

# Tuesday, Oct 20, Lecture 12

## Taxes

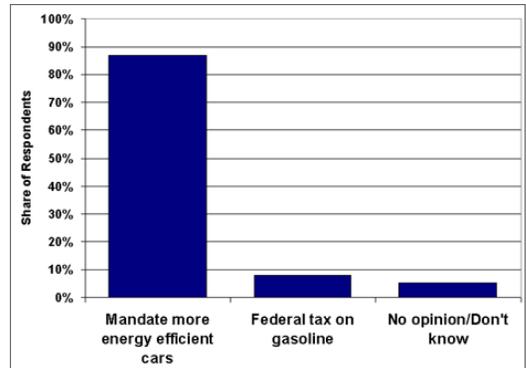


## Americans Hate Taxes

- 241 years ago, in 1775, Americans rebelled against the British, partly because Americans didn't want to pay British taxes.
- Then in 1791, farmers rebelled when the US Federal Government tried to collect Whiskey Taxes.
- President George Washington sent the US Army to stop the tax rebellion.

- Most American voters are still opposed to taxes-- they prefer other kinds of government intervention.

- When Americans were asked, “What is the best way to increase the energy-efficiency of cars?” this is how Americans responded.



- The current American view of taxes is undoubtedly the result of bad teaching by economics professors like me.

## The Purpose of Taxes

- Governments tax goods and services for a number of reasons:
  - to finance government activities,
  - to discourage the consumption of certain goods and services,
  - to increase equity,
  - or to correct for negative externalities *[more on that later...]*

# The Effect of Taxes on Markets

- An **excise tax** is a tax of a fixed size applied to each unit of a good sold, e.g.
  - a tax of \$2 on each pack of cigarettes
  - a tax of \$.60 on each gallon of gasoline
  
- We will analyze how excise taxes affect markets.

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## Excise Taxes

- Suppose there is a \$2 excise tax per pack of cigarettes,...
- ...and you buy a pack for \$5.
  - The seller hands you the pack.
  - You hand the seller 5 dollar bills.
  - But just then, the government reaches out and snatches 2 of the bills away.
  - The seller receives only 3 dollar bills.

- **IMPORTANT:** The buyer pays \$2 more than the seller receives.
  - ◆ The price paid by the **buyer** (\$5) is called the **demand-price**.
  - ◆ The price received by the **seller** (\$3) is called the **supply-price**.

■ Suppose the tax collector isn't at the store.

- Is it better if the seller transfers the taxes to the government? Or better if the buyer does?
- ***It doesn't matter!!!*** The effect of taxes is exactly the same.

## A New Tax

- Suppose you're a shopper in the store when the government implements a new tax.
- If the seller just added the tax to the existing price, the quantity demanded would fall creating an excess supply.
  - So if the seller doesn't want to be stuck with goods on the shelf, she will lower her selling price before she adds the tax to it.
  - The buying-price increase you face *will be less* than the total amount of the tax.
  - The price increase you see is the share of the tax you pay.
  - The seller's price reduction is the share of the tax that the seller pays.

- In equilibrium with an excise tax, ...
  - ...the selling price (*supply price*) is less than the buying price (*demand price*)...
  - ...and the difference between them goes to the government.
  
- Because the seller is paying part of the tax and getting a lower price for her goods,...
  
- ... the seller *supplies a smaller quantity*.
  
- Because the buyer is paying part of the tax and paying a higher price for his goods,...
  
- ...the buyer *demands a smaller quantity*.

- With a tax, *supply price* and *demand price* will adjust in equilibrium...
  - to make *quantity supplied = quantity demanded*,



- There's no excess supply or demand in equilibrium; otherwise, prices would continue to adjust.

