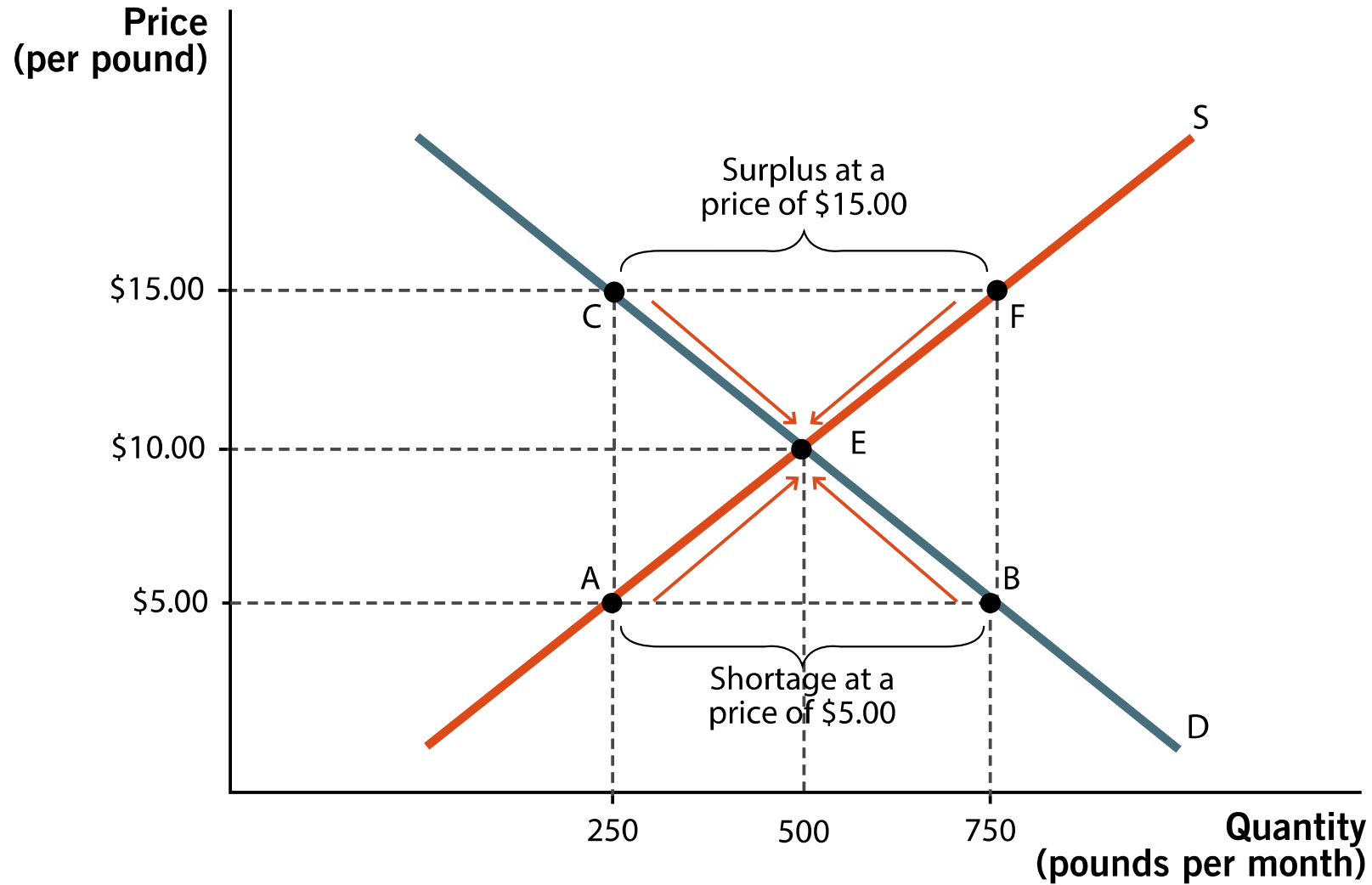


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Market Equilibrium

- **Competitive Market Equilibrium**
- Determined by the intersection of the market **demand** and market **supply** curves
- A price and quantity such that there is no shortage or surplus in the market
- Forces that drive market demand and market supply are balanced, and there is no pressure on prices or quantities to change.
- The equilibrium price is the price that equates quantity demanded with quantity supplied.

