





After studying this chapter, you will be able to:

- ◆ Define, calculate, and explain the factors that influence the price elasticity of demand
- ◆ Define, calculate, and explain the factors that influence the income elasticity of demand and the cross elasticity of demand
- ◆ Define, calculate, and explain the factors that influence the elasticity of supply

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 **Price Elasticity of Demand**

You know that when supply decreases, the equilibrium price rises and the equilibrium quantity decreases.
But does the price rise by a large amount and the quantity decrease by a little?
Or does the price barely rise and the quantity decrease by a large amount?
The answer depends on the responsiveness of the quantity demanded of a good to a change in its price.

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 **Price Elasticity of Demand**

You might think about the responsiveness of the quantity demanded of a good to a change in its price in terms of the *slope of the demand curve*.
If the demand curve is steep, the price rises by a lot; if the demand curve is almost flat, the price barely rises.
But the slope of a demand curve depends on the units in which we measure the price and the quantity. We can choose these units to make the demand curve steep or flat.
To measure responsiveness we need a measure that is *independent* of units of measurement.
Elasticity is such a measure.

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 **Price Elasticity of Demand**

The **price elasticity of demand** is a units-free measure of the responsiveness of the quantity demanded of a good to a change in its price when all other influences on buying plans remain the same.

Calculating Price Elasticity of Demand

The price elasticity of demand is calculated by using the formula:

$$\frac{\text{Percentage change in the quantity demanded}}{\text{Percentage change in the price}}$$

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Price Elasticity of Demand

To calculate the price elasticity of demand:

We express the change in price as a percentage of the *average price*—the average of the initial and new price, ...

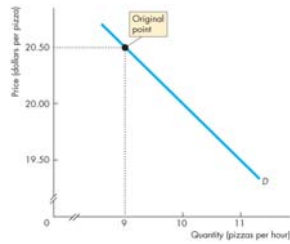
and we express the change in the quantity demanded as a percentage of the *average quantity demanded*—the average of the initial and new quantity.

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Price Elasticity of Demand

Figure 4.1 calculates the price elasticity of demand for pizza.

Initially, the price of a pizza is \$20.50 and the quantity demanded is 9 pizzas an hour.

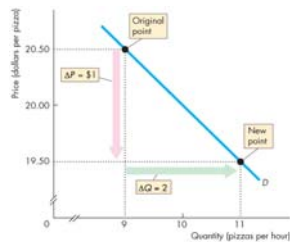


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Price Elasticity of Demand

The price of a pizza falls to \$19.50 and the quantity demanded increases to 11 pizzas an hour.

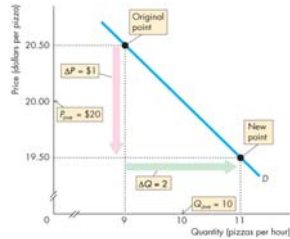
The price falls by \$1 and the quantity demanded increases by 2 pizzas an hour.



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Price Elasticity of Demand

The average price is \$20 and the average quantity demanded is 10 pizzas an hour.

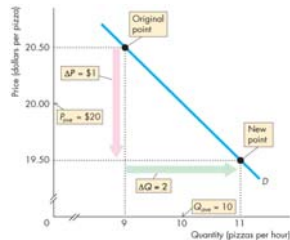


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Price Elasticity of Demand

The percentage change in quantity demanded, $\% \Delta Q$, is calculated as $\Delta Q / Q_{ave} \times 100$, which is $(2/10) \times 100 = 20\%$.

The percentage change in price, $\% \Delta P$, is calculated as $\Delta P / P_{ave} \times 100$, which is $(\$1 / \$20) \times 100 = 5\%$.

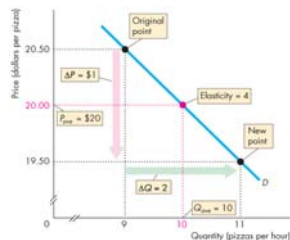


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Price Elasticity of Demand

The price elasticity of demand equals

$$\% \Delta Q / \% \Delta P = 20\% / 5\% = 4.$$



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Price Elasticity of Demand

Average Price and Quantity

By using the *average price* and *average quantity*, we get the same elasticity value regardless of whether the price rises or falls.

