Elasticity

- **Elasticity is the term economists use to measure the responsiveness of one variable to changes in another.**
- **We can measure the responsiveness of quantity demanded to changes in price, income, or other variables.**

Elasticity

- ***Elasticity of demand*: the *percentage* change in quantity demanded divided by the *percentage* change in price.**

$$E_d = \frac{\text{the percentage change in quantity demanded}}{\text{percentage change in price}}$$

- **This will always be a negative number; we take the absolute value.**
- **Larger numbers (in absolute value) mean the demand is more elastic.**

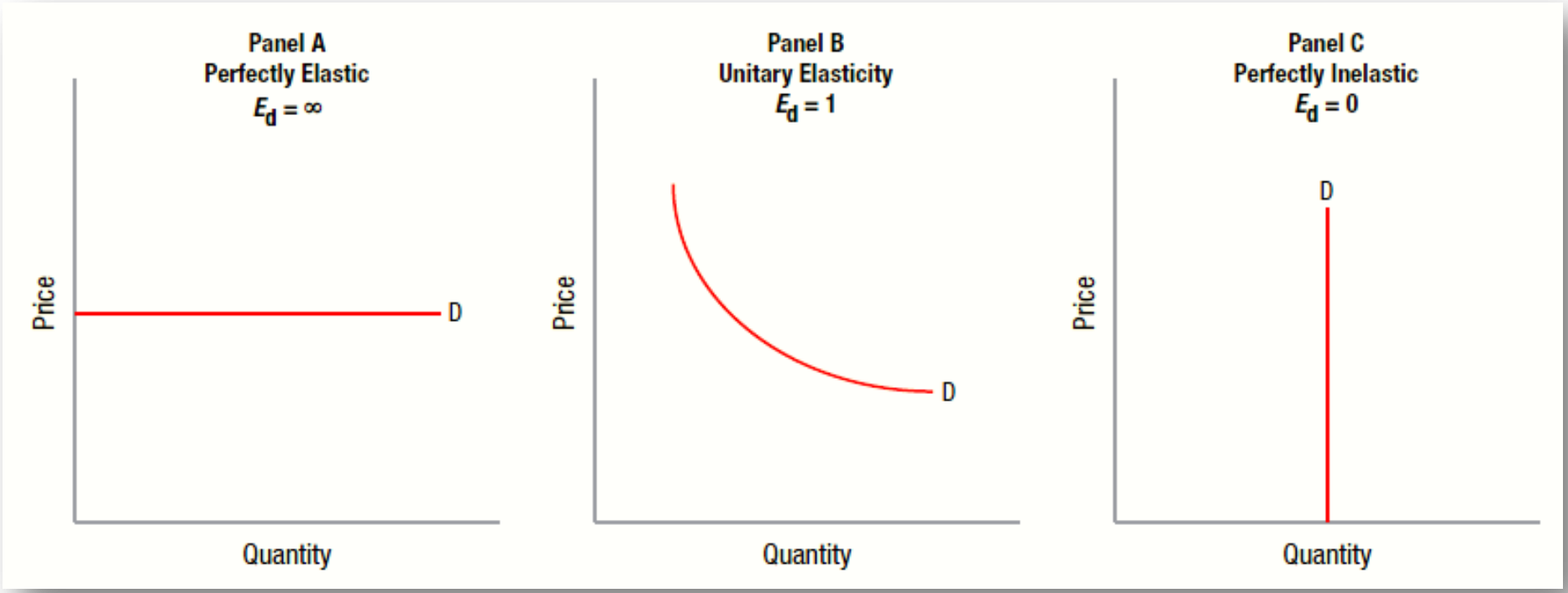
Elastic Demand

When the absolute value is greater than 1, we refer to this as an "elastic demand."

Demand for a product will be relatively more elastic as the number of substitutes rises.

Example: when generic drugs enter a market, elasticity for name brand drugs rises.

Pictures of Elasticity



Inelastic Demand

An absolute value less than one indicates an "inelastic demand."

