Chapter 5

ELASTICITY

Chapter 5: Learning Outcomes
Elasticity

5.1 PRICE ELASTICITY OF DEMAND

- What is price elasticity of demand?
- How do we measure consumers' responses to price changes?
- How do we use the "midpoint method" in calculating price elasticities of demand?
- What determines the price elasticity of demand?

5.2 TOTAL REVENUE AND PRICE ELASTICITY OF DEMAND

- How does the price elasticity of demand impact total revenue?
- How does price elasticity of demand change along a linear demand curve?

Chapter 5: Learning Outcomes
Elasticity

5.3 OTHER DEMAND ELASTICITIES

- What is the cross-price elasticity of demand?
- What is the income elasticity of demand?

5.4 PRICE ELASTICITY OF SUPPLY

- What is the price elasticity of supply?
- How does time affect the supply elasticity?

5.5 ELASTICITY AND TAXES

- What is tax incidence?
- How does the relative elasticity of supply and demand determine the tax burden?

Chapter 5

5.1 Price Elasticity of Demand

5.2 Total Revenue and Price Elasticity of Demand

5.3 Other Demand Elasticities

5.4 Price Elasticity of Supply

5.5 Elasticity and Taxes

5.1 Price Elasticity of Demand

WHAT IS PRICE ELASTICITY OF DEMAND?

- The law of demand establishes that quantity demanded changes inversely with changes in price, *ceteris paribus*.
- Elasticity measures how much quantity changes.
- A demand curve or a portion of a demand curve can be elastic, unit elastic, or inelastic.

5.1 Price Elasticity of Demand

WHAT IS PRICE ELASTICITY OF DEMAND?

- measures how responsive quantity demanded is to a price change.
- defined as the percentage change in quantity demanded divided by the percentage change in price.

$$\text{Price elasticity of demand } (E_D) = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

5.1 Price Elasticity of Demand

WHAT IS PRICE ELASTICITY OF DEMAND?

- Since there is an inverse relationship between price and quantity demanded, price elasticity of demand is always negative.
- Elasticity is expressed in absolute value terms, as a positive number, for simplicity.

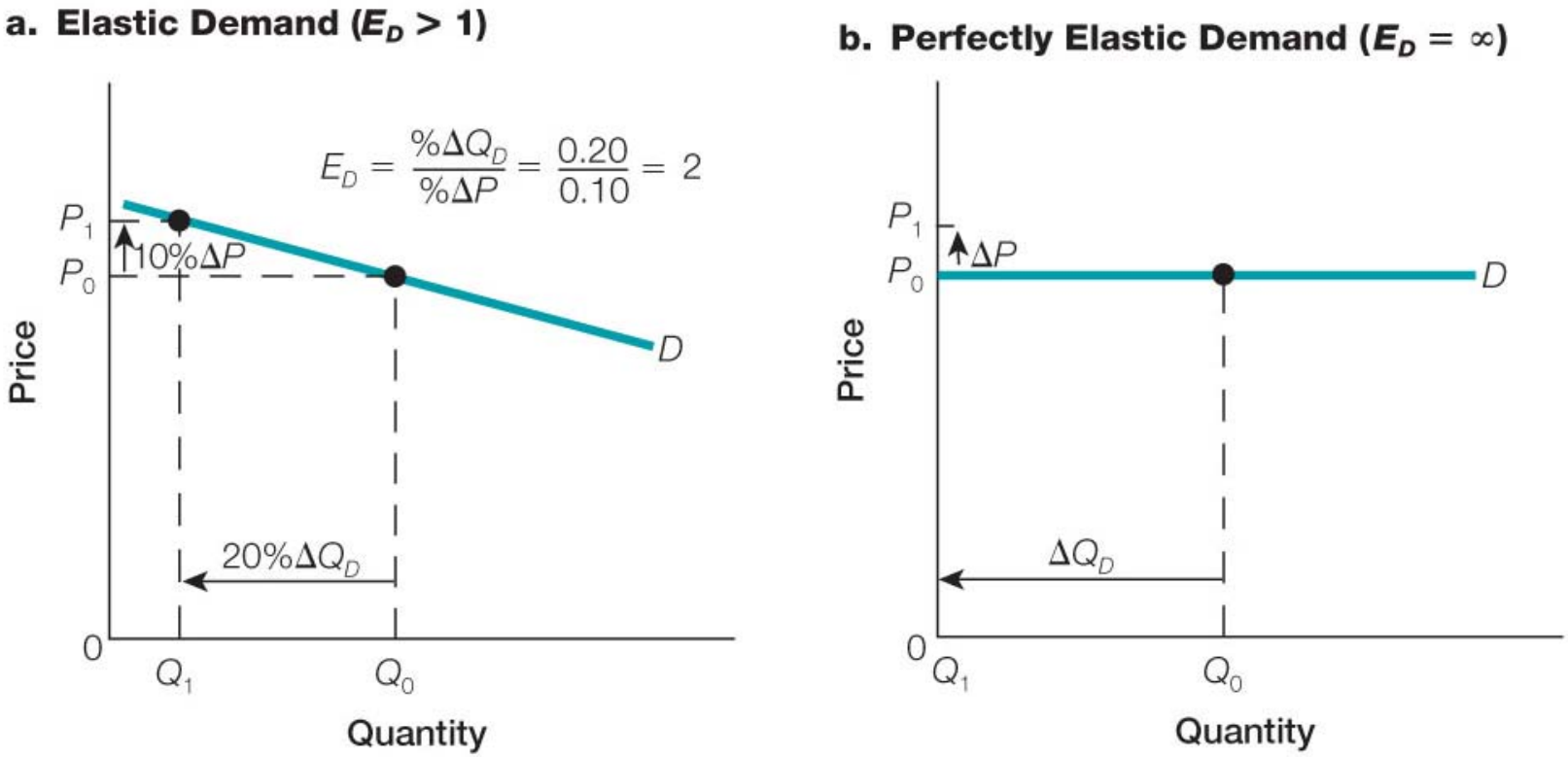
5.1 Price Elasticity of Demand

HOW DO WE MEASURE CONSUMERS' RESPONSES TO PRICE CHANGES?

- Demand is elastic if:
  - the quantity demanded is very responsive to even a small change in price.
  - the percentage change of quantity demanded is greater than the percentage change in price
  - the elasticity of demand is greater than 1

$$E_D > 1$$

5.1 Price Elasticity of Demand



5.1 Price Elasticity of Demand

HOW DO WE MEASURE CONSUMERS' RESPONSES TO PRICE CHANGES?

- Demand is perfectly elastic when:
  - a small increase in price causes the quantity demanded to fall to zero.
  - elasticity of demand is infinity, because the quantity demanded is infinitely responsive.
  - the demand curve is a horizontal line.

