Chapter 5

Elasticity and Its Application

Professor Galvez-Soriano lecture notes. Based on N. Gregory Mankiw, Principles of Microeconomics, 9th Edition.

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The Elasticity of Demand

- Elasticity
  - Measure of the <mark>responsiveness of quantity</mark> demanded or quantity supplied
    - <mark>To a change in one of its determinants</mark>

- Price elasticity of demand
  - How much the **quantity** demanded of a good **responds** to a **change** in the **price** of that good

The Elasticity of Demand

- Price elasticity of demand
  - Percentage change in quantity demanded divided by the percentage change in price
- Elastic demand ($|\varepsilon_D| > 1$)
  - Quantity demanded **responds substantially** to changes in price
- Inelastic demand ($|\varepsilon_D| < 1$)
  - Quantity demanded **responds** only **slightly** to changes in price

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The Elasticity of Demand

- **Determinants** of price elasticity of demand
  - Availability of close **substitutes**
    - Goods with close substitutes: **more elastic** demand
  - **Necessities** versus **luxuries**
    - **Necessities**: **inelastic** demand
    - **Luxuries**: **elastic** demand

The Elasticity of Demand

- **Determinants** of price elasticity of demand
  - Definition of the market
    - **Narrowly defined** markets: **more elastic** demand

      beverages – soda – Coke
  - Time horizon
    - Demand is **more elastic** over **longer time horizons**

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The Elasticity of Demand

- Computing the price elasticity of demand

- Midpoint method
  - Two points: (Q_1, P_1) and (Q_2, P_2)

$$\varepsilon_D = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}$$

The Elasticity of Demand

- Variety of demand curves
  - Demand is elastic
$$|\varepsilon_D| > 1$$
  - Demand is inelastic
$$|\varepsilon_D| < 1$$
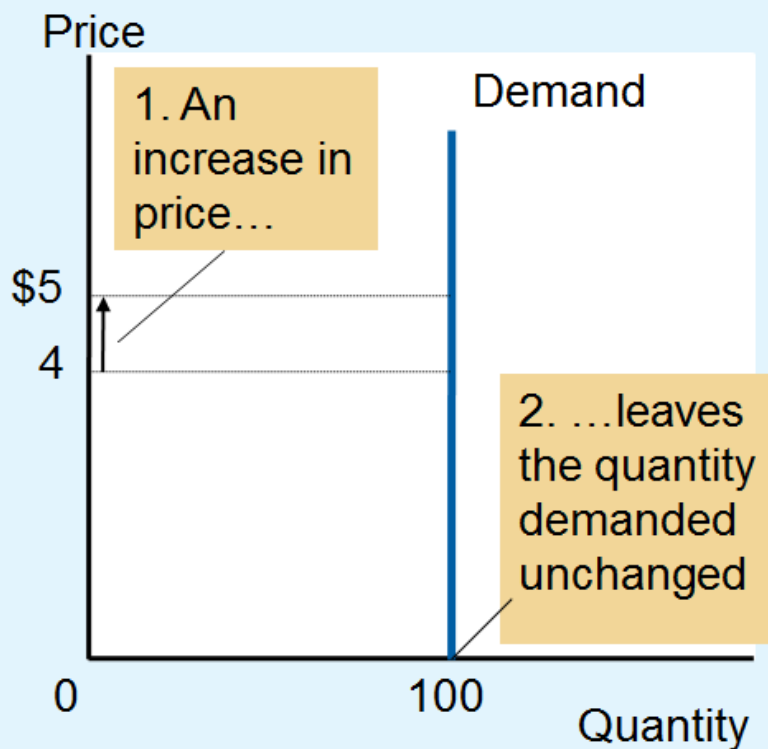 - Demand has unit elasticity
$$|\varepsilon_D| = 1$$

Example

Suppose that during the past year, the price of a laptop rose from $2,100 to $2,230. During the same time period, consumer sales decreased from 406,000 to 254,000 laptops.

$$\varepsilon_D = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}$$

	Original	New	Average	Change	Percentage change
Quantity	406,000	254,000	330,000	-152,000	-0.46
Price	2,100	2,230	2,165	130	0.06

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Figure 1 The Price Elasticity of Demand (a, b)

