

Lecture # 7 -- Taxes

I. Taxes

- Steps to solving a mathematical example
 - Solve for the pre-tax equilibrium.
 - Shift in the demand (supply) curve and find the new equation. This is the demand (supply) curve faced by suppliers (consumers).
 - *Remember to only shift **one** of the curves!*
 - Recall that $P_C = P_S + \text{tax}$. Thus, to shift supply, note that the demand curve equals the old supply curve plus the amount of the tax.
 - Similarly, the equation above can be rewritten as $P_S = P_C - \text{tax}$. Thus, to shift demand, note that the old supply curve equals the old demand curve minus the amount of the tax.
 - In either case, the result is to change the y-intercept of either the demand or supply equation by the amount of the tax.
 - Find the intersection of the new demand (supply) curve with the old supply (demand) curve. This gives you the new equilibrium quantity.
 - To find the prices, plug the quantity into the *original* demand and supply curves.
 - Plugging Q into the original demand curve gives you the price consumers pay.
 - Plugging Q into the original supply curve gives you the price suppliers get to keep.
 - To check your work, the difference between these prices should be equal to the tax.

- Here are the numbers from the example in class today

A numeric example on the tax effect:

Demand: $P_c = 34 - 2Q$

Supply: $P_s = 1 + Q$

Without a tax, we calculate the initial equilibrium price and quantity

$$P_c = P_s$$

$$34 - 2Q = 1 + Q$$

$$33 = 3Q$$

$$\Rightarrow Q = 11$$

$$P_c = P_s = 1 + 11 = \$12$$

Now suppose the government levies a tax: Tax = \$3 per unit

Key Step: $P_c = P_s + \text{Tax}$

$$34 - 2Q = 1 + Q + 3$$

$$34 - 2Q = 4 + Q \text{ (shifted supply curve)}$$

$$30 = 3Q$$

$$\Rightarrow Q = 10, P_c = 34 - 2 \cdot 10 = 14, P_s = 1 + Q = 11$$

$$\text{*Double check: } P_c - P_s = 14 - 11 = \$3$$

To calculate the changes in consumer surplus and producer surplus

The initial equilibrium (without a tax):

$$CS = 0.5 \cdot (34 - 12) \cdot 11 = \$121$$

$$PS = 0.5 \cdot (12 - 1) \cdot 11 = \$60.5$$

$$CS + PS = \$181.5$$

After the tax is levied:

$$CS' = 0.5 \cdot (34 - 14) \cdot 10 = \$100$$

$$PS' = 0.5 \cdot (11 - 1) \cdot 10 = \$50$$

$$\text{Tax Revenue} = 3 \cdot 10 = 30$$

$$CS' + PS' + TR = \$180$$

$$DWL = 181.5 - 180 = \$1.5$$

*Double check the area of the triangle (base: tax per unit; height: change in the equilibrium quantity)

$$DWL = 0.5 \cdot (11 - 10) \cdot 3 = \$1.5$$

Incidence of Tax (Tax = \$3 per unit)