Percentages and Proportions

The ratio of two proportionate changes is the same as the ratio of two percentage changes.

$$\% \Delta Q / \% \Delta P = \Delta Q / \Delta P$$

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Price Elasticity of Demand

A Units-Free Measure

Elasticity is a ratio of percentages, so a change in the units of measurement of price or quantity leaves the elasticity value the same.

Minus Sign and Elasticity

The formula yields a negative value, because price and quantity move in opposite directions.

But it is the *magnitude*, or absolute value, that reveals how responsive the quantity change has been to a price change.

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Price Elasticity of Demand

Inelastic and Elastic Demand

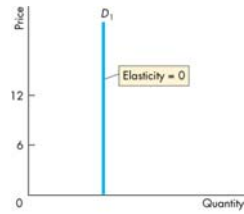
Demand can be inelastic, unit elastic, or elastic, and can range from zero to infinity.

If the quantity demanded doesn't change when the price changes, the price elasticity of demand is zero and the good has a **perfectly inelastic demand**.

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Price Elasticity of Demand

Figure 4.2(a) illustrates the case of a good that has a perfectly inelastic demand. The demand curve is vertical.



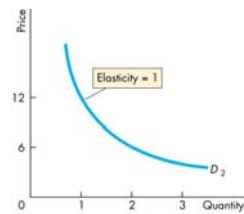
(a) Perfectly inelastic demand

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Price Elasticity of Demand

If the percentage change in the quantity demanded equals the percentage change in price, ... the price elasticity of demand equals 1 and the good has **unit elastic demand**.

Figure 4.2(b) illustrates this case—a demand curve with ever declining slope.



(b) Unit elastic demand

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Price Elasticity of Demand

If the percentage change in the quantity demanded is *smaller* than the percentage change in price,

- the price elasticity of demand is *less* than 1 and the good has **inelastic demand**.

If the percentage change in the quantity demanded is *greater* than the percentage change in price,

- the price elasticity of demand is *greater* than 1 and the good has **elastic demand**.

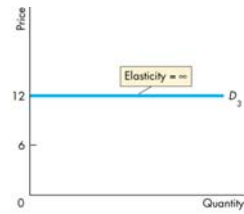
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Price Elasticity of Demand

If the percentage change in the quantity demanded is infinitely large when the price barely changes, ...

the price elasticity of demand is infinite and the good has a **perfectly elastic demand**.

Figure 4.2(c) illustrates the case of perfectly elastic demand—a horizontal demand curve.



(c) Perfectly elastic demand

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Price Elasticity of Demand

The Factors That Influence the Elasticity of Demand

The elasticity of demand for a good depends on:

- The closeness of substitutes
- The proportion of income spent on the good
- The time elapsed since a price change

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Price Elasticity of Demand

Closeness of Substitutes

The closer the substitutes for a good or service, the more elastic is the demand for the good or service.

Necessities, such as food or housing, generally have inelastic demand.

Luxuries, such as exotic vacations, generally have elastic demand.

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Price Elasticity of Demand

Proportion of Income Spent on the Good

The greater the proportion of income consumers spend on a good, the larger is the elasticity of demand for that good.

Time Elapsed Since Price Change

The more time consumers have to adjust to a price change, or the longer that a good can be stored without losing its value, the more elastic is the demand for that good.

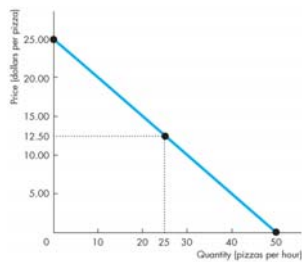
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Price Elasticity of Demand

Elasticity Along a Linear Demand Curve

Figure 4.3 shows how the elasticity of demand changes along a linear demand curve.

At the mid-point of the demand curve, demand is unit elastic.

