Taxes and Subsidies

PRINCIPLES OF ECONOMICS (ECON 210)

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Introduction

• We have already established that taxes are one of the reasons that supply decreases.
  • Subsidies, which could be called a “reverse tax”, have the opposite effect on supply.

• This lecture is devoted to exploring the effect of taxation more thoroughly in the supply and demand model. We will consider questions such as:
  • What happens to equilibrium when a tax is placed on a good?
  • How much tax revenue is generated?
  • What about the gains from trade?

• Also the seemingly obvious question: “who pays the tax?” has a surprising answer.
  • It depends only on the elasticities of demand and supply and **not** on who formally hands the money to the tax authority.
Transaction costs

• When a consumer buys a good, he pays the producer of it some money (price in $/unit).

• There are other accompanying costs that a consumer bears when he gets a new item, though.
  • Shipping costs to transport the new purchase.
  • Set up costs, such as time spent assembling a new item.
  • Ever bought something from Ikea?

• These are all examples of costs borne by the buyer . . . but are not received by the seller.
  • Instead they go to some intermediary or are merely lost, as with time spent waiting or setting up.
Transaction costs (continued)

Ew, English side ruined. Must use French instructions.
Le Grill? What the hell is that?
Equilibrium without taxes

- Reservation price is the opportunity cost of what went into producing it (the height of the supply curve).
- If the price paid by buyers ($P_D$ for Demand) must cover only these, you have the usual equilibrium where sellers receive all the revenue ($P_S = P_D = P^*$ per unit).
Commodity taxes are like transaction costs

• Taxes drive a “wedge” between what buyers pay for a good and what sellers receive for it.

• Whatever price consumers pay has to be enough to cover the seller’s reservation price, as well as the tax.

• Equilibrium is defined according to how many buyers are willing to pay enough to cover the reservation price and the tax.
Equilibrium with taxes

Equation: \( P_D = P_S + \text{tax} \)

Explanation: The equilibrium price \( P_D \) is equal to the sellers' cost plus a $10/unit tax.
Finding the after tax equilibrium

• Define the per unit tax as $t$ per unit.

• Equilibrium occurs where $P_D = P_S + t$.

• So you just have to find a quantity where $P_D$ exceeds $P_S$ by exactly $t$ dollars per unit.

• In the example on the previous slide, this would be at 140 units.
  • I would label this point $Q_t$ (t for tax).
Equilibrium with taxes (concluded)

\[ Q_t < Q^* \ldots \text{more on this later} \]
Who paid the tax?

• In this case, buyers.
• All of it.

• Before the tax, they were paying a price of $40/unit. Afterward they were paying $50/unit.
  • The price sellers received is the same before and after the tax: $40/unit.

• You might say the full burden of the tax fell on buyers.
Because the government collected the tax from buyers, not sellers, right?

• Like how you’re supposed to remember how much stuff you bought on Amazon and tell the state of Indiana to charge you sales tax on it (in April)?
  • No! We haven’t said anything explicitly about who formally handed the money over to the tax authority.
  • If anything, by shifting the supply curve, we implied that sellers were the ones handing the money over.

• Were it the buyers’ responsibility, they would still be the ones effectively paying the tax.
  • We just would have shifted the demand curve inward by $10/unit instead of the supply curve.
What determines how the burden is shared?

• This is a special case because supply is perfectly elastic.
  • That means that even a minute reduction in price will send $Q_S$ all the way to zero.

• If supply were a little less elastic, sellers would be able to absorb part of the tax burden, though.

• Each group’s share of the burden will be:
  
  Consumers’ share = \( \frac{P_D - P^*}{t} \) and Producers’ share = \( \frac{P^* - P_S}{t} \).

• Consider another example in which supply is an upward-sloping line.
What determines tax burden?
(continued)

$P_D = $53 \$/unit
$P^* = $46.50 \$/unit
$P_S = $43 \$/unit
Calculating tax burden

• In this example, sellers pay 35% of the tax and buyers pay 65%. This is because sellers are now able to (somewhat) decrease their price below $P^*$, without driving quantity to zero.

Consumers’ share $= \frac{53 - 46.5}{10} = 0.65$ and Producers’ share $= \frac{46.5 - 43}{10} = 0.35$

• Buyers still pay the majority share, but as supply gets less elastic, the share decreases.
  • From 100% to 65%.
  • Not easy to tell, but supply is slightly more elastic than demand . . . smaller burden for sellers.
Calculating tax burden (continued)

• Tax burden depends directly and entirely on which curve is more elastic.

