- Application: The
- Costs of Taxation

Review

- A tax
  - Drives a wedge between the price buyers pay and the price sellers receive
  - Raises the price buyers pay
  - Lowers the price sellers receive
  - Reduces the quantity bought and sold

These effects are the same whether the tax is imposed on buyers or sellers.

J.B. HANDELSMAN/THE NEW YORKER COLLECTION/THE CARTOON BANK

"You know, the idea of taxation with representation doesn't appeal to me very much, either."

REVIEW: The effects of a tax

Equilibrium with

no tax:

Price = P_E

Quantity = Q_E

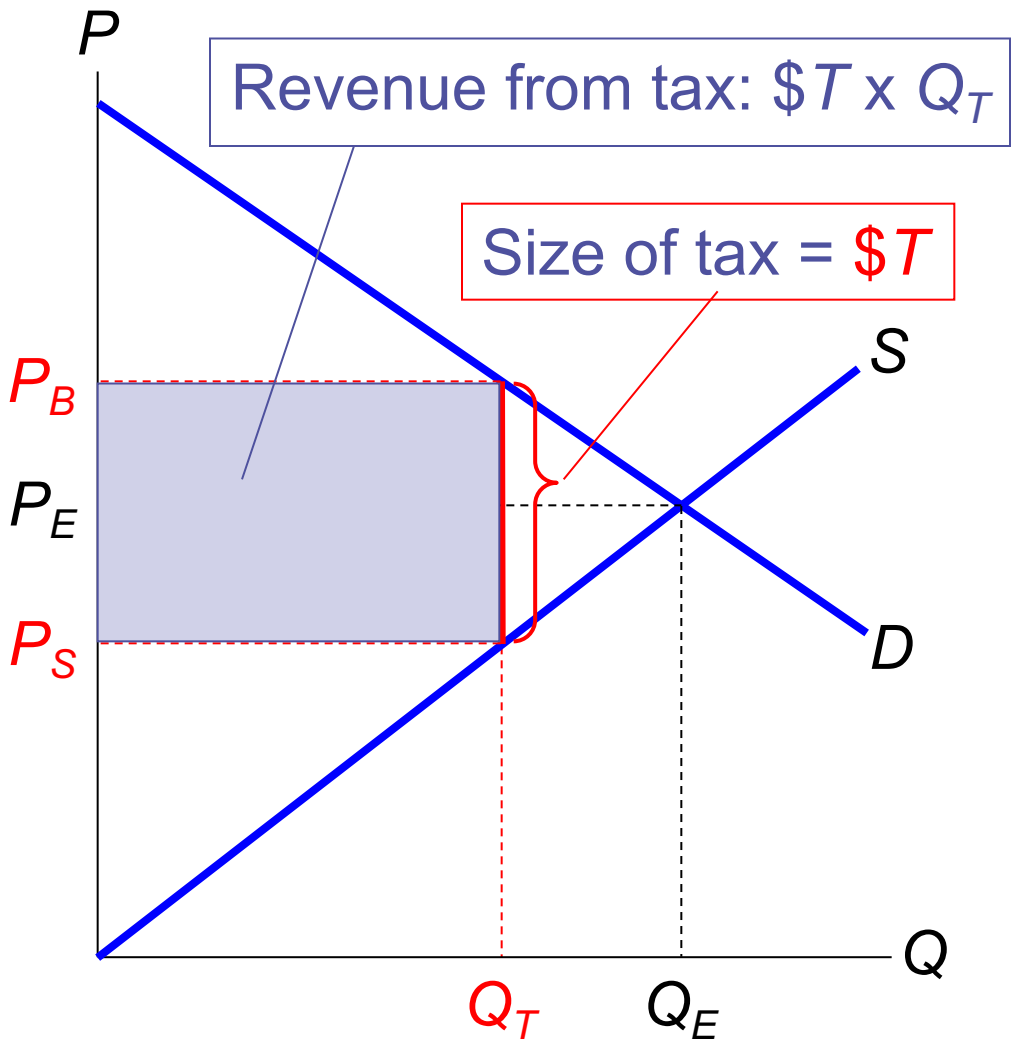
Equilibrium with

tax = $T per unit:

Buyers pay P_B

Sellers receive P_S

Quantity = Q_T



How a Tax Affects Market Participants

- Total surplus = Consumer surplus + Producer surplus
  - Maximized at equilibrium
- With a per-unit tax of $T:
  - ***CS*** decreases (higher P_B, lower Q_T)
  - ***PS*** decreases (lower P_S, lower Q_T)
  - Government gains tax revenue ($T × Q_T)
  - What happens to total surplus?