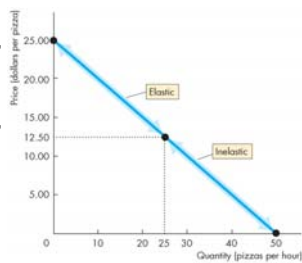


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Price Elasticity of Demand

At prices above the mid-point of the demand curve, demand is elastic.

At prices below the mid-point of the demand curve, demand is inelastic.



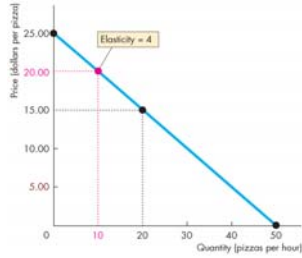
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Price Elasticity of Demand

For example, if the price falls from \$25 to \$15, the quantity demanded increases from 0 to 20 pizzas an hour.

The average price is \$20 and the average quantity is 10 pizzas.

The price elasticity of demand is $(20/10)$ divided by $(10/20)$, which equals 4.



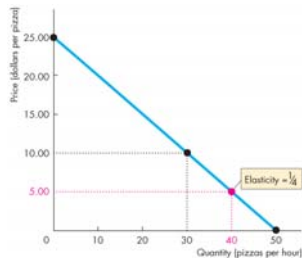
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Price Elasticity of Demand

If the price falls from \$10 to \$0, the quantity demanded increases from 30 to 50 pizzas an hour.

The average price is \$5 and the average quantity is 40 pizzas.

The price elasticity is $(20/40)$ divided by $(10/5)$, which equals $1/4$.



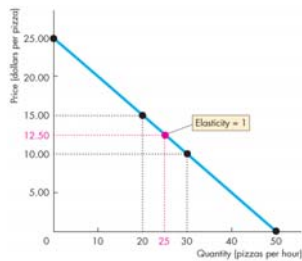
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Price Elasticity of Demand

If the price falls from \$15 to \$10, the quantity demanded increases from 20 to 30 pizzas an hour.

The average price is \$12.50 and the average quantity is 25 pizzas.

The price elasticity is $(10/25)$ divided by $(5/12.5)$, which equals 1.



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Price Elasticity of Demand

Total Revenue and Elasticity

The **total revenue** from the sale of a good or service equals the price of the good multiplied by the quantity sold.

When the price changes, total revenue also changes.

But a rise in price doesn't always increase total revenue.

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Price Elasticity of Demand

The change in total revenue due to a change in price depends on the elasticity of demand:

- If demand is *elastic*, a 1 percent price cut increases the quantity sold by more than 1 percent, and total revenue increases.
- If demand is *inelastic*, a 1 percent price cut increases the quantity sold by less than 1 percent, and total revenues decreases.
- If demand is *unit elastic*, a 1 percent price cut increases the quantity sold by 1 percent, and total revenue remains unchanged.

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Price Elasticity of Demand

The **total revenue test** is a method of estimating the price elasticity of demand by observing the change in total revenue that results from a price change (when all other influences on the quantity sold remain the same).

- If a price cut increases total revenue, demand is elastic.
- If a price cut decreases total revenue, demand is inelastic.
- If a price cut leaves total revenue unchanged, demand is unit elastic.

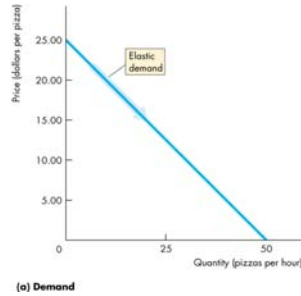
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Price Elasticity of Demand

Figure 4.4 shows the relationship between elasticity of demand and the total revenue.

As the price of a pizza falls from \$25 to \$12.50, the quantity demanded increases from 0 to 25 pizzas an hour.

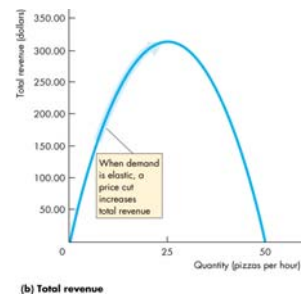
Demand is elastic, and total revenue increases.