Market Equilibrium



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Shortages & Surpluses

- If $Q^d > Q^s$ (at a given price in a market, there is a shortage
 - Prices will rise to clear the shortage
- If $Q^d < Q^s$ (at a given price in a market, there is a surplus
 - Prices will lower to clear the surplus
- If $Q^d = Q^s$ (at a given price in a market, there is neither a surplus nor shortage and therefore no incentive for price to rise or fall and the market has reached an equilibrium
- At equilibrium

$$P^*: Q^d = Q^s = Q^*$$

- To find the market equilibrium (P^*, Q^*) solve the system of two equations

Market Equilibrium in Action

- Consider a market with demand and supply functions, respectively, as

$$Q^d = 10 - 2P \text{ and } Q^s = 2 + 2P$$

- A competitive market equilibrium exists at a price, P^e , such that $Q^d(P^e) = Q^s(P^e)$. That is,

$$10 - 2P = 2 + 2P$$

$$8 = 4P$$

$$P^e = \$2$$

$$Q^e = 10 - 2(\$2) = 6 \text{ and } Q^e = 2 + 2(\$2) = 6$$

$$Q^e = 6 \text{ units}$$

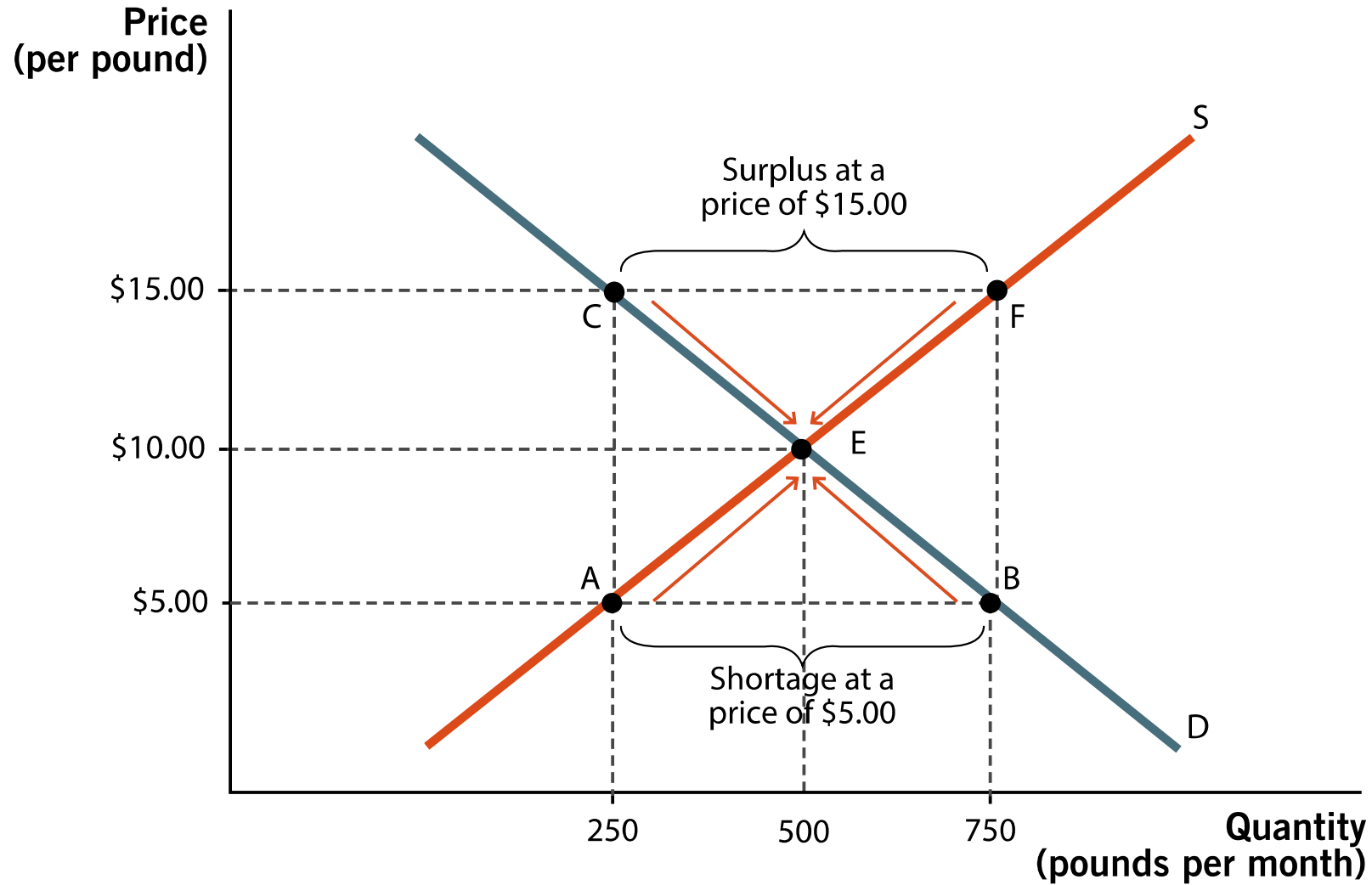
How to allocate resources?

