

CM8: INDIRECT (SALES) TAXES (3/28/21)

SOME, BUT NOT ALL, OF WHAT YOU SHOULD KNOW

1. What is the difference between direct and indirect taxes?
2. Why are indirect taxes generally regressive?
3. What is the difference between an *ad valorem* and a lump sum tax?
4. What is the difference between the legal and the actual incidence of a tax?
5. What is the effect of a lump sum tax on the firm's supply curve and its WTA.
6. In what sense do sales taxes drive a "wedge" between the MB and MC curves?
7. Are indirect taxes economically "inefficient"?
8. How is the DWL of a tax calculated?
9. If a sales tax creates a DWL then does that mean that sales taxes are bad for society?
10. What determines who actually pays the tax?
11. How is the burden of the tax related to the slope of the demand curve?
12. Why are sales taxes usually placed on goods with unresponsive demands?

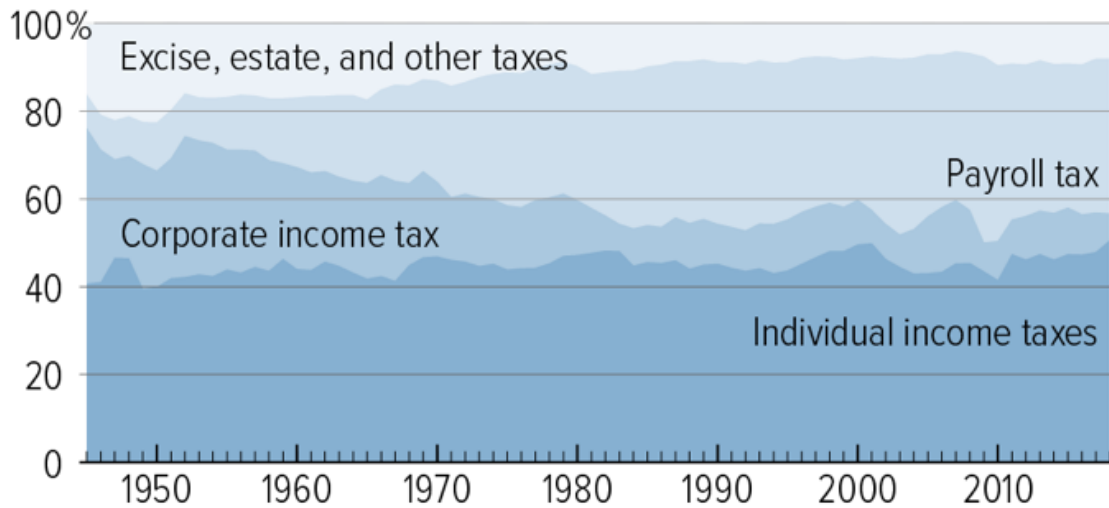
When asked why he robbed banks Willie Sutton replied: "That's where the money is."

1. TAXES

1. The Federal Tax Code is 6,000 pages long and contains three million words. It provides much employment for lawyers and accountants, not all of which is socially productive. Rich households pay most of the income taxes because they have most of the income. But low-income households pay significant amounts of Social Security and Medicare taxes. There are many types of taxes: taxes on income (including Social Security and Medicare taxes – FICA), unemployment insurance taxes levied on employers, sales and use taxes, excise taxes (gas,

alcohol, tobacco, etc.), property taxes, customs duties, estate and gift taxes, and licenses (vehicle, accountants, auto mechanics, etc.), and corporate taxes.

Sources of Federal Tax Revenue, 1945-2018



Note: "Other Taxes" category includes profits on assets held by the Federal Reserve.

Source: Office of Management and Budget

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2. Economists point out that taxes on consumption have advantages compared to taxes on income because taxing income taxes what we *contribute* to society, whereas taxing consumption taxes what we *take out* of society. Taxes on income deter work effort and savings, both of which are usually considered to be beneficial to society. However, the disincentive effects of income taxes are often exaggerated.

<https://www.pewresearch.org/fact-tank/2016/04/13/high-income-americans-pay-most-income-taxes-but-enough-to-be-fair/>

<https://www.taxpolicycenter.org/briefing-book/how-do-us-taxes-compare-internationally>

2 INDIRECT TAXES

1. An *indirect tax* is a sales tax, not an income tax. Indirect taxes are taxes on goods and services purchased, not taxes on income, wealth or profits. The US government relies mainly on income, profits, and wealth taxes to raise revenue; in Europe a higher proportion of government revenue comes from indirect taxes (Value Added Taxes – VAT) – see the second link above. Income taxes can be *progressive* – as your income rises so does the *proportion* of your income you

pay in tax, although the current degree of progressivity in the US is not high, less than during the Presidency of Ronald Reagan.

2. States, counties, and cities impose taxes, Washington has only a sales tax whereas Oregon has only an income tax. *Sales taxes are generally regressive*, i.e. a sales tax is a higher *proportion* of a low-income household's income than that of a high-income household – the Gates family pays the same rate of sales tax as does the Sleeman family.

Washington, a very “blue” state, has the second most regressive tax system in the US.