(a) Perfectly Inelastic Demand: Elasticity Equals 0

Price

1. An increase in price…

Demand

$5

4

2. …leaves the quantity demanded unchanged

0   100

Quantity

(b) Inelastic Demand: Elasticity Is Less Than 1

Price

1. A 22% increase in price…

2. … leads to an 11% decrease in quantity demanded

$5

4

Demand

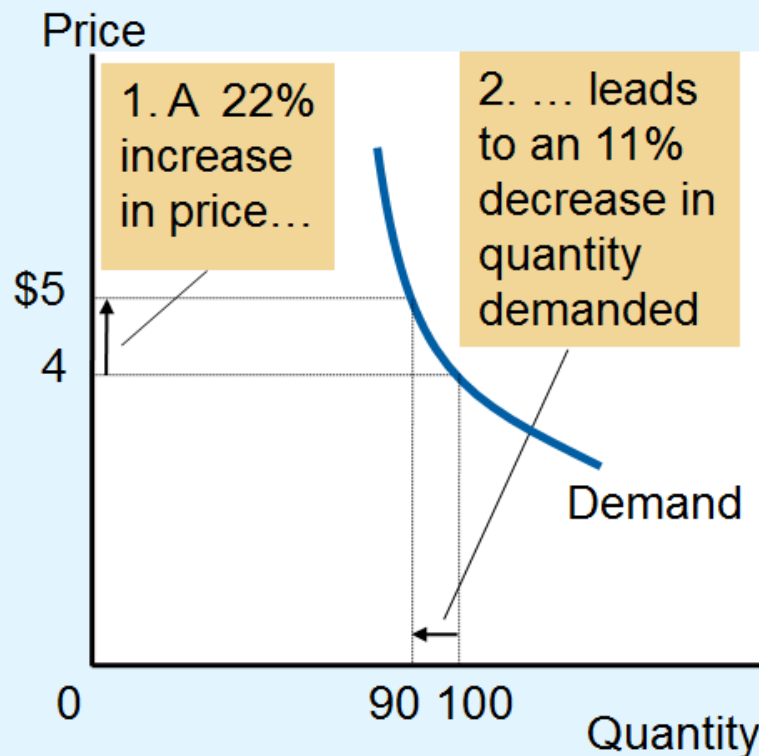0   90 100

Quantity

Figure 1 The Price Elasticity of Demand (c)