- Resources are scarce, we can't give everyone everything!
 - This means some people who 'want' a good may not get it.
- How do we decide how to allocate resources to people?
 - First come first served?
 - Hair colour?
- Free market economics uses a price system to allocate resources.
 - People who are willing to pay (and able to) receive the good.
- Economists argue that is an efficient way of allocating resources as it maximizes overall surplus.
 - Efficiency does not necessarily equal fair

Price Controls

- **Price controls** limit how high or low a price is legally allowed to go.
- **Price ceilings** limit how high a price can go. When a price ceiling is set below the equilibrium price, shortages result.
 - Example: in our market example, if $P_{\text{ceiling}} = \$5,000$, this would result in a shortage because it is a binding price ceiling.
- **Price floors** limit how low a price can go. When a price floor is set above the equilibrium price, surpluses result.
 - Example: in our market example, if $P_{\text{floor}} = \$15,000$, this would result in a surplus because it is a binding price floor.

Market Equilibrium

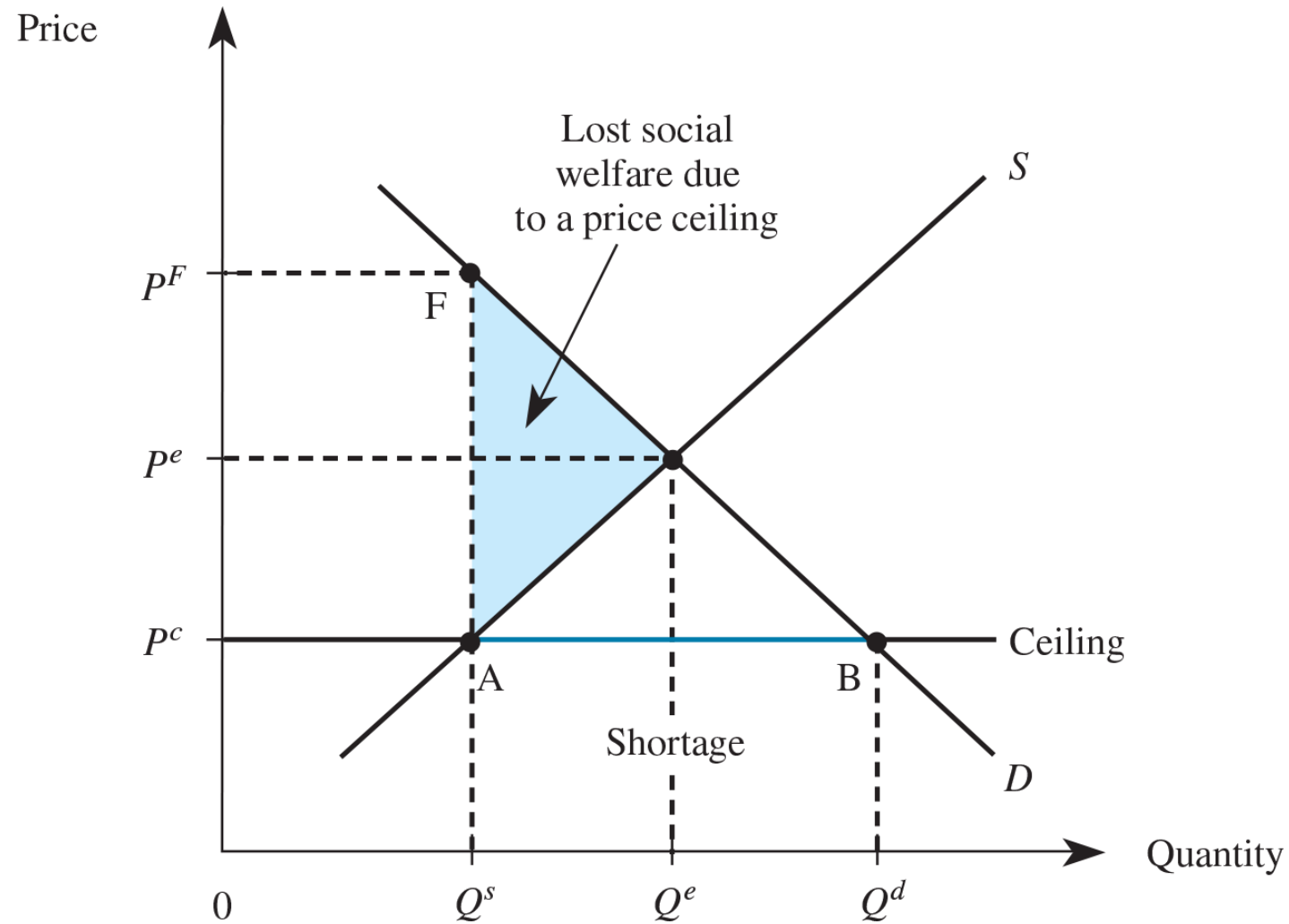


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Price Controls

- A price control is ***binding*** if it pushes the market away from its equilibrium. A price control is ***non-binding*** if it has no effect on a market
- Example 1: in our market example, if $P_{\text{floor}} = \$5,000$, this would have no effect on our market because equilibrium price is already higher than the floor, so this would be a non-binding price floor.
- Example 2: in our market example, if $P_{\text{ceiling}} = \$16,000$, this would have no effect on our market because equilibrium price is already lower than the ceiling, so this would be a non-binding price floor.

Price Ceilings and deadweight loss



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Price Ceiling in Action

Assume we have the following two supply and demand equations:

