Principles of Economics

Chapter 8:

Application:
The Costs of Taxation

In This Chapter

▸ How does a Tax affect consumer surplus, producer surplus, and total surplus?

▸ What is the Deadweight Loss (DWL) of a tax?

▸ What factors determine the size of this deadweight loss?

▸ How does tax revenue depend on the size of the tax?

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

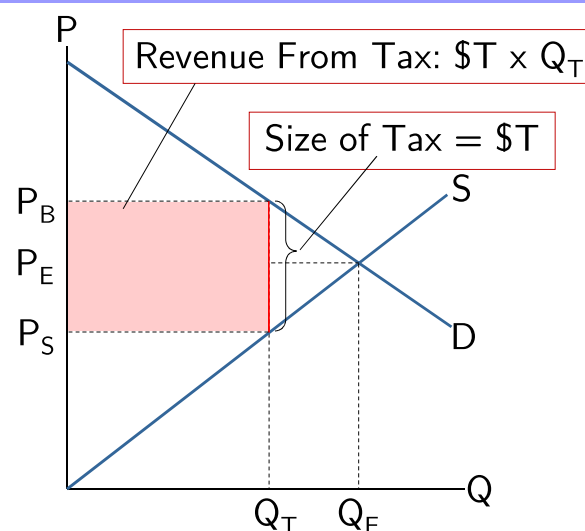## Review: The Effects of a Tax

‣ 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

Revenue From Tax: $T x Q_T

Size of Tax = $T

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How a Tax Affects Market Participants

▸ Total Surplus = Consumer Surplus + Producer Surplus

  ▸ Maximized at equilibrium

▸ With Taxes:

  ▸ CS decreases (higher P_B, lower Q_T)

  ▸ PS decreases (lower P_S, lower Q_T)

  ▸ Government gains tax revenue (per unit Tax * Q_T)

  ▸ What happens to Total Surplus?

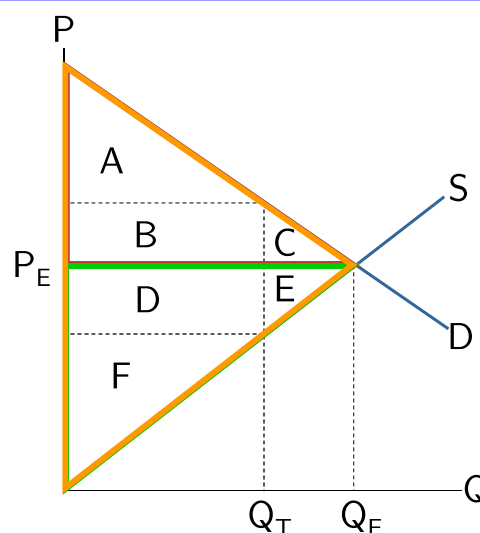## Example: The Effects of a Tax

Without a Tax,

  ▸ CS = A + B + C

  ▸ PS = D + E + F

  ▸ Tax Revenue = 0

Total Surplus

= CS + PS

= A + B + C + D + E + F

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Example: The Effects of a Tax

C + E is the Deadweight Loss (DWL) of the Tax, the fall in Total Surplus resulting from a market distortion, such as a tax.
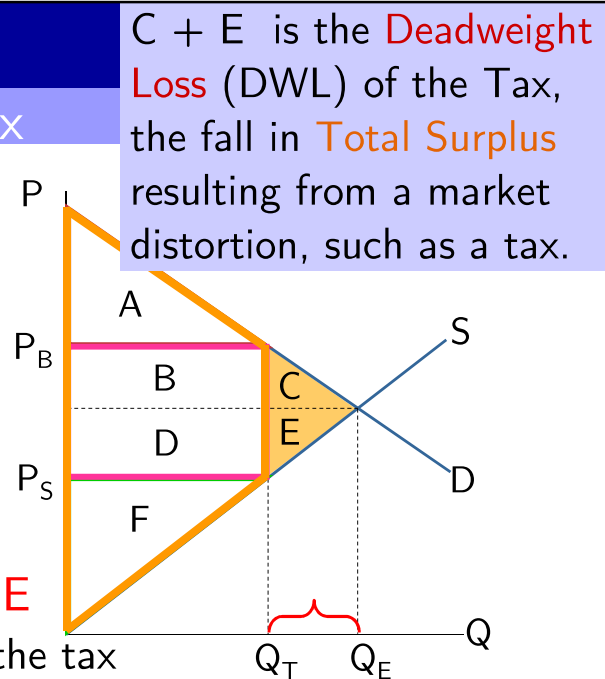
With the Tax,
- CS = A
- PS = F
- Tax Revenue = B + D

Total Surplus
= CS + PS + Tax Revenue
= A + B + D + F

The Tax Reduces TS by C + E

$Q_E - Q_T$ = units not sold due to the tax

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Example: 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 NT$3300, and Ethan's cost is NT$2800.
- They agree on a price of NT$3000 per month.

