

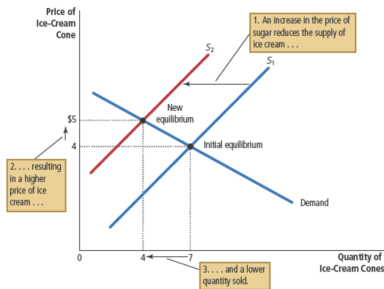
Chapter 5. Elasticity and Its Application

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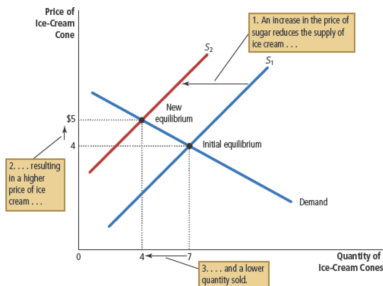
Introduction

- We learned in Chapter 4 how to analyze the change of market equilibrium price and quantity if some events shift the demand curve or supply curve.



Introduction

- The analysis presented in Chapter 4 yields a qualitative outcome, indicating whether the equilibrium price and quantity will increase or decrease. Often in reality this is not enough.
- Qualitative outcomes alone may not suffice; in many real-world scenarios, understanding the magnitude of changes in equilibrium price and quantity becomes crucial.



Introduction

- To carry out quantitative analysis, we need to introduce a new terminology, elasticity. Elasticity is a key concept in quantitative analysis in economics.
- It provides a quantitative measure of the responsiveness or sensitivity of quantity demanded or supplied to changes in economic variables such as price, income, or the price of related goods.

Introduction

■ Qualitative analysis:

- Tensions in the Middles east that tighten the world supply of oil drive up the price of gasoline and people buy less gas.

■ Quantitative analysis:

- How much would gas purchase fall due to higher price?

- Why elasticity is important in economics?
 - Elasticity helps us understand how sensitive quantity demanded or supplied is to changes in price. This knowledge is crucial for businesses in setting prices, optimizing revenue, and forecasting demand.
 - Elasticity is fundamental for businesses to optimize their total revenue. Understanding the elasticity of demand allows firms to determine whether a price increase or decrease would be more beneficial for revenue generation.
 - Cross-price and income elasticities provide additional insights into how the demand for one good responds to changes in the price of another good or changes in income, respectively.

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The Price Elasticity of Demand

- Price elasticity of demand: a measure of how much the quantity demanded of a good responds to a change in its price.
- Price elasticity of demand is calculated as the percentage change in quantity demanded divided by the percentage change in price.
 - Price elasticity in demand = $\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$

Absolute Change Vs Percent Change

- Absolute change is synonymous with difference. Absolute change = new value - reference value.
- The absolute change describes the actual increase or decrease from a reference value to a new value. For example, if you were to get a raise from \$15 per hour to \$16.50 per hour, the absolute change would be \$1.50 per hour.
- Percent change (relative change): Percent change is the ratio of absolute change to the reference value. Percent change = $\text{absolute change} / \text{reference value} \times 100\%$.

Absolute Change Vs Percent Change

- A raise in your salary. Say your boss gives you a raise of \$1,000 per year. Is that a lot if you're already making \$10,000 per year? How about if you're already making \$100,000 per year?
 - Utilizing absolute changes poses challenges when comparing variations across different units. A one-dollar increase in price differs from a one-euro increase, despite both having a magnitude of one.
 - A one-dollar increase in the price of eggs has a different impact than a one-dollar increase in the price of an iPhone, even though the absolute change is \$1 in both cases.
 - Comparing the percent change in this scenario is more reasonable, as it accounts for the relative impact based on the initial prices of the respective items.

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The Price Elasticity of Demand

■ Example

- Price elasticity in demand = $\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$

■ Example: suppose that after a 10 percent increase in the price of an ice-cream cone, you buy 20 percent fewer cones.

- Price elasticity in demand = $\frac{20 \text{ percent}}{10 \text{ percent}} = 2$

The Price Elasticity of Demand

■ Example

- Point A: Price = \$4 Quantity = 120
 - Point B: Price = \$6 Quantity = 80
- Calculate the price elasticity of demand if price increases from \$4 to \$6.
- The percent change of quantity: $\frac{80-120}{120} * 100\% = -33.3\%$
 - The percent change of price: $\frac{6-4}{4} * 100\% = 50\%$
 - Price elasticity in demand = $\frac{-33.3\%}{50\%} = -0.666$
- Calculate the price elasticity of demand if price decreases from \$6 to \$4.