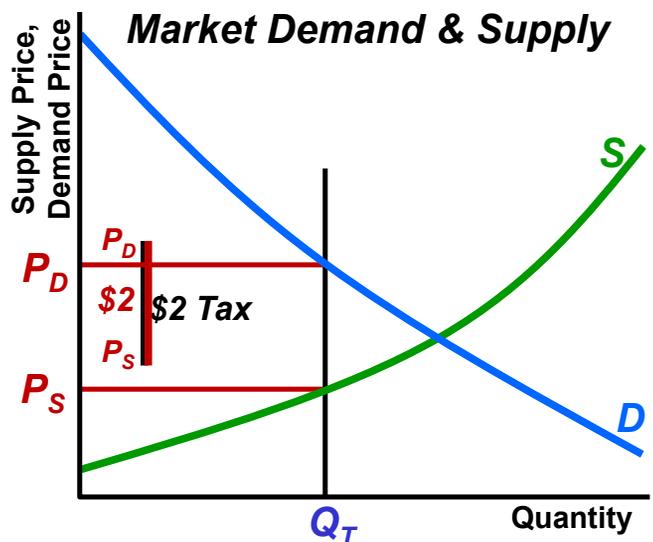
# Clicker Question

Suppose a tax is imposed on cigarettes. Then, in equilibrium,

- the quantity demanded is greater than the quantity supplied.
- the quantity supplied is greater than the quantity demanded.
- the price the seller receives is less than the price the buyer pays.
- the result depends on whether the government collects the tax from the buyer or the seller.

## Graph of Market Equilibrium with Taxes

- The demand curve is graphed using the demand-price.
- The supply curve is graphed using the supply-price.
- Suppose there is a **\$2 tax**.
- Let  $P_D$  be the equilibrium demand price.
- Let  $P_S$  be the equilibrium supply price.
- Then  $P_D - P_S = \$2$
- Let  $Q_T$  be the equilibrium quantity.
- In equilibrium there is no excess demand,  
 $Q_T = Q_S = Q_D$ .
- How do we find  $Q_T, P_D, P_S$ ?
- After sliding the “tax wedge,”  $Q_T, P_D$  and  $P_S$  are determined.



# Finding the Equilibrium with Algebra

- Suppose demand, supply, and the tax, are given by

- $Q_D = 10 - P_D$  and  $Q_S = P_S$
- Tax:  $T = 2$

- Then in equilibrium

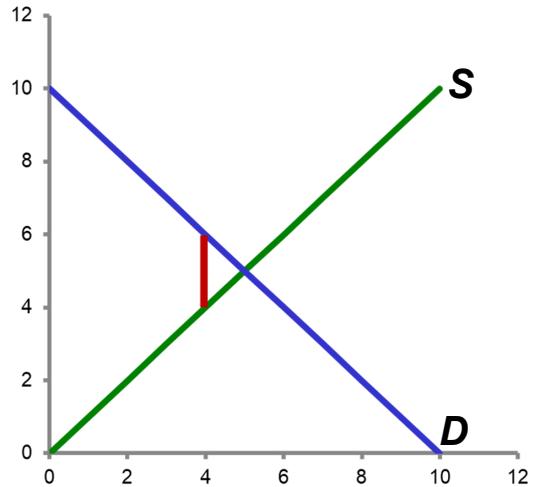
- $Q_D = Q_S$  and  $P_D - P_S = T$

- So

- $10 - P_D = P_S$
- $P_D - P_S = 2$

- Solution:

- $P_D = 6, P_S = 4, Q_D = Q_S = 4$



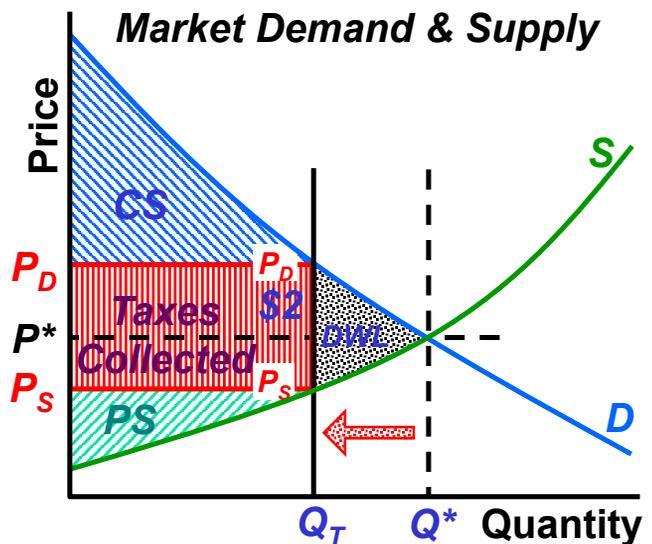
# Tax and No-Tax Comparisons

- As compared with the no-tax price  $P^*$ ,
- the tax creates a higher  $P_D$ , and lower  $P_S$ ,
- which pushes  $Q_T$  below the surplus-maximizing level  $Q^*$ .

- This creates a DWL,
- and reduces consumer and producer surplus.