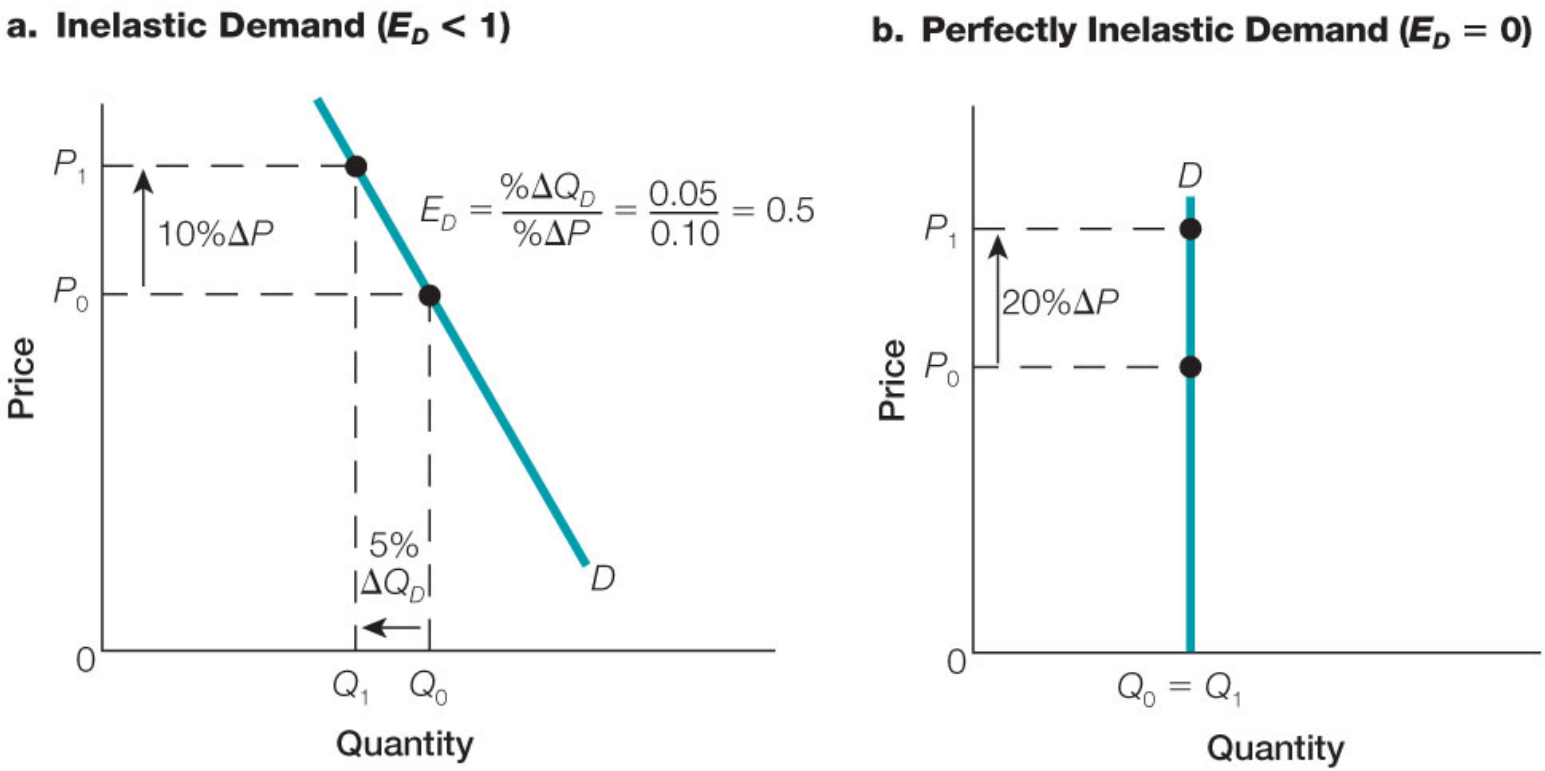
5.1 Price Elasticity of Demand

HOW DO WE MEASURE CONSUMERS' RESPONSES TO PRICE CHANGES?

- Demand is inelastic if:
  - the quantity demanded is not very responsive to a change in price.
  - the percentage change of quantity demanded is less than the percentage change in price
  - the elasticity of demand is less than 1

$$E_D < 1$$

5.1 Price Elasticity of Demand



5.1 Price Elasticity of Demand

HOW DO WE MEASURE CONSUMERS' RESPONSES TO PRICE CHANGES?

- Demand is perfectly inelastic when:
  - quantity demanded is the same regardless of price
  - elasticity of demand is zero, because the quantity demanded is not at all responsive to price.
  - the demand curve is a vertical line.

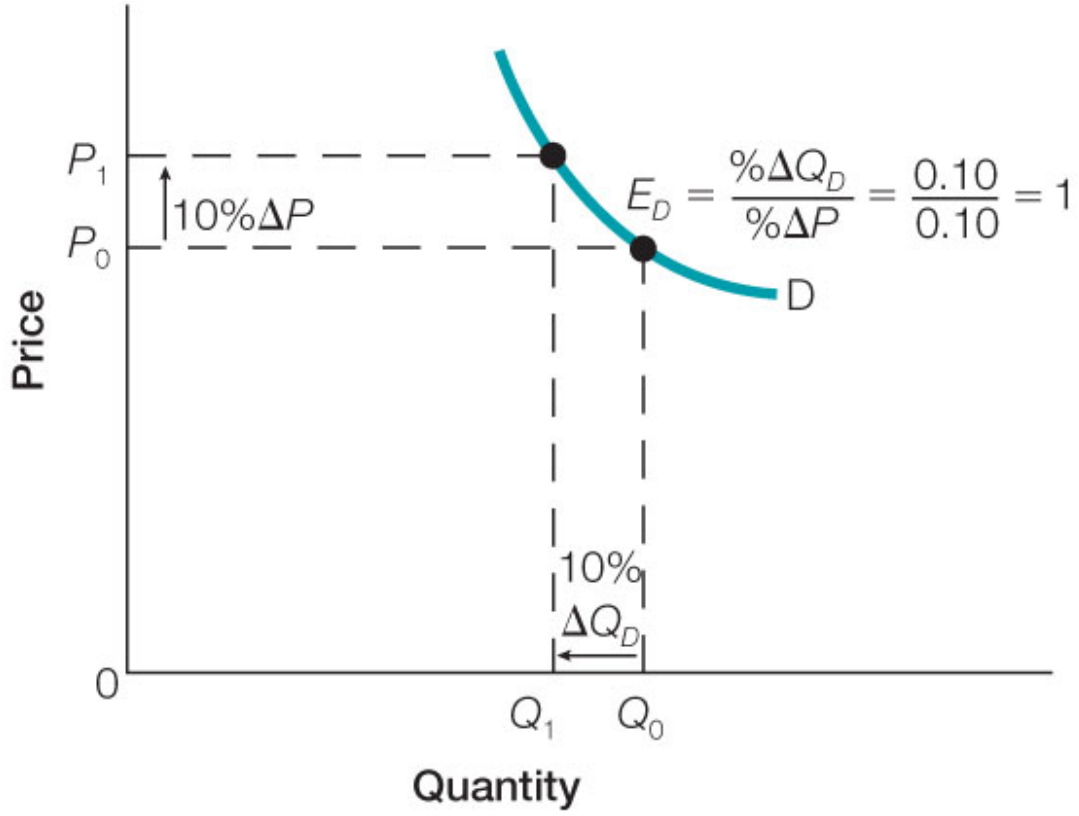
5.1 Price Elasticity of Demand

HOW DO WE MEASURE CONSUMERS' RESPONSES TO PRICE CHANGES?

- Demand is unit elastic if:
  - the percentage change of quantity demanded is equal to the percentage change in price
  - the elasticity of demand is exactly 1

$$E_D = 1$$

5.1 Price Elasticity of Demand



The percentage change in quantity demanded is the same as the percentage change in price that caused it ($E_D = 1$).

5.1 Price Elasticity of Demand

What determines the price elasticity of demand?

- Availability of close substitutes
- Narrowly defined goods
- Proportion of income spent on the good
- Time

5.1 Price Elasticity of Demand

What determines the price elasticity of demand?

1. Availability of Close Substitutes

- goods with close substitutes tend to have more elastic demands.
  - example: different brands of gasoline
- Goods without close substitutes tend to have inelastic demands
  - example: emergency medical care

5.1 Price Elasticity of Demand

What determines the price elasticity of demand?

2. Narrowly defined goods

- when demand for a good is broadly defined, it tends to be less elastic.
- demand for food (broad category) is inelastic, as there are few close substitutes
- demand for pizza (narrow category) is more elastic, as there are many substitutes

5.1 Price Elasticity of Demand

What determines the price elasticity of demand?

3. Proportion of Income Spent on Good

- the smaller the proportion of income spent on a good, the lower its elasticity of demand;
- change in price has little impact on a consumer's budget.

5.1 Price Elasticity of Demand

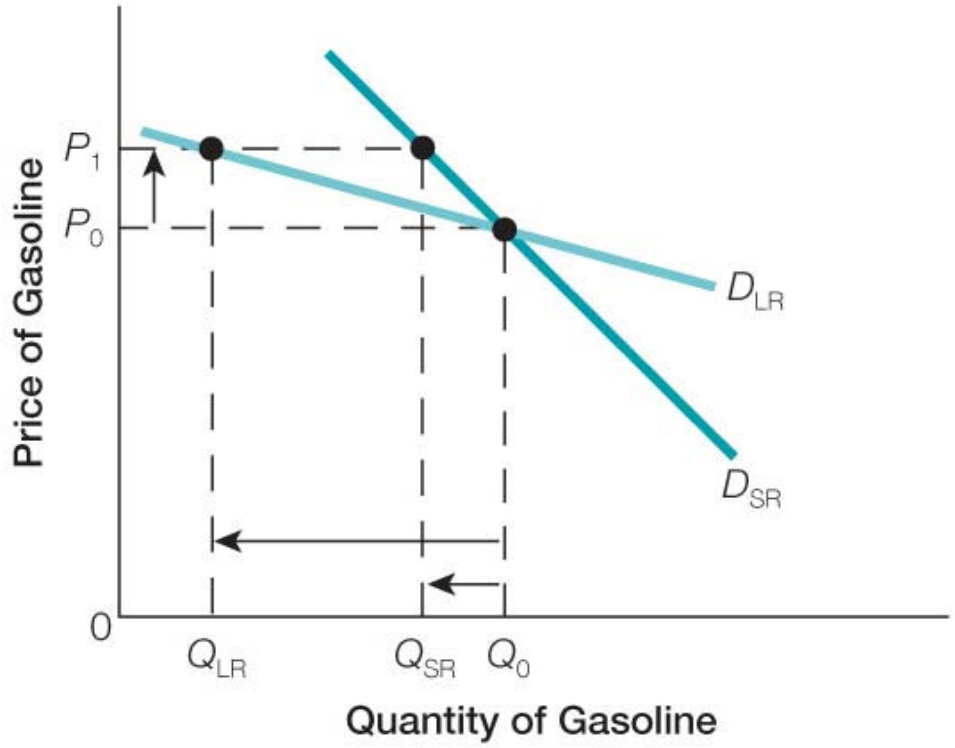
What determines the price elasticity of demand?