The Price Elasticity of Demand: The Midpoint Method

- The elasticity between two points, (Q_1, P_1) and (Q_2, P_2) :
- Midpoint: $(\frac{P_1+P_2}{2}, \frac{Q_1+Q_2}{2})$
- Price elasticity in demand = $\frac{(Q_2-Q_1)/[(Q_2+Q_1)/2]}{(P_2-P_1)/[(P_2+P_1)/2]}$

The Price Elasticity of Demand

■ Example

- Point A: Price = \$4 Quantity = 120
- Point B: Price = \$6 Quantity = 80
- Midpoint: Price = \$5 Quantity = 100

■ Calculate the price elasticity of demand if price increases from \$4 to \$6 using midpoint method.

- The percent change of quantity: $\frac{80-120}{100} * 100\% = -40\%$
- The percent change of price: $\frac{6-4}{5} * 100\% = 40\%$
- Price elasticity in demand = $\frac{-40\%}{40\%} = -1$

■ Calculate the price elasticity of demand if price decreases from \$6 to \$4 using midpoint method.

A Few Elasticities from the Real World

■ Example

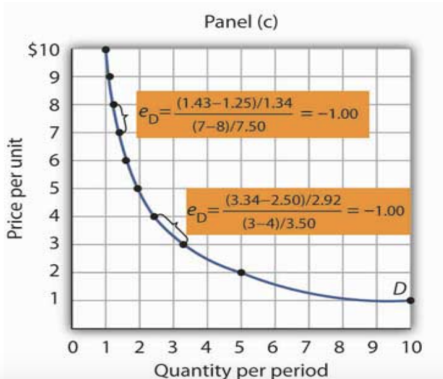
- Eggs: 0.1
- Healthcare 0.2
- Cigarettes 0.4
- Beef: 1.6
- Restaurant Meals 2.3
- Mountain Dew 4.4

The Determinants of Price Elasticity of Demand

- Availability of close substitutes
- Necessities and Luxuries
- Defining the market broadly or narrowly: narrowly defined markets tend to have more elastic demand.
- Time horizon: demands tends to be more elastic over longer periods of time.

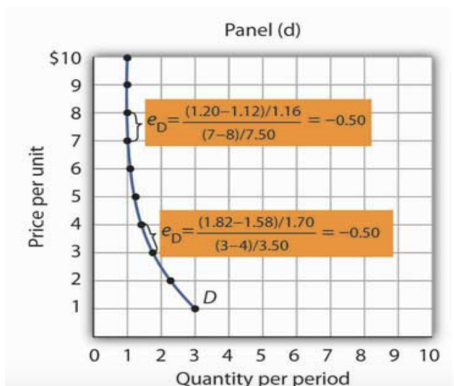
The Variety of Demand Curves

- Unit elasticity: when the percentage change in quantity equals the percentage change in price, the elasticity is exactly one, and demand is said to have unit elasticity.
- One percentage increase (decrease) in price will result in exactly 1 percentage decrease (increase) in demand.



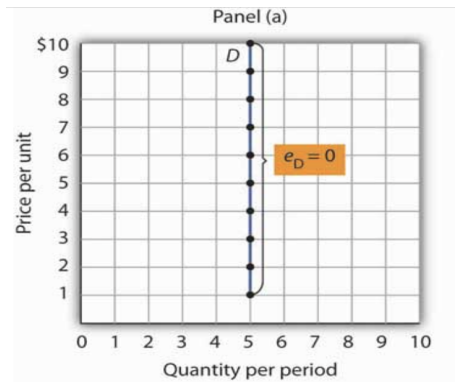
The Variety of Demand Curves

- Inelastic: when the quantity moves proportionately less than the price, the elasticity is less than one, and demand is said to be inelastic.
- One percentage increase (decrease) in price will result in less than 1 percentage decrease (increase) in demand.