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Price Elasticity of Demand

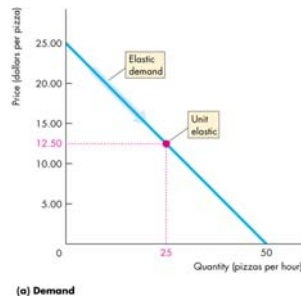
In part (b), as the quantity increases from 0 to 25 pizzas an hour, demand is elastic, and total revenue increases.



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Price Elasticity of Demand

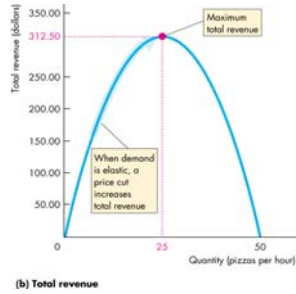
At \$12.50 a pizza, demand is unit elastic and total revenue stops increasing.



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Price Elasticity of Demand

At 25 pizzas an hour, demand is unit elastic, and total revenue is at its maximum.

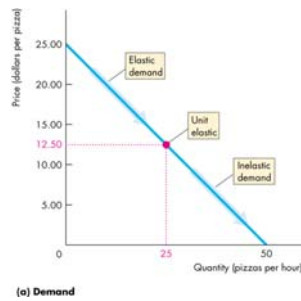


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Price Elasticity of Demand

As the price of a pizza falls from \$12.50 to zero, the quantity demanded increases from 25 to 50 pizzas an hour.

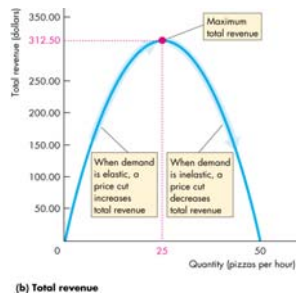
Demand is inelastic, and total revenue decreases.



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Price Elasticity of Demand

As the quantity increases from 25 to 50 pizzas an hour, demand is inelastic, and total revenue decreases.



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Price Elasticity of Demand

Your Expenditure and Your Elasticity

- If your demand is elastic, a 1 percent price cut increases the quantity you buy by more than 1 percent and your expenditure on the item *increases*.
- If your demand is inelastic, a 1 percent price cut increases the quantity you buy by less than 1 percent and your expenditure on the item *decreases*.
- If your demand is unit elastic, a 1 percent price cut increases the quantity you buy by 1 percent and your expenditure on the item *does not change*.

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More Elasticities of Demand

Income Elasticity of Demand

The **income elasticity of demand** measures how the quantity demanded of a good responds to a change in income, other things remaining the same.

The formula for calculating the income elasticity of demand is

$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

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More Elasticities of Demand

If the income elasticity of demand is greater than 1, demand is *income elastic* and the good is a *normal good*.

If the income elasticity of demand is greater than zero but less than 1, demand is *income inelastic* and the good is a *normal good*.

If the income elasticity of demand is less than zero (negative) the good is an *inferior good*.

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More Elasticities of Demand

Cross Elasticity of Demand

The **cross elasticity of demand** is a measure of the responsiveness of demand for a good to a change in the price of a *substitute* or a *complement*, other things remaining the same.

The formula for calculating the cross elasticity is:

$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of substitute or complement}}$$

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More Elasticities of Demand

The cross elasticity of demand for

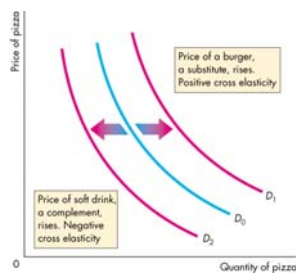
- a *substitute* is positive.
- a *complement* is negative.

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More Elasticities of Demand

Figure 4.5 shows the increase in the quantity of pizza demanded when the price of a burger (a substitute for pizza) rises.

The figure also shows the decrease in the quantity of pizza demanded when the price of a soft drink (a complement of pizza) rises.



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Elasticity of Supply

You know that when the demand for a good increases, its equilibrium price rises and the equilibrium quantity of the good increases.

But does the price rise by a large amount and the quantity increase by a little?

Or does the price barely rise and the quantity increase by a large amount?

