



Elasticity and its applications

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01 | Price elasticity of demand

The Elasticity of Demand

- **Why Elasticity (Alfred Marshall)?**
- Law of Demand can only justifies the inverse relationship between the price and Quantity demanded, no more
- Measure of the responsiveness of quantity demanded or quantity supplied, to a change in one of its determinants, can tell more (**many policy implications**)
- **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**
- Quantity demanded responds substantially to changes in price
- **Inelastic demand**
- Quantity demanded responds only slightly to changes in price

A Naïve method

- Point A: price = \$4, Quantity = 120
- Point B: price = \$6, Quantity = 80
- If the point changes from A to B
- If the point changes from B to A

The elasticity of demand (computation)

- Computing the price elasticity of demand
- Percentage change in quantity demanded divided by percentage change in price
- Can use **absolute value** to drop the sign
- **A better method: midpoint method**
- Two points: (Q1, P1) and (Q2, P2)

$$\text{Price elasticity of demand} = \frac{(Q_2 - Q_1) / [(Q_2 + Q_1) / 2]}{(P_2 - P_1) / [(P_2 + P_1) / 2]};$$

$$\text{Formally} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

An example

Price	Quantity Demanded
\$0	50
\$2	40
\$4	30
\$6	20
48	10

What is the price elasticity of demand if price changes from \$2 to \$4?

The elasticity of demand

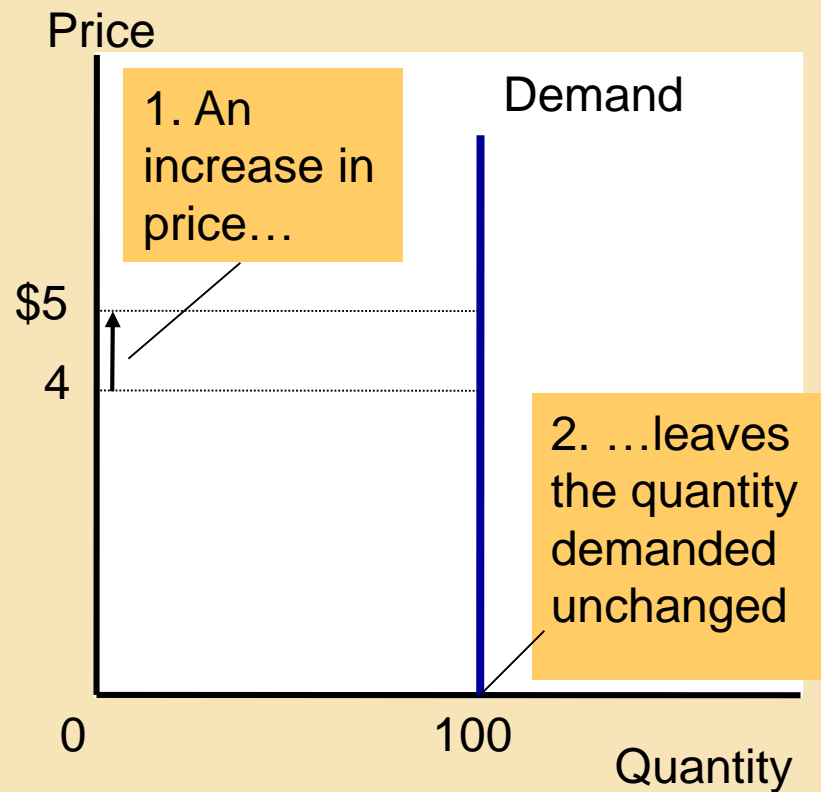
- Variety of demand curves
- Demand is elastic
- Price elasticity of demand > 1
- Demand is inelastic
- Price elasticity of demand < 1
- Demand has unit elasticity
- Price elasticity of demand $= 1$

The elasticity of demand

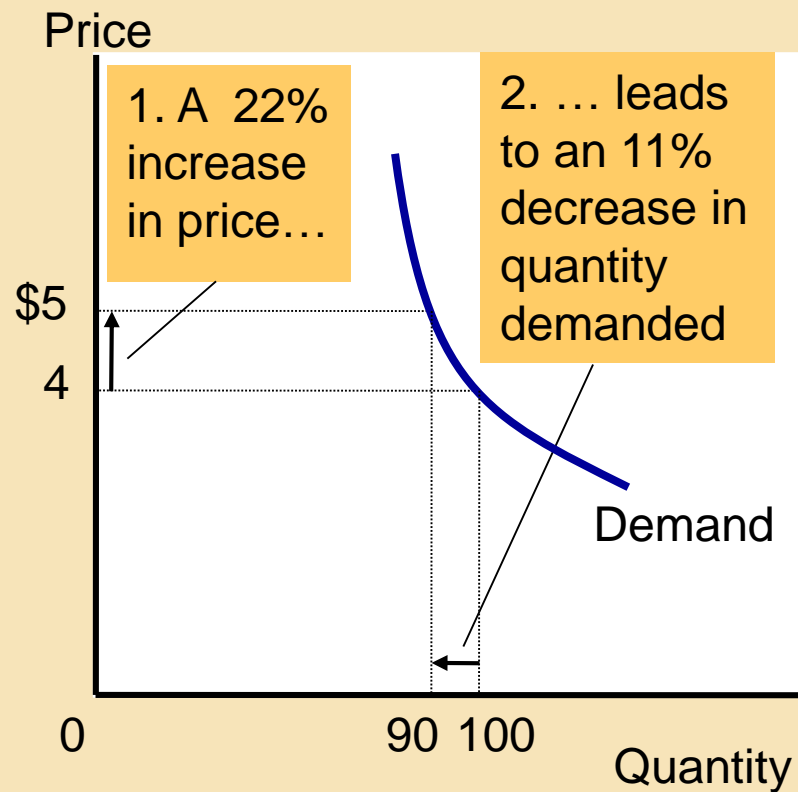
- Variety of demand curves
- Demand is perfectly inelastic
- Price elasticity of demand = 0
- Demand curve is vertical
- Demand is perfectly elastic
- Price elasticity of demand = infinity
- Demand curve is horizontal
- The **flatter** the demand curve
- The **greater** the price elasticity of demand

The Price Elasticity of Demand (a, b)