EXAMPLE 1: The effects of a tax – 1

Welfare without a tax (P_E, Q_E),

CS = A + B + C

PS = D + E + F

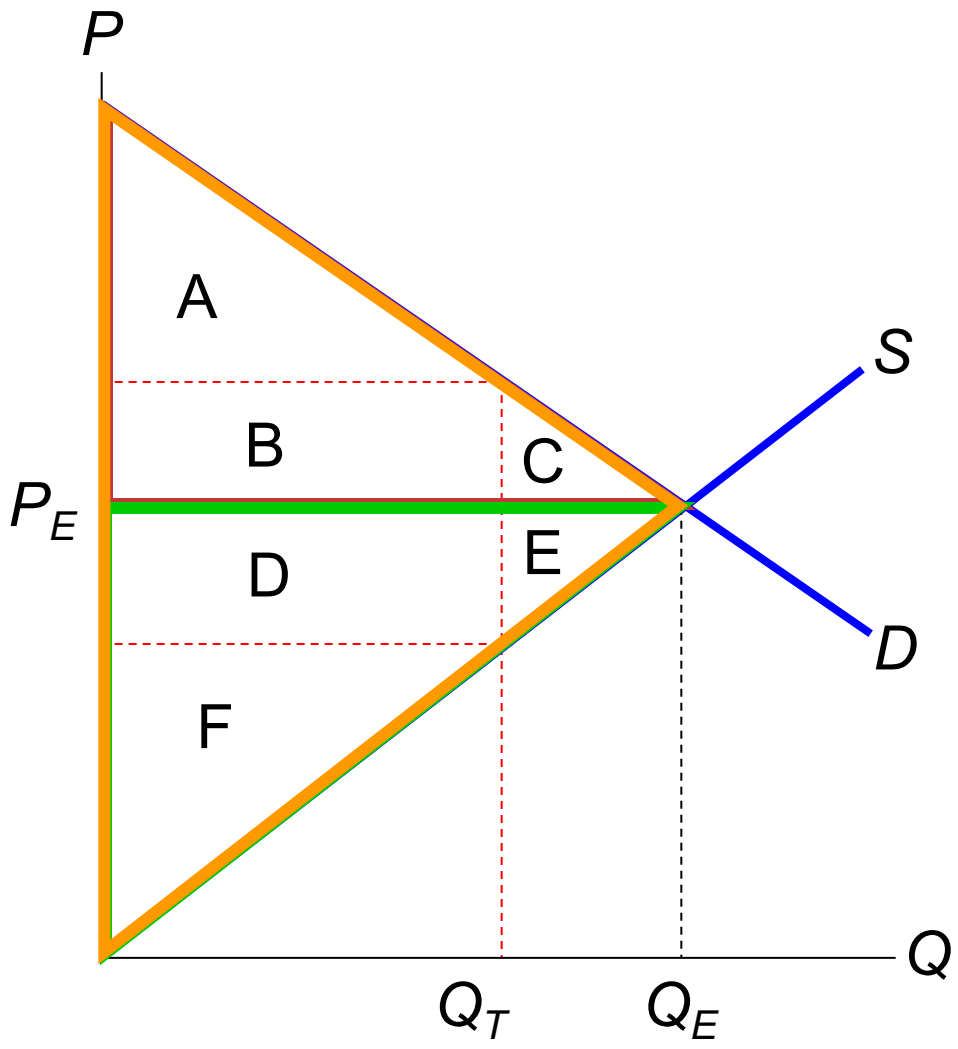
Tax revenue = 0

Total surplus

= ***CS*** + ***PS***

= A + B + C

+ D + E + F



EXAMPLE 1: The effects of a tax – 2

With the tax (P_B, P_S, Q_T),

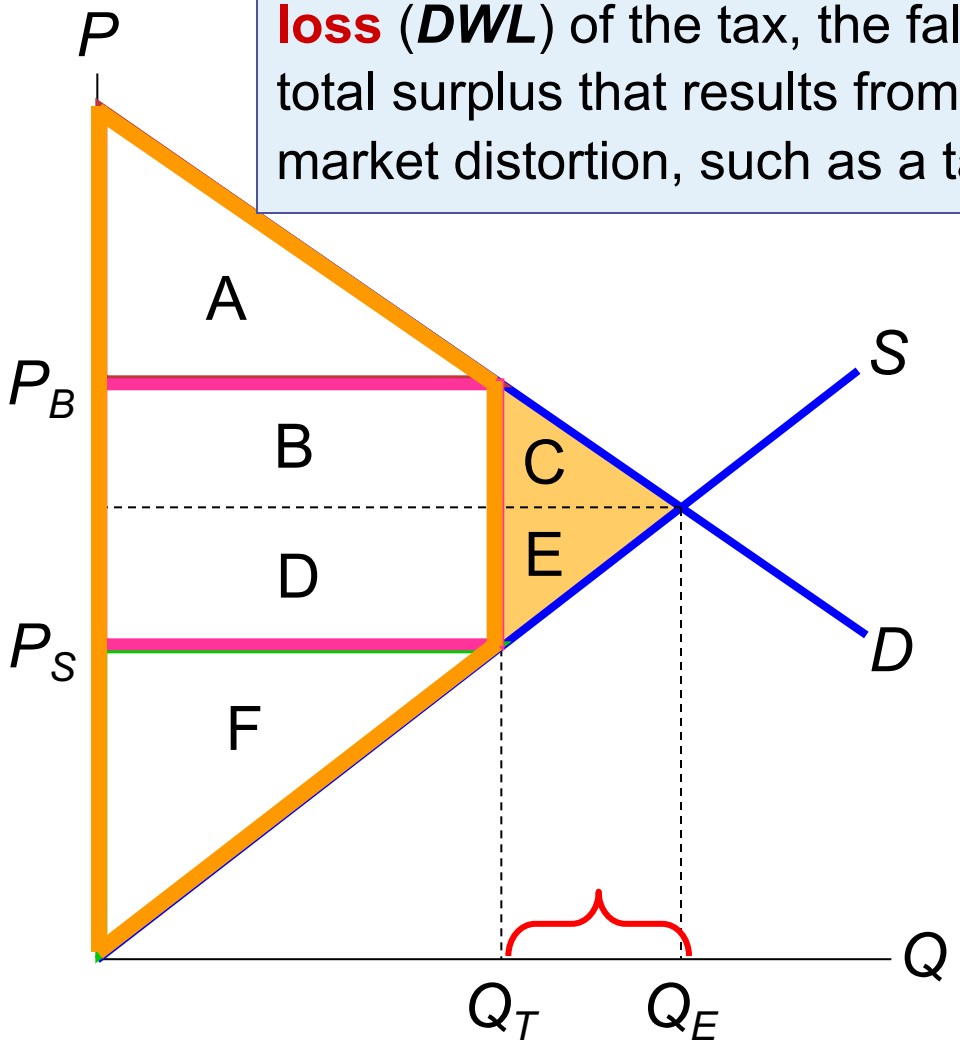
- ***CS*** = A
- ***PS*** = F
- Tax revenue = B + D

Total surplus
= ***CS*** + ***PS*** + tax revenue
= A + B + D + F

The tax reduces total surplus by ***C + E***

$Q_E - Q_T$ = units not sold because of the tax

C + E is called the **deadweight loss** (***DWL***) of the tax, the fall in total surplus that results from a market distortion, such as a tax.



EXAMPLE 2: DWL and the gains from trade

Zaria is taking her laundry to Ethan's dry cleaning and laundry services business. For this arrangement, each month, Zaria is willing to pay $165, and Ethan's cost is $140. They agree on a price of $150 per month.

A. Calculate ***CS***, ***PS***, and ***TS***.

B. The government imposes a $35 tax on all laundry service providers. What happens to ***CS***, ***PS***, and ***TS***?

EXAMPLE 2: Solutions, A

Zaria's ***WTP*** = $165; Ethan's cost = $140

P = $150 per month.

A. Calculate ***CS***, ***PS***, and ***TS***.

- Zaria's ***CS*** = ***WTP*** – ***P*** = 165 – 150 = $15
- Ethan's ***PS*** = ***P*** – cost = 150 – 140 = $10
- ***TS*** = ***CS*** + ***PS*** = $25

EXAMPLE 2: Solutions, B

Zaria's ***WTP*** = $165; Ethan's cost = $140

P = $150 per month.

B. $35 tax

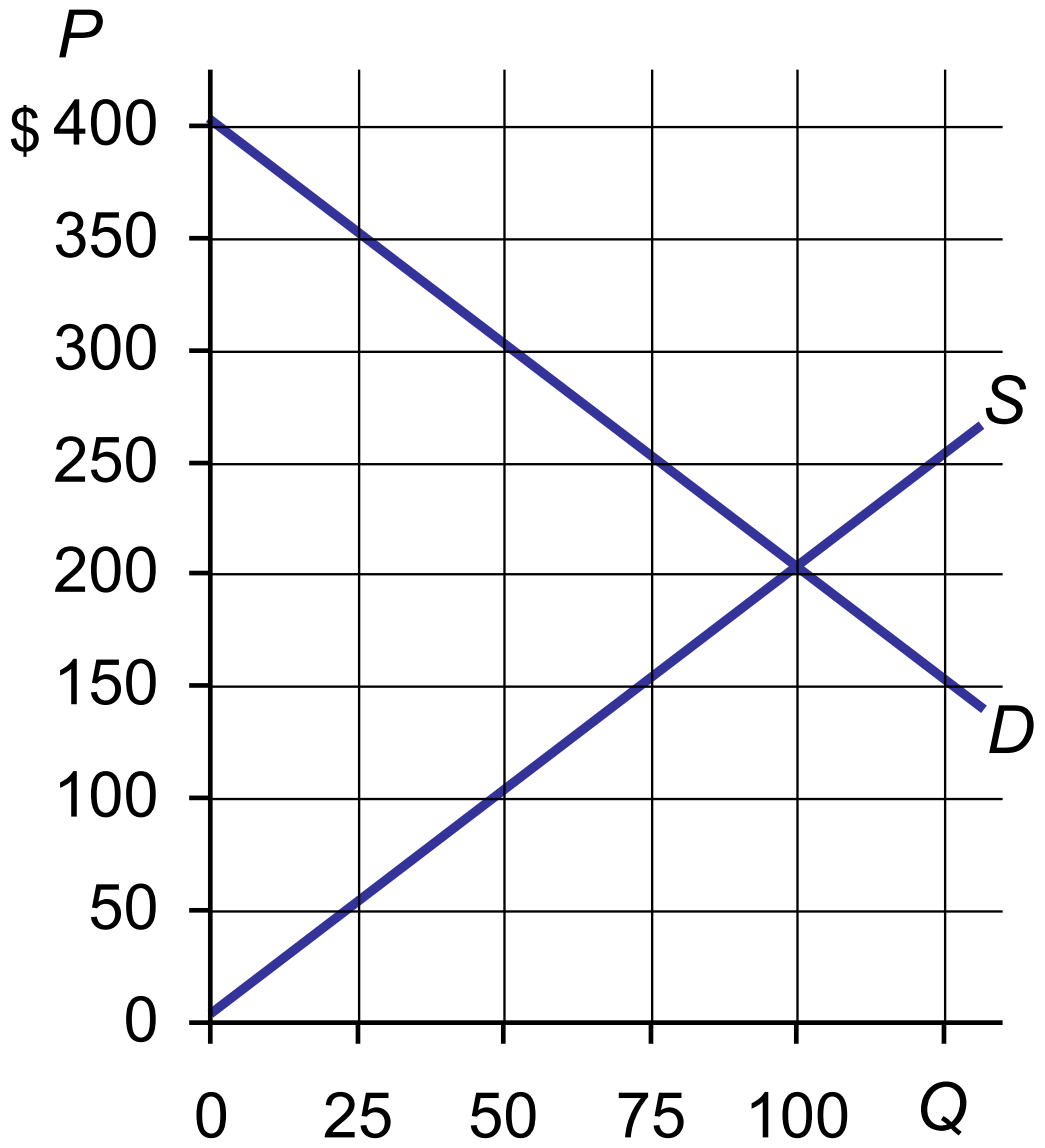
Ethan needs 140 + 35 = $175 to provide laundry services to Zaria, but Zaria's ***WTP*** = $165