- **This will be observed when consumers feel that there are few good substitutes available for the product.**
- **Example: oil**

Unitary Elasticity

- ***Unitary elasticity of demand:*** **The absolute value of the price elasticity of demand is equal to 1.**
- **Example: tires**

Selected Elasticity Estimates

Inelastic		Roughly Unitary Elastic		Elastic	
Salt	0.1	Movies	0.9	Restaurant meals	2.3
Cigarettes	0.24	Private education	1.1	Air travel	2.4
Medical care	0.3	Shoes	0.9	Foreign travel	4.0
Taxi service	0.6	Automobiles	1.2	Furniture	1.5
Gasoline (short run)	0.2	Tires	1.0	Fresh vegetables	2.5
Medical prescriptions	0.3			Commuter rail service (long run)	1.6
Pesticides	0.2–0.5			Shrimp	1.25

Source: Compiled from numerous studies reporting estimates for price elasticity of demand.

Determinants of Elasticity

- **Demand will be relatively more elastic when:**
  - **There are more substitutes available**
  - **The good represents a larger portion of the household budget**
  - **A longer time period is being considered**
  - **The good is more of a luxury rather than a necessity**

Calculating Elasticity

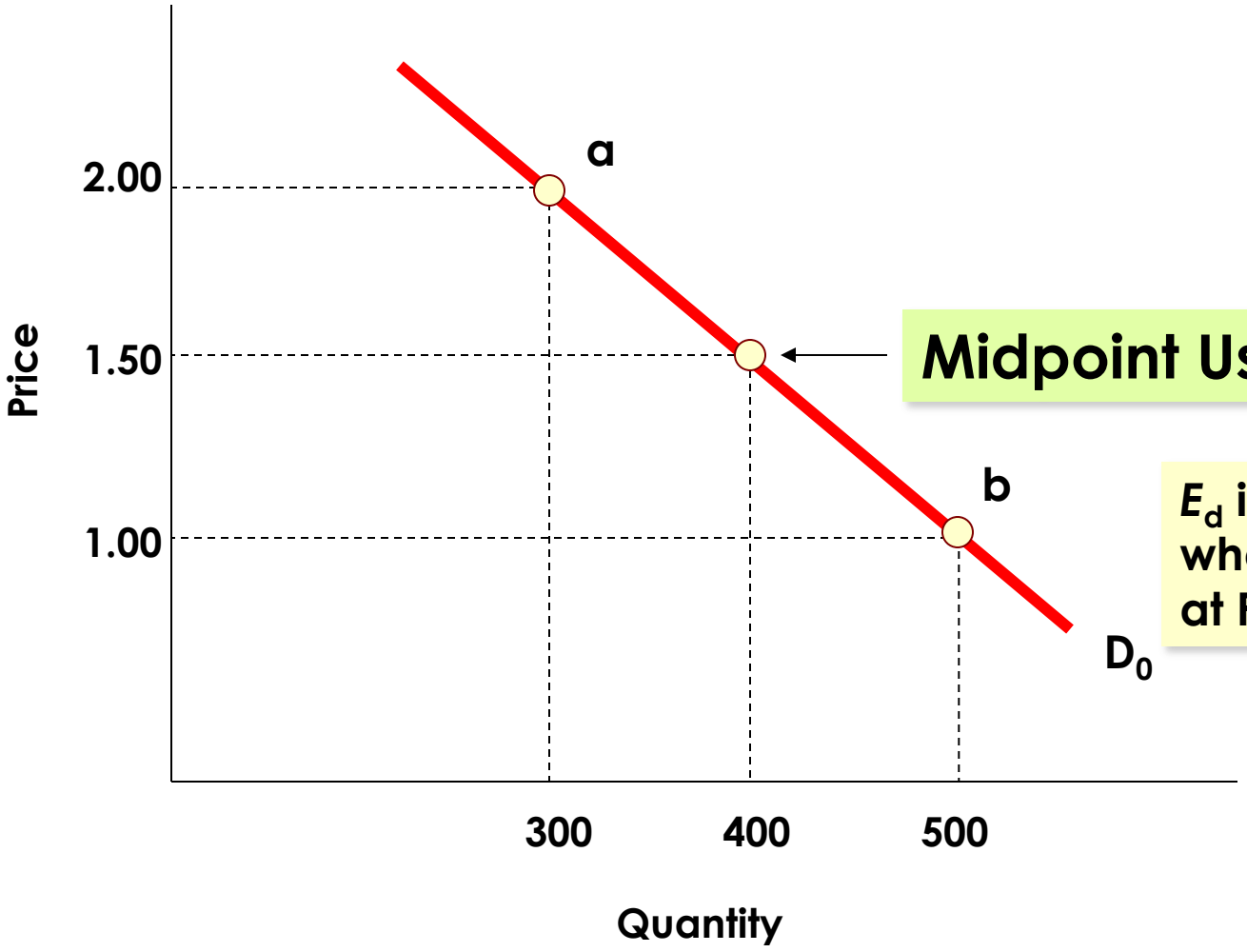
We use a midpoint formula so that the numeric value will be the same regardless of the direction of the change.