(a) Perfectly Inelastic Demand: Elasticity Equals 0



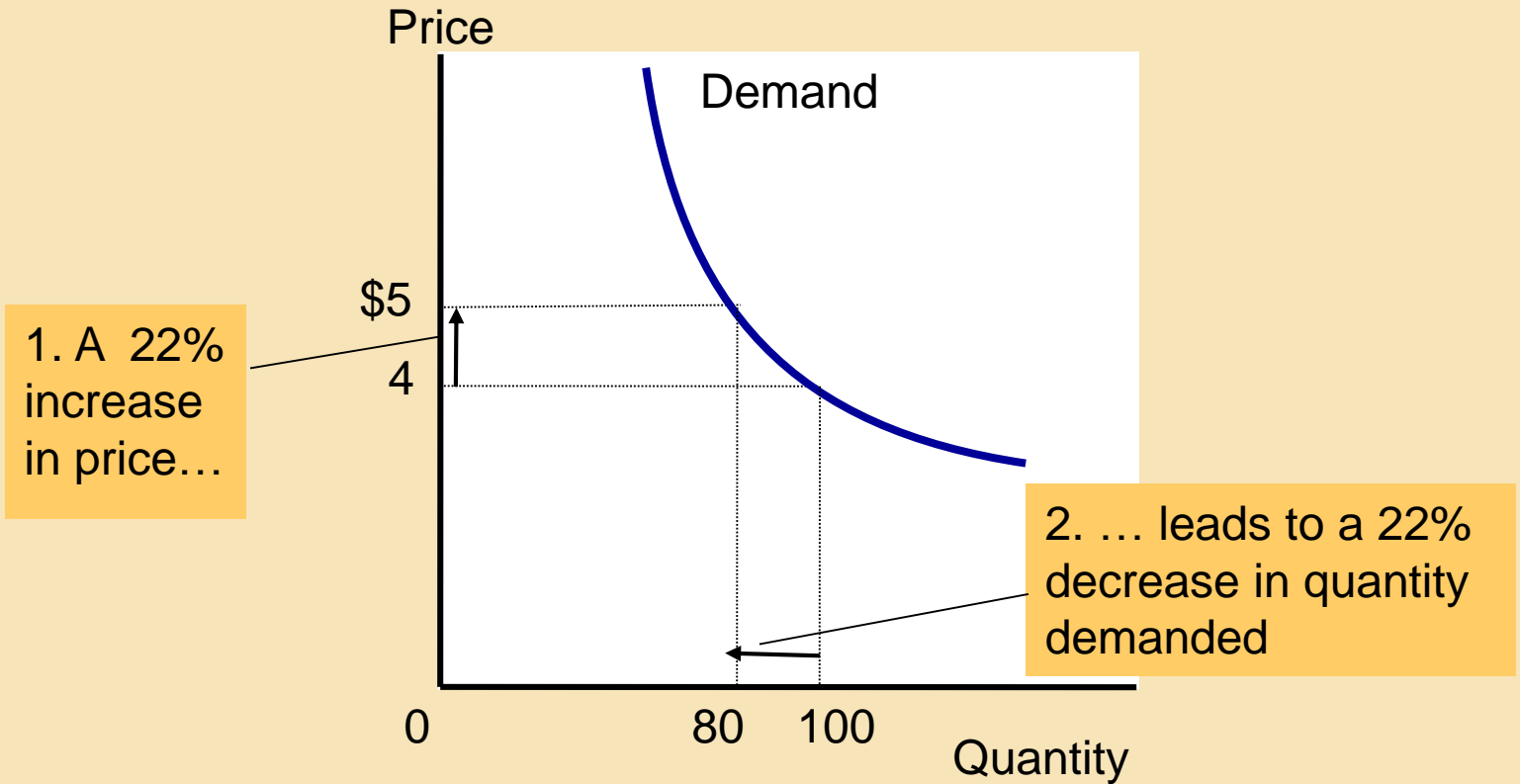
(b) Inelastic Demand: Elasticity Is Less Than 1



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

The Price Elasticity of Demand (c)

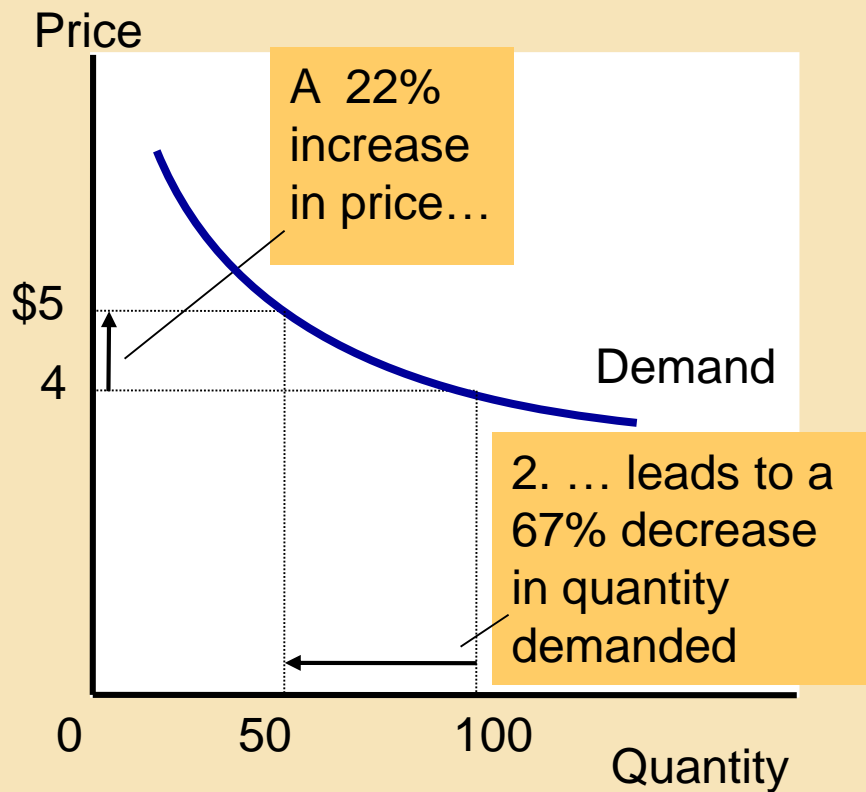
(c) Unit Elastic Demand: Elasticity Equals 1