- Trade doesn't happen!
- The tax has made both worse off: ***DWL*** = $25
- How about the government? The government gets $0 in tax revenue because Ethan and Zaria are not trading.

Active Learning 1: Analysis of a tax

A. Compute ***CS***, ***PS***, and total surplus without a tax.

B. If a $200 tax per unit is imposed, compute ***CS***, ***PS***, tax revenue, total surplus, and ***DWL***.

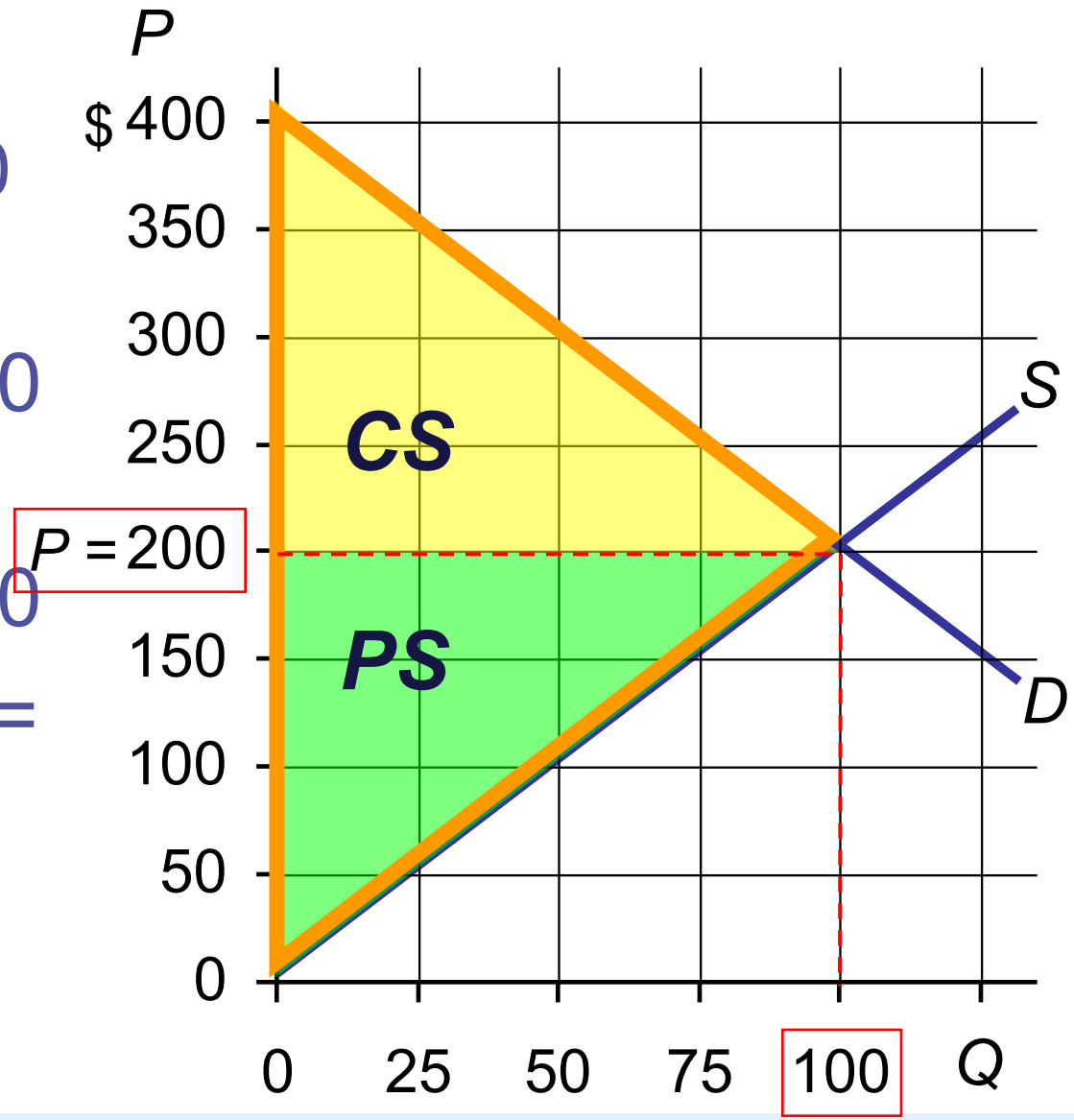


Active Learning 1: A. Without a tax

A. Without tax:

P = \$200, ***Q*** = 100

- ***CS*** = ½ x \$200 x 100 = \$10,000
- ***PS*** = ½ x \$200 x 100 = \$10,000
- ***TS*** = ***CS*** + ***PS*** = \$20,000