Using Midpoints to Compute Elasticity

The Midpoint Formula:

- **% change Q_d= calculate the difference between the two quantities, and divide by the average quantity.**
- **% change P = calculate the difference between the two prices, and divide by the average price.**

Using the Midpoint Method



Midpoint Used as Base

E_d is the same whether you start at P=$2 or P=$1

Expanded Equation

$$E_d = \left(\frac{Q_1 - Q_0}{(Q_1 + Q_2) \div 2}\right) \div \left(\frac{(P_1 - P_0)}{(P_1 + P_0) \div 2}\right)$$

Example: if $P_0 = 2$, $Q_0 = 300$, $P_1 = 1$, $Q_1 = 500$, calculate E_d

Answer: $E_d = |-0.75|$ or 0.75

Elasticity and Total Revenue

Total revenue: **Price times quantity demanded (sold).**

$$TR = P \times Q$$

Elasticity and Total Revenue

- **When demand is inelastic, any price change will be larger than the quantity change (in % terms)**
  - **So an increase in price will cause only a slight reduction in the quantity demanded.**
  - **In this instance, total revenue will rise when the price rises (and vice versa)**
  - **What happens if salt prices go up? TR will likely rise.**

Elasticity and Total Revenue

When demand is elastic, any price change will be smaller than the quantity change (in % terms)

- **So an increase in price will cause significant reduction in the quantity demanded.**
- **In this instance, total revenue will fall when the price rises (and vice versa)**
- **What happens if airfare goes up? TR will likely fall.**

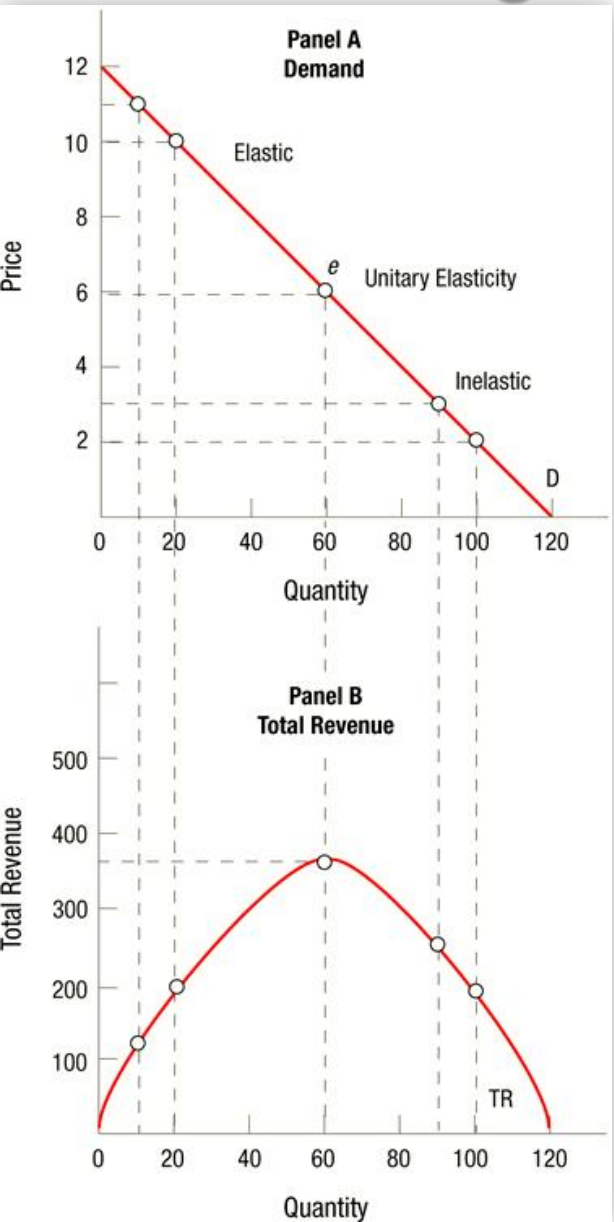
Elasticity and Total Revenue

- **When demand is unit elastic, then % change in Q_d = % change in P.**
  - **An increase in price will cause a reduction in the quantity demanded by the same proportion.**
  - **In this instance, TR for the firm will not change when the price changes.**