(c) Unit Elastic Demand: Elasticity Equals 1

1. A 22% increase in price…

2. … leads to a 22% decrease in quantity demanded

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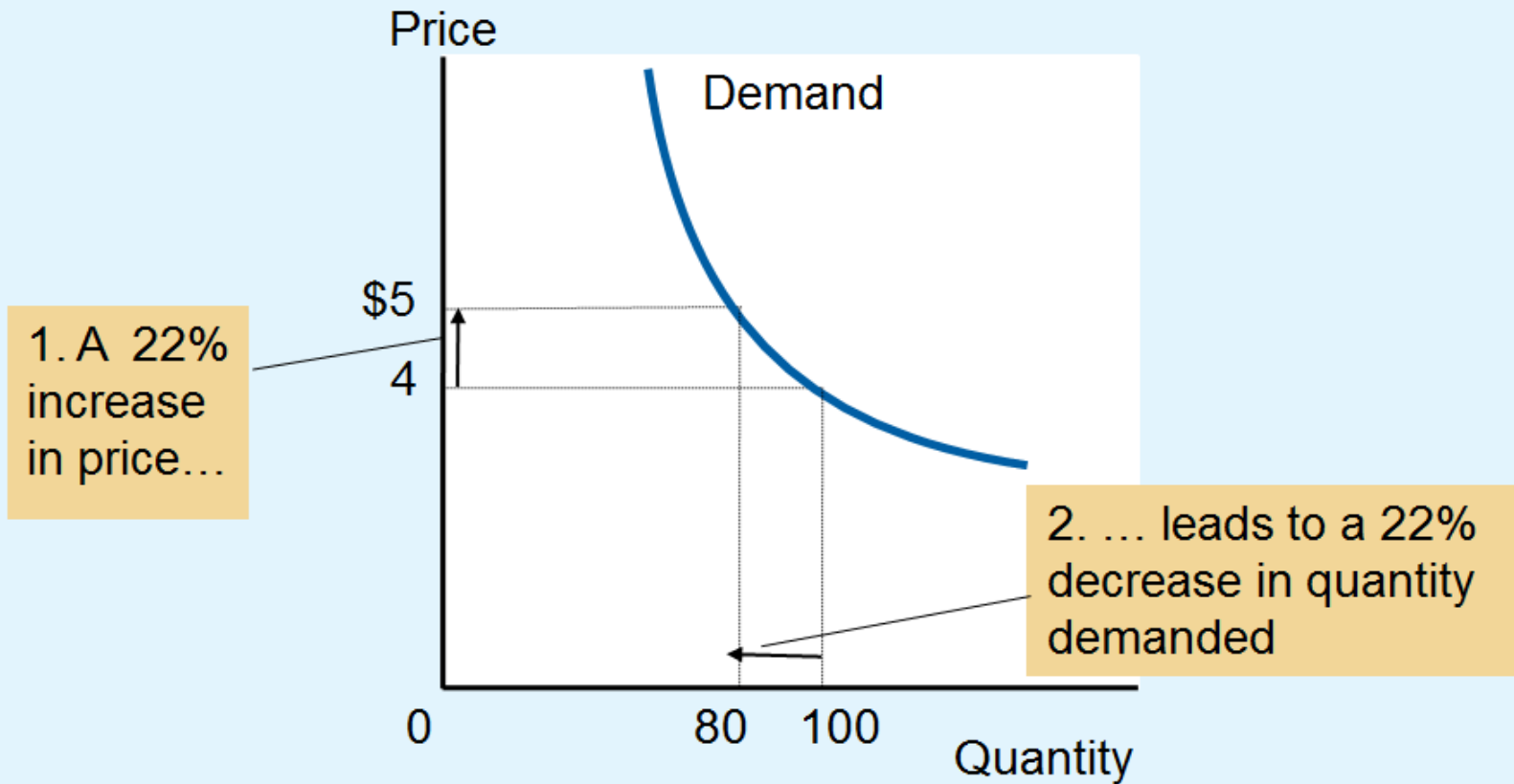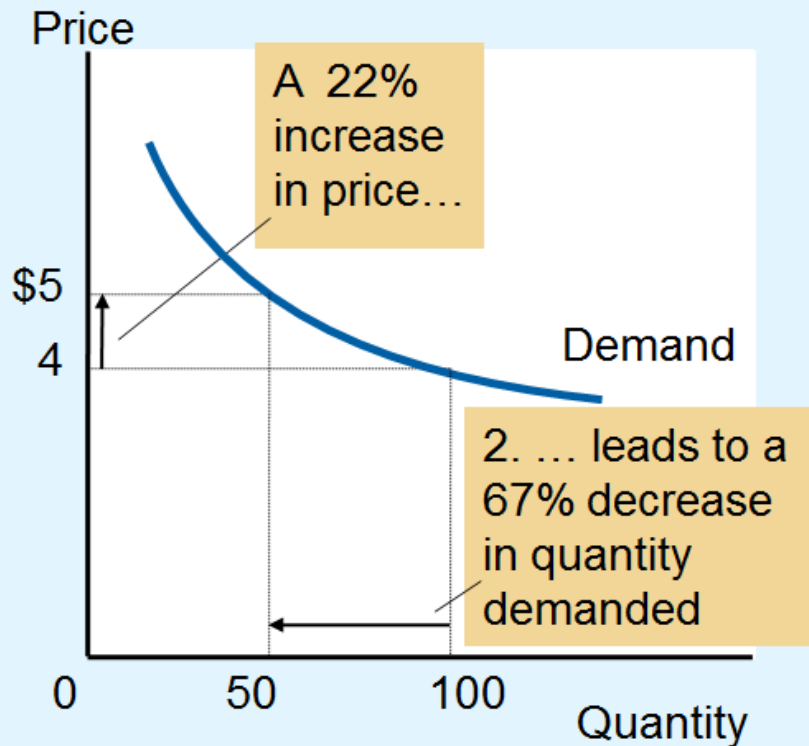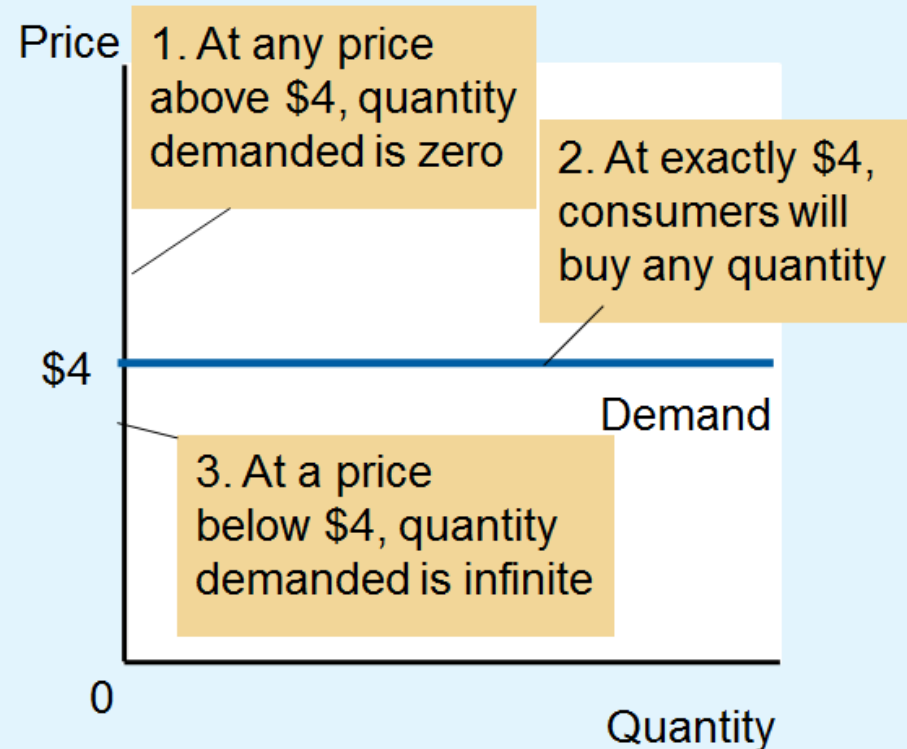
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Figure 1 The Price Elasticity of Demand (d, e)