4. Time

- the more time that people have to adapt to a price change, the greater the elasticity of demand.
- the short-run demand curve is generally less elastic than the long-run demand curve

section 5.1
Exhibit 4

Short-Run and Long-Run Demand Curves



For many goods, like gasoline, price is much more elastic in the long run than the short run because buyers take time to change their consumption patterns. In the short run, the increase in price from P_0 to P_1 has only a small effect on the quantity demanded for gasoline. In the long run, the effect of the price increase will be much larger.

5.1 Price Elasticity of Demand

HOW DO WE USE THE "MIDPOINT METHOD" IN CALCULATING PRICE ELASTICITIES OF DEMAND?

- when calculating elasticity, the direction of the calculation affects the answer.
  - from point A to point B, ED = 0.6
  - from point B to point A, ED = 3.0

Note the difference!!

Point	Price	Quantity
A	$2	100
B	$4	40

5.1 Price Elasticity of Demand

HOW DO WE USE THE "MIDPOINT METHOD" IN CALCULATING PRICE ELASTICITIES OF DEMAND?

- To use the midpoint, or average, price and quantity, add together the points, and divide by 2

  - Quantity: (100+40)/ **2** = 70
  - Price: (2+4)/ **2** = 3

These are the midpoints

Point	Price	Quantity
A	$2	100
B	$4	40

5.1 Price Elasticity of Demand

HOW DO WE USE THE "MIDPOINT METHOD" IN CALCULATING PRICE ELASTICITIES OF DEMAND?

- Now calculate the elasticity, using the midpoint formula going from 100 to 40 and from $2 to $4:
  - 60/70÷-2/3
  - .86/.67 = 1.3 (rounded)
- Now try it the other way, from 40 to 100 and $4 to $2

Point	Price	Quantity
A	$2	100
B	$4	40
Midpoint	*$3*	*70*

(QtyA – QtyB)/Midpoint Qty ÷ (PriceA – PriceB)/Midpoint Price

(100-40)/70 ÷ ($2 - $4)/3 60/70 ÷ -2/3

0.86 ÷ -0.67= 1.3 rounded

Midpoint Qty = (100+40)/2= 70

Midpoint Price = ($2 + $4)/2 = $3

5.1 Price Elasticity of Demand

HOW DO WE USE THE "MIDPOINT METHOD" IN CALCULATING PRICE ELASTICITIES OF DEMAND?

- The midpoint formula gives the same coefficient in either direction
  - From A to B: ED = 86% / 67% = 1.3
  - From B to A: ED = 86% / 67% = 1.3

Now it's the same!

Point	Price	Quantity
A	$2	100
B	$4	40
Midpoint	*$3*	*70*

5.1 Price Elasticity of Demand

HOW DO WE USE THE "MIDPOINT METHOD" IN CALCULATING PRICE ELASTICITIES OF DEMAND?

- The midpoint formula can be expressed generically like this:

$$E_D = \frac{\%\Delta\ Q_D}{\%\Delta\ P} = \frac{(Q_A - Q_B)/[(Q_A + Q_B)/2]}{(P_A - P_B)/[(P_A + P_B)/2]}$$

5.1 Price Elasticity of Demand

Section Check

- Price elasticity of demand measures the percentage change in quantity demanded divided by the percentage change in price.
- If the demand for a good is price elastic in the relevant range, quantity demanded is very responsive to a price change. If the demand for a good is relatively price inelastic, quantity demanded is not very responsive to a price change.

5.1 Price Elasticity of Demand

Section Check

- The “midpoint method” for calculating percentage change involves using the average of the changing values, thereby eliminating the direction bias found in the traditional approach.
- The price elasticity of demand depends on (1) the availability of close substitutes, (2) the proportion of income spent on the good, and (3) the amount of time that buyers have to respond to a price change.

5.2 Total Revenue and Price Elasticity of Demand

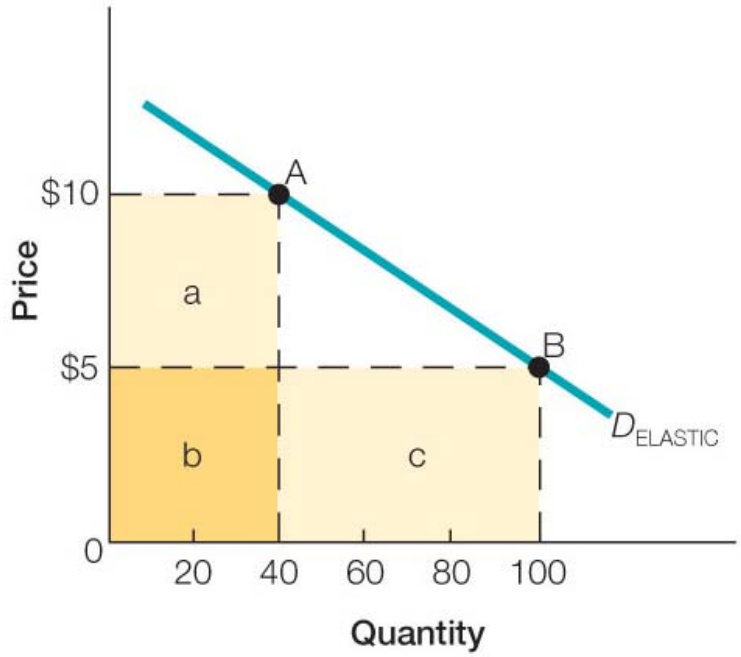
HOW DOES THE PRICE ELASTICITY OF DEMAND IMPACT TOTAL REVENUE?

- When Demand is Price Elastic (ED>1)
  - total revenues rise as price declines.
    TR ↑ = ↓ P x ↑ Q
  - total revenues decline as price rises.
    TR ↓ = ↑ P x ↓ Q
  - percentage change in quantity demanded is greater than the percentage change in price.

5.2 Total Revenue and Price Elasticity of Demand

section 5.2
Exhibit 1

Elastic Demand and Total Revenue



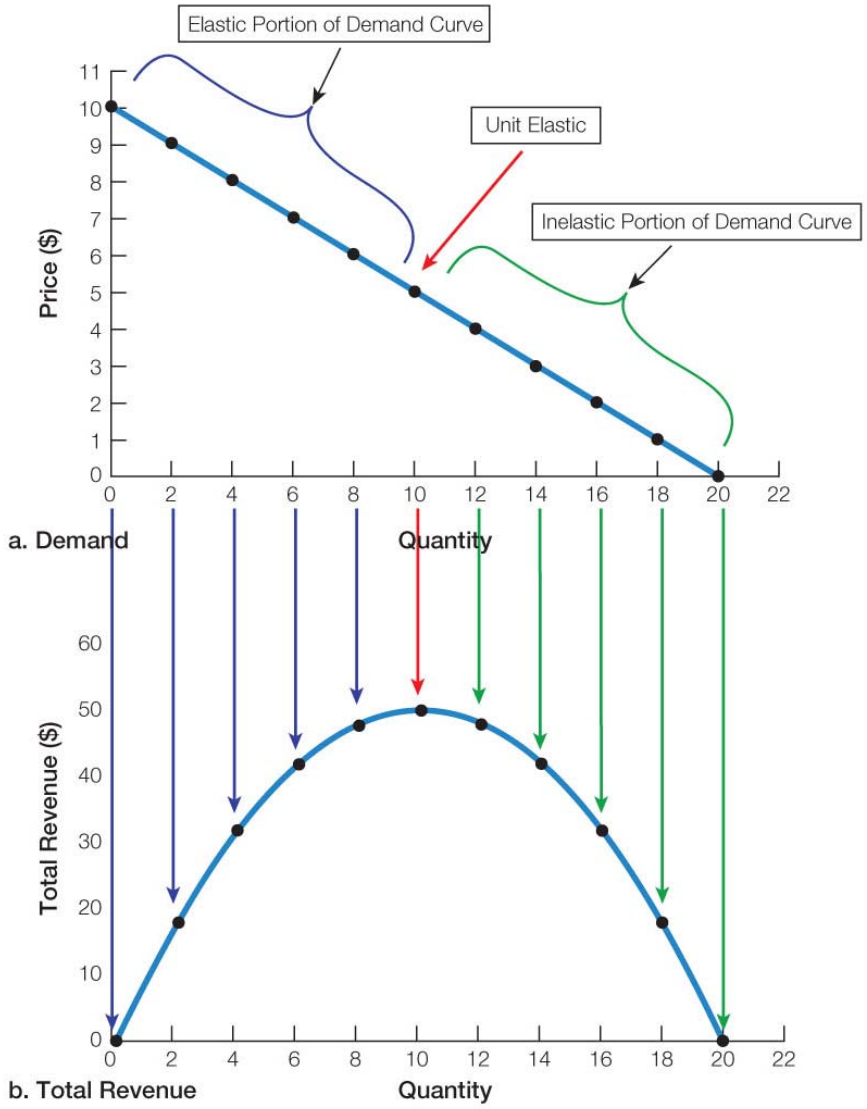
At point A, total revenue is \$400 (\$10 × 40), or area a + b. At point B, the total revenue is \$500 (\$5 × 100), or area b + c. Total revenue has increased by \$100. We can also see in the graph that total revenue has increased because the area b + c is greater than area a + b, or c > a.