Summary of Effects

	Elasticity		
Price Change	**Inelastic**	**Elastic**	**Unitary**
Price increases	TR increases	TR decreases	No change in TR
Price decreases	TR decreases	TR increases	No change in TR

Elasticity and Total Revenue Along a Straight-Line Demand Curve



- **Along a demand curve with a constant slope:**
  - **the upper portions of the curve will be elastic**
  - **the midpoint will be of unitary elasticity**
  - **lower portions will be inelastic.**
- **Total revenue will be maximized at the midpoint.**

Other Elasticities of Demand

- **We measure the elasticity of other variables too…**
  - **Income Elasticity of Demand**
  - **Cross Elasticity of Demand**

Income Elasticity of Demand

$$E_y = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}$$

- **For normal goods, E_y is positive.**
  - ***Normal goods:* Goods that have positive income elasticities of less than 1. When consumer income grows, Q_d rises, but less than the rise in income.**

Income Elasticity of Demand

$$E_y = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}$$

- **For luxury goods, E_y is greater than one.**
  - ***Luxury goods:*** **Goods that have income elasticities greater than 1. When consumer income grows, Q_d rises more than the rise in income.**

Income Elasticity of Demand

$$E_y = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}$$

- **For inferior goods, E_y is negative.**
  - ***Inferior goods:* Goods that have income elasticities that are negative. When consumer income grows, quantity demanded falls.**

Cross Elasticity of Demand

- ***Cross elasticity of demand:*** **Measures how responsive the Q_d of one good is to changes in the price of another good.**

Cross Elasticity of Demand

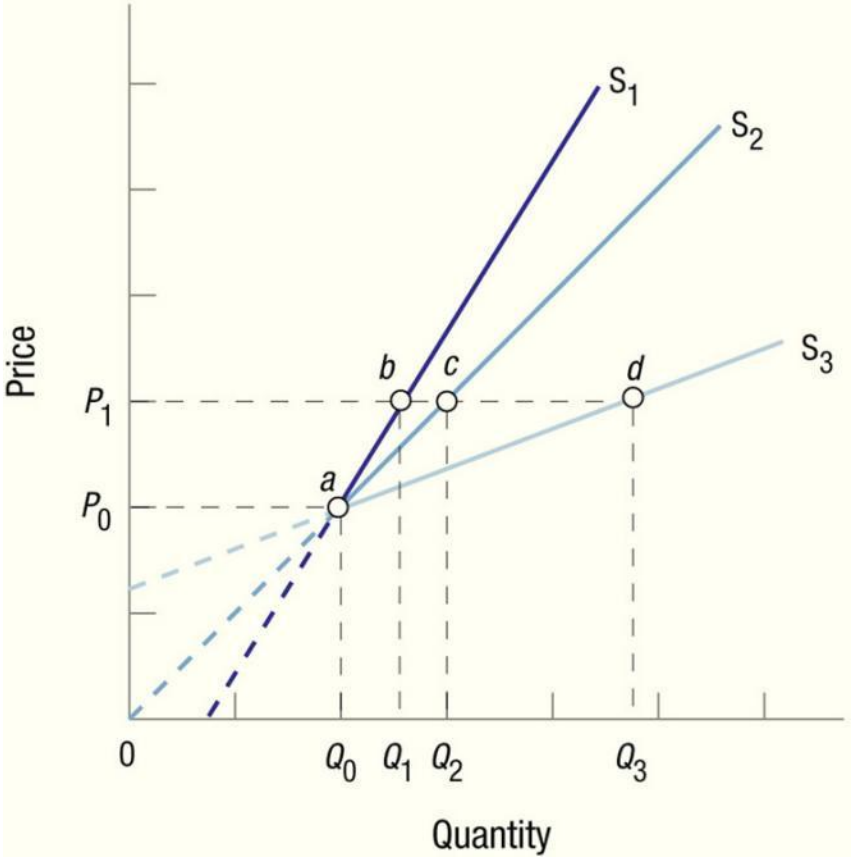
$$E_{ab} = \frac{\text{Percentage Change in Quantity Demanded of product a}}{\text{Percentage Change in Price of product b}}$$