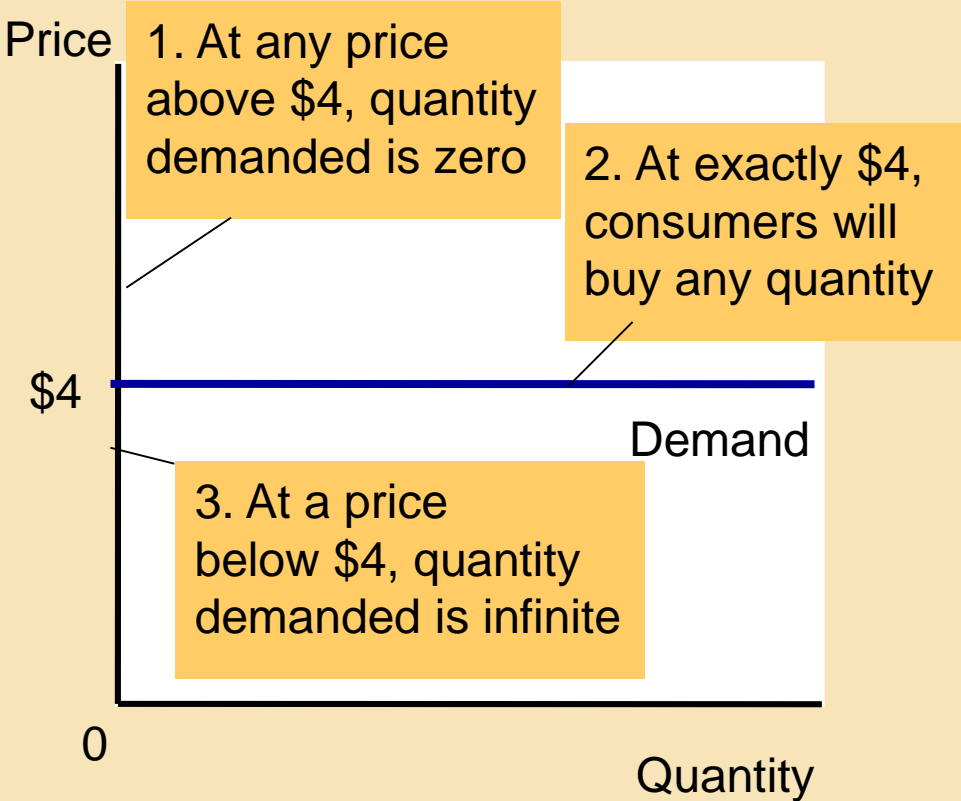
The price elasticity of demand determines whether the demand curve is steep or flat. Note that all percentage changes are calculated using the midpoint method.

The Price Elasticity of Demand (d, e)

(d) Elastic demand:
Elasticity > 1



(e) Perfectly elastic demand:
Elasticity equals infinity



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

The Elasticity of Demand

- **Determinants of price elasticity of demand**
 - Availability of close substitutes
 - Goods with close substitutes – more elastic demand
 - Necessities vs. 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 because it is easier to find substitutes (different brands of milk teas)
 - Time horizon
 - Demand is more elastic over longer time horizons (for example, gasoline, 小灵通)