5.2 Total Revenue and Price Elasticity of Demand

HOW DOES THE PRICE ELASTICITY OF DEMAND IMPACT TOTAL REVENUE?

- When Demand is Price Inelastic (ED<1)
  - total revenues rise as price rises.
    TR ↑ = ↑ P x ↓ Q
  - total revenues decline as price declines.
    TR ↓ = ↓ P x ↑ Q
  - percentage change in quantity demanded is less than the percentage change in price.

5.2 Total Revenue and Price Elasticity of Demand



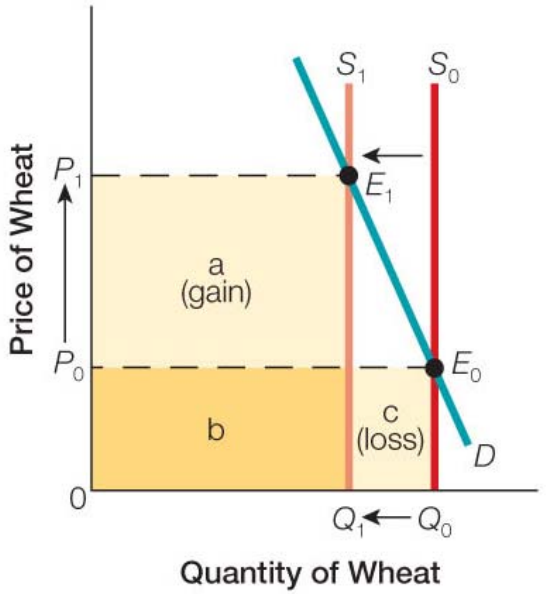
5.2 Total Revenue and Price Elasticity of Demand

HOW DOES THE PRICE ELASTICITY OF DEMAND IMPACT TOTAL REVENUE?

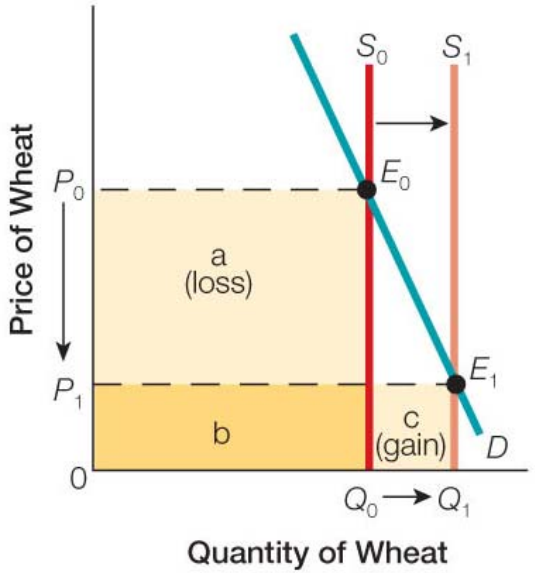
- A change in supply
  - As shown in Exhibit 3(a), if demand for wheat is inelastic, a reduction in supply without a simultaneous reduction in demand will result in a higher price for wheat and a rise in total revenues for farmers.

5.2 Total Revenue and Price Elasticity of Demand

a. Total Revenue and Inelastic Demand: A Reduction in Supply



b. Total Revenue and Inelastic Demand: An Increase in Supply

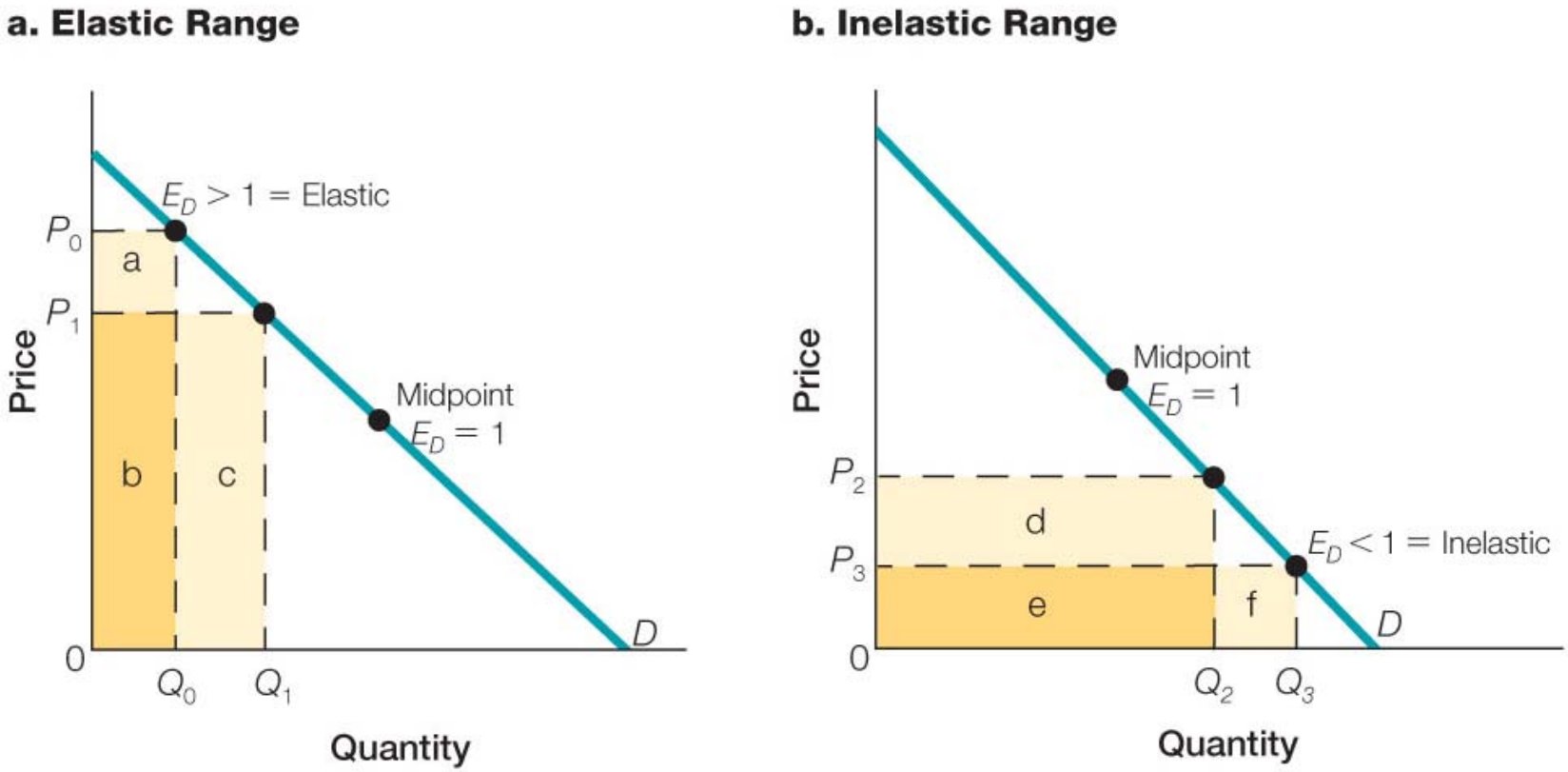


5.2 Total Revenue and Price Elasticity of Demand

HOW DOES THE PRICE ELASTICITY OF DEMAND CHANGE ALONG A LINEAR DEMAND CURVE?

- The slope of a demand curve can be used to estimate its relative elasticity:
  - steeper curve = more inelastic
- A linear curve is:
  - more price elastic at higher prices.
  - more inelastic at lower prices.
  - unit elastic at the midpoint.

5.2 Total Revenue and Price Elasticity of Demand



5.2 Total Revenue and Price Elasticity of Demand

Section Check

- If demand is price elastic (ED>1), total revenue will vary inversely with a change in price. If demand is price inelastic (ED<1), total revenue will vary in the same direction as a change in price.
- A linear demand curve is more price elastic at higher price ranges and more price inelastic at lower price ranges, and it is unit elastic at the midpoint: ED=1

5.3 Other Demand Elasticities

WHAT IS THE CROSS-PRICE ELASTICITY OF DEMAND?

- a measure of the impact that a price change of one good will have on the quantity demanded of another good at a given price.
- determines whether the goods are substitutes or complements.

5.3 Other Demand Elasticities

WHAT IS THE CROSS-PRICE ELASTICITY OF DEMAND?