• Specifically according to this formula.

\[
\frac{E_S}{|E_D| + E_S} = \text{Consumers’ burden and } \frac{|E_D|}{|E_D| + E_S} = \text{Producers’ burden.}
\]

• There is a document uploaded to BlackBoard explaining how this is derived from the definitions of elasticity.
  • Under “Lecture Notes”, “Articles” folder.
Summary

• Tax burden is not determined by who formally submits the tax revenue to the government.

• It is determined by buyers’ and sellers’ abilities to substitute away from the good:
  • By demanding fewer or
  • By producing fewer.

• As a group, the more flexible you are, the smaller will be your burden of the tax.
  • If one curve is perfectly elastic, that group pays zero share of the burden.
  • If one curve is perfectly inelastic, that group pays the entire burden of the tax.
Welfare analysis of taxation

• Use the tools of consumer and producer surplus to analyze the effects of a commodity tax.

• Usually the gains from trade in a market are allocated like this.

• With the tax, the outcome is different because consumers have to pay more than $P^*$ and sellers receive less than $P^*$.
  • The tax “wedge”.

[Diagram showing consumer and producer surplus with the impact of a tax]
Consumer surplus is the area under the demand curve and above $P_D$.

Producer surplus is the area above the supply curve and below $P_S$.

What happens to the rest of the area in the old gains from trade?
- Tax revenue is generated.
- Some gains from trade are lost!
Tax revenue

• The rectangle between CS and PS is pretty easy to interpret.
• It has dimensions: base is $Q_t$ (number of units sold) and height is $t$ (tax per unit).
• So the area is the total tax revenue ($T$).

$$T = t \times Q_t \ldots \text{base times height}$$
Deadweight loss

• The other triangle between the tax revenue and the competitive equilibrium represents a combination of consumer and producer surplus that no longer exists because of the tax.
  • This area is called deadweight loss or “DWL.”

• DWL is the unfortunate consequence of taxation. It is lost welfare that is not even re-distributed to other agents, as some tax revenue is.
  • Ideally tax revenue is used to pay for public goods that are produced efficiently.
  • But DWL doesn’t go to anyone good, bad or otherwise.
  • It just gets lost to the universe.
  • It is the waste and inefficiency that results form a tax.

• DWL is an economist’s worst enemy.
Deadweight loss (continued)

• The size of deadweight loss increases with the size of the tax.

• Higher taxes mean greater reductions in quantity ($Q_t$ gets smaller).
  • Fewer mutually beneficial trades occurring.

• This is why taxes have efficiency costs: there are some trades near the intersection of supply and demand that are “just barely” worth it. Make the parties pay a tax and they cease to be worth it at all.

• DWL generally increases with the elasticity of either supply or demand.
  • This recommends taxing things with inelastic demand.
  • Unfortunately goods with inelastic demand tend to be “necessities”, so such taxes would be regressive.
Designing the tax system

• Does this mean that the “tax man” has an incentive to raise taxes as high as possible, even at the expense of the well-being of buyers and sellers?

• “Yes and no”.

• If the tax authority is trying to maximize revenue there is an optimal tax rate.
  • In the sense that raising or lowering it would decrease tax revenue.

• Unless the tax authority “cares about” the welfare of buyers and sellers, it has an incentive to raise tax rates up to this point.
Tax revenue with a “modest” tax
Higher tax revenue with a higher tax rate
Tax revenue decreases with an excessively high tax rate
The Laffer curve

• The relationship between tax rate and tax revenue is shown by this inverted “U” relationship, named after Arthur Laffer.
• The three rate/revenue combinations from the previous graphs are labeled here.
• Revenue would be maximized with a tax of $55/unit in this market.
  • The optimal tax rate.
  • Would be even lower if you were also trying to minimize DWL.
Designing the tax system (concluded)

• The maximum of the Laffer curve (optimal tax rate) is lower the more elastic either demand is or supply is.

• Again this recommends taxing inelastic goods to squeeze out the most revenue.
  • While also cutting down on DWL.

• This tends to hit poorer households relatively hard:
  • necessities usually have more inelastic demand, and they make up larger shares of the budgets in poorer households.
  • “regressive”: poorer households taxed at higher rate.
Subsidies: reverse taxes

As such the following properties still apply.

