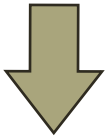
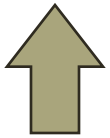
Chapter 3: Elasticity

- Price elasticity
  - demand
  - supply
- Cross elasticity
- Income elasticity

Basic idea

- We know when P 

Qd 

Qs 

holding other factors constant

but how much?

- if price doubles

  how much does Qd fall?
  - by 10%
  - by 50%
  - by 300%?
- price elasticity tells us

I. Price Elasticity of Demand

example

- mocha latte at Starbucks
- price rises from $3 to $5 per cup
- Qd falls from 15 to 5 cups per hr.

equation

$$\frac{\%\ \text{change in Qd}}{\%\ \text{change in P}}$$

% change in Qd

$$\frac{\text{new Qd - initial Qd}}{\underbrace{\text{average Qd}}_{\text{midpoint method}}} \times 100$$

example

$$\frac{5 \text{ cups} - 15 \text{ cups}}{(5+15)/2 \text{ cups}} \times 100$$

$$\frac{-10 \text{ cups}}{10 \text{ cups}} \times 100 = -100\%$$

% change in P

$$\frac{\text{new P - initial P}}{\underbrace{\text{average P}}_{\text{midpoint method}}} \times 100$$

example

$$\frac{\$5 - \$3}{(\$5+\$3)/2} \times 100$$

$$\frac{\$2}{\$4} \times 100 = 50\%$$

demand elasticity

$$\frac{\%\ \text{change in Qd}}{\%\ \text{change in P}}$$

$$\frac{-100\%}{50\%} = -2$$

- If price of latte increases 1%,

  Qd of latte decreases 2%

demand elasticity

- a unit-free measure
  - compare all goods & services
- changes for different points

  on the demand curve

if price elasticity of demand (absolute value)

- = 1

  unit elastic

  % change Qd = % change P

- > 1

  elastic

  % change Qd > %change P

  sensitive to P changes

- < 1

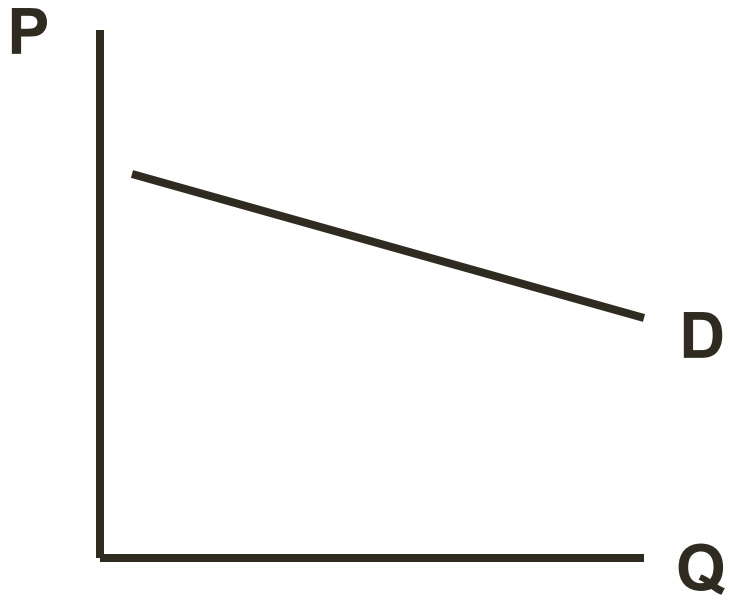
  inelastic

  % change Qd < %change P

  not sensitive to P changes

elastic demand (>1)