- defined as the percentage change in the quantity demanded of one good (good A) divided by the percentage change in price of another good (good B).

$$(E_{AB}) = \frac{\text{Percentage change in quantity demanded of A}}{\text{Percentage change in the price of B}}$$

5.3 Other Demand Elasticities

WHAT IS THE CROSS-PRICE ELASTICITY OF DEMAND?

- if the cross-price elasticity is negative, the two goods are complements.
  - the price of one good and the demand for the other move in opposite directions

5.3 Other Demand Elasticities

WHAT IS THE CROSS-PRICE ELASTICITY OF DEMAND?

- if the cross-price elasticity is positive, the two goods are substitutes.
  - the price of one good and the demand for the other move in the same direction

5.3 Other Demand Elasticities

WHAT IS INCOME ELASTICITY OF DEMAND?

- a measure of the responsiveness of the quantity demanded of a good to a change in income.

$$(E_I) = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

5.3 Other Demand Elasticities

WHAT IS INCOME ELASTICITY OF DEMAND?

- If the income elasticity is positive, then the good in question is a normal good
  - income and demand move in the same direction.
- If income elasticity is negative, then the good is an inferior good
  - income and demand move in opposite directions

5.3 Other Demand Elasticities

Section Check

- The cross-price elasticity of demand is the percentage change in the quantity demanded of one good divided by the percentage change in the price of another related good (complements and substitutes).
- The income elasticity of demand is the percentage change in quantity demanded divided by the percentage change in income (normal and inferior goods).

5.4 Price Elasticity of Supply

WHAT IS THE PRICE ELASTICITY OF SUPPLY?

- according to the law of supply, there is a positive relationship between price and quantity supplied, ceteris paribus.
- the price elasticity of supply measures how responsive the quantity sellers are willing to sell is to changes in the price.

5.4 Price Elasticity of Supply

WHAT IS THE PRICE ELASTICITY OF SUPPLY?

- defined as the percentage change in the quantity supplied divided by the percentage change in price.

$$E_S = \frac{\text{Percentage change in the quantity supplied}}{\text{Percentage change in price}}$$

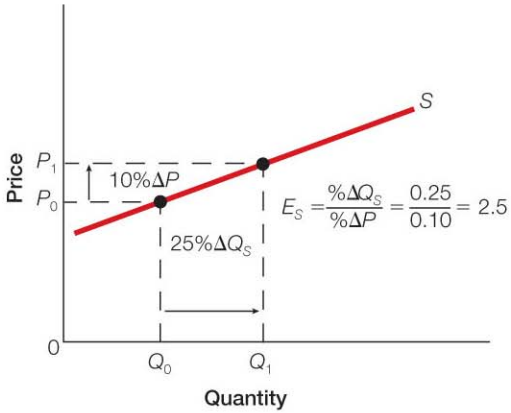
5.4 Price Elasticity of Supply

WHAT IS THE PRICE ELASTICITY OF SUPPLY?

- Elastic Supply
  - goods with a supply elasticity greater than 1 ($E_s > 1$) are relatively elastic in supply.
  - a 1 percent change in the price will lead to a proportionately larger change in quantity supplied
  - the extreme case is perfectly elastic supply, where E_s = infinity.

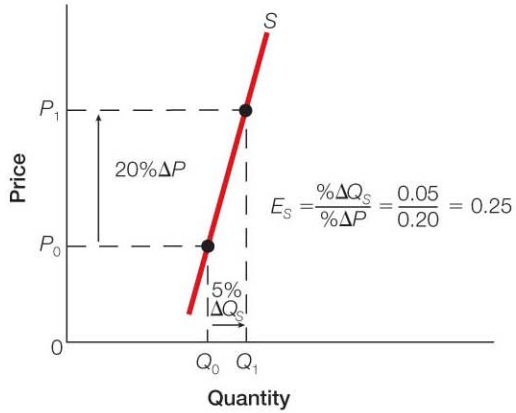
5.4 Price Elasticity of Supply

a. Elastic Supply ($E_S > 1$)



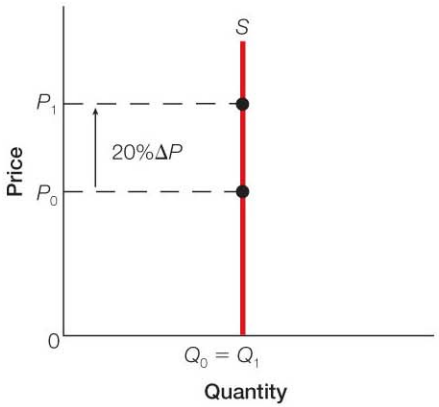
A change in price leads to a larger percentage change in quantity supplied.

b. Inelastic Supply ($E_S < 1$)



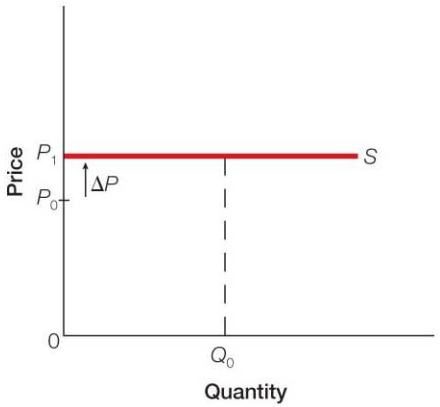
A change in price leads to a smaller percentage change in quantity supplied.

c. Perfectly Inelastic Supply ($E_S = 0$)



The quantity supplied does not change regardless of the change in price.

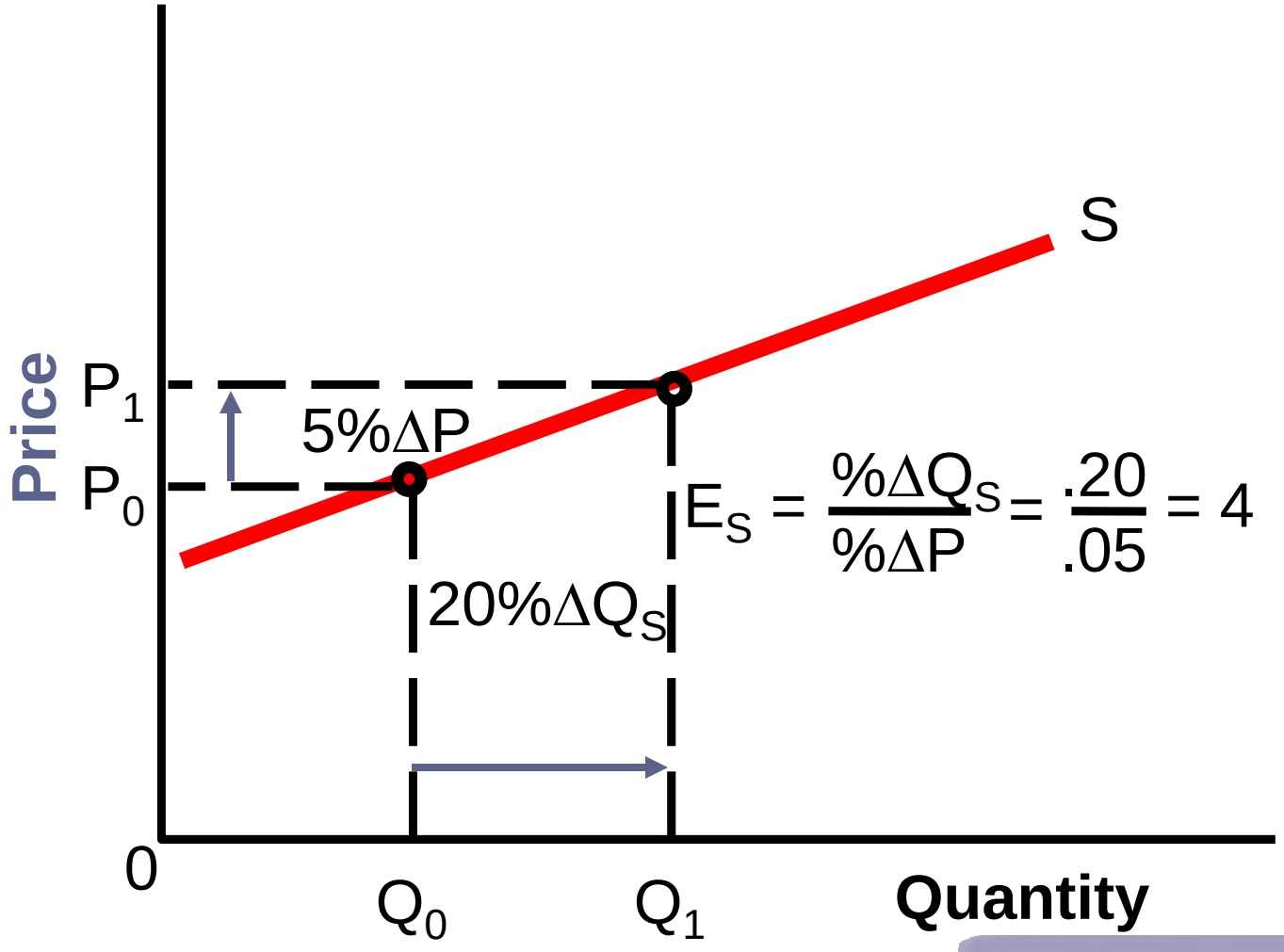
d. Perfectly Elastic Supply ($E_S = \infty$)



Even a small percentage change in price will change quantity supplied by an infinite amount.