(d) Elastic demand:
Elasticity > 1

(e) Perfectly elastic demand:
Elasticity equals infinity

Price

A 22% increase in price…

$5
4

Demand

2. … leads to a 67% decrease in quantity demanded

0   50   100   Quantity

Price

1. At any price above $4, quantity demanded is zero

2. At exactly $4, consumers will buy any quantity

$4

Demand

3. At a price below $4, quantity demanded is infinite

0   Quantity

Example
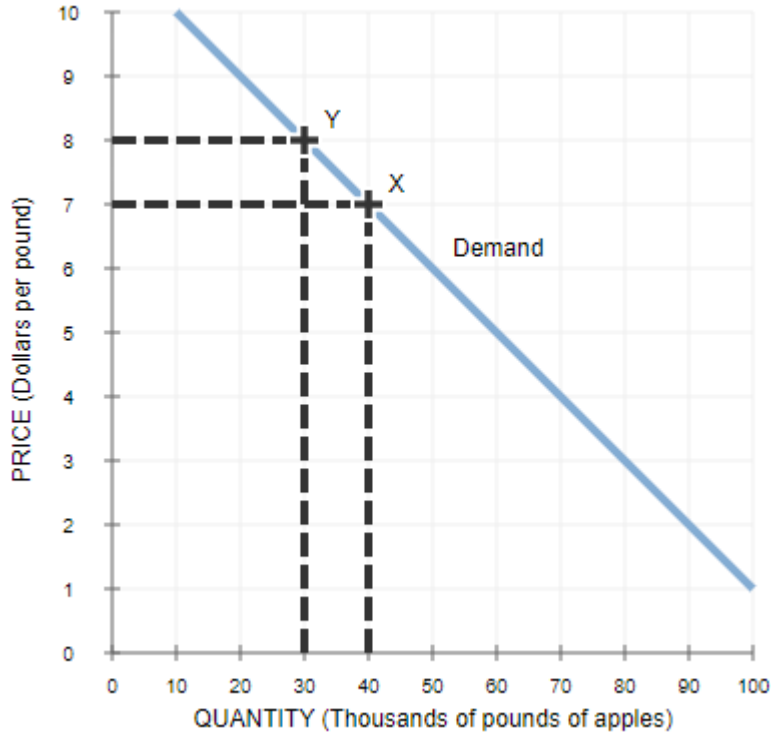
	Original	New	Average	Change	Percentage change
Quantity	40	30	35	-10	-0.29
Price	7	8	8	1	0.13

$$\varepsilon_D = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}$$

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The Elasticity of Demand

- Total revenue, **TR**
  - Amount paid by buyers and received by sellers of a good
  - Price of the good times the quantity sold (**P × Q**)
- For a **price increase**
  - If demand is **inelastic**, **TR** **increases**
  - If demand is **elastic**, **TR** **decreases**

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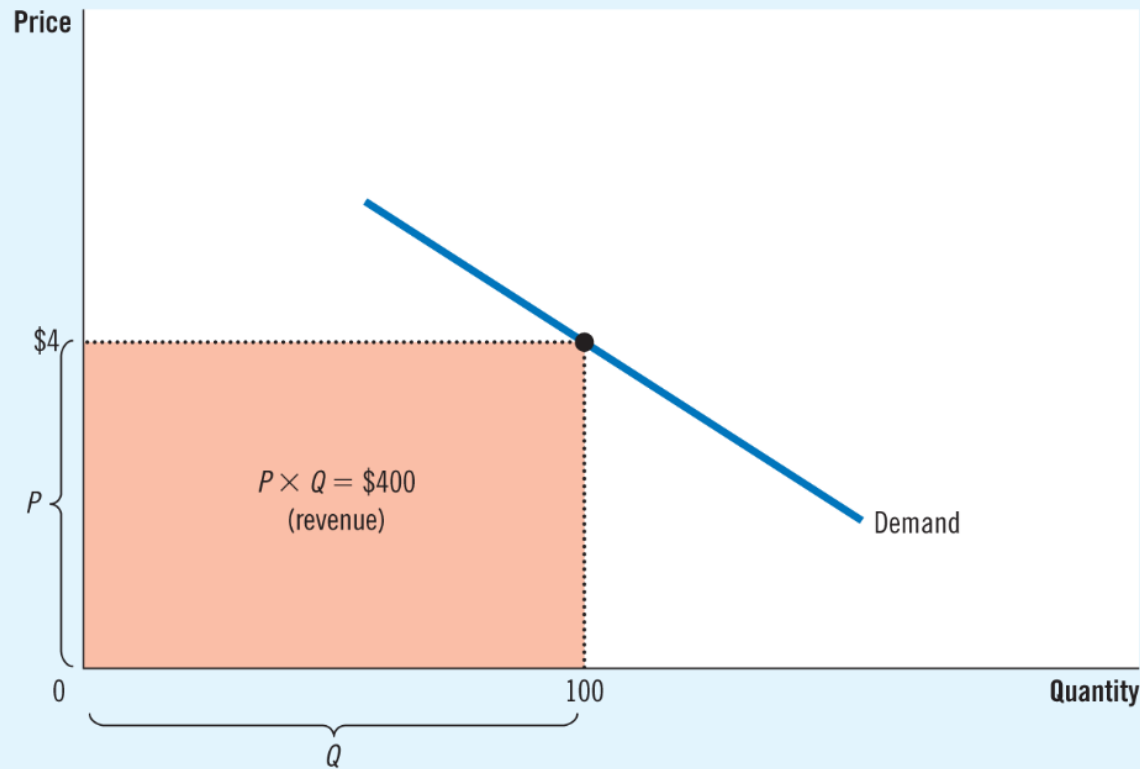
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Figure 2 Total Revenue

FIGURE 2

Total Revenue

The area of the box under the demand curve, $P \times Q$, equals the total amount paid by buyers as well as the total revenue received by sellers. Here, at a price of $4, the quantity demanded is 100 and total revenue is $400.