A. Calculate CS, PS, and TS.
- The government imposes a NT$700 tax on all laundry service providers.

B. What happens to CS, PS, and TS?

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Zaria is taking her laundry to Ethan's dry cleaning and laundry services business.
For this arrangement, each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month.
How much is the CS?

ⓘ Start presenting to display the poll results on this slide.

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Zaria is taking her laundry to Ethan's dry cleaning and laundry services business.
For this arrangement, each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month.
How much is the PS?

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Zaria is taking her laundry to Ethan's dry cleaning and laundry services business.

For this arrangement, each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.

They agree on a price of NT$3000 per month.

How much is the TS?

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Example: A. Calculate CS, PS, and TS

▸ Zaria's WTP = NT$3300; Ethan's Cost = NT$2800

▸ P = NT$3000 per month.

▸ Zaria's CS = WTP − P = 3300 − 3000 = NT$300

▸ Ethan's PS = P − cost = 3000 − 2800 = NT$200

▸ TS = CS + PS = NT$500

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Each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month, but the government imposes a NT$700 tax.
How much is CS now?

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Each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month, but the government imposes a NT$700 tax.
How much is PS now?

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Each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month, but the government imposes a NT$700 tax.
How much is governmental tax revenue?

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Each month, Zaria is willing to pay NT$3300, and Ethan's cost is NT$2800.
They agree on a price of NT$3000 per month, but the government imposes a NT$700 tax.
How much is TS now?

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Example: B. $700 Tax

- ‣ Zaria's WTP = NT$3300; Ethan's Cost = NT$2800;
- ‣ P = NT$3000 per month.
- ‣ Ethan needs 2800 + 700 = NT$3500 to provide laundry services to Zaria, but
- ‣ Zaria's WTP = NT$3300!! Trade doesn't happen!
- ‣ The tax has made both worse off: DWL = NT$500
- ‣ How about the government? Government gets NT$0!
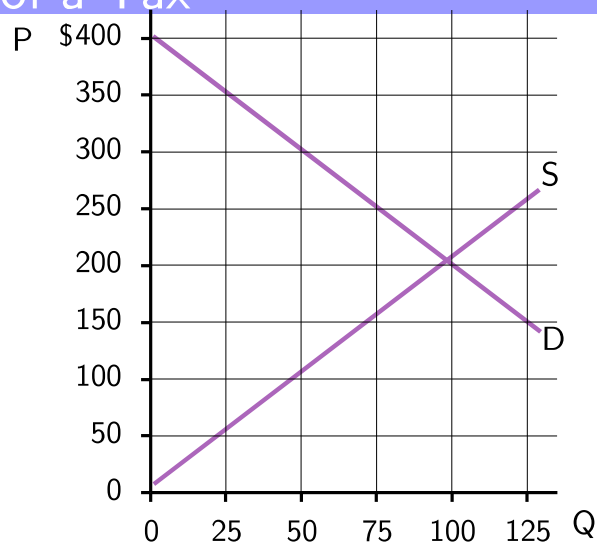 - ‣ No tax revenue because Ethan and Zaria are not trading…

Active Learning: 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.

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What is the CS without tax?

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What is the PS without tax?

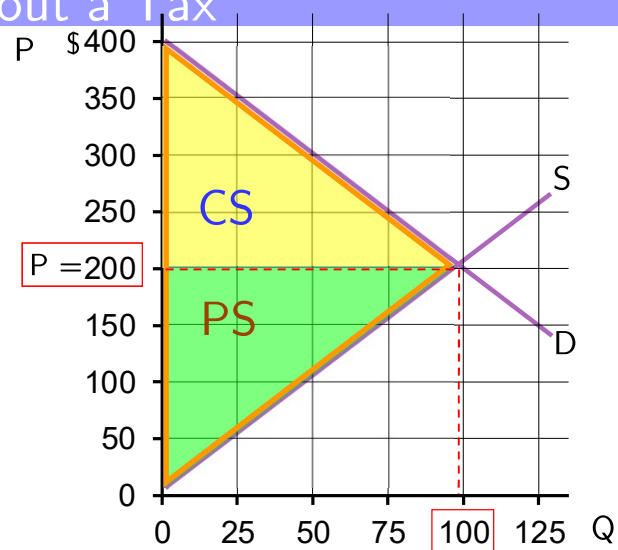ⓘ Start presenting to display the poll results on this slide.