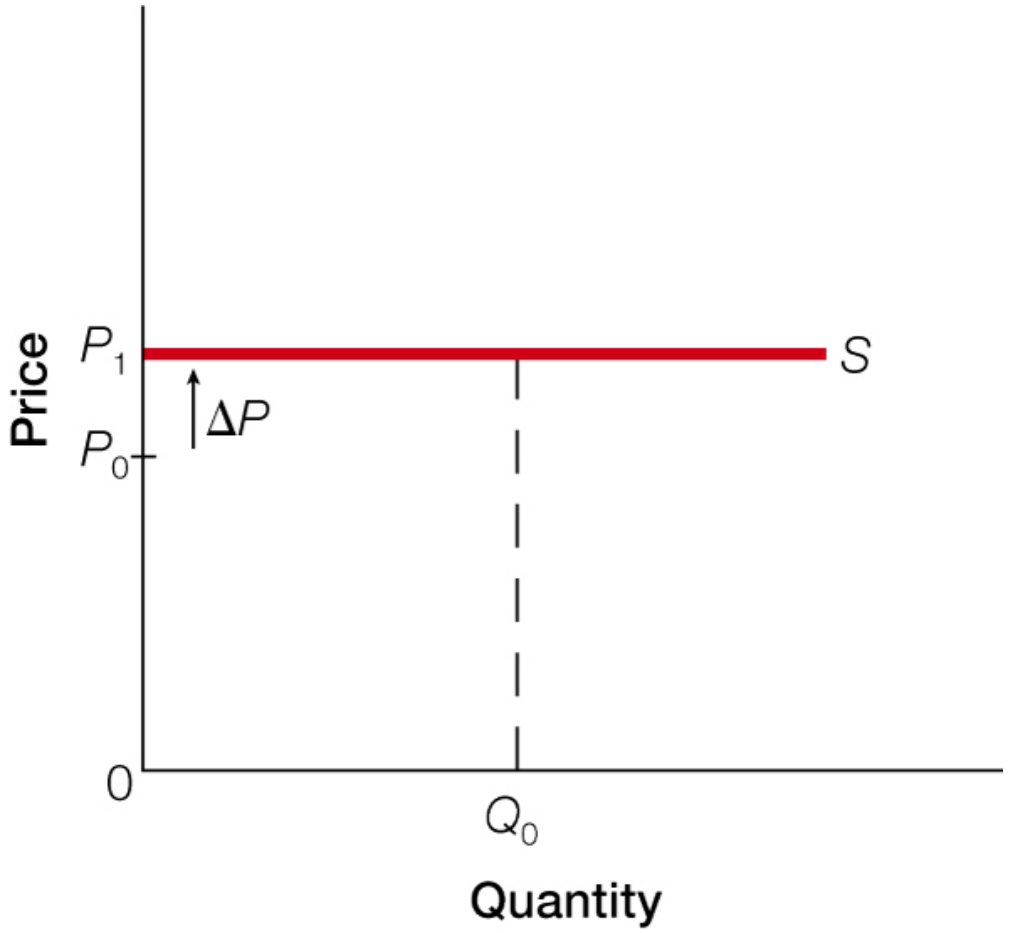
5.4 Price Elasticity of Supply

a. Elastic Supply ($E_S > 1$)



5.4 Price Elasticity of Supply

d. Perfectly Elastic supply (ES = ∞)



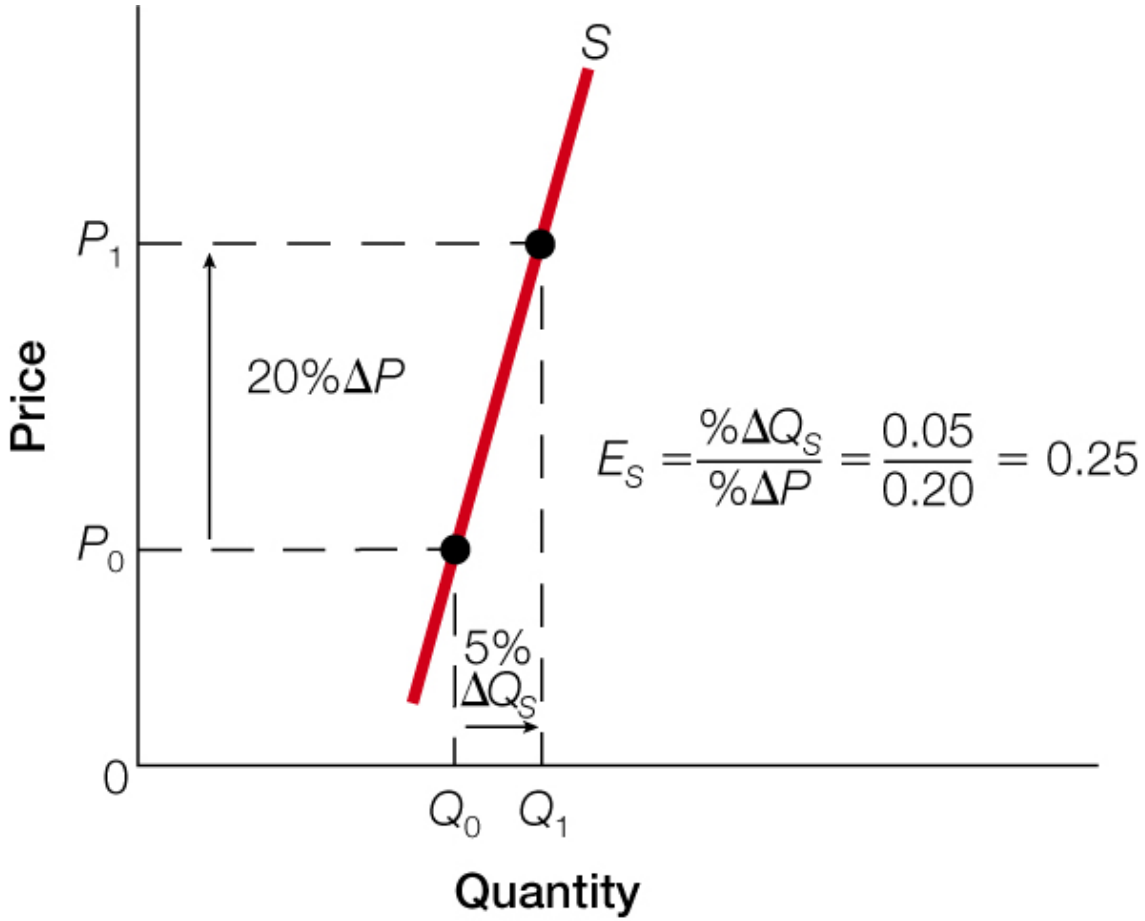
5.4 Price Elasticity of Supply

WHAT IS THE PRICE ELASTICITY OF SUPPLY?

- Inelastic Supply
  - goods with a supply elasticity less than 1 (Es<1) are relatively inelastic in supply.
  - a 1 percent change in the price will lead to a proportionately smaller change in quantity supplied.
  - the extreme case is perfectly inelastic supply, where Es = 0.