- The subsidy’s beneficiaries are independent of who formally receives the money from the government.
- The gains from the subsidy go to buyers and sellers based on elasticity of demand and elasticity of supply.
- They have to be paid for by taxes on other goods.
- Subsidies still create DWL, but on the right side of the equilibrium. Government pays for the consumption of goods that are less valuable to consumers than they are costly to produce.
DWL from subsidies

- Picture the supply curve shifting **outward** by the amount of per unit subsidy, instead of inward with a tax.
- Think of it as lowering the reservation prices of sellers because the government is paying for some of the costs of production.
  - Some of this is “passed along” to buyers as lower prices (point d).
  - The rest is retained by sellers and acts as an incentive to produce more (point b).
Conclusion

• In terms of accomplishing public policy goals, here is what taxes and subsidies do.
  • Taxes result in less production of what is being taxed.
    • Good for drugs, polluting energy sources, et al. Not so good for incomes, research and development expenditure (by firms).
  • Subsidies result in more production of what is being subsidized.
    • Good for labor supply of marginally attached workers. Not so good for transportation fuel.

• Taxes generate revenue for government; subsidies require an expenditure by government.
  • Both policies create inefficiency (Deadweight Loss) by squashing mutually beneficial trades or inducing negative sum trades.
  • The designer of the tax and subsidy system must balance these losses against accomplishing the goals of raising tax revenue.

• The one sentence take-away: “tax the bad stuff”.
  • Economists marvel at how poor a job law makers do sometimes of remembering this principle.
Cowen and Tabarrok #1 (challenges)

Let’s apply the economics of taxation to romantic relationships.

a. What does it mean to have an inelastic demand for your boyfriend or girlfriend? How about an elastic demand?

b. Sometimes relationships have taxes. Suppose that you and your boyfriend or girlfriend live one hour apart. Using the tools developed in the chapter, how can you predict which one of you will do most of the driving? That is, which one of you will bear the majority of the relationship tax?
Cowen and Tabarrok #1 (challenges) solution

An inelastic demand means you can’t live without him or her. An elastic demand means that there are good substitutes for the current boyfriend or girlfriend.

All other things being equal, the more inelastic party will do most of the driving—the other party has good substitutes.
In the chapter, most of the taxes we discussed were equal to a certain dollar amount per unit. In this case, a tax on sellers results in a parallel upward shift of the supply curve; a tax on buyers results in a parallel downward shift of the demand curve. In reality, however, many taxes are expressed as a percentage.

Graphically, how would you show a 100% tax on the sellers of a good?

How would you show a 100% tax on the buyers of a good?

One of the results of this chapter is that it doesn’t matter on whom the tax is levied—the result is the same. Show graphically that this also applies to percentage taxes.
A proportional tax would rotate the curves, not just shift them parallel.

- For a 100% tax, the sellers’ costs would double at every quantity, so it would rotate counterclockwise.
- If the tax were applied to buyers, their willingness to pay for the good itself would be cut in half, so the demand curve would also rotate counterclockwise.

The illustration shows that the effect on equilibrium quantity is the same either way, just like with a per unit tax.
When governments are trying to raise tax revenue, they sometimes attempt to target higher-income people, since they are in a better position to bear the burden of a tax. However, it can be very difficult to earn tax revenue from wealthy people.

a. Consider the progressive nature of the U.S. federal income tax system: It’s designed so that higher incomes are taxed at higher tax rates.

Thinking about the elasticity of labor supply, why might it be more difficult to collect tax revenue from a wealthy individual than from a poor person, all else equal?
Cowen and Tabarrok #4a solution

- The wealthy may have more elastic labor supply than the poor.
  - Mobility. Resources to move to find a better job that a poor person does not.
  - Search costs. Wealthy can be more patient searching for the best match.
  - Other forms of non-wage compensation. Could take salary in other fringe benefits instead of wage.
- Better position to escape the effect of income taxes.
b. Another way governments have tried to collect taxes from the wealthy is through the use of luxury taxes, which are exactly what they sound like: taxes on goods that are considered luxuries, like jewelry, expensive cars and real estate. What is true about the demand for luxuries? Consider jewelry.

Is a luxury tax more likely to hurt the buyers of jewelry, or the sellers of jewelry?
Cowen and Tabarrok #4b solution

• The demand is elastic for luxuries. Buyers may easily substitute away from them by spending on other discretionary items if the price goes up by much.

• Unless supply is also elastic, the producers of luxury items will pay the majority of the tax burden, rather than the wealthy buyers.
  • And the producers are less likely to be wealthy themselves.

• Luxury taxes can be surprisingly regressive.
Cowen and Tabarrok #4c (thinking and problem solving section)

c. The chapter began by discussing another tax that targets wealthy individuals: the estate tax. Comment on the effectiveness of this tax (in terms of government revenue), considering the demand of wealthy individuals for leaving an inheritance.
Cowen and Tabarrok #4c solution

• The demand for bequests is likely more inelastic by comparison to the other methods.
  • The only substitute is spending all your money while you’re alive.
  • Taxes may have to rise quite a bit to motivate the wealthy to do that.

• Probably a more effective method of taxing the wealthy than the others.