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What is the TS without tax?

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Active Learning: A. Without a Tax

A. Without Tax:

▸ CS = ½ x $200 x 100
   = $10,000

▸ PS = ½ x $200 x 100
   = $10,000

▸ TS = $20,000

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What is the CS if a $200 tax per unit is imposed?

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What is the PS if a $200 tax per unit is imposed?

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What is the tax revenue if a $200 tax per unit is imposed?

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What is the TS if a $200 tax per unit is imposed?

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What is the DWL if a $200 tax per unit is imposed?

ⓘ Start presenting to display the poll results on this slide.

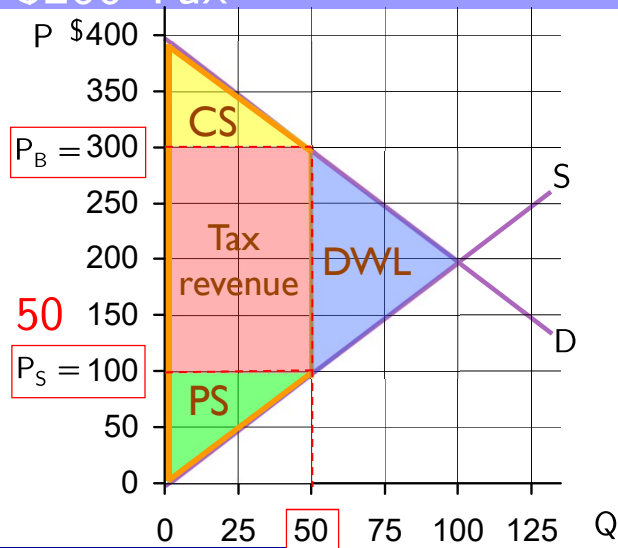## Active Learning: B. With $200 Tax

B. With $200 Tax:

▸ CS = ½ x $100 x 50

    = $2,500

▸ PS = $2,500

▸ Tax Revenue = $200 x 50

    = $10,000

▸ TS = $15,000

▸ DWL = $5,000

P $400 / 350 / $P_B = 300$ / 250 / 200 / 150 / $P_S = 100$ / 50 / 0

CS, Tax revenue, DWL, PS, S, D

0 25 50 75 100 125 Q

The Determinants of the Deadweight Loss

▸ Price elasticities of supply and demand

  ▸ More elastic supply curve

    ▸ Larger deadweight loss

  ▸ More elastic demand curve

    ▸ Larger deadweight loss

▸ The greater the elasticities of supply and demand

  ▸ The greater the deadweight loss of a tax

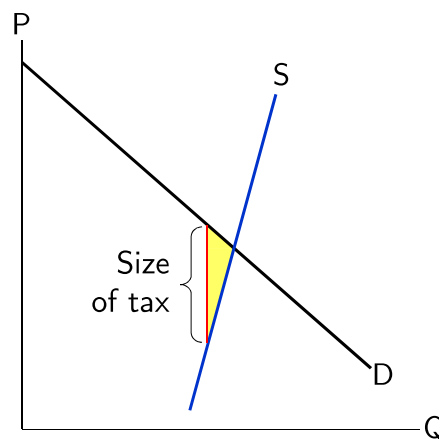## Example: DWL and the Elasticity of Supply

When supply is inelastic,

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

▸ DWL is small.

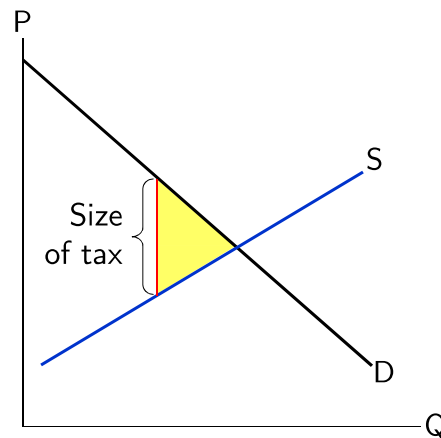## Example: DWL and the Elasticity of Supply