Active Learning 1: B. With $200 tax

B. With $200 tax

P_S = \$100, P_B = \$300,
Q_T = 50

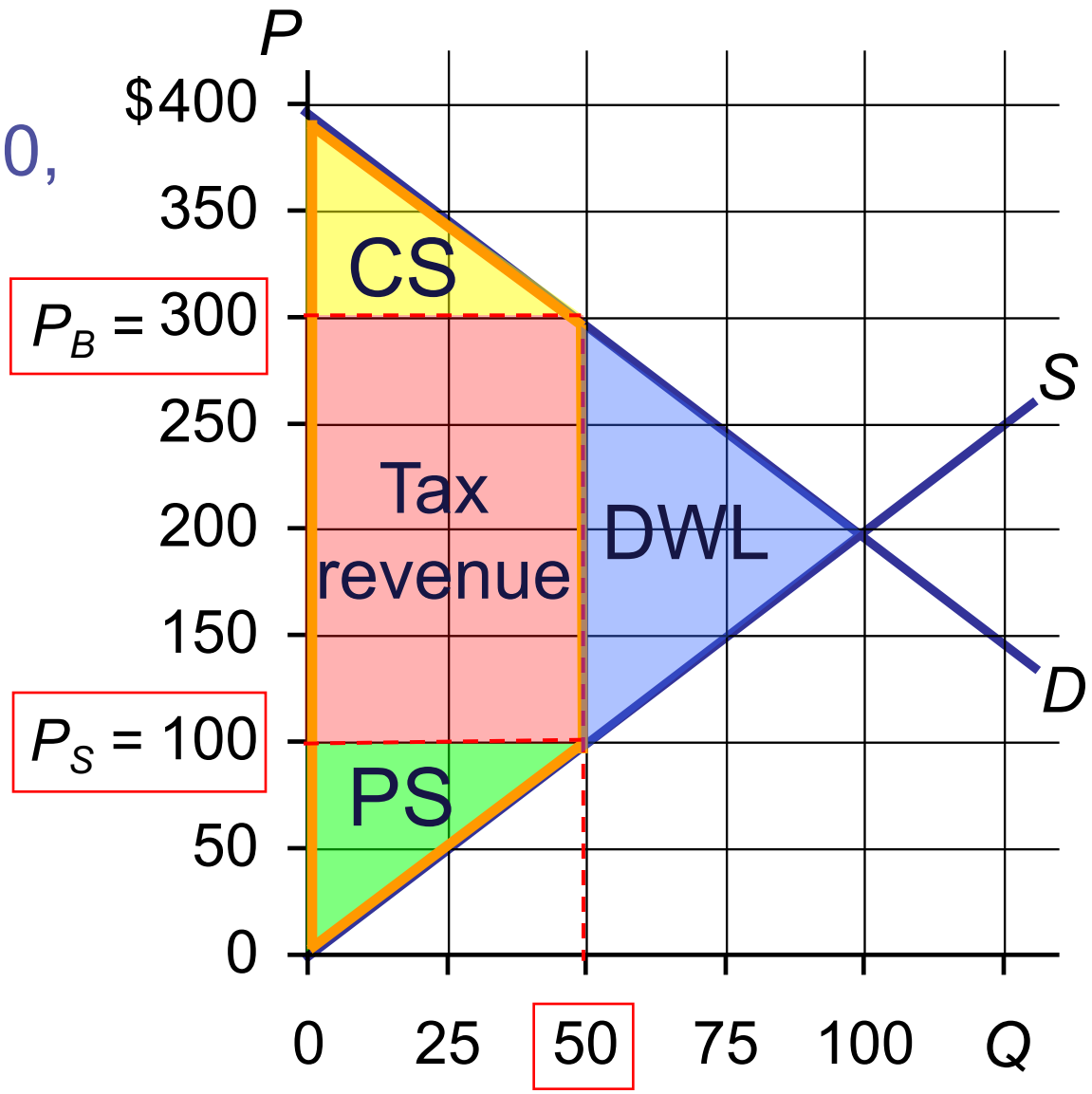
CS = ½ x \$100 x 50
= \$2,500

PS = \$2,500

Tax revenue
= \$200 x 50
= \$10,000

TS = \$15,000

DWL = \$5,000



The Determinants of the Deadweight Loss

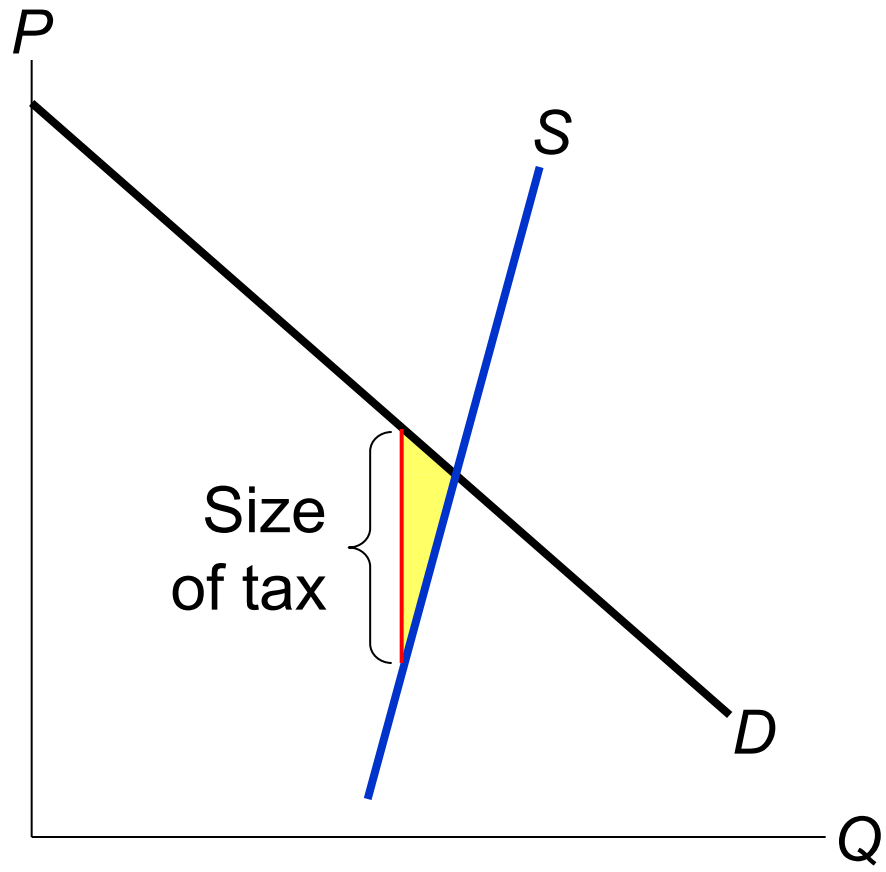
- Price elasticities of supply and demand
  - For a given demand, the more elastic the supply curve, the larger the DWL
  - For a given supply, the more elastic the demand curve, the larger the DWL
- The greater the elasticities of supply and demand
  - The greater the deadweight loss of a tax

EXAMPLE 3: DWL and elasticity of supply – 1

When supply is inelastic,

- A change in price leads to a small change in quantity supplied.

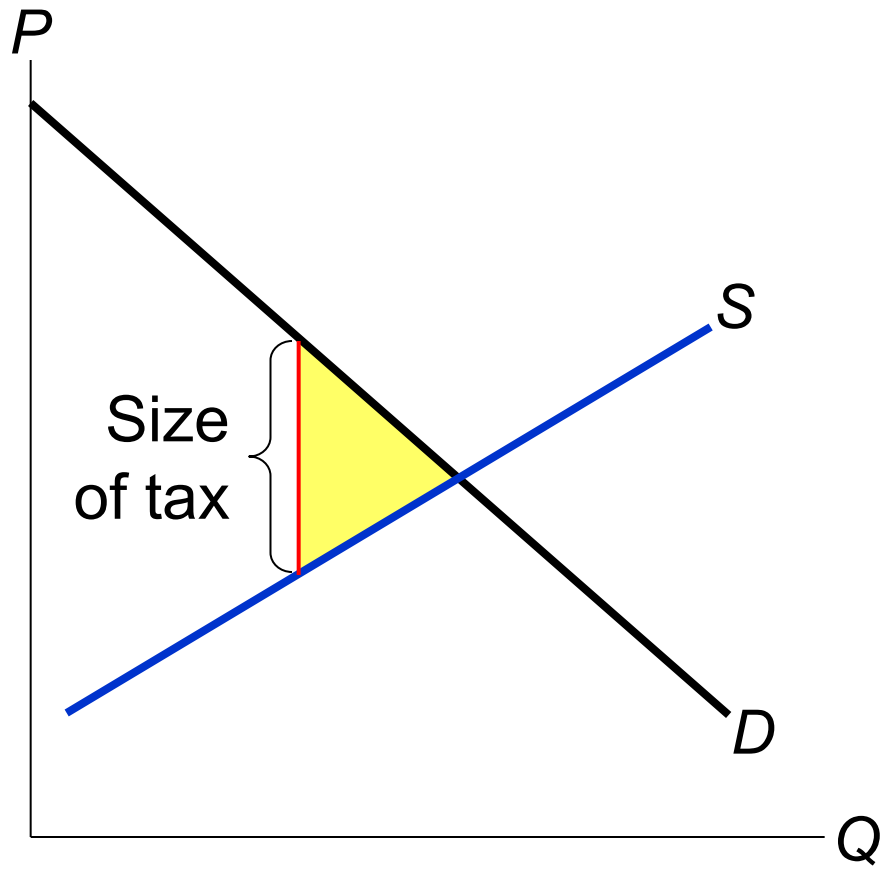
- ***DWL*** is small.