$$Q_x^d = 50 - 2P_x$$

$$Q_x^s = 0.5P_x - 5$$

The competitive equilibrium is

$$Q_x^d = Q_x^s$$
$$50 - 2P_x = 0.5P_x - 5$$

$$55 = 2.5P_x$$

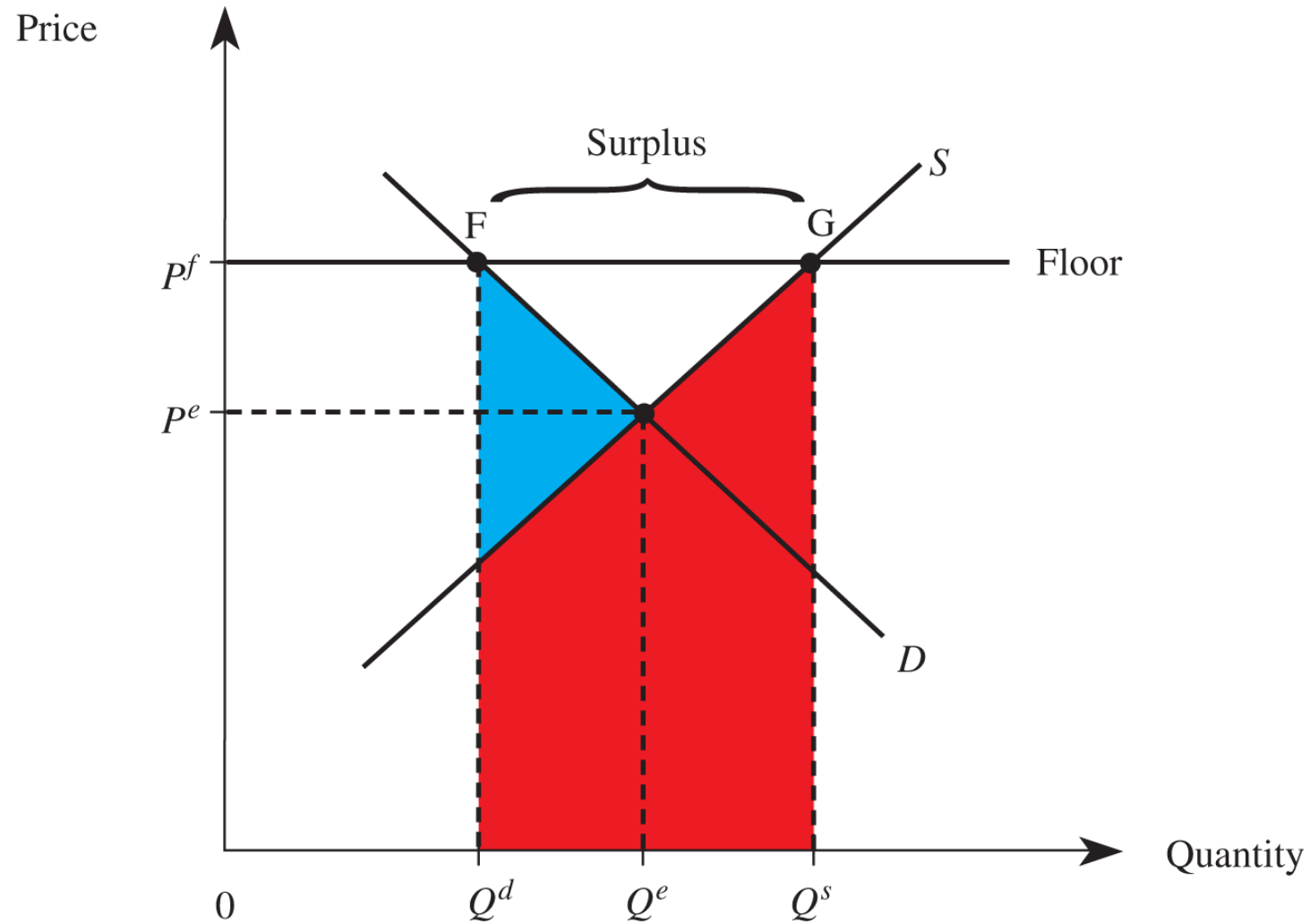
$$P_x = \$22$$

$$Q_x^d = Q_x^s = 6$$

Price Ceiling in Action

What if we introduce a price ceiling of \$15

Price Floors



Price Floor in Action

What if we introduce a price Floor of \$24

Price Floor Nuances

The costs of a price floor can differ depending on how it is implemented.

Minimum Wage: The MW is a classic example of a price floor (firms can't pay less than the MW). While this will distort the market, the DWL will only be the blue triangle area.

Products (agriculture) d: However, when a price floor is implemented for a product, sellers will overproduce that product. This means costs for these products will not be recuperated (red area).

- The Government may sometimes purchase the surplus (*price support*).
 - *The total cost to the government is $P^F(Q_s - Q_D)$*
 - Note: This is still deadweight loss if the government can't redistribute (or find other use) for the products.