The more elastic is the supply,

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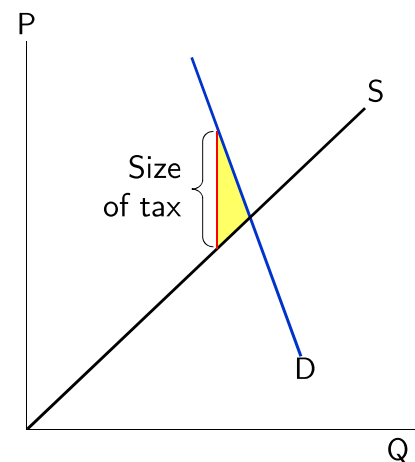
▸ The greater the DWL.

P

S

Size of tax

D

Q

Example: DWL and the Elasticity of Demand

When demand is inelastic,

▸ A change in price leads to a small change in quantity demanded.

▸ DWL is small.

P

S

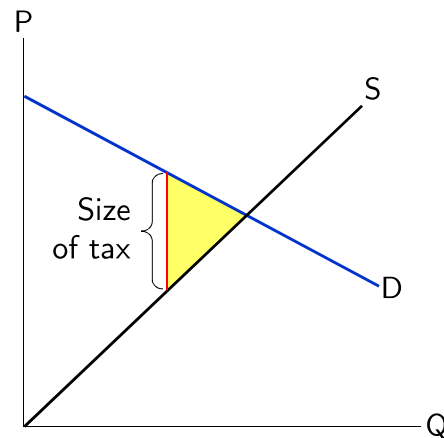Size of tax

D

Q

Example: DWL and the Elasticity of Demand

The more elastic is demand,

▸ The greater the change in quantity demanded due to a change in price...

▸ and the greater the DWL.

P

S

Size of tax

D

Q

Active Learning: 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?

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The DWL of a tax would be larger if the tax were imposed on only Mountain Dew or soda in general?

ⓘ Start presenting to display the poll results on this slide.

Active Learning: 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.

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The DWL of a tax would be larger if the tax were imposed on airfare in the short run or airfare in the long run?

ⓘ Start presenting to display the poll results on this slide.

Active Learning: 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.

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The DWL of a tax would be larger if the tax were imposed on groceries or meals at fancy restaurants?

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Active Learning: 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.

How Big Should the Government Be?

‣ 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

How Big Should the Government Be?

‣ Marginal tax rate on labor income = 40%

- ‣ Social Security tax, Medicare tax, federal income tax, state income taxes
- ‣ Biggest source of government revenue

‣ How big is the DWL?

- ‣ Depends on the elasticity of labor supply

How Big Should the Government Be?

‣ Some economists believe the 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

Other Economists: Labor Supply is More Elastic

‣ Elastic Supply: Labor taxes are highly distortionary

‣ Many groups of workers have elastic supply and respond more to incentives

  1. Many workers can adjust their hours
  2. Some families have 2nd earners; some discretion over whether and how much to work
  3. Many of the elderly can choose when to retire; may decide to work part-time
  4. Some people work in the "underground economy" to evade high taxes

Ask The Experts
The Laffer Curve

"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."

▸ Do you Agree or Disagree?

▸ Do Economists Agree or Disagree?

Source: IGM Economic Experts Panel, June 26, 2012.

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Do you "Agree" or "Disagree"?
"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."

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Do Economists Agree or Disagree?
"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."

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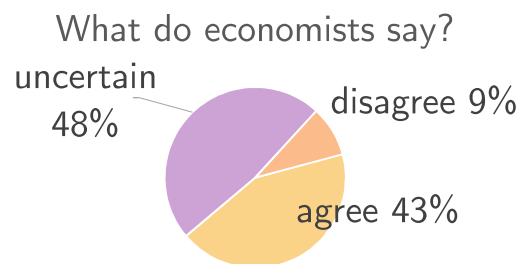# Ask The Experts
The Laffer Curve

"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."

What do economists say?

uncertain
48%

disagree 9%

agree 43%

Source: IGM Economic Experts Panel, June 26, 2012.