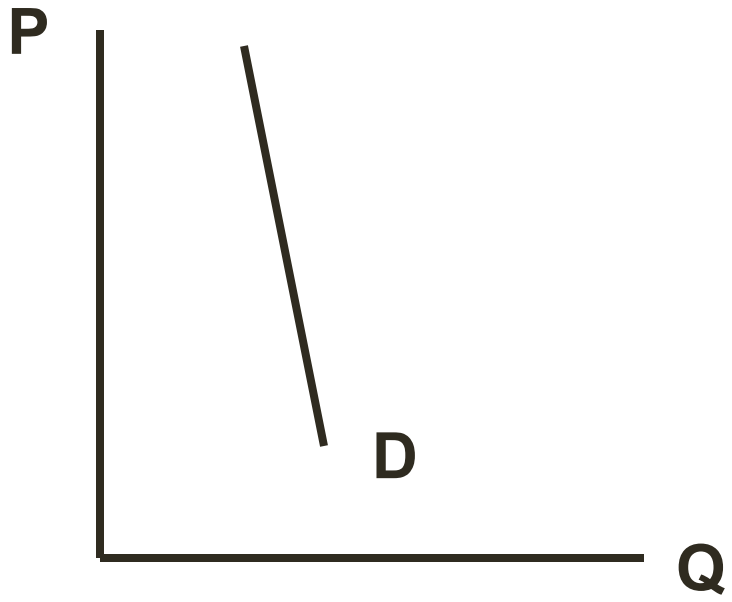
- flatter curve



small change in P
big change in Qd

inelastic demand (<1)

- steep curve

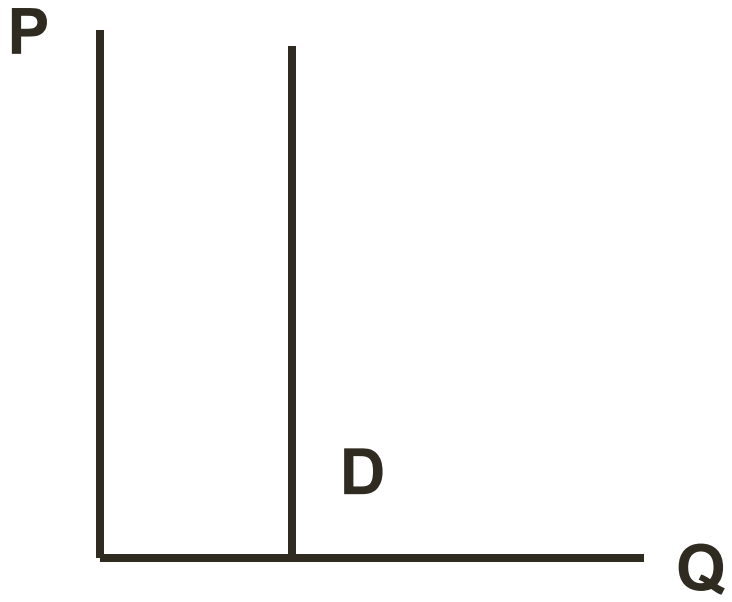


big change in P

small change in Qd

perfectly inelastic demand

- vertical line

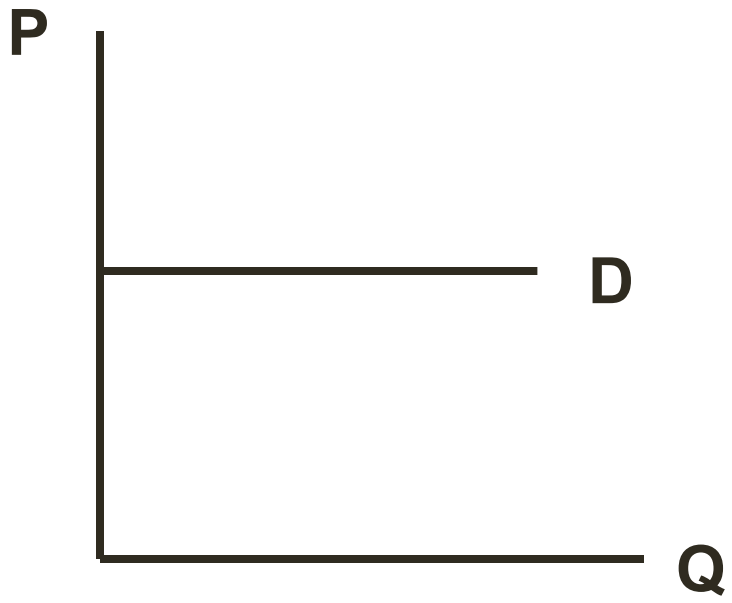


change in P

no change in Qd

perfectly elastic demand

- horizontal line



any change in P

Qd falls to zero

effect on total revenue

- total revenue (TR)

  = P x Q
- if demand is elastic,
  - TR falls as price rises
- if demand is inelastic,
  - TR rises as price rises

example: cup of latte

- initial P=$3, Qd = 15.