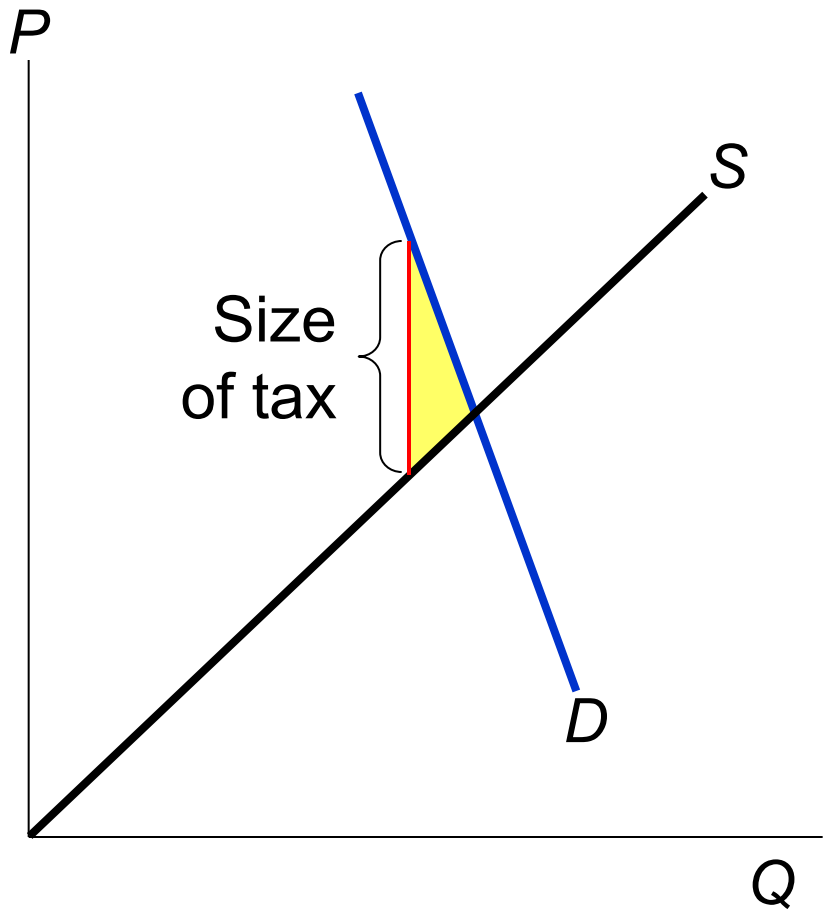
EXAMPLE 3: DWL and the elasticity of supply – 2

The more elastic is the supply,

- The greater the change in quantity supplied due to a change in price...
- The greater the ***DWL***.



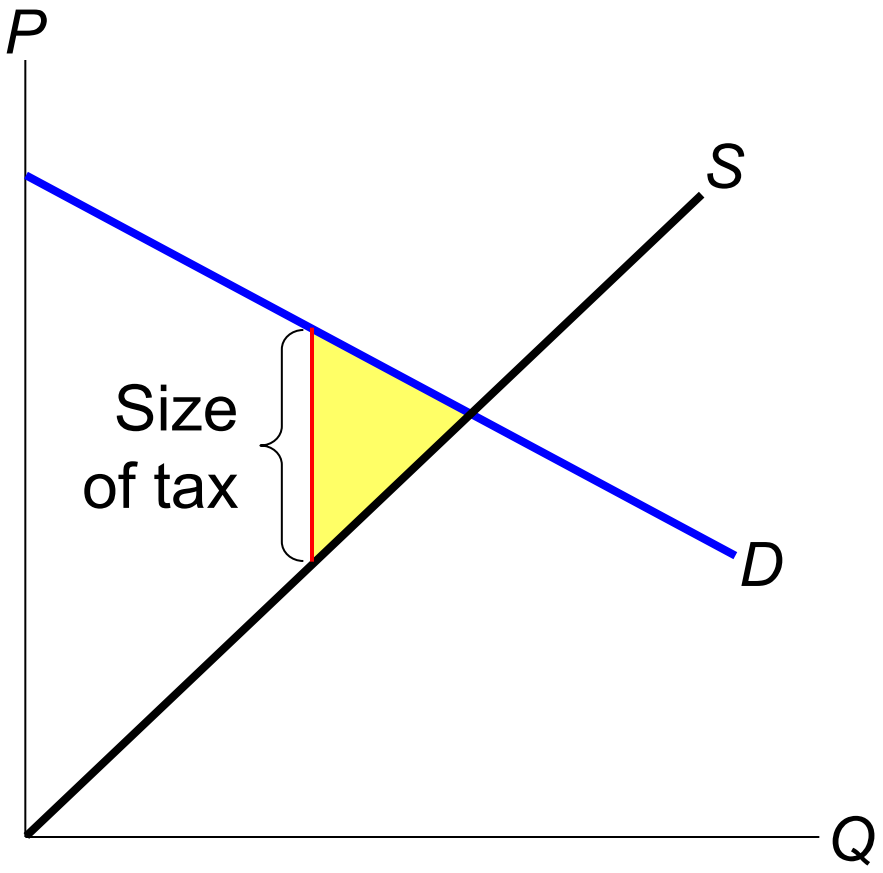
EXAMPLE 4: DWL and elasticity of demand – 1



When demand is inelastic,

- A change in price leads to a small change in quantity demanded.
- ***DWL*** is small.

EXAMPLE 4: DWL and the elasticity of demand – 2



The more elastic is demand,

- The greater the change in quantity demanded due to a change in price…

- and the greater the ***DWL***.

Active Learning 2: Elasticity and the DWL

In each situation, explain if the DWL of a tax would be larger if the tax were imposed on:

A. Only Mountain Dew or soda in general?

B. Airfare in the short run or airfare in the long run?

C. Groceries or meals at fancy restaurants?

Active Learning 2: A. Mountain Dew or soda?

A. Mountain Dew or soda ?

From Chapter 5:
A good with many close substitutes (such as Mountain Dew) has a more price-elastic demand than a broadly defined good (such as soda).

- So, a tax on Mountain Dew would cause a larger DWL than a tax on soda.

Active Learning 2: B. Short run or long run?

B. Airfare in the short run or airfare in the long run?

From Chapter 5:
The price elasticities of demand and supply
are larger in the long run than in the short run.