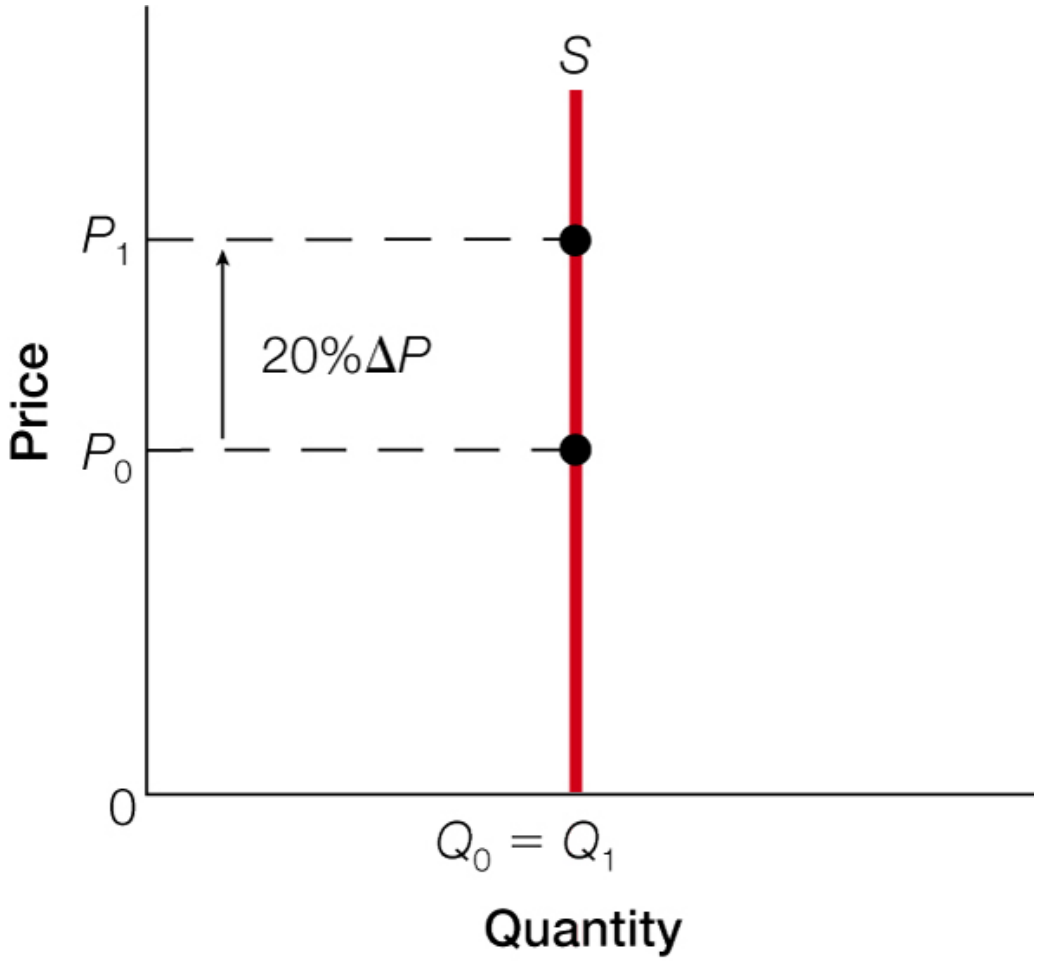
5.4 Price Elasticity of Supply

b. Inelastic Supply ($E_S < 1$)



5.4 Price Elasticity of Supply

c. Perfectly Inelastic Supply $E_S = 0$)

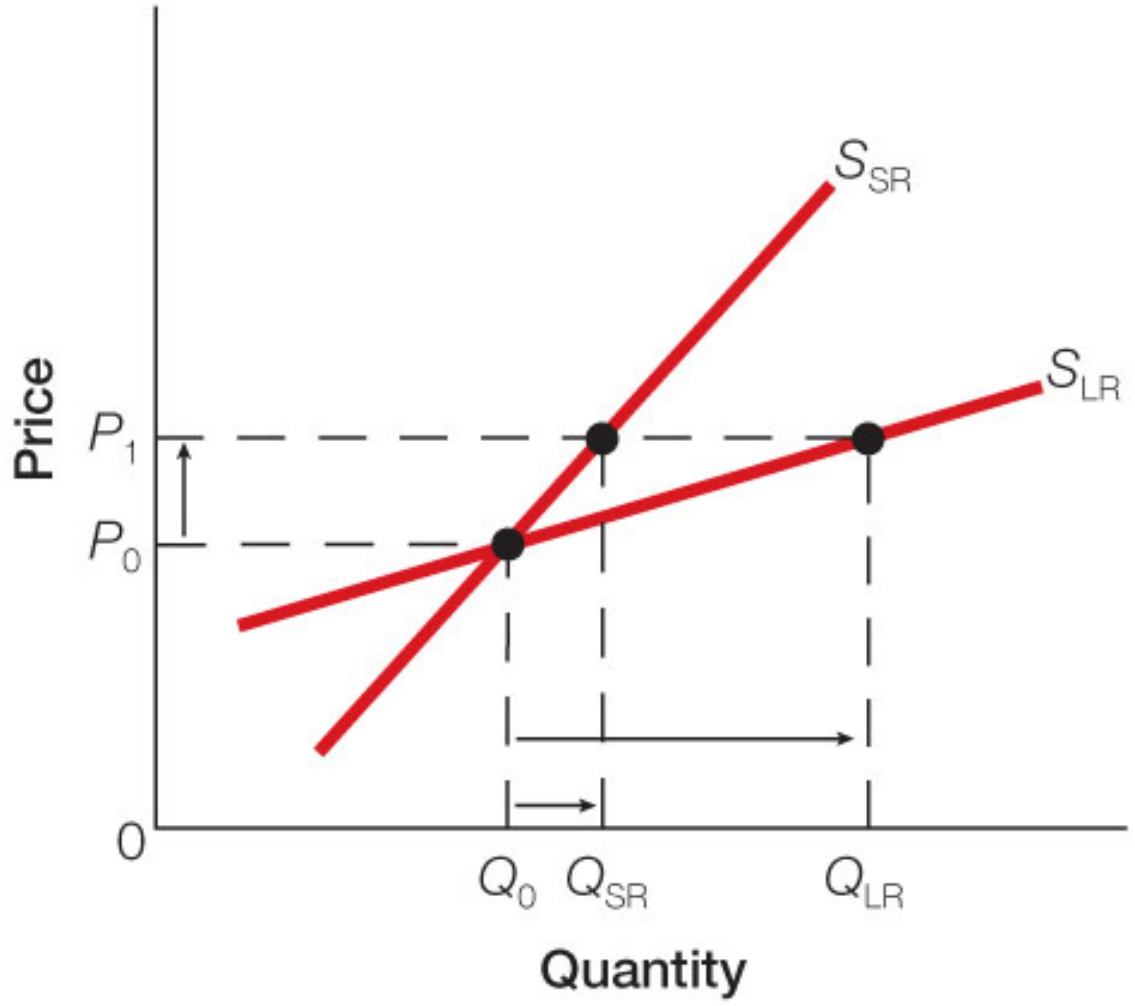


5.4 Price Elasticity of Supply

HOW DOES TIME AFFECT THE SUPPLY ELASTICITY?

- supply tends to be more elastic in the long run than the short run.
- some resources are limited in the short run (e.g. factory capacity).
- can more easily increase resources in the long run (e.g. build new factory).

5.2 Total Revenue and Price Elasticity of Demand



5.4 Price Elasticity of Supply

Section Check

- The price elasticity of supply measures the relative change in the quantity supplied that results from a change in price.
- Supply tends to be more elastic in the long run than the short run.

5.5 Elasticity and Taxes

WHAT IS TAX INCIDENCE?

- tax incidence refers to the analysis of the effect of a particular tax on the distribution of economic welfare.
- looks at the ultimate burden of a tax
- has nothing to do with who actually pays the tax at the time of purchase.

5.5 Elasticity and Taxes

WHAT IS TAX INCIDENCE?

- relative elasticity of supply and demand determines the distribution of the tax burden.
- in general, the tax burden falls on the side of the market that is less elastic.

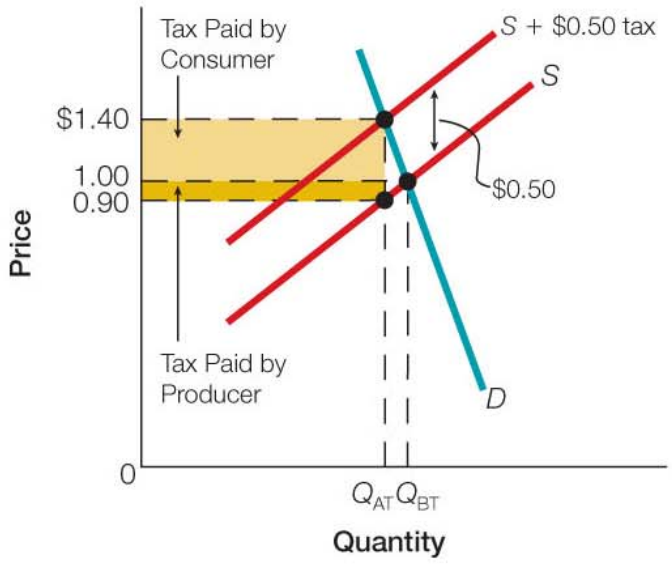
5.5 Elasticity and Taxes

HOW DOES THE RELATIVE ELASTICITY OF SUPPLY AND DEMAND DETERMINE THE TAX BURDEN?