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Figure 3 How Total Revenue Changes When Price Changes (a)

(a) The Case of Inelastic Demand

FIGURE 3

How Total Revenue Changes When Price Changes

The impact of a price change on total revenue (the product of price and quantity) depends on the elasticity of demand. In panel (a), the demand curve is inelastic. In this case, an increase in the price leads to a proportionately smaller decrease in quantity demanded, so total revenue increases. Here an increase in the price from $4 to $5 causes the quantity demanded to fall from 100 to 90. Total revenue rises from $400 to $450.
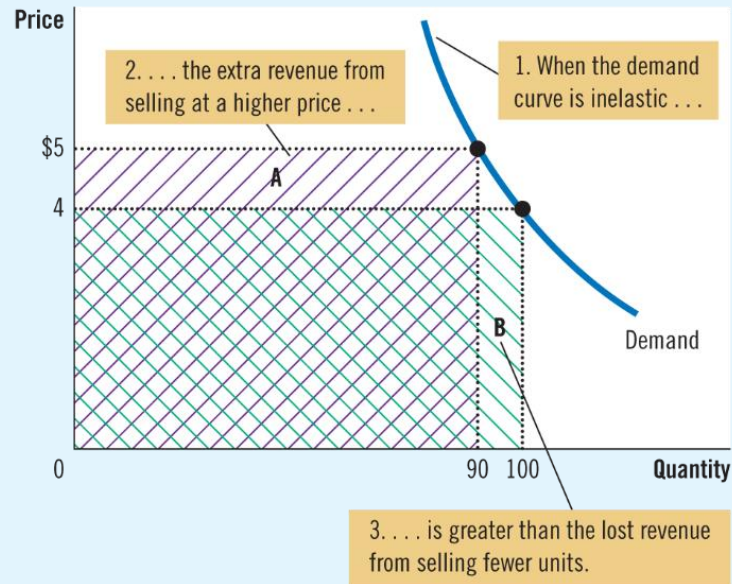
(a) The Case of Inelastic Demand

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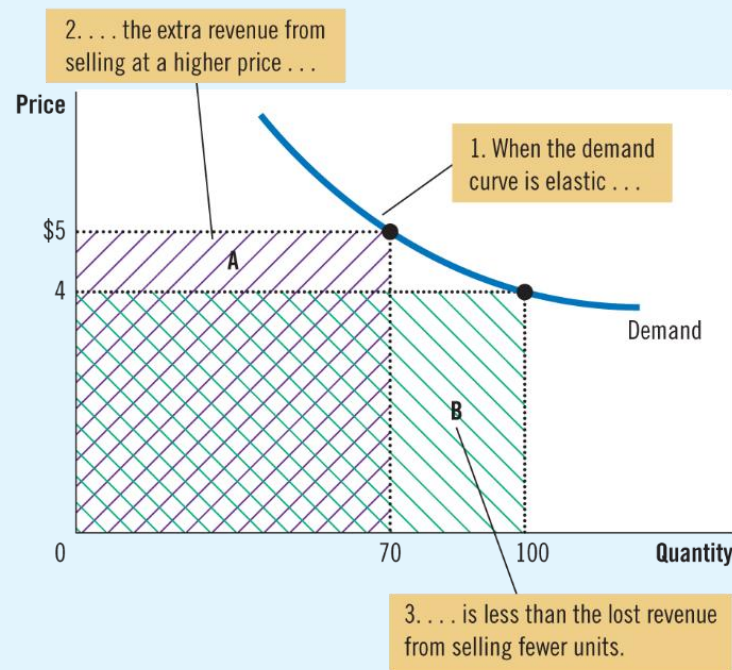# Figure 3 How Total Revenue Changes When Price Changes (b)

(b) The Case of Elastic Demand

FIGURE 3

How Total Revenue Changes When Price Changes

The impact of a price change on total revenue (the product of price and quantity) depends on the elasticity of demand. In panel (a), the demand curve is inelastic. In panel (b), the demand curve is elastic. In this case, an increase in the price leads to a proportionately larger decrease in quantity demanded, so total revenue decreases. Here an increase in the price from $4 to $5 causes the quantity demanded to fall from 100 to 70. Total revenue falls from $400 to $350.

(b) The Case of Elastic Demand

2. . . . the extra revenue from selling at a higher price . . .

1. When the demand curve is elastic . . .

3. . . . is less than the lost revenue from selling fewer units.