- So, a tax on air travel would cause a larger DWL in the long run (when the demand and supply of airfare are more elastic) than in the short run.

Active Learning 2: C. Groceries or restaurants?

C. Groceries or meals at fancy restaurants?

From Chapter 5:
The demand for necessities (groceries) are less price-elastic than the demand for luxuries (meals at fancy restaurants).

- So, a tax on restaurant meals would cause a larger DWL than a tax on groceries.

CASE STUDY

How Big Should the Government Be? – 1

- If taxes result in large DWL
  - The DWL = strong argument for a leaner government (does less and taxes less)
- If taxes impose small DWL
  - Government programs are less costly than they otherwise might be
  - Argument for a more expansive government.
- Marginal tax rate on labor income = 40%
  - Social Security tax, Medicare tax, federal income tax, state income taxes
  - Biggest source of government revenue

CASE STUDY

How Big Should the Government Be? – 2

40% marginal tax rate on labor income – how big is the ***DWL***?

- Depends on the elasticity of labor supply

- Some economists: labor supply is fairly inelastic
  - Almost vertical: most people would work full-time regardless of wage
    - Workers in their prime working years and main breadwinners of their families
  - Tax on labor leads to a small ***DWL***

CASE STUDY

How Big Should the Government Be? – 3

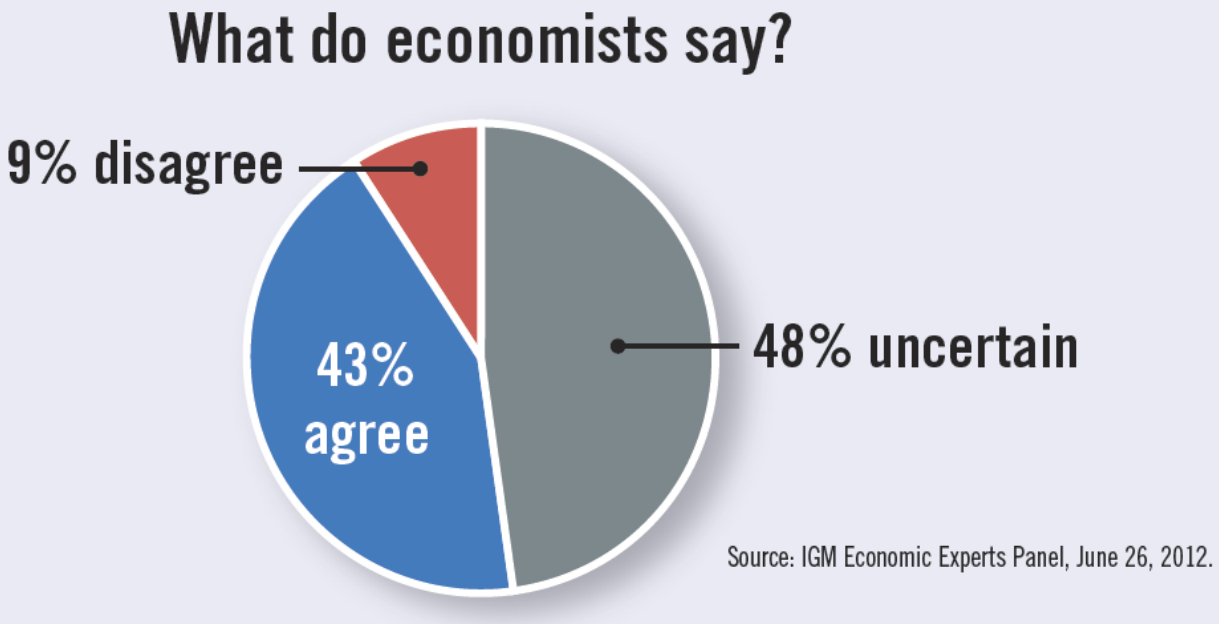
Other economists: labor supply is more elastic

- Labor taxes are highly distortionary
- Many groups of workers have elastic supply and respond more to incentives
  - Many workers can adjust their hours
  - Many families have 2nd earners; some discretion over whether and how much to work
  - Many people can choose when to retire; incentive to work part-time
  - Some work in the "underground economy" to evade taxes

Ask the Experts

The Laffer Curve – 1

"A cut in federal income tax rates in the United States right now [2012] would lead to higher national income within five years than without the tax cut."



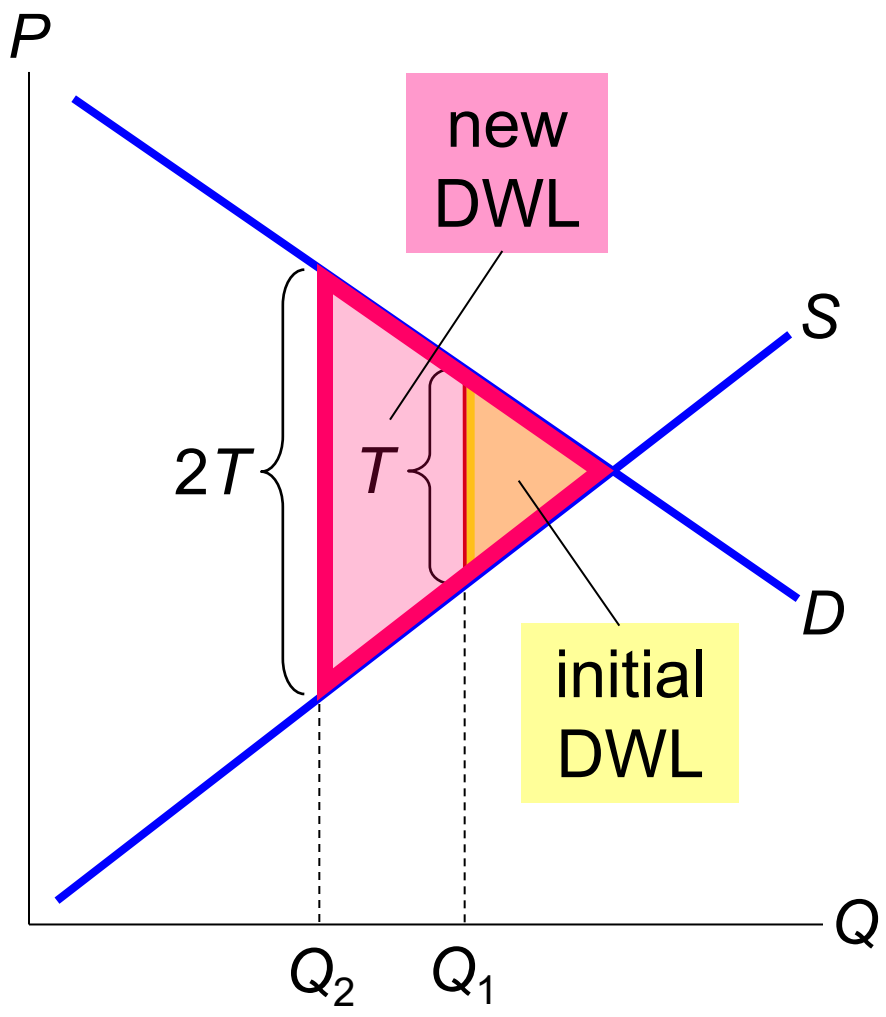
DWL and Tax Revenue as Taxes Vary

- As the tax increases
  - Deadweight loss increases
    - Even more rapidly than the size of the tax
  - Tax revenue
    - Increases initially
    - Then decreases
    - The higher tax: drastically reduces the size of the market

EXAMPLE 5: DWL and the size of the tax – 1

Initially, the tax is ***T*** per unit.