  TR = $3 x 15 = $45
- new P = $5, Qd = 5

  TR = $5 x 5 = $25
- demand for latte is elastic

  TR falls as P rises

what makes demand elastic or inelastic?

1. is it a luxury or necessity
   - if luxury, demand is elastic
   - if necessity, demand is inelastic

example

- mocha latte at Starbucks

  is a luxury
- a liver transplant is not

2. definition of good

- latte at Starbucks,
  narrow definition= many substitutes
  (other brands of coffee, tea)
  demand is elastic

- coffee in general,
  broad definition = fewer substitutes
  demand is less elastic

3. time since price change

- short time

  no time to adjust,

  demand is inelastic

- long time

  time to adjust,

  demand is elastic

example

- Price of gas per gallon
- the day price rises
  - demand inelastic
- years later
  - demand much more elastic

    as carpool or buy smaller car

factors 1-3

all get at same issue:

- can consumers substitute a cheaper good easily?
  - if yes, demand is elastic
  - if no, demand is inelastic

4. Is item large part of your budget?
   - if yes, then demand elastic
     (forced to change behavior)
   - if no, then demand inelastic
     (no need to change behavior)

example

- soap
  - if price doubles, will you buy less?
- rent
  - if rent doubles?

    -- stay on campus?

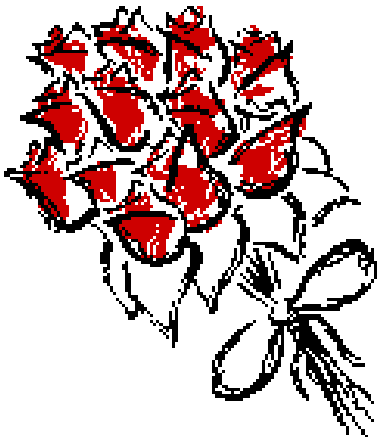
    -- more roommates?