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
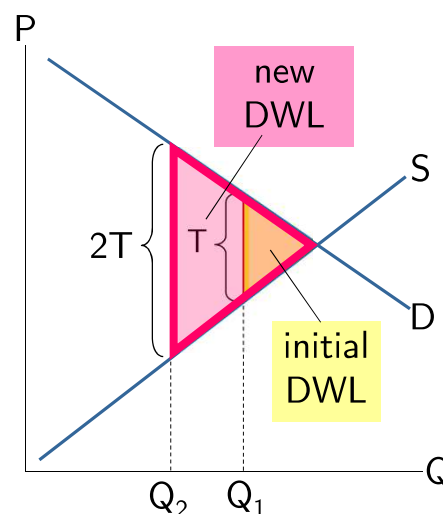 - ‣ The higher tax: drastically reduces the size of the market

Example: DWL and the Size of the Tax

- ‣ Initially, the tax is T per unit.

- ‣ Increasing the tax to 2T per unit...
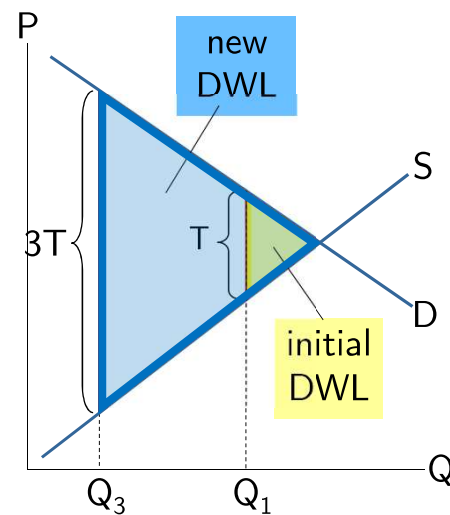
- ‣ Causes the DWL to more than double.

Example: DWL and the Size of the Tax

▸ Initially, the tax is T per unit.

▸ Increasing the tax even more, to 3T per unit...
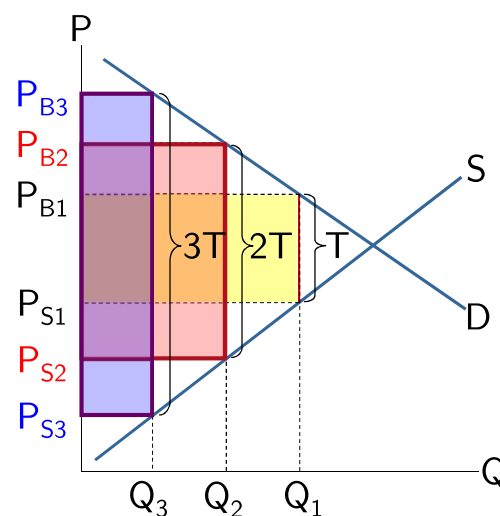
▸ Causes the DWL to more than triple.

Example: Revenue and the Size of the Tax

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

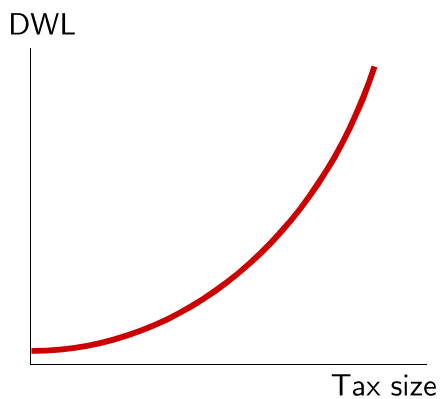▸ When the tax is larger, increasing it causes tax revenue to fall.

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.

DWL

Tax revenue

The Laffer curve

Tax size

Tax size

Ask The Experts
The Laffer Curve

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

▸ Do you Agree or Disagree?

▸ Do Economists Agree or Disagree?

Source: IGM Economic Experts Panel, June 26, 2012.

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Do you "Agree" or "Disagree"?
"A cut in federal income tax rates in the United States right now would raise taxable income enough so that the annual total tax revenue would be higher within five years than without the tax cut."

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Do Economists Agree or Disagree?
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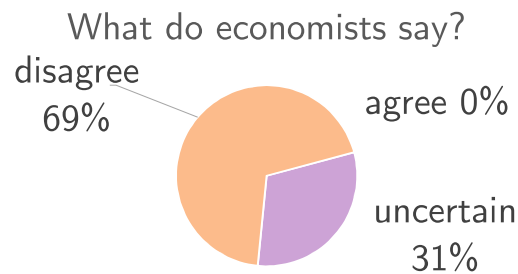
Ask The Experts
The Laffer Curve

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

What do economists say?

disagree
69%

agree 0%

uncertain
31%

Source: IGM Economic Experts Panel, June 26, 2012.