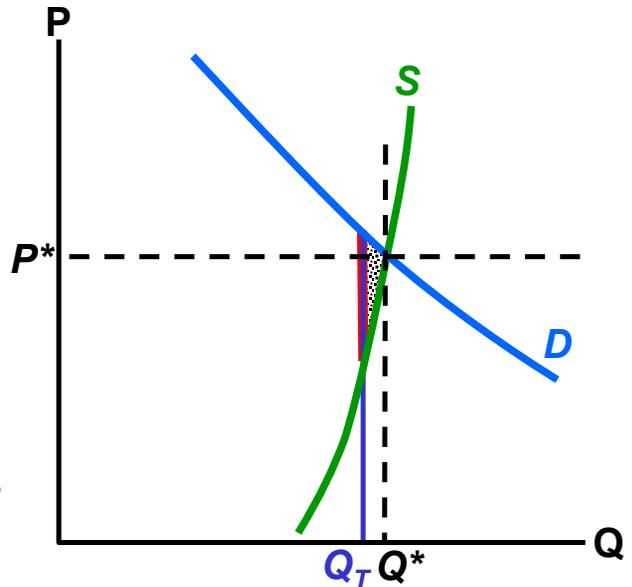
- The remaining surplus takes the form of *Taxes Collected*.

- If the government uses tax money productively to provide public services and increase equity, *Taxes Collected* will not be a DWL.



# Taxes and the Size of the DWL

- If supply (or demand) is very inelastic,...
- then when a tax is imposed,...
- the quantity transacted doesn't change much.
- Therefore, the dead-weight loss will be small.



## Clicker Question

Suppose an excise tax is imposed on sugar. Then,

- there will be a shortage of sugar in equilibrium.
- there will be a surplus of sugar in equilibrium.
- producer surplus will increase.
- NONE** of the above

# Can taxes increase social surplus?

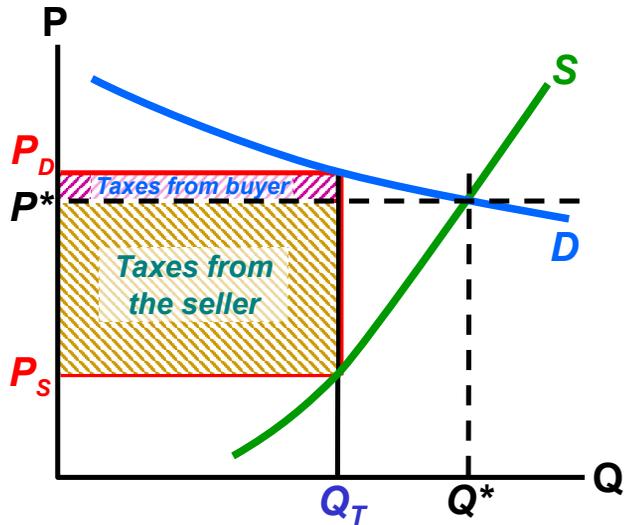
- Although taxes reduce social surplus in most markets,...
- ...taxes on goods with negative externalities (which impose costs on other people) can increase total surplus in the economy.
  - **Example:** Gasoline has externalities (congestion and environmental damage),...
  - and so do cigarettes,...
  - so taxes on gasoline or cigarettes would increase total economic surplus *[explained in a future lecture]*.

## Tax Incidence

- The **tax incidence** is the relative amount of the taxes that originate from the buyer and from the seller.
- The tax incidence depends on the elasticities of supply and of demand.
- If the elasticity of demand is very large, the sellers will have to absorb the tax,...
- because if they try to pass it on to buyers, they will lose many of their customers.
- The opposite happens if the elasticity of supply is very large.
- Tax incidence is **unrelated** to whether the **seller** or the **buyer** hands the money to the government.

# Tax Incidence with Elastic Demand

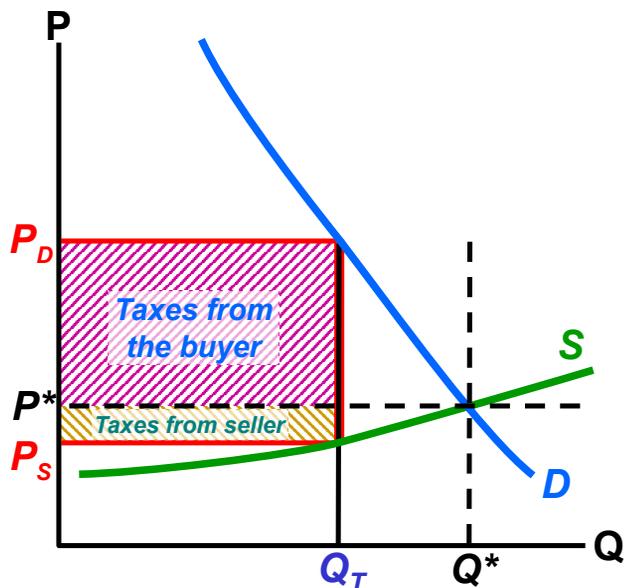
- Here we have a **very elastic** demand curve,...
- and an ordinary supply curve.
- After a tax is imposed,...
- the equilibrium **quantity**, **demand price** and **supply price** all change.
- Why does the **red-shaded area** represent taxes from the buyer? the **yellow-shaded area**, taxes from the seller?