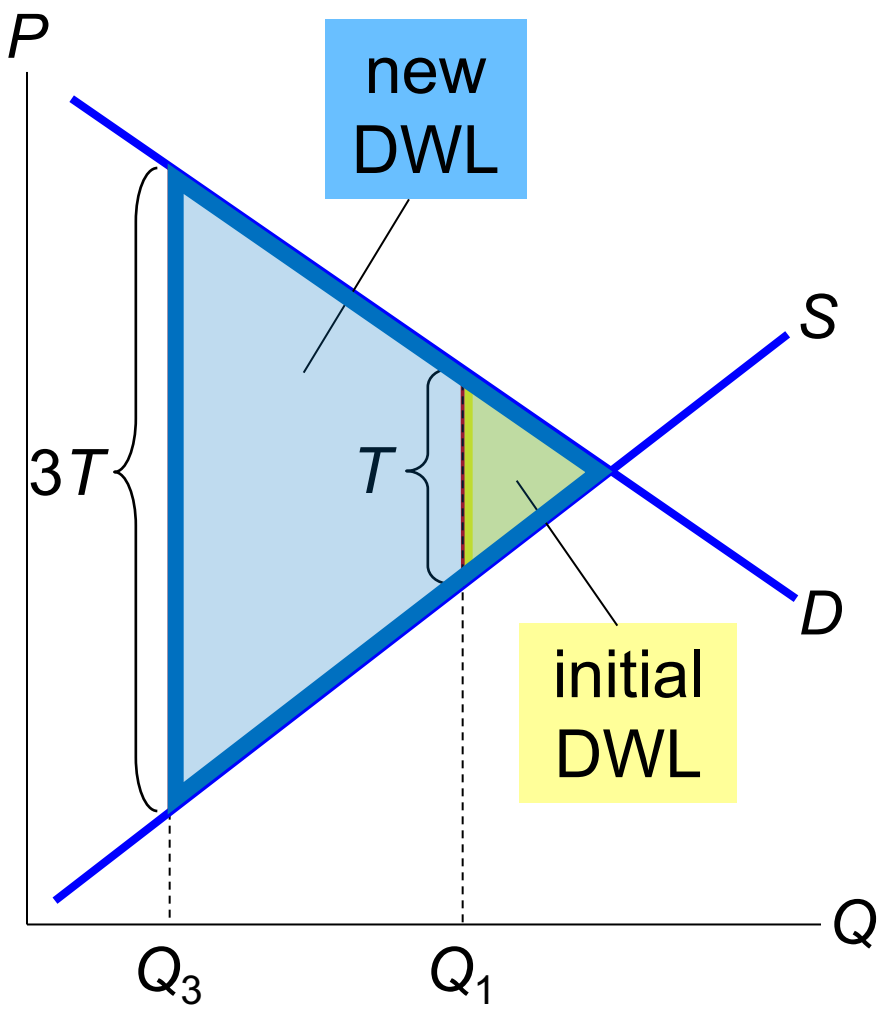
- Increasing the tax to ***2T*** per unit…
- causes the ***DWL*** to more than double.



EXAMPLE 5: DWL and the size of the tax – 2

Initially, the tax is ***T*** per unit.

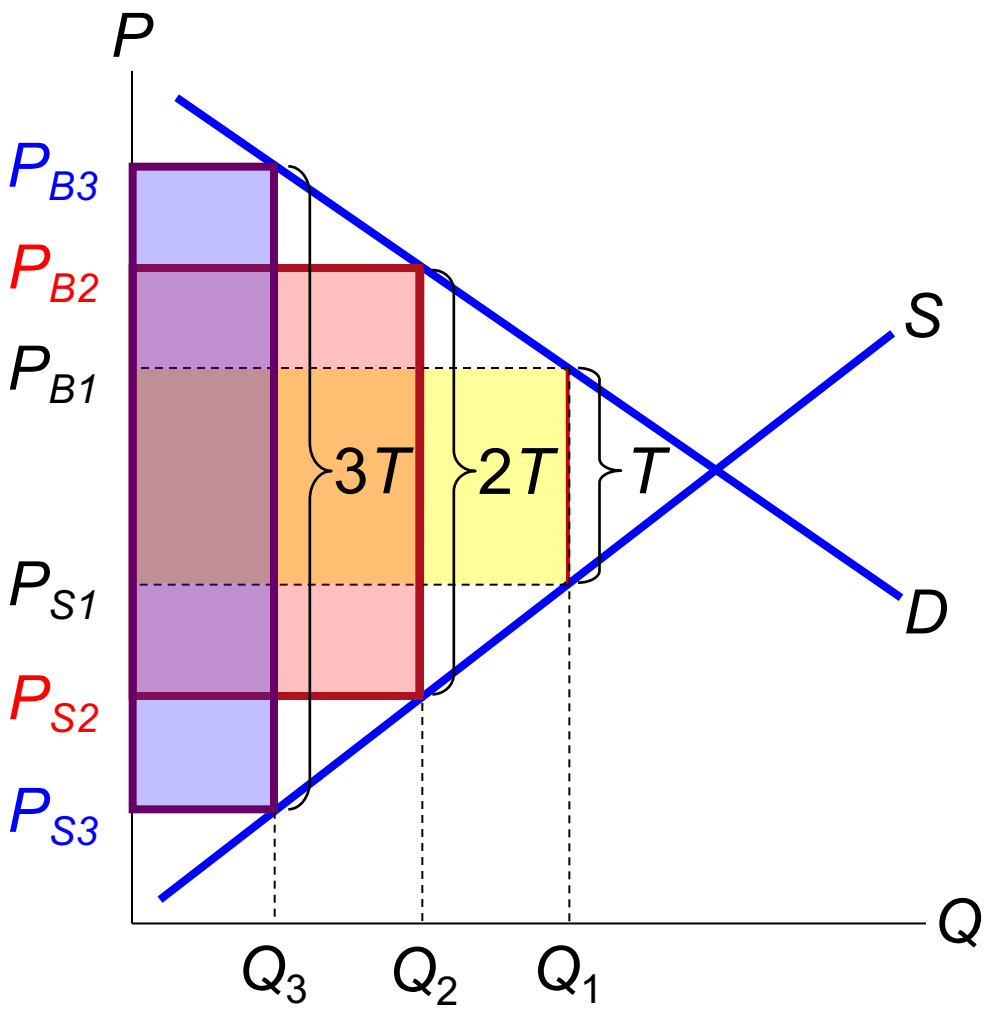
- Increasing the tax even more, to ***3T*** per unit…
- causes the ***DWL*** to more than triple.