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Think-Pair-Share
You are watching Econman on YouTube w/ your mom

▸ Econman: Taiwan has a budget deficit of NT$204.1 billion in 2020 financed with investment gains (from the central bank).

▸ Taiwan currently collects NT$241.5 billion from 5% sales tax.

▸ Mom: "Taiwan can fix its deficit by increasing the sales tax to 10%. That will increase tax revenue to NT$483 billion providing the needed NT$204.1 billion."

A. Will doubling a tax double the tax revenue? Explain.

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

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"Taiwan can fix its deficit by increasing the sales tax to 10%. That will increase tax revenue to NT$483 billion providing the needed NT$204.1 billion."
Will doubling a tax double the tax revenue? Explain.

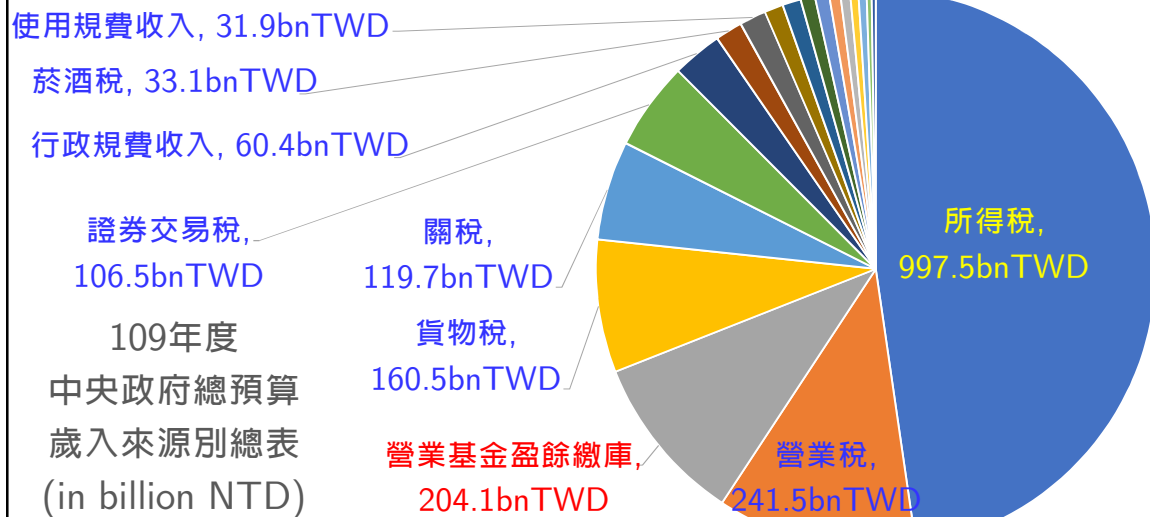ⓘ Start presenting to display the poll results on this slide.

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"Taiwan can fix its deficit by increasing the sales tax to 10%. That will increase tax revenue to NT$483 billion providing the needed NT$204.1 billion."
Will increasing the sales tax affect tax revenue and DWL in all markets to the same degree? Explain.

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109年度中央政府總預算歲入來源別總表 in billion NT$

使用規費收入, 31.9bnTWD

菸酒稅, 33.1bnTWD

行政規費收入, 60.4bnTWD

證券交易稅, 106.5bnTWD

109年度
中央政府總預算
歲入來源別總表
(in billion NTD)

關稅, 119.7bnTWD

貨物稅, 160.5bnTWD

營業基金盈餘繳庫, 204.1bnTWD

所得稅, 997.5bnTWD

營業稅, 241.5bnTWD

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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.

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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.

Chapter 8: The Costs of Taxation

▸ Welfare Analysis of Taxation
▸ Deadweight Loss (DWL = Harburger Triangle)

▸ Homework:
  ▸ Mankiw, Ch.8, Problem 2, 4, 5, 8, 10
▸ Challenge Questions/ex-Midterm:
  ▸ 2007 - Essay Q3, Q4
  ▸ 2008 - Essay B (Multi-Choice Q8)

Chapter 8: Challenge Questions/ex-Midterm

- ‣ 2009 - Essay A (Multi-Choice Q12)
- ‣ 2010 - Essay B
- ‣ 2012 - Essay A10-A12, B (True/False Q7-Q8)
- ‣ 2013 - Essay C, D (True/False Q9-Q10)
- ‣ 2014 - Essay A
- ‣ 2017 - Essay A
- ‣ 2019 - Essay B2
- ‣ 2020 - Essay C2-C4, D3-5

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Audience Q&A Session

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