II. Price Elasticity of Supply

$$\frac{\%\ \text{change in Qs}}{\%\ \text{change in P}}$$

example

- bunch of roses
- P = $40/bunch, Qs = 6 (million bunches)
- P = $60, Qs = 15



% change Qs

$$\frac{15 - 6}{(6+15)/2} \times 100$$

$$\frac{9}{10.5} \times 100 = 86\%$$

% change P

$$\frac{60 - 40}{(60+40)/2} \times 100$$

$$\frac{20}{50} \times 100 = 40\%$$

supply elasticity

$$\frac{\%\ \text{change in Qs}}{\%\ \text{change in P}}$$

$$\frac{86\%}{40\%} = 2.15$$

- if price rises 1%,

  Qs rises 2.15%
- unit-free measure
- depends on points chosen

  on the supply curve

if price elasticity of supply

- = 1

  unit elastic

  % change Qs = % change P
- > 1

  elastic

  % change Qs > %change P

  sensitive to P changes

- < 1

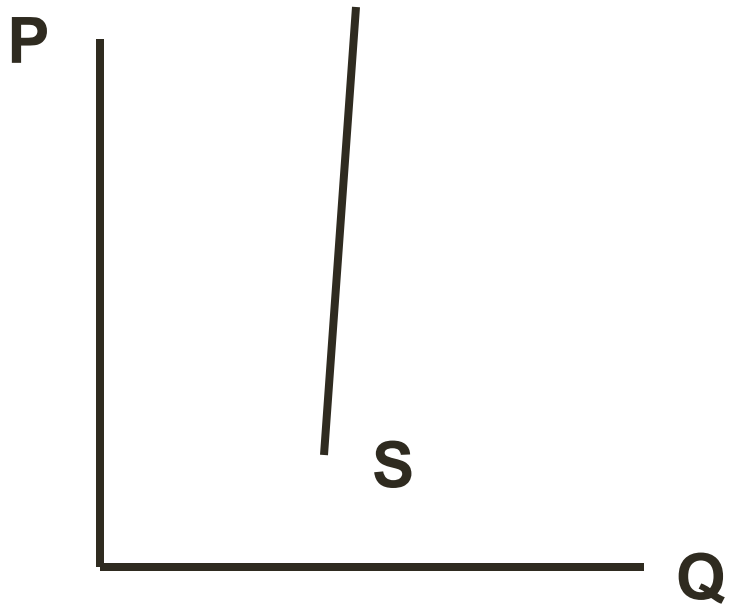
  inelastic

  % change Qs < %change P

  not sensitive to P changes

inelastic supply

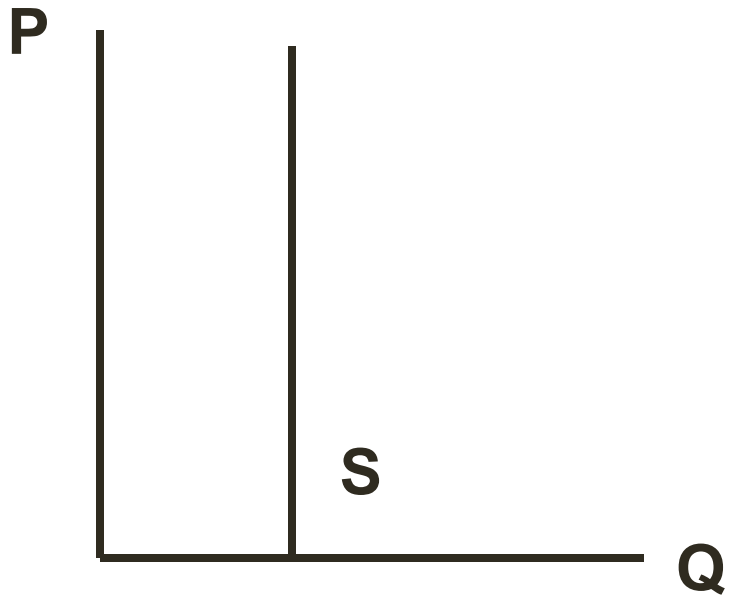
- steep curve



big change in P
small change in Qs

perfectly inelastic supply

- vertical line



change in P

no change in Qs

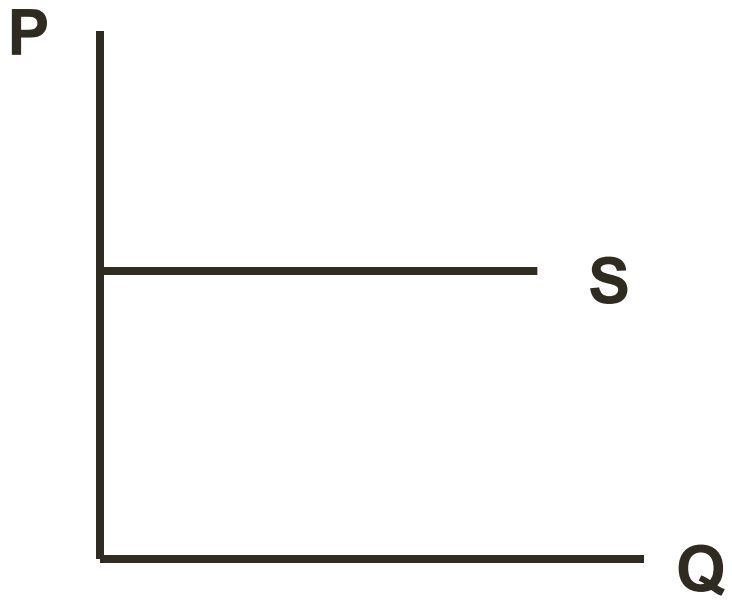
elastic supply

- flatter curve

small change in P
big change in Qs

perfectly elastic supply

- horizontal line



any change in P

Qs falls to zero

what makes supply elastic or inelastic?