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The Elasticity of Demand

- Linear demand curve
  - Constant slope
  - Different price elasticities

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Figure 4 Elasticity along a Linear Demand Curve
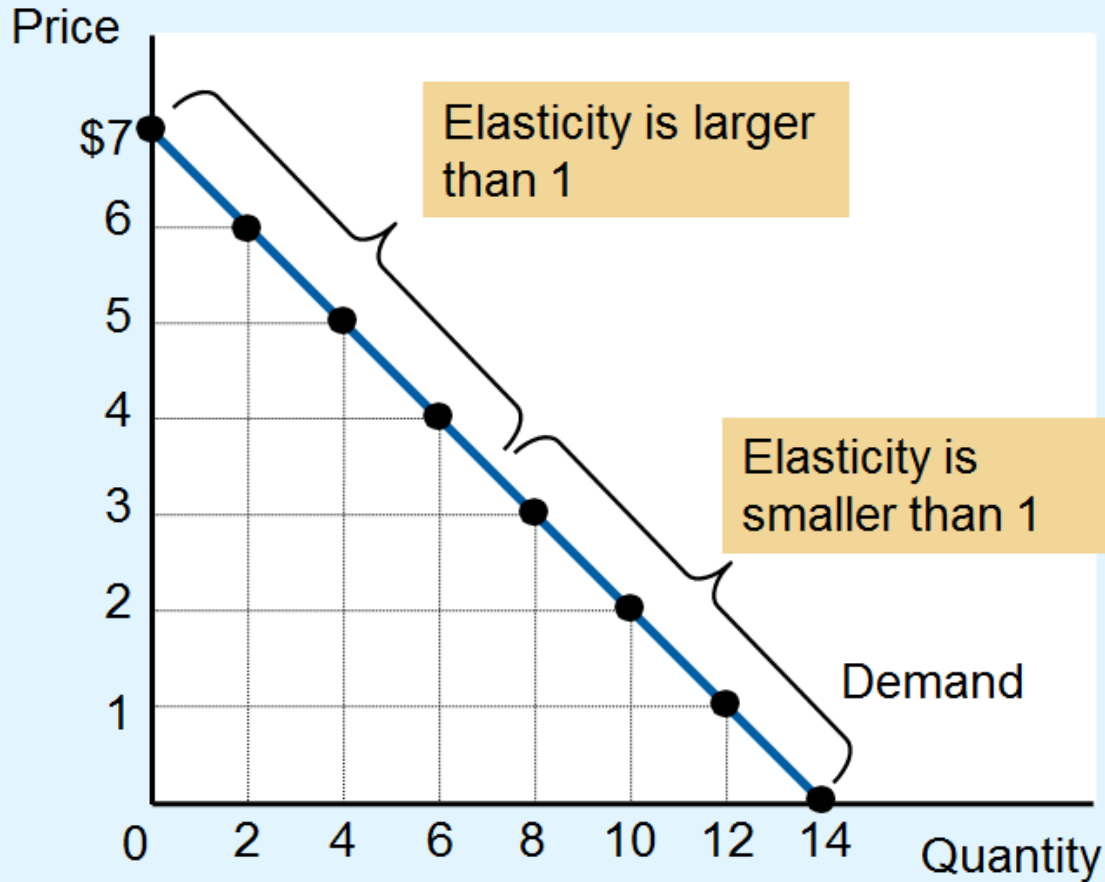
The slope of a linear demand curve is constant, but its elasticity is not.

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Figure 4 Elasticity along a Linear Demand Curve

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

The Elasticity of Demand

- **Income elasticity** of demand
  - How much the **quantity demanded** of a good **responds to** a change in consumers' **income**

The Elasticity of Demand

- Normal goods
  - Positive income elasticity
  - **Necessities**
    - **Smaller** income elasticities
  - **Luxuries**
    - **Large** income elasticities
- Inferior goods
  - Negative income elasticities

The Elasticity of Demand

- Cross-price elasticity of demand
  - How much the quantity demanded of one good responds to a change in the price of another good

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The Elasticity of Demand

- **Substitutes**
  - Goods typically used in place of one another
  - Positive cross-price elasticity
- **Complements**
  - Goods that are typically used together
  - Negative cross-price elasticity

The Elasticity of Supply

- Price elasticity of supply
  - How much the ==quantity supplied== of a good ==responds to== a change in the ==price== of that good
  - Depends on the flexibility of sellers to change the amount of the good they produce

The Elasticity of Supply

- Elastic supply ($|\varepsilon_S| > 1$)

- Inelastic supply ($|\varepsilon_S| < 1$)

- **Determinant** of price elasticity of supply
  - Time period
    - Supply is more elastic in the long run