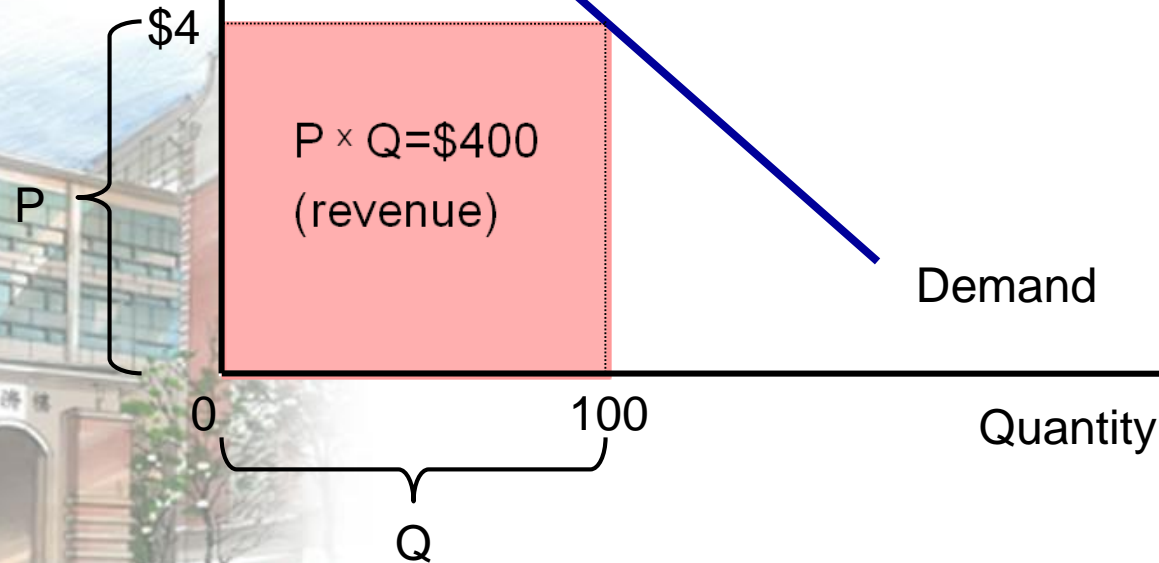


02 | Relationship with TR

Total Revenue



Price

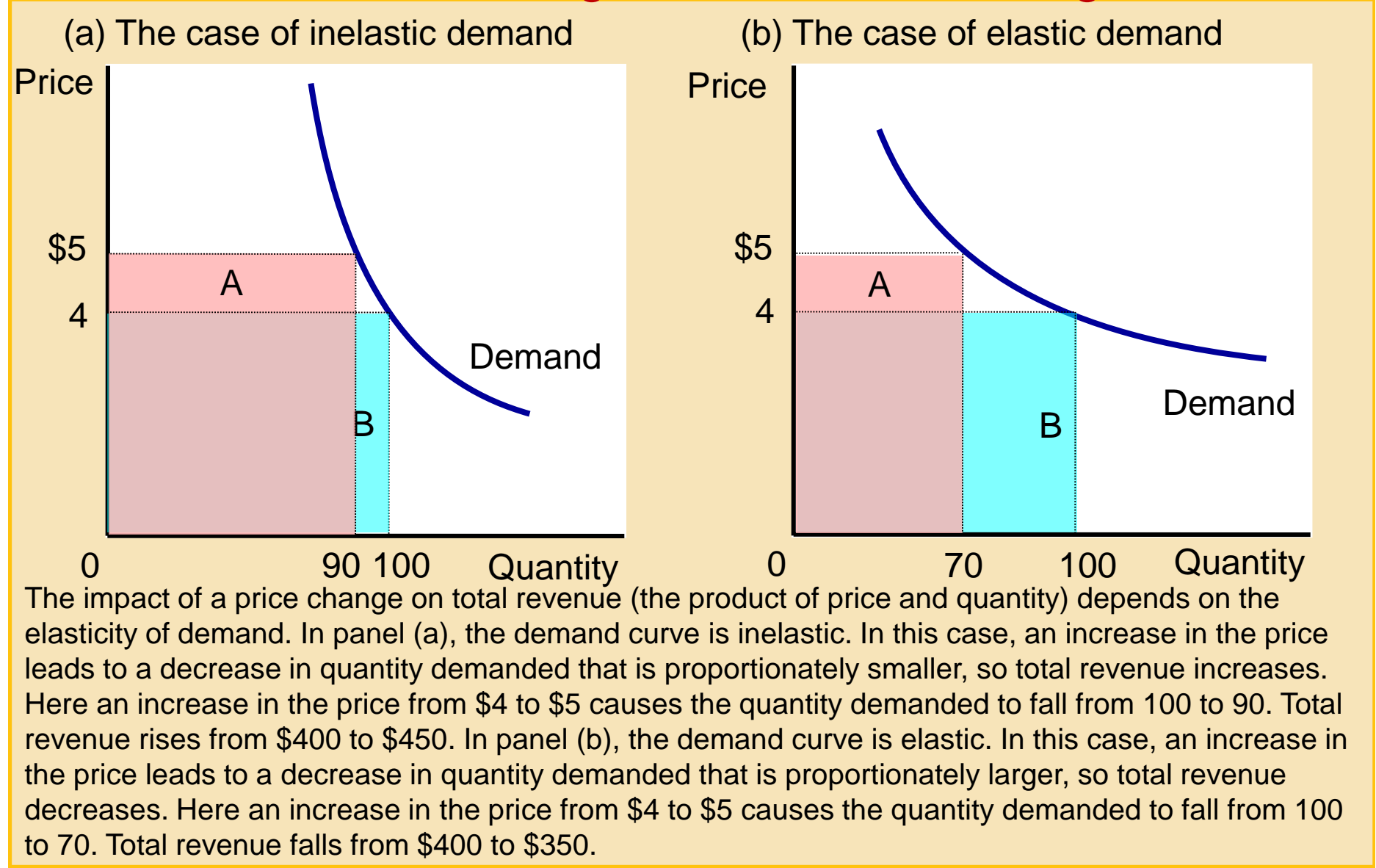


The total amount paid by buyers, and received as revenue by sellers, equals the area of the box under the demand curve, $P \times Q$. Here, at a price of \$4, the quantity demanded is 100, and total revenue is \$400.

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 ($P \cdot Q$)
- **For a price increase**
 - If demand is inelastic, TR increases
 - If demand is elastic, TR decreases
- **What is the math representation?**

How Total Revenue Changes When Price Changes



The Elasticity of Demand

- When demand is inelastic (elasticity < 1)
 - Price and total revenue move in the same direction
- When demand is elastic (elasticity > 1)
 - Price and total revenue move in opposite directions
- If demand is unit elastic (elasticity $= 1$)
 - Total revenue remains constant when the price changes

The Elasticity of Demand

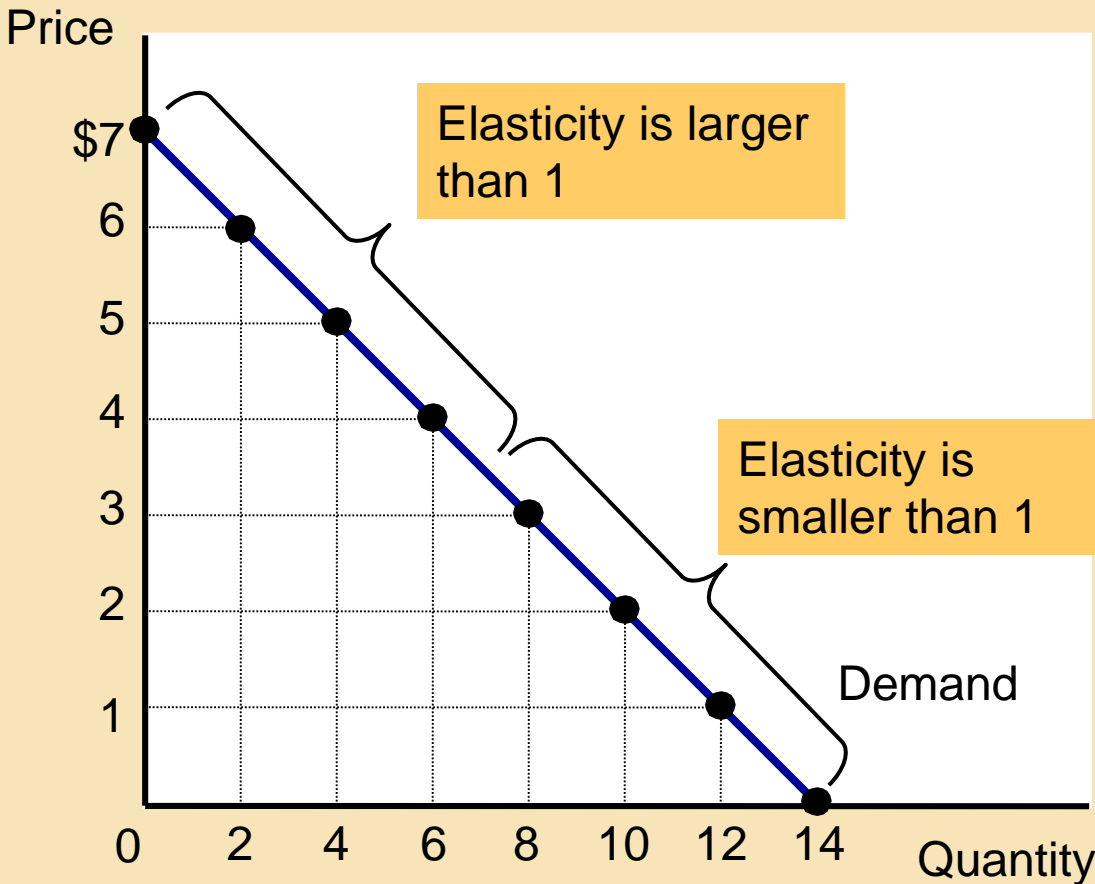
- Linear demand curve
 - Constant slope
 - Rise over run
 - Different price elasticities
 - Points with low price & high quantity
 - Inelastic demand
 - Points with high price & low quantity
 - Elastic demand

Elasticity of a Linear Demand Curve (schedule)

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

The slope of a linear demand curve is constant, but its elasticity is not. The demand schedule in the table was used to calculate the price elasticity of demand by the midpoint method. At points with a low price and high quantity, the demand curve is inelastic. At points with a high price and low quantity, the demand curve is elastic.