- **For substitutes, E_{ab} is positive.**
  - ***Substitutes:*** **Goods consumers substitute for one another depending on their relative prices.**
  - **An increase in the price of one brand of milk will increase the demand for other brands.**
- **For complements, E_{ab} is negative.**
  - ***Complements:*** **Goods that are typically consumed together.**
  - **An increase in the price of milk causes a decrease in demand for Oreos.**

Elasticity of Supply

How responsive are suppliers to price changes?

- **Elastic Supply: E_s>1 (S_3)**
- **Inelastic Supply: E_s<1 (S_1)**
- **Unitary Elastic Supply: E_s=1 (S_2)**



$$E_s = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$$

Elasticity of Supply

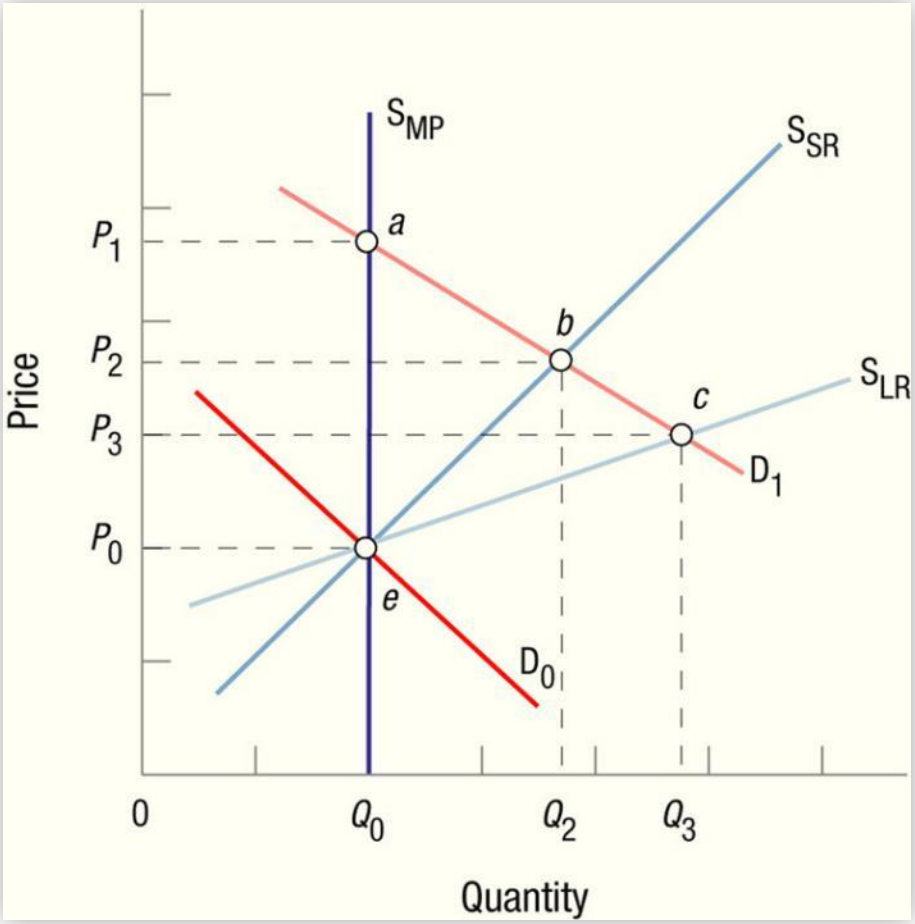
$$E_s = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$$

- **Supply becomes relatively more elastic over time, as firms have more ability to adjust output in response to a changing demand.**
- **The *market period* is a period of time so short that the output and number of firms are fixed.**

Short and Long Run

- ***The short run*** **is a period of time in which the number of firms does not change, but each firm can adjust the output level.**
- ***The long run*** **is a period of time long enough for new firms to enter the industry.**