The Elasticity of Supply, Part 3

- Computing price elasticity of supply

- Midpoint method
  - Two points: (Q_1, P_1) and (Q_2, P_2)

$$\varepsilon_S = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}$$

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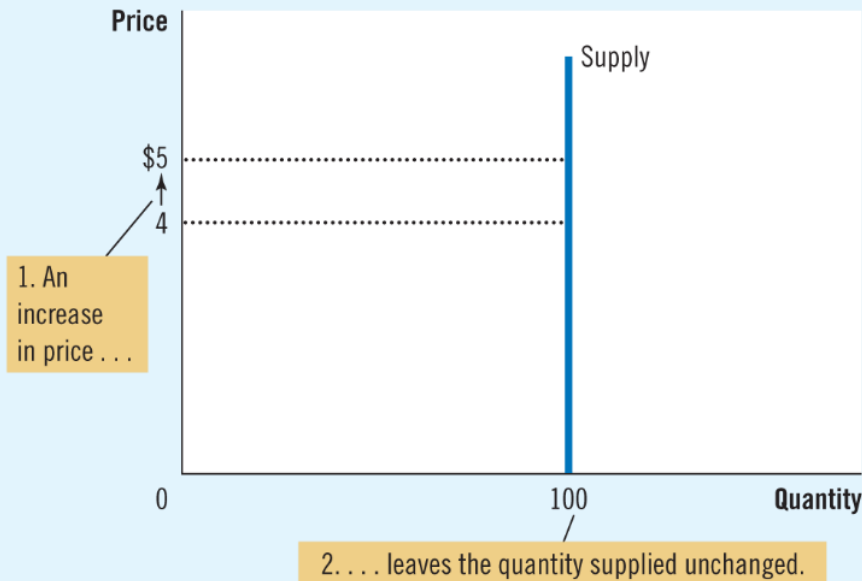
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Figure 5 The Price Elasticity of Supply (a, b)

The price elasticity of supply determines whether the supply curve is steep or flat. Note that all percentage changes are calculated using the midpoint method.

FIGURE 5

The Price Elasticity of Supply

(a) Perfectly Inelastic Supply: Elasticity Equals 0

Price

Supply

$5
4

1. An increase in price . . .

0   100   Quantity

2. . . . leaves the quantity supplied unchanged.

(b) Inelastic Supply: Elasticity Is Less Than 1

Price

Supply

$5
4

1. A 22% increase in price . . .

0   100 → 110   Quantity

2. . . . leads to a 10% increase in quantity supplied.

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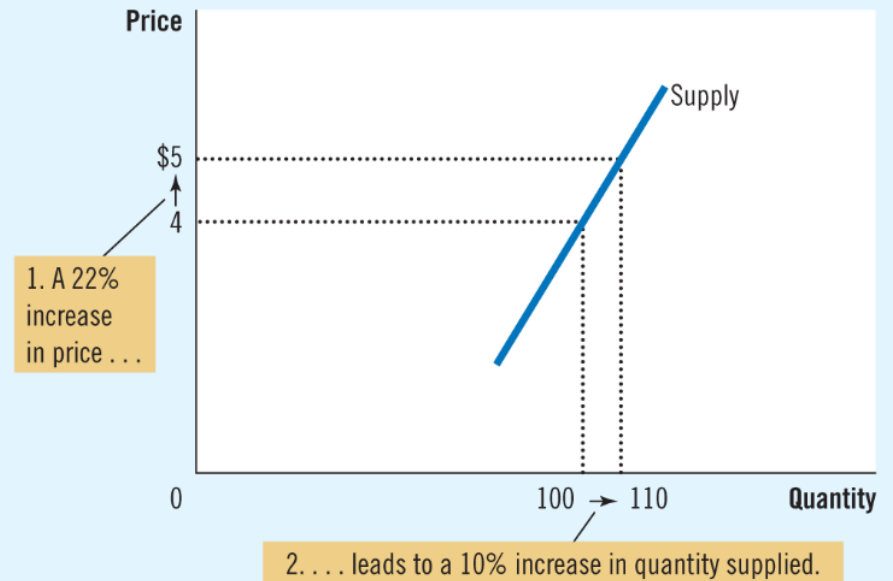
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Figure 5 The Price Elasticity of Supply (c)

The price elasticity of supply determines whether the supply curve is steep or flat. Note that all percentage changes are calculated using the midpoint method.

FIGURE 5

The Price Elasticity of Supply

(c) Unit Elastic Supply: Elasticity Equals 1

Price

Supply

$5

4

1. A 22% increase in price . . .

0

100 → 125

Quantity

2. . . . leads to a 22% increase in quantity supplied.