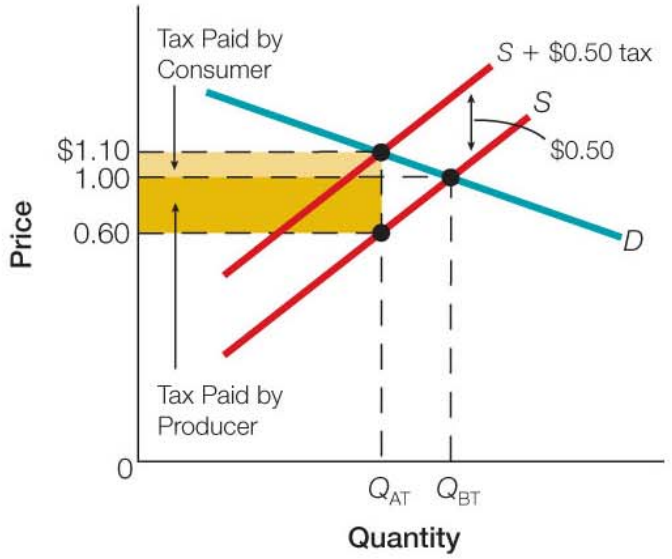
- relative elasticity of supply and demand determines the distribution of the tax burden.
- in general, the tax burden falls on the side of the market that is less elastic.
- has nothing to do with who actually pays the tax at the time of purchase.

5.5 Elasticity and Taxes

a. Demand Is Relatively Less Elastic than Supply

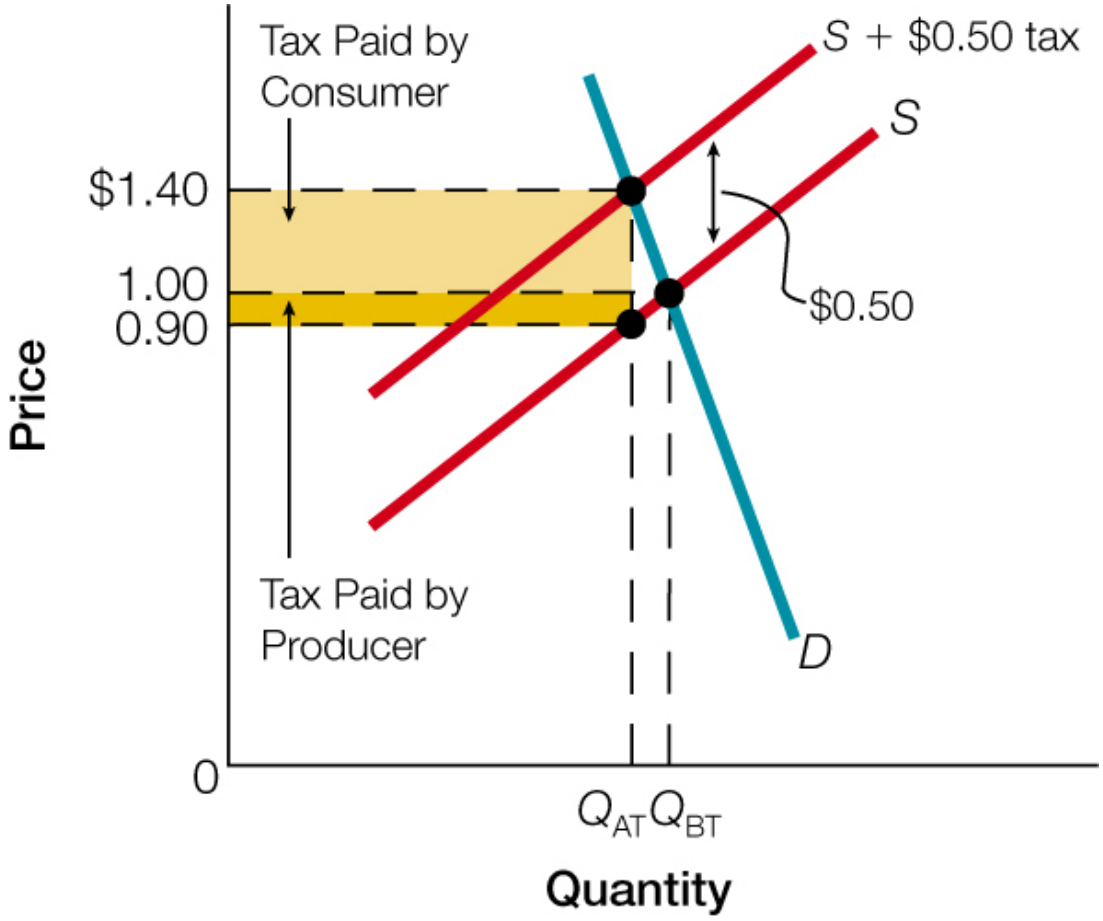


b. Demand Is Relatively More Elastic than Supply



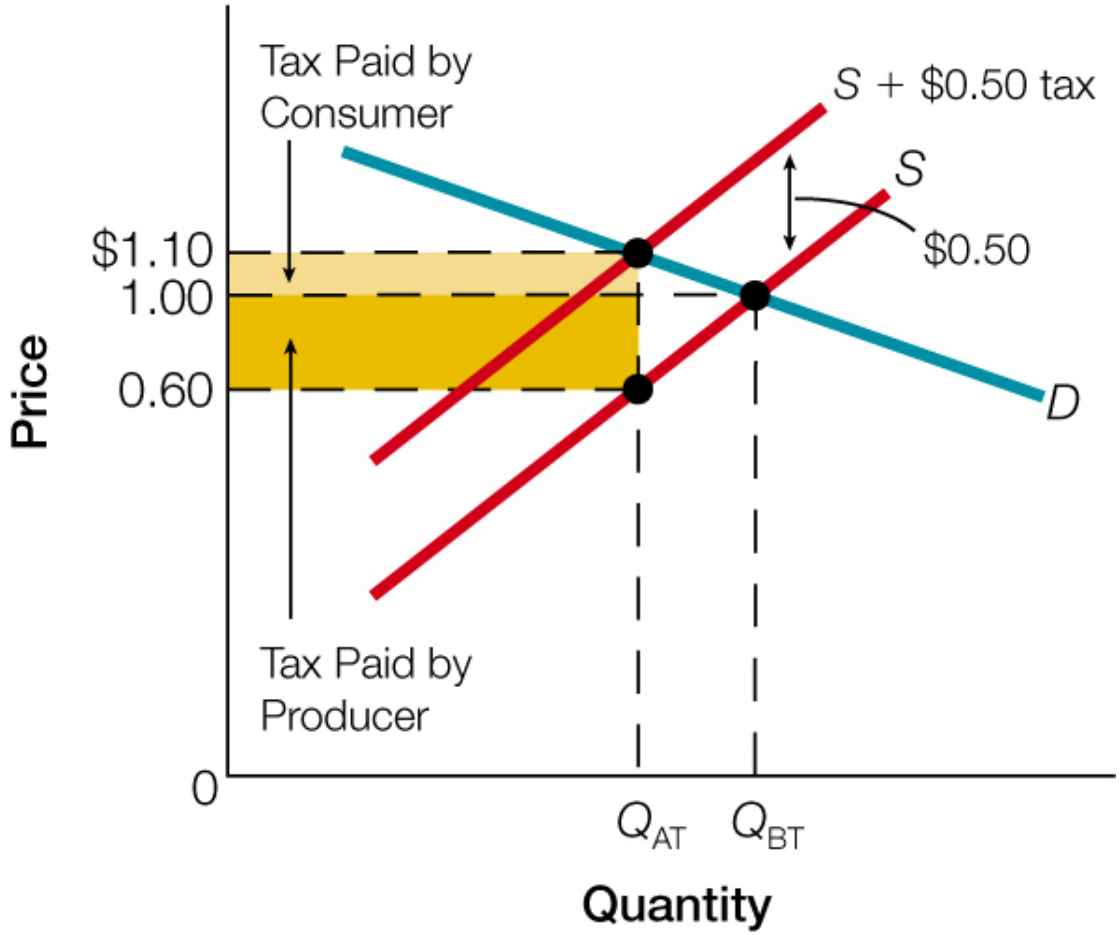
5.5 Elasticity and Taxes

a. Demand Is Relatively Less Elastic than Supply



5.5 Elasticity and Taxes

b. Demand Is Relatively More Elastic than Supply



5.5 Elasticity and Taxes

Section Check

- Tax incidence refers to the analysis of the effect of particular taxes of the distribution of economic welfare.
- If demand is more elastic than supply, producers bear the greater burden of the tax; however, if supply is more elastic than demand, consumers bear the greater burden of the tax.

Reviewing the Learning Outcomes

- **5.1 PRICE ELASTICITY OF DEMAND**
  - What is price elasticity of demand?
  - How do we measure consumers' responses to price changes?
  - How do we use the "midpoint method" in calculating price elasticities of demand?
  - What determines the price elasticity of demand?
- **5.2 TOTAL REVENUE AND PRICE ELASTICITY OF DEMAND**
  - How does the price elasticity of demand impact total revenue?
  - How does price elasticity of demand change along a linear demand curve?

Reviewing the Learning Outcomes

- **5.3 OTHER DEMAND ELASTICITIES**
  - What is the cross-price elasticity of demand?
  - What is the income elasticity of demand?
- **5.4 PRICE ELASTICITY OF SUPPLY**
  - What is the price elasticity of supply?
  - How does time affect the supply elasticity?
- **5.5 ELASTICITY AND TAXES**
  - What is tax incidence?
  - How does the relative elasticity of supply and demand determine the tax burden?