Elasticity of Supply Over Time



Supply tends to become more elastic (flatter) over time

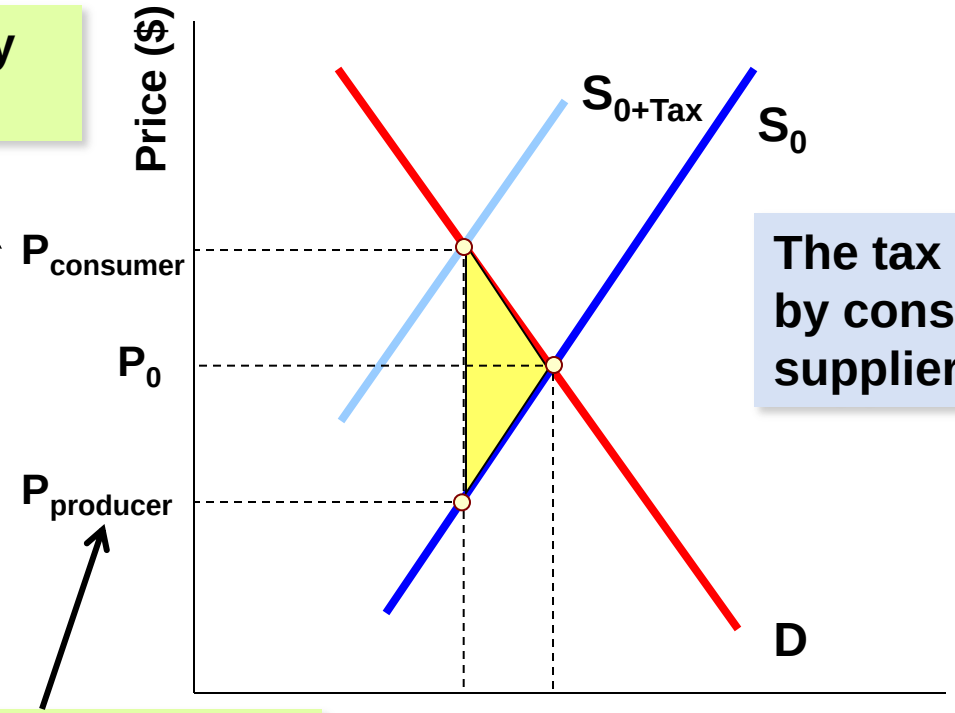
Taxes and Elasticity

- ***"Incidence" of a tax:* who bears the economic burden of the tax?**
- **Relative elasticities of supply and demand will help us measure the incidence of a tax.**

Taxes and Elasticity

- **An excise tax on a good will shift the supply curve to the left, generating a higher price.**
  - **But the price rises by less than the full amount of the tax.**
- **To the extent that the price rises, the burden is shifted to the consumer.**

Graphing Taxes and Deadweight Loss



The tax burden is ***shared*** by consumers and suppliers.

The amount of the deadweight loss will depend on the relative elasticity of supply.