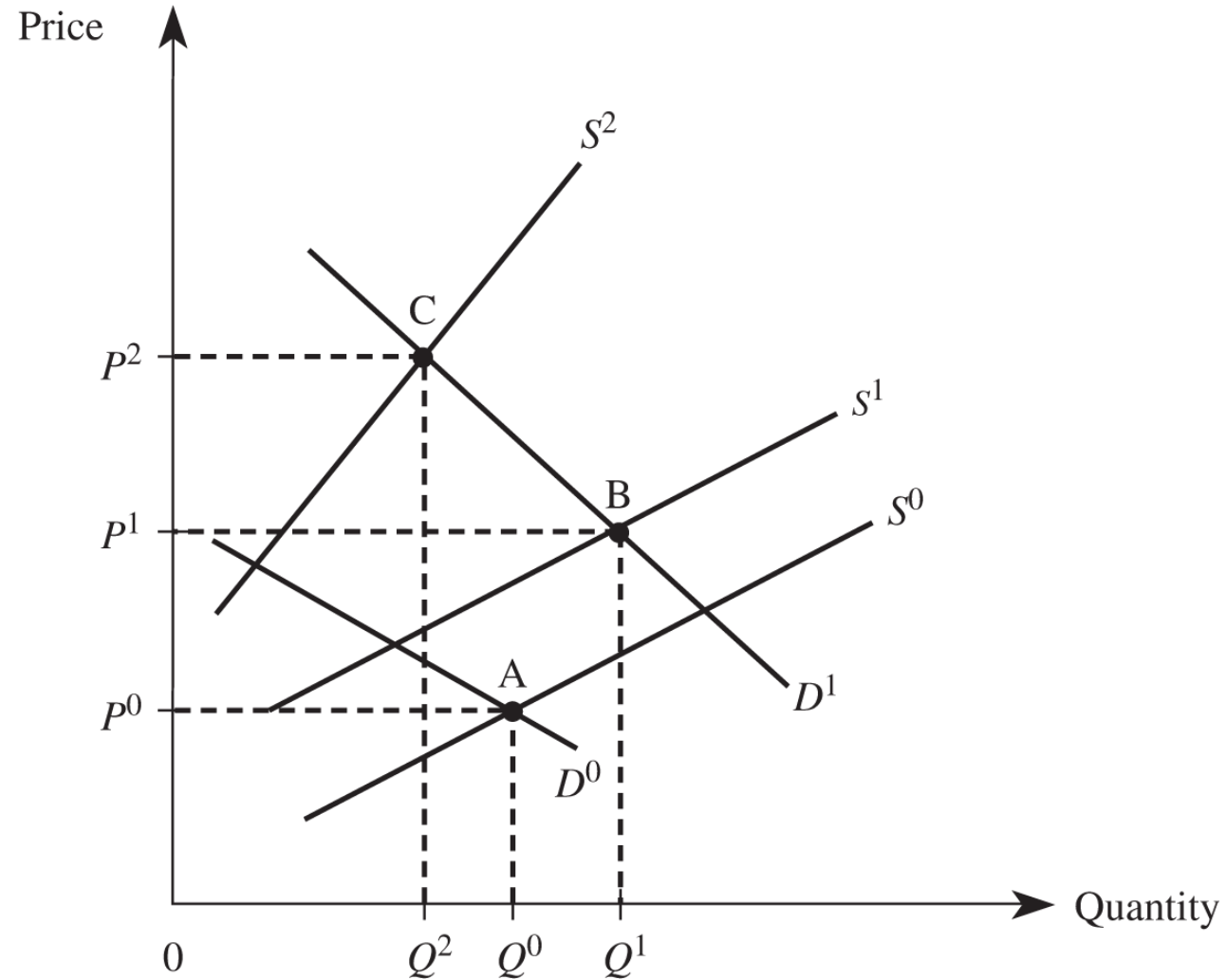
Comparative Statics

- ***Comparative static analysis***
 - The study of the movement from one equilibrium to another
- Competitive markets, operating free of price restraints, will be analyzed when:
 - Demand changes.
 - Supply changes.
 - Demand and supply simultaneously change.
- We have already looked at what happens when supply and demand change on their own
 - Demand increases (equilibrium price and quantity increase)
 - Supply increases (equilibrium price decreases and quantity increases)

Simultaneous Shifts in Supply and Demand

- Suppose that simultaneously the following events occur:
- An earthquake hits Kobe, Japan, and decreases the supply of fermented rice used to make sake wine.
- The stress caused by the earthquake leads many to increase their demand for sake and other alcoholic beverages.
- What is the combined impact on Japan's sake market?
 - It depends!

Simultaneous Shifts in Supply and Demand



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Simultaneous Shifts in Supply and Demand

Table 2–2

Equilibrium Price and Quantity: The Impact of Simultaneous Shifts in Demand and Supply

Nature of the Change	Increase in Demand	Decrease in Demand
Increase in Supply	Price: Ambiguous	Price: Decreases
	Quantity: Increases	Quantity: Ambiguous
Decrease in Supply	Price: Increases	Price: Ambiguous
	Quantity: Ambiguous	Quantity: Decreases