Elasticity of a Linear Demand Curve (graph)



The slope of a linear demand curve is constant, but its elasticity is not.

03 | Other elasticity of demand

The Elasticity of Demand

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

The Elasticity of Demand

- **Normal goods**
 - Positive income elasticity
 - Necessities
 - Small 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
- Percentage change in quantity demanded of the first good
- Divided by the percentage change in price of the second good

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

04 | The elasticity of supply

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
- Percentage change in quantity supplied
 - Divided by the percentage change in price
- Depends on the flexibility of sellers to change the amount of the good they produce

The Elasticity of Supply

- **Computing price elasticity of supply**
 - Percentage change in quantity supplied divided by percentage change in price
 - Always positive
- **Midpoint method**
 - Two points: (Q_1, P_1) and (Q_2, P_2)
 - What is the formula?

The Elasticity of Supply

Elastic supply

- Quantity supplied responds substantially to changes in the price

Inelastic supply

- Quantity supplied responds only slightly to changes in the price

Determinant of price elasticity of supply

- Time period
 - Supply is more elastic in long run

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The Elasticity of Supply

Variety of supply curves

- Supply is unit elastic
 - Price elasticity of supply = 1
- Supply is elastic
 - Price elasticity of supply > 1
- Supply is inelastic
 - Price elasticity of supply < 1

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The Elasticity of Supply

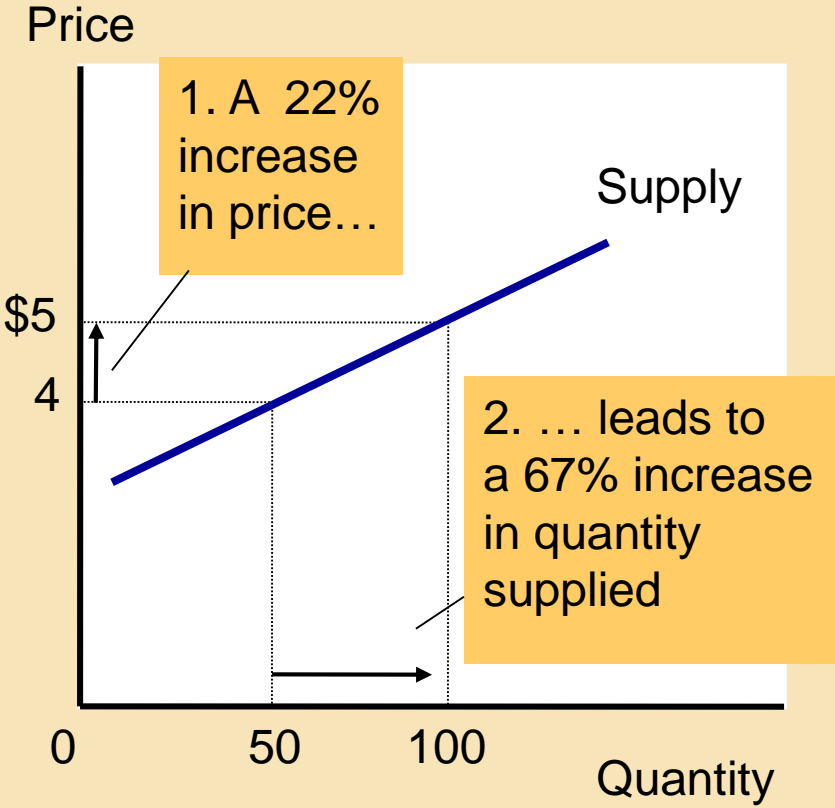
Variety of supply curves

- Supply is perfectly inelastic
 - Price elasticity of supply = 0
 - Supply curve – vertical
- Supply is perfectly elastic
 - Price elasticity of supply = infinity
 - Supply curve – horizontal

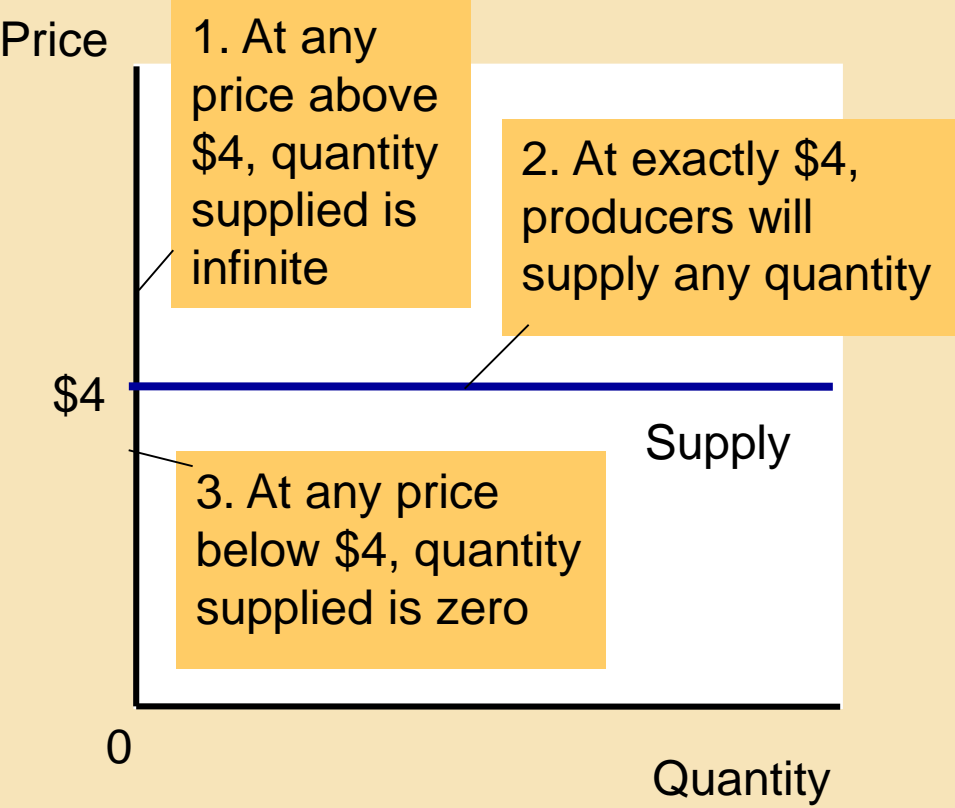
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The Price Elasticity of Supply (d, e)