- Why are taxes from the buyer small compared with the taxes from the seller?
  - The buyers will run away if you tax them too much!

# Tax Incidence with Elastic Supply

- Here we have a **very elastic** supply curve,...
- and an ordinary demand curve.
- After a tax is imposed,...
- the equilibrium **quantity**, **demand price** and **supply price** all change.
- The taxes from the seller...
- are small compared with the taxes from the buyer.



# Tax Incidence in General

- In general, the larger the elasticity of demand,
  - the greater the share of taxes that comes from the seller,
  - and the smaller the share from the buyer.
  
- The larger the elasticity of supply,
  - the greater the share of taxes that comes from the buyer,
  - and the smaller the share from the seller.
  
- Here's why...

## Tax Incidence Ratio

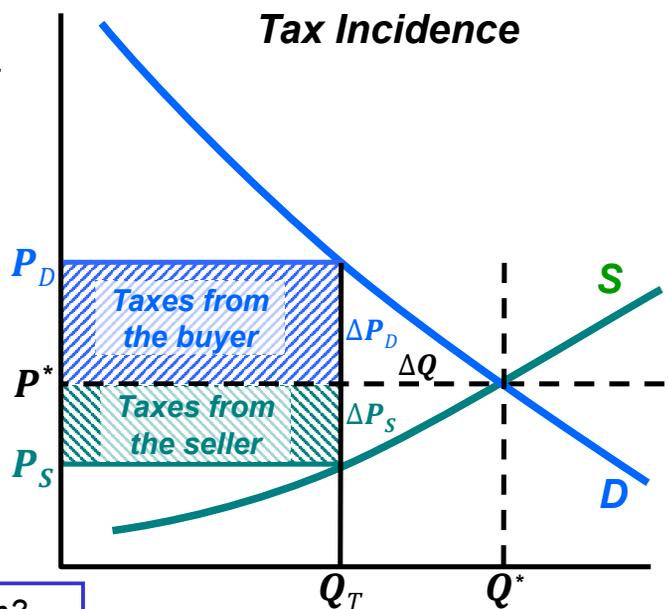
Note: In these calculations all quantities are taken as positive.

$$\text{Taxes from the buyer} = Q_T \Delta P_D$$

$$\text{Taxes from the seller} = Q_T \Delta P_S$$

$$\text{Ratio} = \frac{Q_T \Delta P_D}{Q_T \Delta P_S}$$

$$= \frac{\Delta P_D}{\Delta P_S} = \frac{\epsilon_S}{\epsilon_D}$$



$$\frac{\text{Taxes from Buyer}}{\text{Taxes from Seller}} = \frac{\epsilon_S}{\epsilon_D}$$

Can you prove this equation?  
Ok, I'll do it for you on the next page

# Calculations

$$\blacksquare \varepsilon_D = \frac{\Delta Q/Q^*}{\Delta P_D/P^*}$$

$$\blacksquare \varepsilon_S = \frac{\Delta Q/Q^*}{\Delta P_S/P^*}$$

$$\blacksquare \frac{\varepsilon_S}{\varepsilon_D} = \frac{\frac{\Delta Q/Q^*}{\Delta P_S/P^*}}{\frac{\Delta Q/Q^*}{\Delta P_D/P^*}} = \frac{\Delta P_D}{\Delta P_S} \quad (\text{everything else cancels out})$$

*Note: In these calculations all quantities are taken as positive (minus signs are dropped).*

$$\blacksquare \frac{\text{Taxes from Buyer}}{\text{Taxes from Seller}} = \frac{\Delta P_D}{\Delta P_S} = \frac{\varepsilon_S}{\varepsilon_D}$$

## Taxes on Goods and Services

- Like other kinds of government intervention in markets for goods and services, taxes tend to reduce social surplus.
- But in general, economists prefer taxes to other kinds of intervention,...
- ...because in the presence of taxes, supply-price and demand-price adjust until the market clears (no excess supply or demand),...
- ...so taxes do not lead to nonprice rationing.
- Therefore, people with lower WTP do not get the goods and DWL is small.