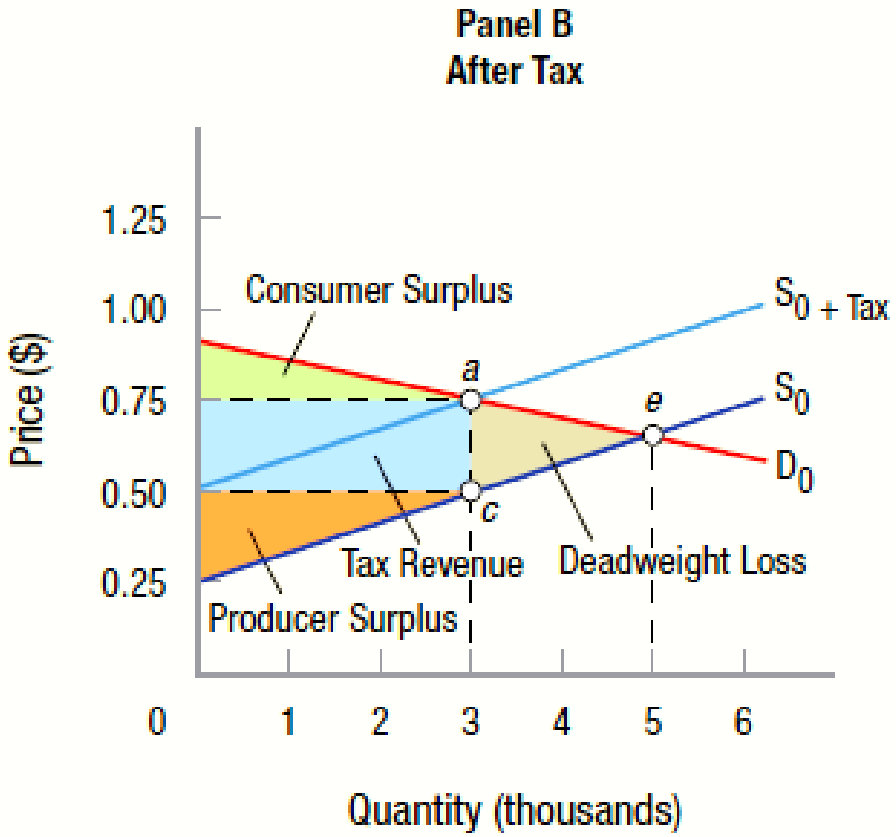
Deadweight Loss

- ***Deadweight loss:*** **The loss in consumer and producer surplus due to inefficiency because some transactions cannot be made and therefore their value to society is lost.**

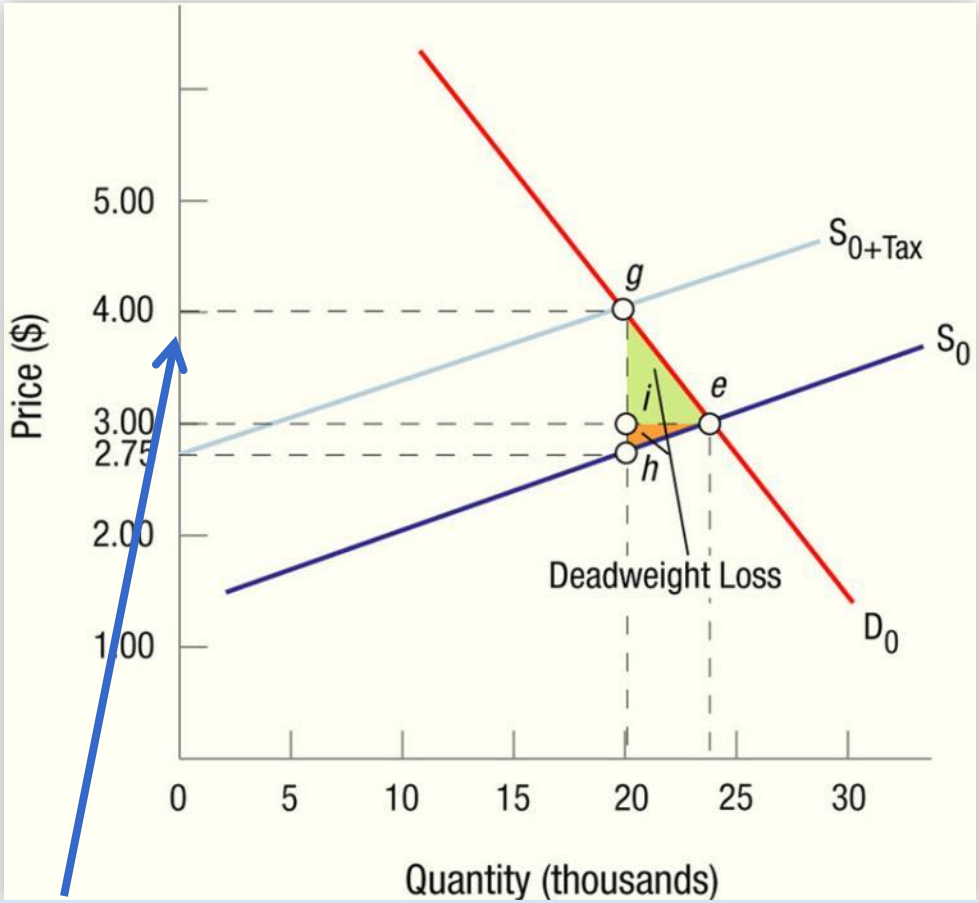
Elasticity and Deadweight Loss

Whenever a tax is imposed, the market outcome will be altered from its initial equilibrium point.

This always generates a deadweight loss, but the magnitude of the loss will be greater when either demand or supply (or both) are relatively elastic.