1. production possibilities
   - Can you make more easily?
     - NO
       - then supply is inelastic
     - YES
       - then supply is elastic

example

- oceanfront property
  - can’t make more
  - inelastic supply
- salt
  - almost an infinite amount
  - elastic supply

2. time since price change

- it takes time to produce
- if a short time,

  supply is inelastic
- if a long time

  supply is elastic

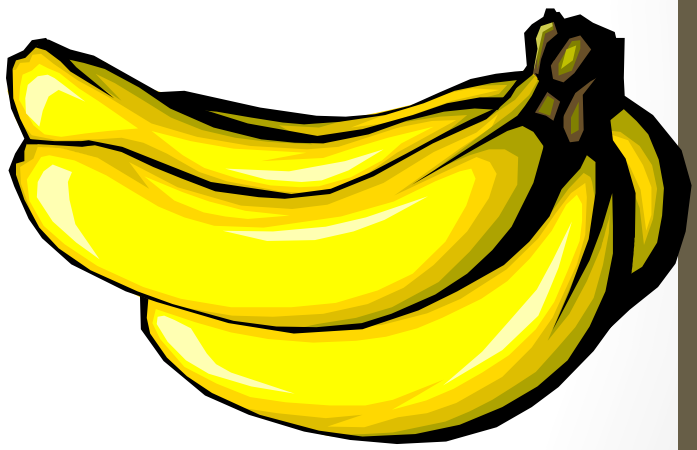
example

- hotel rooms
  - takes time to build
  - supply inelastic in short-run,
    elastic in long-run

3. Can you store it easily/cheaply?
   - if yes, then elastic
   - if no, then inelastic

example

- bananas
  - storage time limited
  - supply inelastic



III. Income Elasticity of Demand

- impact of income changes on demand
- size of shift

  in the demand curve

  when income changes

equation

$$\frac{\%\ \text{change in Qd}}{\%\ \text{change in income}}$$

- > 0 normal good
- < 0 inferior good

example: jewelry

- income increases 10%
- Qd jewelry increases 35%

income elasticity

$$\frac{\text{\% change in Qd jewelry}}{\text{\% change in income}}$$

$$\frac{35\%}{10\%} = 3.5$$

IV. Cross Elasticity of Demand

- impact of price change of
  substitutes or complements
- size of shift
  in demand curve
  when price of a related good changes

equation

$$\frac{\%\ \text{change in Qd}}{\%\ \text{change in P of related good}}$$

cross elasticity

- > 0 for substitutes
- < 0 for complements

example: Peanut butter

- what happens to Qd of PB,
  when price of jelly rises?
- PB & jelly are complements

price jelly = $3 jar, Qd PB = 2 jars per month

price jelly = $4 jar, Qd PB = 1 jar per month

% change in Qd PB

$$\frac{\text{1 jar - 2 jars}}{\text{1.5 jars}} \times 100 = -66.7\%$$

% change in P of jelly

$$\frac{\$4 - \$3}{\$3.5} \times 100 = 28.6\%$$

cross price elasticity of PB

- with respect to price of jelly

$$\frac{\%\ \text{change in Qd PB}}{\%\ \text{change in P jelly}}$$

$$\frac{-\ 66.7\%}{28.6\%} = -\ 2.33$$

example: Peanut butter

- what happens to Qd of PB,
  when price of butter rises?
- PB & butter are substitutes

P butter = $1 stick, Qd PB = 2 jars per month

P butter = $3 stick, Qd PB = 2.2 jars per mo.

% change in Qd PB

$$\frac{\text{2.2 jar - 2 jars}}{\text{2.1 jars}} \times 100 = 9.5\%$$

% change in P of butter

$$\frac{\$3 - \$1}{\$2} \times 100 = 100\%$$

cross price elasticity of PB

- with respect to price of butter

$$\frac{\%\ \text{change in Qd PB}}{\%\ \text{change in P butter}}$$

$$\frac{9.5\%}{100\%} = .095$$

summary

- law of demand & supply
  - direction of change in Qd/Qs
    when P changes
- price elasticity
  - how large are these Qd/Qs changes?
- cross/income elasticity
  - size of shift in demand curve