(d) Elastic Supply: Elasticity Is Greater Than 1



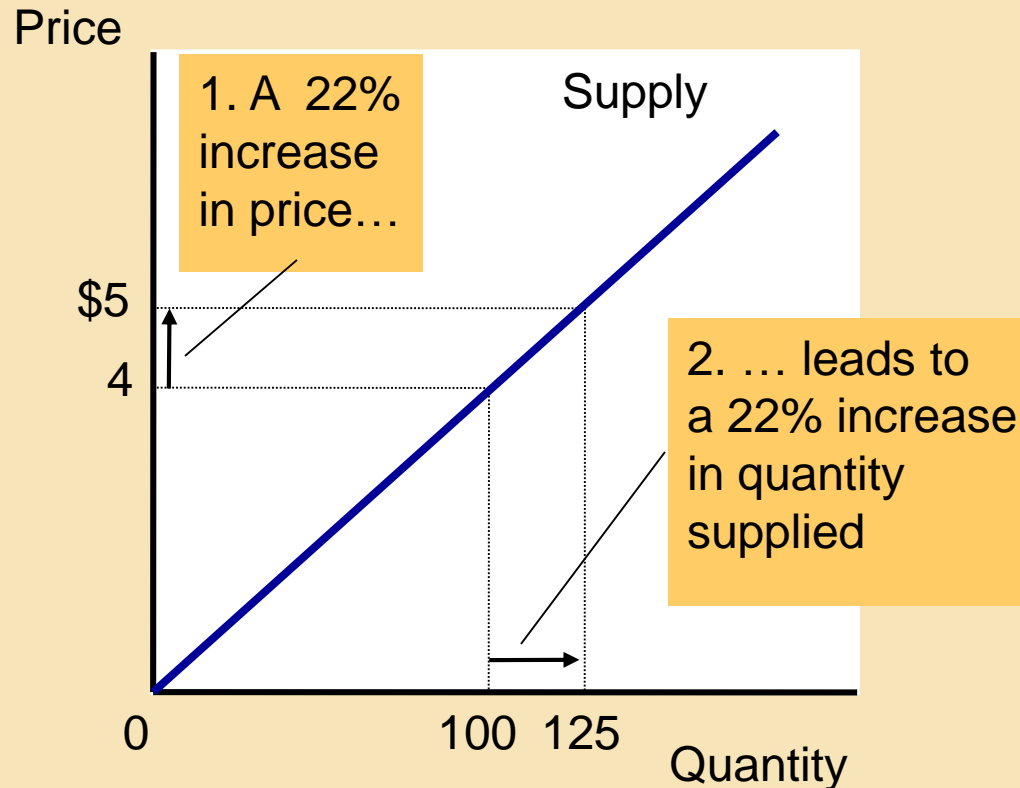
(e) Perfectly Elastic Supply: Elasticity Equals Infinity



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.

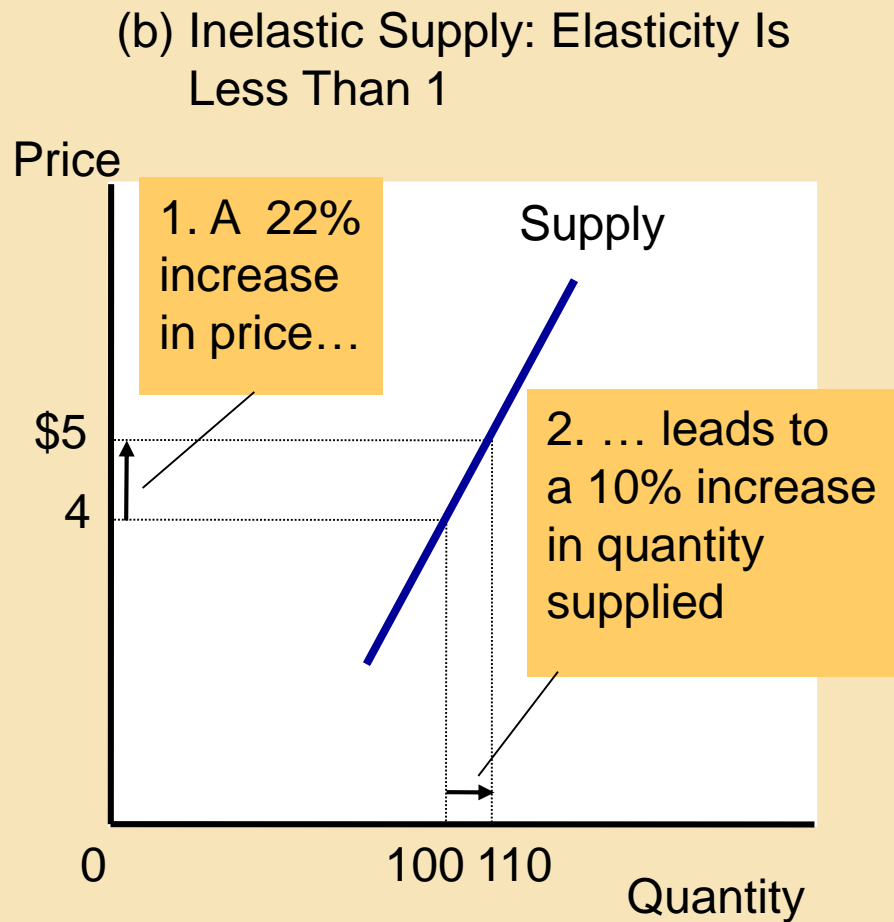
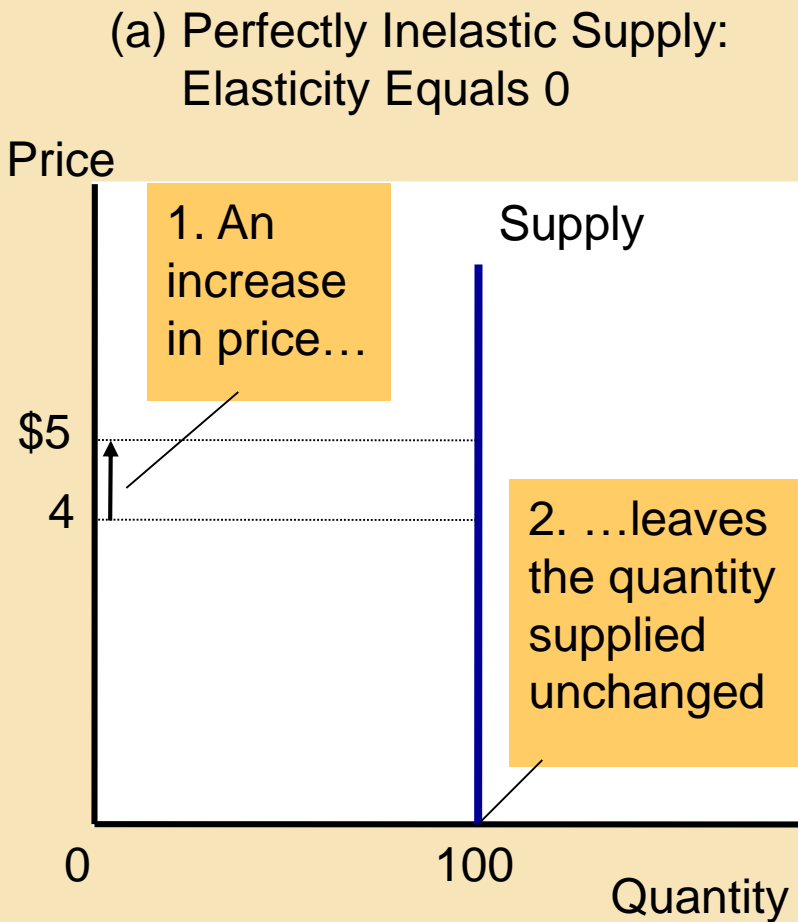
The Price Elasticity of Supply (c)