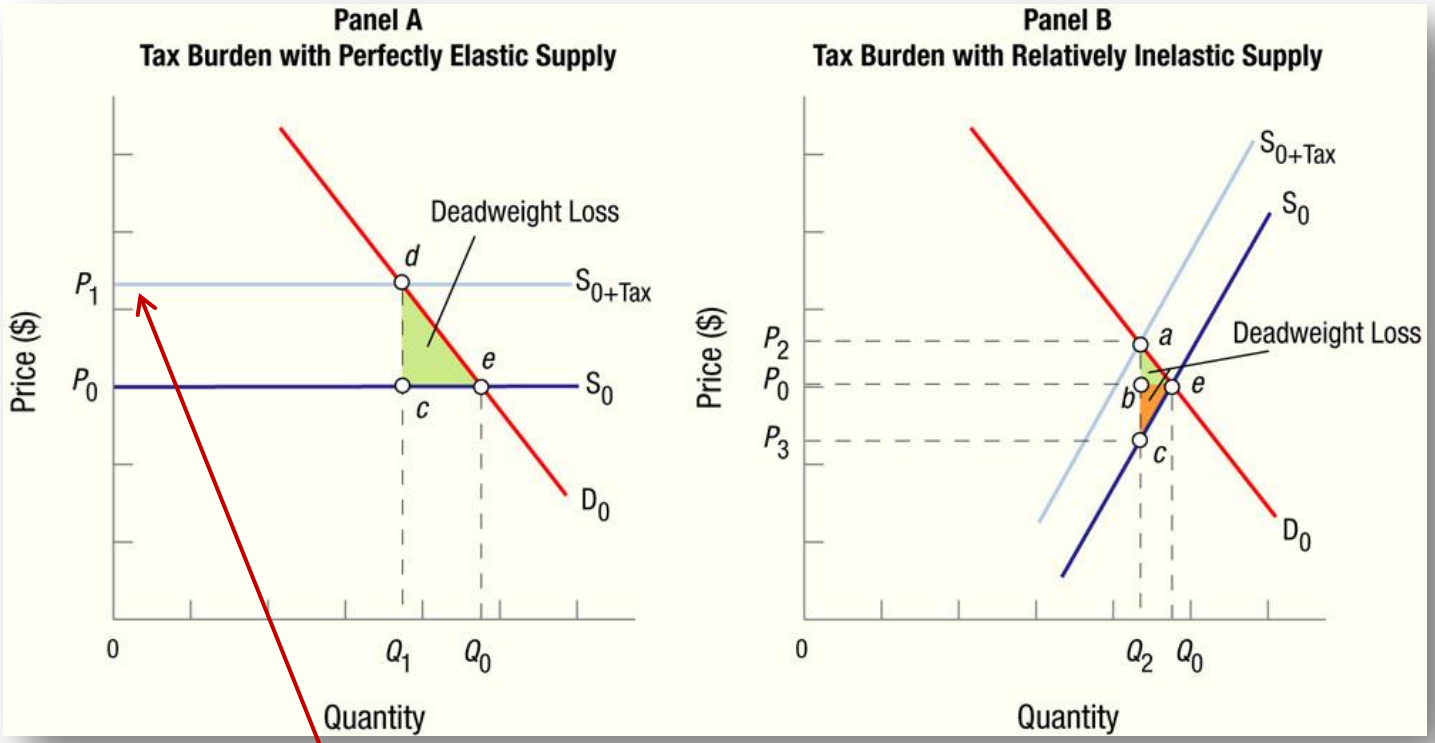


Inelastic Demand and Tax Burden



When demand is relatively inelastic (and the demand curve is steep), more of the burden is shifted to the consumer.

Elasticity of Supply and Tax Burdens



- **The higher the elasticity of supply, the greater the tax burden on consumers.**
  - **Example: perfectly elastic supply curve will force the consumers to bear 100% of the tax burden**
- **The lower the elasticity of supply, the greater the tax burden on producers.**

Summary of Elasticity and Taxes

Elasticity		Tax Burdens		
Demand	Supply	On Consumers	On Business	Deadweight Loss
Elastic	No change	Lower	Higher	Large
Inelastic	No change	Higher	Lower	Small
No change	Elastic	Higher	Lower	Large
No change	Inelastic	Lower	Higher	Small