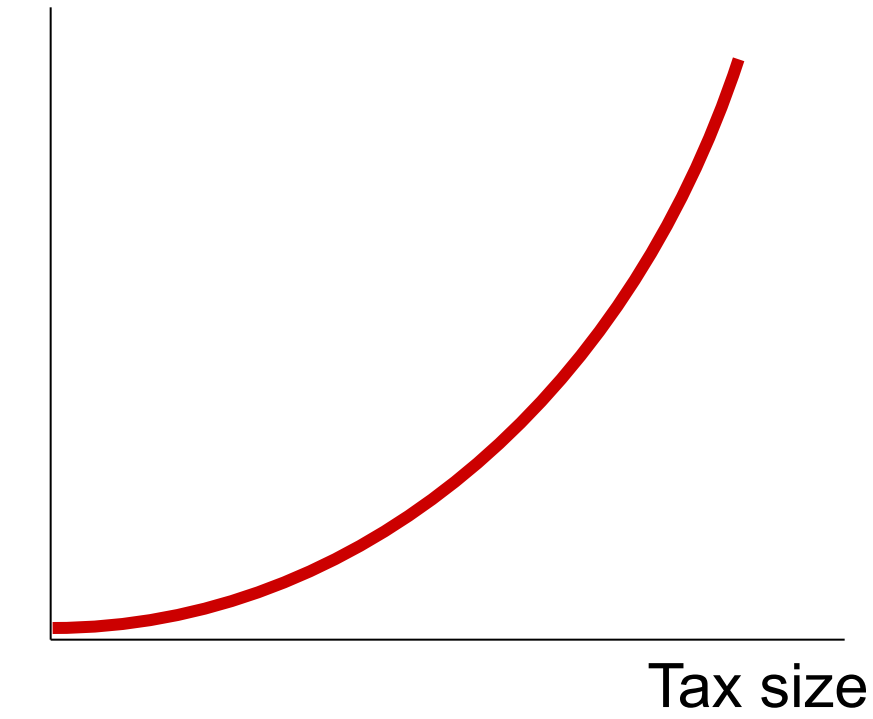
EXAMPLE 6: Revenue and the size of the tax

When the tax is small, increasing it causes tax revenue to rise.

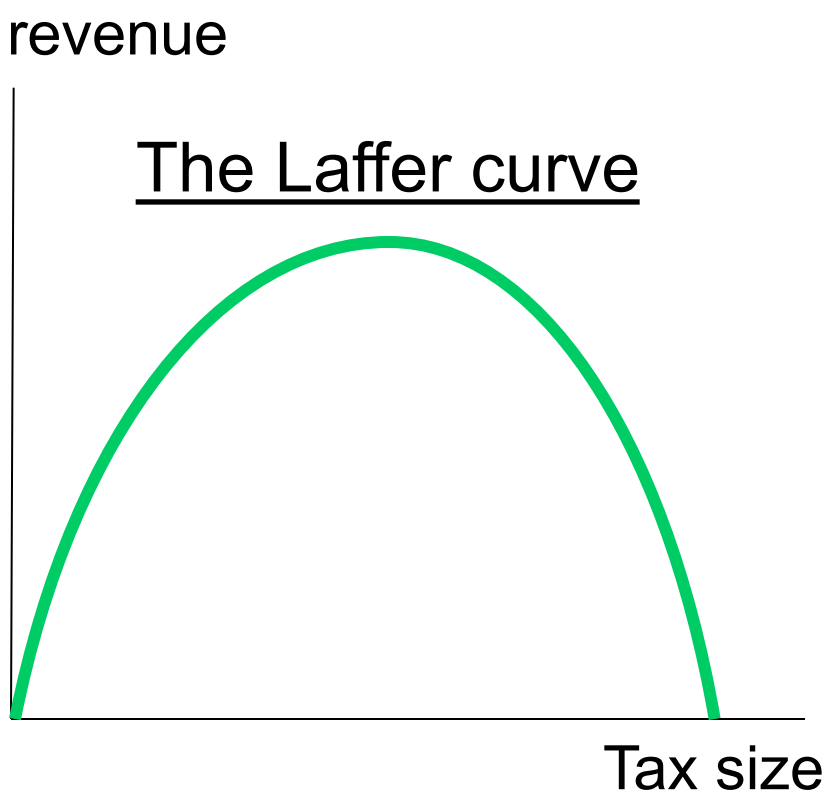
When the tax is larger, increasing it causes tax revenue to fall.



DWL and tax revenue as taxes vary



When a tax increases, DWL rises even more.

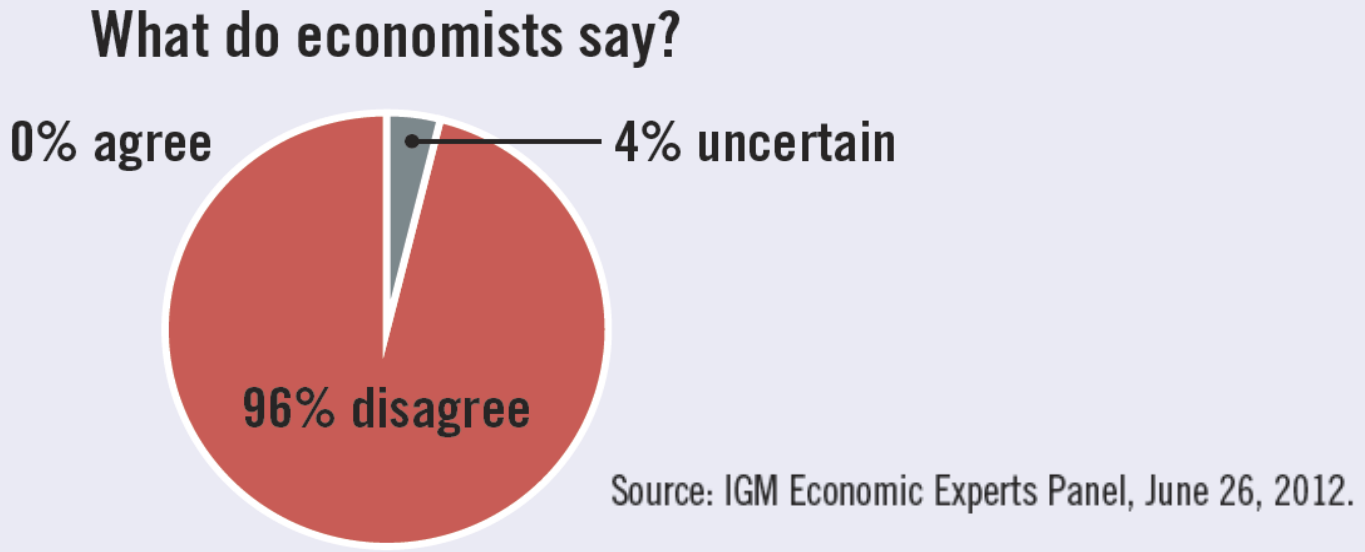


When a tax increases, tax revenue initially increases, then decreases.

Ask the Experts

The Laffer Curve – 2

"A cut in federal income tax rates in the United States right now [2012] would raise taxable income enough so that the annual total tax revenue would be higher within five years than without the tax cut."



THINK-PAIR-SHARE

You are watching the local news report with your mom. The news anchor reports that the state budget has a deficit of $200 million. The state currently collects exactly $100 million from its 5% sales tax. Mom says, “The state can fix their deficit by increasing the sales tax to 15%. That will increase tax revenue from $100 million to $300 million and provide the needed $200 million.”

A. Will tripling a tax always triple the tax revenue? Explain.

B. Will increasing the sales tax affect the tax revenue and the DWL in all markets to the same degree? Explain.

CHAPTER IN A NUTSHELL

- A tax on a good reduces the welfare of buyers and sellers, and the reduction in ***CS*** and ***PS*** usually exceeds the revenue raised by the government.
  - The fall in total surplus is ***DWL*** of a tax.
- Taxes have deadweight losses (DWL).
  - Buyers consume less and pay a higher P.
  - Sellers produce less and receive a lower P.

CHAPTER IN A NUTSHELL

- Large S and D elasticities: larger DWL
- As a tax grows larger
  - Distorts incentives more
  - Its DWL grows larger
  - Tax revenue first rises with the size of a tax, but if the tax gets large enough, tax revenue starts to fall.