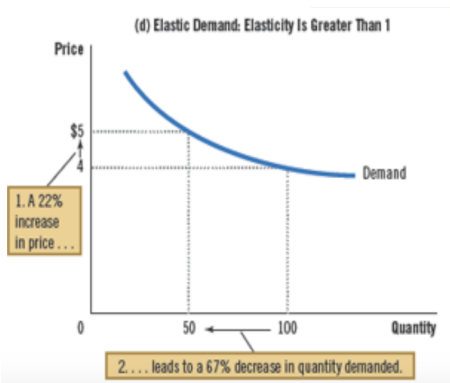
The Variety of Demand Curves

- Perfectly inelastic: the elasticity is zero. Demand doesn't change if price changes. The demand curve is vertical.
- One percentage increase (decrease) in price will result in zero change in demand.



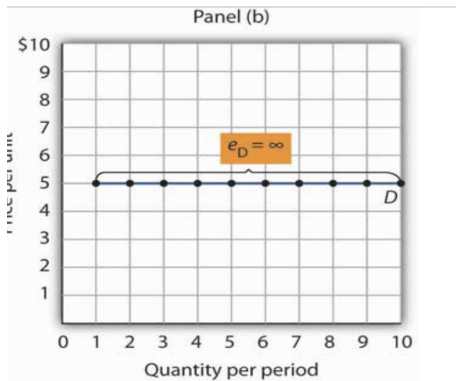
The Variety of Demand Curves

- Elastic: when the quantity moves proportionately more than the price, the elasticity is greater than one, and demand is said to be elastic.
- One percentage increase (decrease) in price will result in more than 1 percentage decrease (increase) in demand.



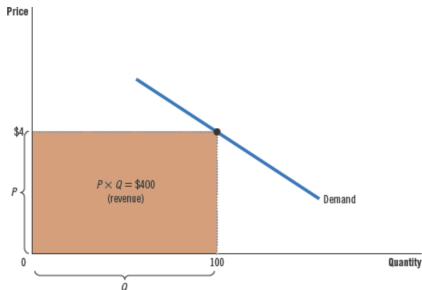
The Variety of Demand Curves

- Perfectly elastic: the elasticity is so large that it approaches infinity. The demand curve becomes horizontal..
- Tiny changes in the price lead to huge changes in the quantity demanded.



Total Revenue and the Price Elasticity of Demand

- Total revenue: The amount paid by buyers and received by the sellers, calculated as the price of the good times the quantity sold.
- Total Revenue = $P * Q$



Total Revenue and the Price Elasticity of Demand

- Percentage change in total revenue = Percentage change in price + Percentage in quantity sold.
- Example:
 - If price increases by one percent and quantity sold remains the same, the total revenue will increase by one percent.
 - If quantity decreases by two percent and price remains the same, the total revenue will decrease by two percent.
 - If price increases by one percent and, as a result, quantity sold decreases by two percent, the total revenue will decrease by one percent.
- How can we know the percentage of quantity sold if the percentage change in price is given?

Total Revenue and the Price Elasticity of Demand

- Percentage change in total revenue = Percentage change in price + Percentage in quantity sold.
- Example: unit elasticity
 - If price increases by one percent, as a result, quantity sold will decrease by one percent. The total revenue will not change.
 - If price decreases by one percent, as a result, quantity sold will increase by one percent. The total revenue will not change.

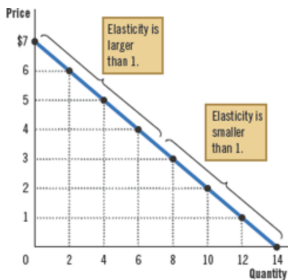
Total Revenue and the Price Elasticity of Demand

- Percentage change in total revenue = Percentage change in price + Percentage in quantity sold.
- Example: inelastic (price elasticity of demand smaller than one)
 - If price increases by one percent, as a result, quantity sold will decrease by less than one percent. The total revenue will increase.
 - If price decreases by one percent, as a result, quantity sold will increase by less than one percent. The total revenue will decrease.
- If demand is inelastic, raising price can increase total revenue.

Total Revenue and the Price Elasticity of Demand

- Percentage change in total revenue = Percentage change in price + Percentage in quantity sold.
- Example: elastic (price elasticity of demand larger than one)
 - If price increases by one percent, as a result, quantity sold will decrease by more than one percent. The total revenue will decrease.
 - If price decreases by one percent, as a result, quantity sold will increase by more than one percent. The total revenue will increase.
- If demand is elastic, lowering price can increase total revenue.