(c) Unit Elastic Supply: Elasticity Equals 1



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.

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.

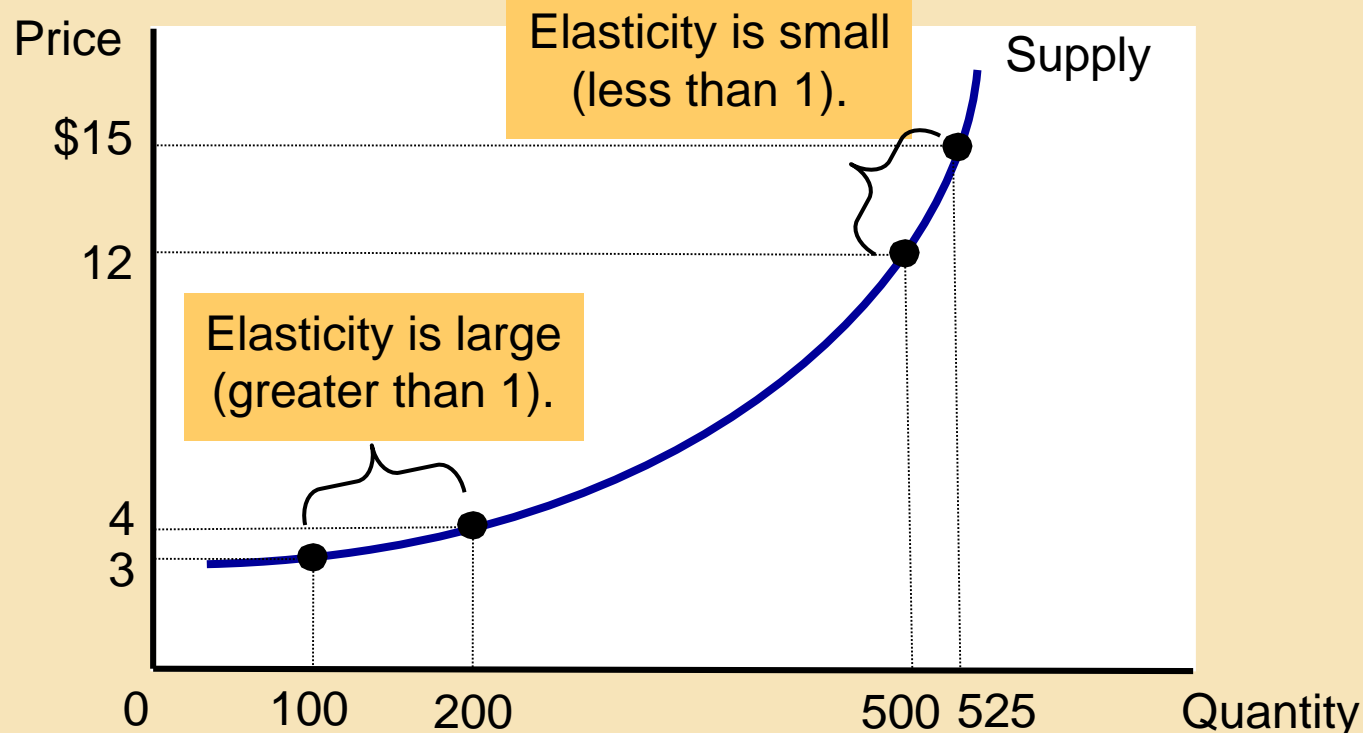
The Elasticity of Supply

Supply curve

- Different price elasticities
 - Points with low price & low quantity
 - Elastic supply
 - Capacity for production not being used
 - Points with high price & high quantity
 - Inelastic supply

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How the Price Elasticity of Supply Can Vary



Because firms often have a maximum capacity for production, the elasticity of supply may be very high at low levels of quantity supplied and very low at high levels of quantity supplied. Here an increase in price from \$3 to \$4 increases the quantity supplied from 100 to 200. Because the 67 percent increase in quantity supplied (computed using the midpoint method) is larger than the 29 percent increase in price, the supply curve is elastic in this range. By contrast, when the price rises from \$12 to \$15, the quantity supplied rises only from 500 to 525. Because the 5 percent increase in quantity supplied is smaller than the 22 percent increase in price, the supply curve is inelastic in this range.