The answer depends on the responsiveness of the quantity supplied of a good to a change in its price.

The answer depends on the *elasticity of supply* of the good.

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Elasticity of Supply

The **elasticity of supply** measures the responsiveness of the quantity supplied to a change in the price of a good, when all other influences on selling plans remain the same.

Calculating the Elasticity of Supply

The elasticity of supply is calculated by using the formula:

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

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Elasticity of Supply

Figure 4.6 on the next slide shows three cases of the elasticity of supply.

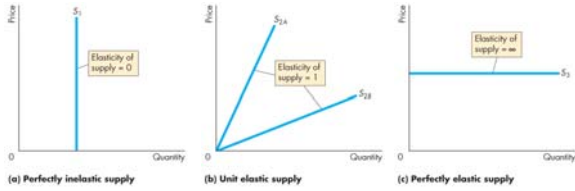
Supply is *perfectly inelastic* if the supply curve is vertical and the elasticity of supply is 0.

Supply is *unit elastic* if the supply curve is linear and passes through the origin. (Note that slope is irrelevant.)

Supply is *perfectly elastic* if the supply curve is horizontal and the elasticity of supply is infinite.

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Elasticity of Supply



Elasticity of Supply

The Factors That Influence the Elasticity of Supply

The elasticity of supply depends on

- Resource substitution possibilities
- Time frame for supply decision

Resource Substitution Possibilities

The easier it is to substitute among the resources used to produce a good or service, the greater is its elasticity of supply.

Elasticity of Supply

Time Frame for Supply Decision

The more time that passes after a price change, the greater is the elasticity of supply.

Momentary supply is perfectly inelastic. The quantity supplied immediately following a price change is constant.

Short-run supply is somewhat elastic.

Long-run supply is the most elastic.

Table 4.1 provides a glossary of all the elasticity measures.

TABLE 4.1 A Compact Glossary of Elasticities

Price Elasticities of Demand A relationship is described as	When its magnitude is	Which means that
Perfectly elastic	Infinity	The smallest possible increase in price causes an infinitely large decrease in the quantity demanded*
Elastic	Less than infinity but greater than 1	The percentage decrease in the quantity demanded exceeds the percentage increase in price
Unit elastic	1	The percentage decrease in the quantity demanded equals the percentage increase in price
Inelastic	Less than 1 but greater than zero	The percentage decrease in the quantity demanded is less than the percentage increase in price
Perfectly inelastic	Zero	The quantity demanded is the same at all prices

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TABLE 4.1 A Compact Glossary of Elasticities

Cross Elasticities of Demand A relationship is described as	When its value is	Which means that
Close substitutes	Large	The smallest possible increase in the price of one good causes an infinitely large increase in the quantity demanded* of the other good
Substitutes	Positive	If the price of one good increases, the quantity demanded of the other good also increases
Unrelated goods	Zero	If the price of one good increases, the quantity demanded of the other good remains the same
Complements	Negative	If the price of one good increases, the quantity demanded of the other good decreases

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TABLE 4.1 A Compact Glossary of Elasticities

Income Elasticities of Demand A relationship is described as	When its value is	Which means that
Income elastic (normal good)	Greater than 1	The percentage increase in the quantity demanded is greater than the percentage increase in income*
Income inelastic (normal good)	Less than 1 but greater than zero	The percentage increase in the quantity demanded is greater than zero but less than the percentage increase in income
Negative (inferior good)	Less than zero	When income increases, quantity demanded decreases

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TABLE 4.1 A Compact Glossary of Elasticities

Elasticities of Supply A relationship is described as	When its magnitude is	Which means that
Perfectly elastic	Infinity	The smallest possible increase in price causes an infinitely large increase in the quantity supplied*
Elastic	less than infinity but greater than 1	The percentage increase in the quantity supplied exceeds the percentage increase in the price
Unit elastic	1	The percentage increase in the quantity supplied equals the percentage increase in the price
Inelastic	Greater than zero but less than 1	The percentage increase in the quantity supplied is less than the percentage increase in the price
Perfectly inelastic	Zero	The quantity supplied is the same at all prices

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