# Why are taxes useful?

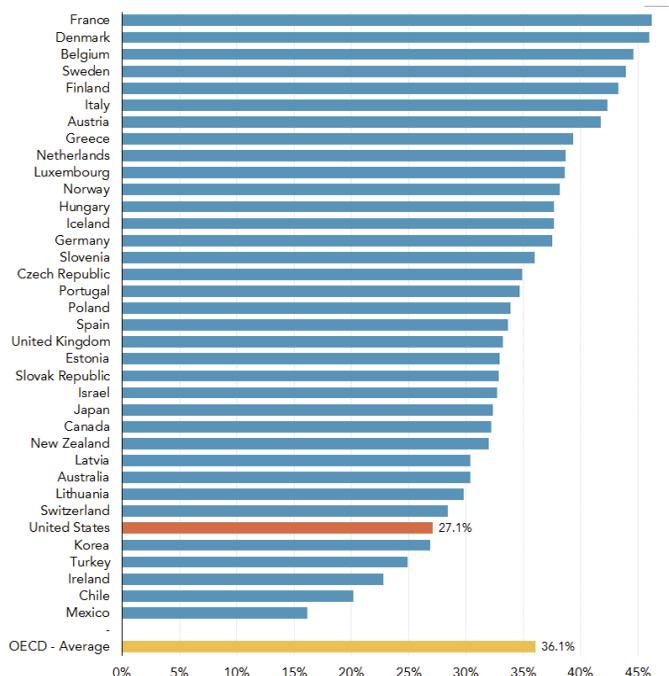
- Although taxes normally reduce surplus, they have very important uses.
  - Taxes allow government to supply public goods, like police protection and clean streets—not easily supplied by private markets. *[To be explained later]*
  - When there are negative externalities (social costs not included in the price--e.g. gasoline), taxes can increase surplus. *[To be explained later]*
  - And taxes can increase equity, important to many societies.
- Many US politicians argue that US taxes are too high...

- But some policy makers believe that US taxes are too low.

- Taxes in most other wealthy countries are higher than in the United States.

Total Tax Revenue as a Share of GDP

Organisation for Economic Co-operation and Development (OECD) Countries, 2017



Source: OECD Revenue Statistics, Comparative Tables (retrieved 08.02.2019).  
 Notes: (a) Includes tax revenues from both federal and sub-national governments; b) The "OECD - Average" is weighted by GDP for a countries excluding the United States; (c) Data for Australia and Japan is for 2016.

# Subsidies

■ Consider a subsidy of  $b$  per unit. The government pays  $b$  each time a unit is sold.

■ Subsidies are the opposite of taxes.

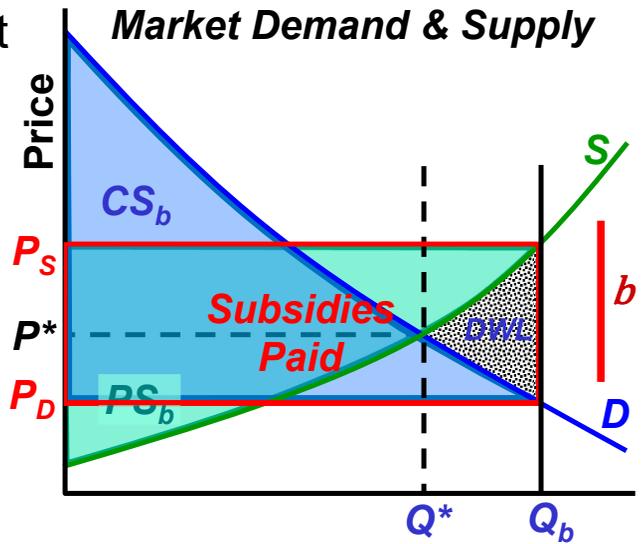
■ Buyer pays less than seller receives,...

■ so in equilibrium,

$$P_S - P_D = b$$

■ The quantity produced  $Q_b > Q^*$ .

■ But **Total Surplus** =  $CS_b + PS_b - \text{Subsidy}$



## Clicker Question

Taxes on a good normally reduce social surplus, because

- taxes reduce the quantity sold in the market.
- government revenues are a deadweight loss.
- consumers pay for all tax revenues.
- producers pay for all tax revenues.

# End of Lecture 12