Applications

Does Drug Interdiction Increase or Decrease Drug-related Crime?

- Increase the number of federal agents devoted to the war on drugs
 - Illegal drugs - Supply curve shifts left
 - Higher price; lower quantity
 - Amount of drug-related crimes
 - Inelastic demand for drugs
 - Higher drugs price – higher total revenue
 - Increase drug-related crime

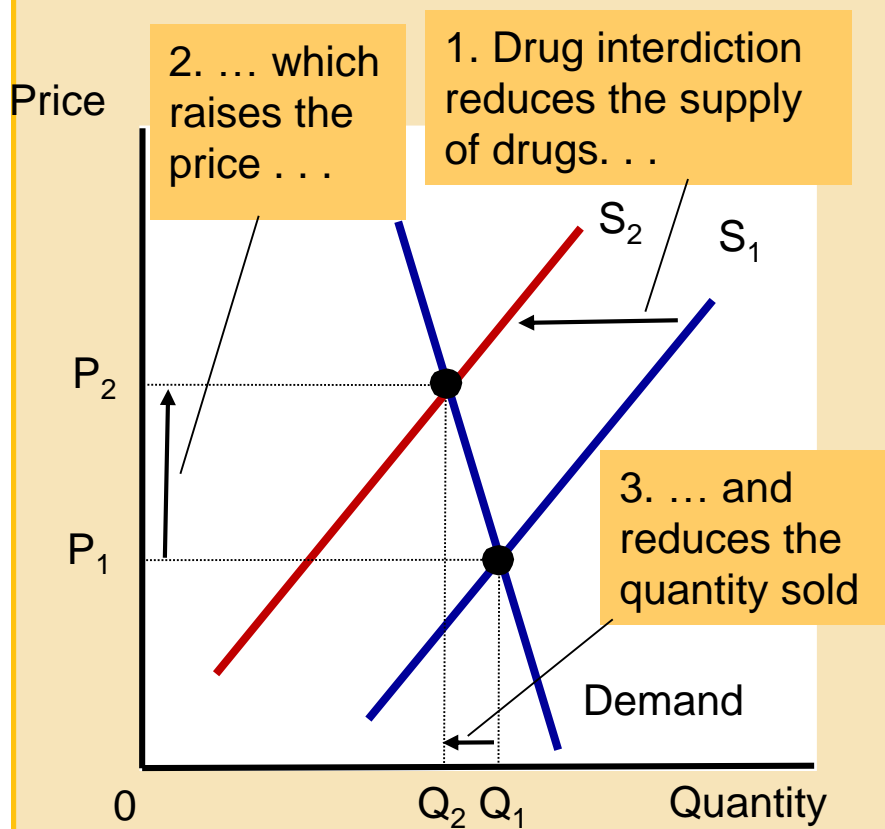
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Application

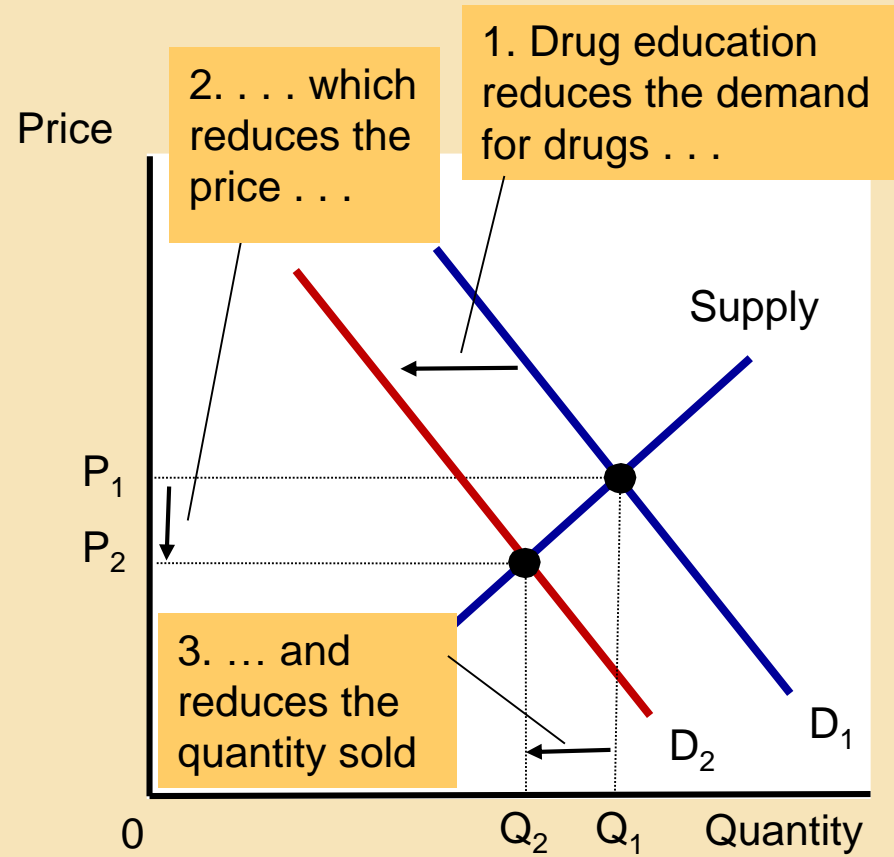
- Does Drug Interdiction Increase or Decrease Drug-related Crime?
 - Policy of drug education
 - Reduce demand for illegal drugs
 - Left shift of demand curve
 - Lower quantity
 - Lower price
 - Reduce drug-related crime

Policies to Reduce the Use of Illegal Drugs

(a) Drug Interdiction



(b) Drug Education



Drug interdiction reduces the supply of drugs from S_1 to S_2 , as in panel (a). If the demand for drugs is inelastic, then the total amount paid by drug users rises, even as the amount of drug use falls. By contrast, drug education reduces the demand for drugs from D_1 to D_2 , as in panel (b). Because both price and quantity fall, the amount paid by drug users falls



谢谢!

THANK YOU!