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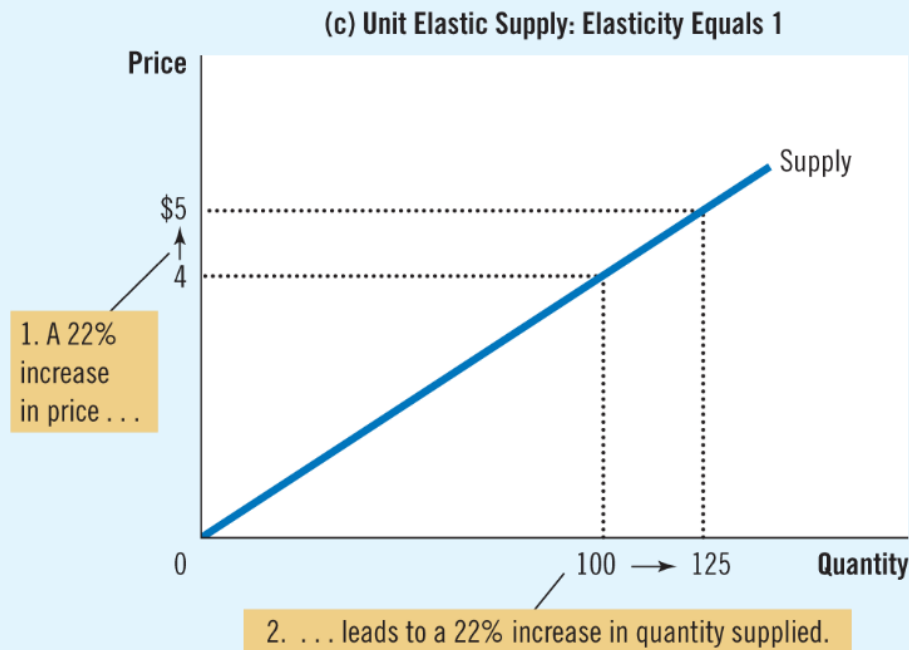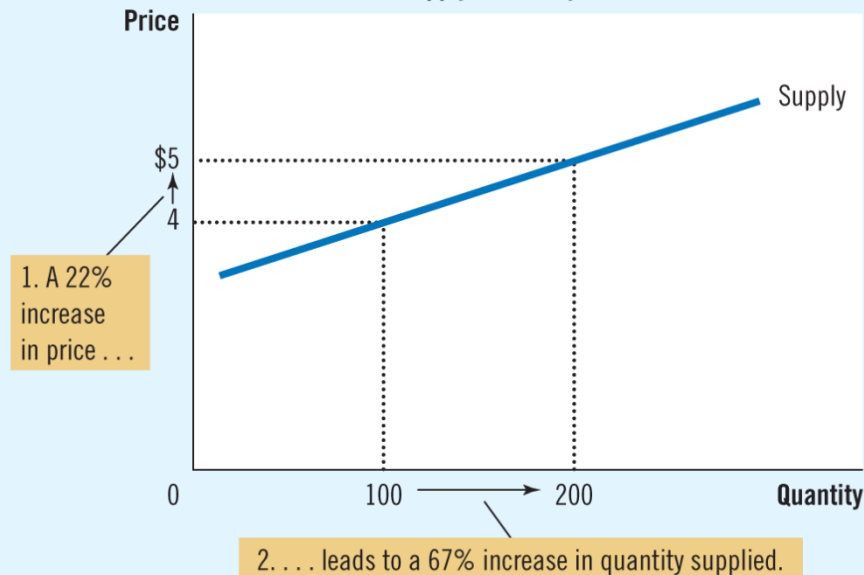
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Figure 5 The Price Elasticity of Supply (d, e)

The price elasticity of supply determines whether the supply curve is steep or flat. Note that all percentage changes are calculated using the midpoint method.

FIGURE 5

The Price Elasticity of Supply

(d) Elastic Supply: Elasticity Is Greater Than 1

Price

Supply

$5

4

1. A 22% increase in price . . .

0   100   200   Quantity

2. . . . leads to a 67% increase in quantity supplied.

(e) Perfectly Elastic Supply: Elasticity Equals Infinity

Price

1. At any price above $4, quantity supplied is infinite.

$4   Supply

2. At exactly $4, producers will supply any quantity.

0   Quantity

3. At a price below $4, quantity supplied is zero.

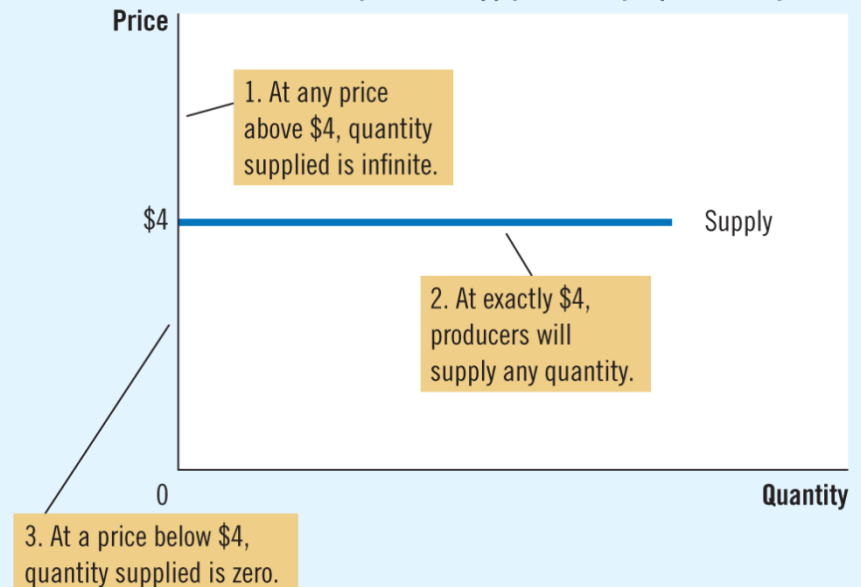Professor Galvez-Soriano lecture notes. Based on N. Gregory Mankiw, Principles of Microeconomics, 9th Edition.

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Figure 6 How the Price Elasticity of Supply Can Vary

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