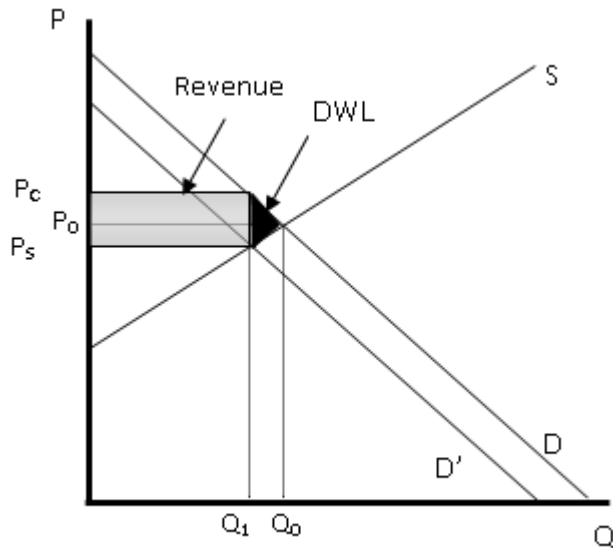
$$P_0 = \$12, P_c = \$14, P_s = \$11$$

$$\text{Change in } P_c = \$2$$

$$\text{Change in } P_s = \$1$$

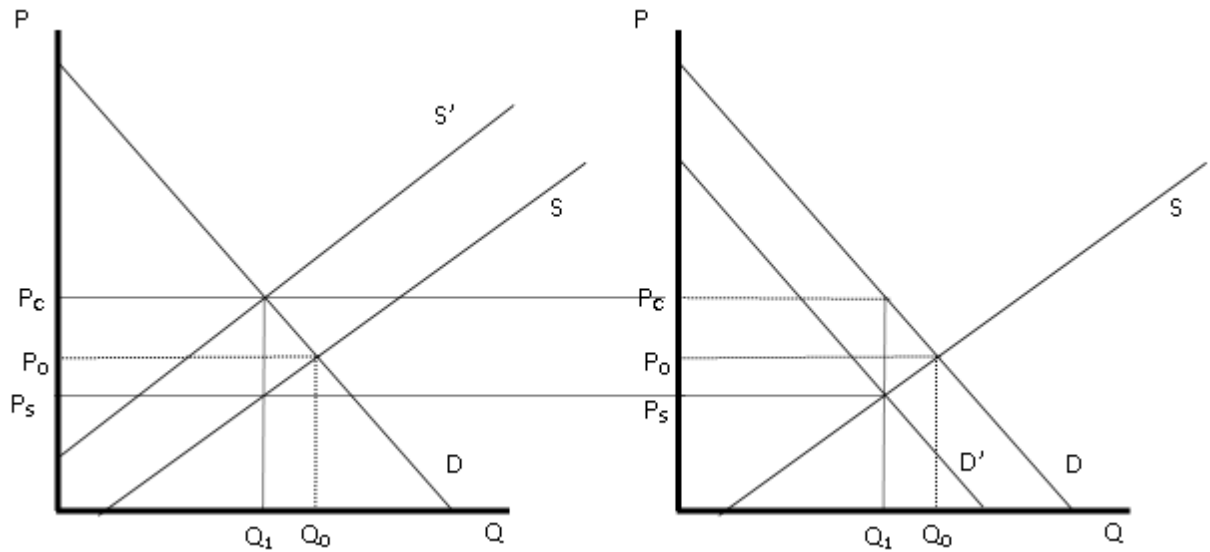
So we see that consumers bear a larger burden of the tax in this case.

- Below is an illustration showing the deadweight loss and the revenue collected from a tax.
 - As shown in class, consumer and producer surplus will be smaller after the tax.
 - Remember to always use the original demand and supply curves to find consumer and producer surplus.
 - Some of the original surpluses now go the government as tax revenue.
 - However, some simply disappears. This is *deadweight loss*.
 - The deadweight loss occurs because some sales that took place before the tax (and were beneficial to consumers and producers) no longer occur.
 - The deadweight loss is a measure of the *inefficiency* of the tax.
 - Elasticity is also important for efficiency.
 - Since deadweight loss comes from beneficial transactions that no longer take place, it is greater when there is elastic supply and demand.



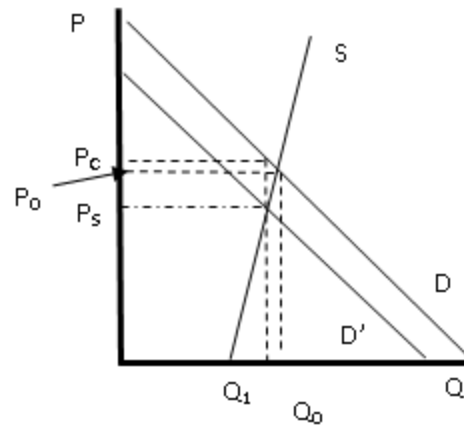
II. Tax Incidence

- The economic burden of the tax does not depend on the legal burden.
 - Taxes will generally be shifted, so that both parties bear part of the burden. The amount shifted is the same whether the legal incidence falls on consumers or producers.
 - Note in the figures below that prices shift by the same amount whether the legal burden is on suppliers (left) or consumers (right).

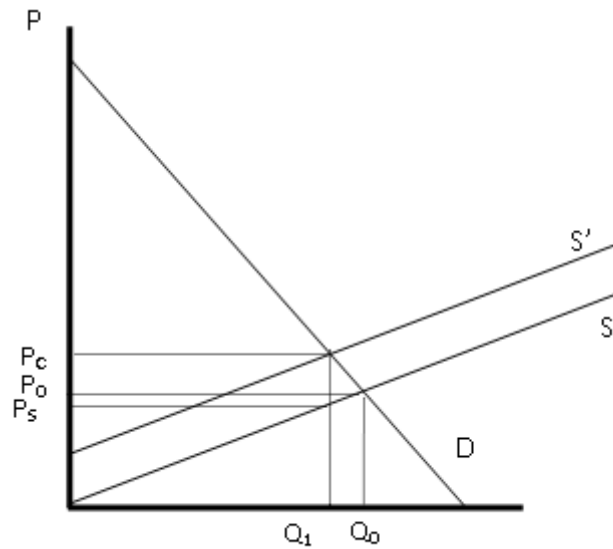


- Elasticity and tax incidence

- The greater share of the economic burden of a tax falls on the more inelastic party. Economists refer to the share of the economic burden as *tax incidence*.
 - Intuition: inelastic parties are less able to change their behavior in response to a tax. Thus, they have a harder time avoiding the tax.
 - Here is an example with an inelastic supply curve:
 - Because supply is inelastic, the drop in supplier price is greater than the increase in consumer price. Suppliers bear a larger burden of the tax.