- For a linear demand curve, even though the slope is constant, the elasticity is not.
- Slope is the ratio of changes in the two variables, while elasticity is the ratio of percentage changes in them.
- At points with a low price and high quantity, a linear demand curve is inelastic. At points with a high price and low quantity, a linear demand curve is elastic.



Elasticity and Revenue along a Linear Demand Curve

- In short, the price elasticity of demand need not be the same at all points on a demand curve. A linear demand curve never has a constant elasticity.

Price	Quantity	Total Revenue (Price × Quantity)	Percentage Change in Price	Percentage Change in Quantity	Elasticity	Description
\$7	0	\$0				
6	2	12	15	200	13.0	Elastic
5	4	20	18	67	3.7	Elastic
4	6	24	22	40	1.8	Elastic
3	8	24	29	29	1.0	Unit elastic
2	10	20	40	22	0.6	Inelastic
1	12	12	67	18	0.3	Inelastic
0	14	0	200	15	0.1	Inelastic



Income Elasticity of Demand

- Income elasticity of demand measures of how the quantity demanded changes as consumer income changes.
- Income elasticity of demand is calculated as the percentage change in quantity demanded divided by the percentage change in income.
 - Income elasticity in demand = $\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$

Income Elasticity of Demand

- Normal goods: higher income increases the quantity demanded.
- Normal goods have positive income elasticities.
- Inferior goods: higher income reduces the quantity demanded.
- Inferior goods have negative income elasticities.

Income Elasticity of Demand

- Assume that a 4 percent increase in income results in a 2 percent increase in the quantity demanded of a good.
- The income elasticity of demand for the good is?
- Normal goods or inferior goods?

Cross-Price Elasticity of Demand

- The cross-price elasticity of demand measures of how the quantity demanded of one good responds to a change in the price of another.
- Cross-price elasticity of demand is calculated as the percentage change in quantity demanded of good one divided by the percentage change in the price of good two.
 - Cross-price elasticity in demand =
$$\frac{\text{Percentage change in quantity demanded of good one}}{\text{Percentage change in the price of good two}}$$

Cross-price Elasticity of Demand

- Substitutes: goods that are typically used in place of one another (hamburgers and hot dogs).
- For substitutes, cross-price elasticity is positive.
- Complements: goods that are typically used together (computers and software).
- For complements, cross-price elasticity is negative

Cross-price Elasticity of Demand

- Suppose that when the price of good X increases from \$500 to \$660, the quantity demanded of good Y decreases from 66 to 10.
- Using the midpoint method, the cross-price elasticity of demand is about ?
- X and Y are substitutes or complements?

The Elasticity of Supply

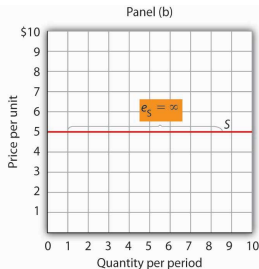
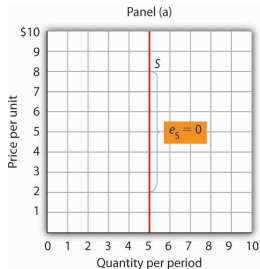
- Price elasticity of supply: a measure of how much the quantity supplied of a good responds to a change in its price.
- It is calculated as the percentage change in quantity supplied divided by the percentage change in price.
 - Price elasticity of supply = $\frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$

The Elasticity of Supply: Example

- Suppose price of milk increases from \$2.85 to \$3.15 per gallon and the quantity supplied increases from 9,000 to 11,000 gallons per month.
- Calculate milk's price elasticity of supply using midpoint method.

The Variety of Supply Curves

- Unit elasticity supply: elasticity equals one.
- Elastic supply: elasticity is greater than one.
 - Perfectly elastic supply: elasticity equals infinity.
- Inelastic supply: elasticity is less than one.
 - Perfectly inelastic supply: elasticity equals 0.



Different Elasticities along the Supply Curves

- In some markets, the elasticity is not constant but varies over the supply curve.
 - For low levels of quantity supplied, firms have additional capacity for production and can respond substantially to price changes. Thus, the elasticity of supply is high.
 - For high levels of quantity supplied, firms approach the limits of their current capacity and can only respond slightly to price changes. Thus, the elasticity of supply is inelastic.