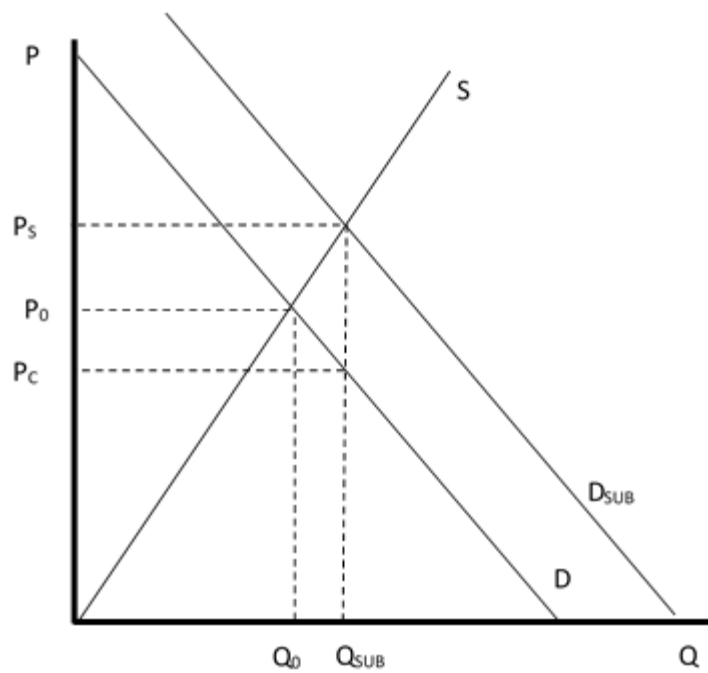
- Compare to a case where supply is elastic. Here, the increase in consumer price is greater. Consumers bear a larger burden of the tax.



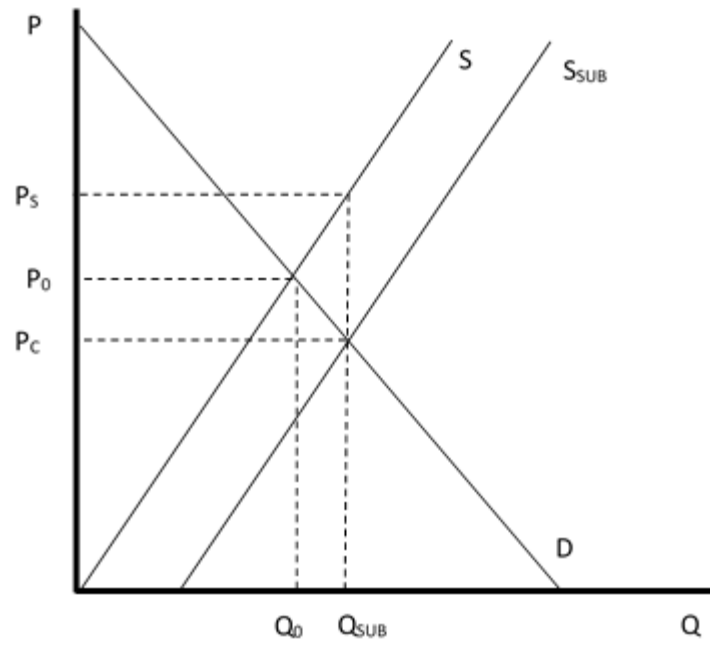
- Note as well that it doesn't matter whether supply or demand has shifted. In one case above, I shifted demand. In the other I shifted supply.
- The *Post-Standard* article on the gasoline tax cap is an example.
 - Consumers can avoid the increased tax by going to another county. They have more flexibility than gas station owners in Onondaga County, who cannot move.
- Similarly, the *Economist* article on property taxes discusses why taxing land is efficient.
- Finally, the article on corporate income taxes highlights several factors that affect how likely the burden of the corporate tax could be passed on to others, including labor.
 - Note how these examples relate to elasticity.

III. Subsidies

- In the case of a subsidy, we shift the demand or supply *out* by the amount of the subsidy
 - The example below shifts demand
 - Quantity increases because of the subsidy
 - As before, we find the prices using the *original* supply and demand curves
 - Consumers pay a bit less (P_C)
 - Since the government adds the subsidy, sellers make a bit more money (P_S)



- As before, the result is the same if we shift supply instead:



- The *Economist* article on wage subsidies shows that the same rules for incidence apply for subsidies.
 - In this case, since a subsidy provides a benefit, it is the inelastic party that benefits from the subsidy.
- In the wage subsidy example, studies show that most of the benefit goes to workers (suppliers of labor). That suggests that labor supply is more inelastic, as illustrated below.
 - Note that the price paid to workers goes up by a lot (P_S) but firms only pay a little less than they did before (P_C). Thus, most of the revenues from the subsidy are going to workers.