<https://www.seattlepi.com/seattlenews/article/Report-Washington-regressive-tax-income-excise-13318033.php>

<https://itep.org/whopays/>

3. Sales Taxes are usually *ad valorem* taxes, i.e. the tax is a percentage of the value of the purchase, say 8.5% is added to the base price and therefore something that has a price tag of \$100 on the shopping aisle actually costs you \$108.50 at the checkout stand. We will only analyze a *lump sum tax*, where you pay 8.5 cents *per item* whether the total cost is \$1, \$10, \$100 or \$1,000, because the diagrams are easier to handle and the qualitative predictions are the same for both types of tax.

3. TAX INCIDENCE

3.1 THE CONCEPT OF TAX INCIDENCE

1. Sales Taxes are usually collected by the seller – the retailer or the firm – and paid to the government (Federal/State/local). This is administratively easier than taxing the buyers. There are fewer retailers than households and it is easier to monitor retailers than households and individuals.

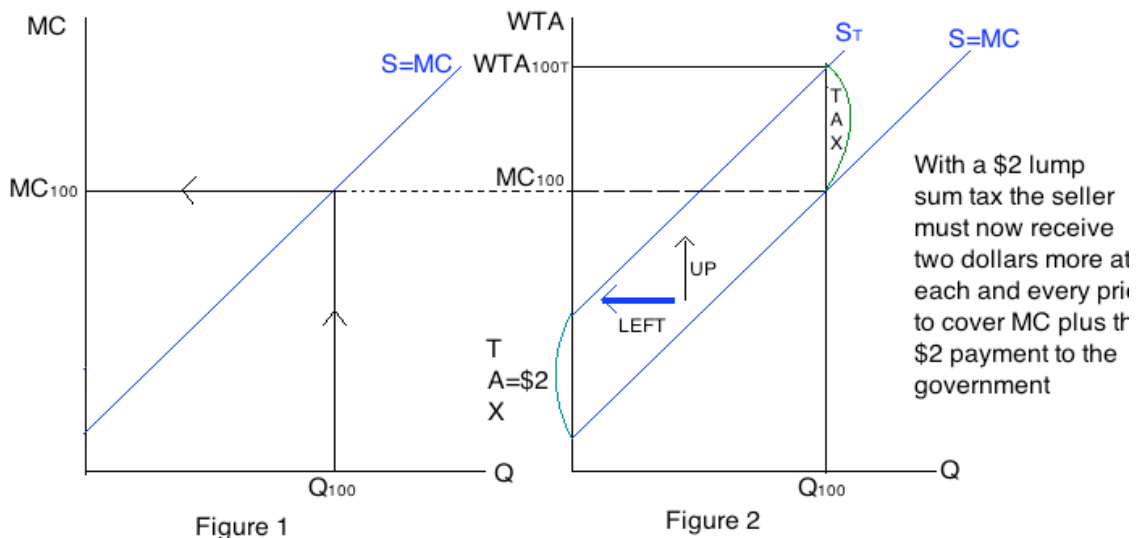
The person from whom the tax is collected bears *the legal burden of the tax*, what we call *the legal incidence* of the tax. Economists are interested in *the actual economic incidence of the tax* – *who really pays the tax in the sense of who does the burden or cost of the tax fall on*. It is easy to show that as far as tax incidence is concerned it does not matter who actually pays the government. *The crucial issue is: does the price of the good or service change when the tax is imposed? If the price changes then the seller can shift part, or all, of the tax onto the buyer.*

3.2 TAX INCIDENCE AT THE FIRM LEVEL

1. The supply curve is the firm's MC curve. In Figure 1 the Q_{100} th unit has a MC of MC_{100} . In order to persuade the firm to produce the Q_{100} th unit consumers have to pay at least the MC of producing the Q_{100} th unit, and so the price of the Q_{100} th unit must be (at least) MC_{100} . The firm will not accept less than the MC of Q_{100} in exchange for that unit, therefore the MC is also the firm's "willingness to accept" (WTA) curve. The *height* of the supply curve at any Q tells us *the price of that unit, the MC of that unit, and the firm's WTA for that unit*. If the price of the Q_{100} th unit is $P_{100} = \$10$ then $MC_{100} = \$10$ and $WTA_{100} = \$10$. The supply curve performs three roles at each Q : the height of the supply curve at that Q tells us the price of that unit, the MC of that unit, and the firm's WTA for that unit.¹

2. In Figure 2 a government (Federal, State, local) has placed a *lump sum* tax of \$2 *per unit sold* on the good or service. The tax places a *legal requirement* on the firm to give the government \$2 for every unit of the good or service it sells, whether it is the first or the last unit sold, that is tax is the same amount *per unit*; \$2 if $Q = 1$, \$200 if $Q = 100$, and \$2000 if $Q = 1,000$.

Before the tax was imposed the firm's MC was equal to its WTA but now *the WTA has risen by the amount of the tax*. This is because the firm's revenue from the sale of each unit of the good is the price less the amount paid to the



¹ To make things even more complicated economists also call the firm's WTA its "reservation price", but I will not use that term.

government, $P - T$, which is less than P . Therefore, *the firm's after-tax supply curve is S_T , which is **higher** than the original supply curve (S) by the amount of the tax.* The height of S_T is $MC+T$ at each and every quantity sold.

3. Assume that the MC of producing the Q_{100} th unit is \$10. The firm will only produce the Q_{100} th unit of output if it keeps \$10 to cover the MC of producing the Q_{100} th unit. If the tax is \$2 per unit then the firm must receive \$12 if it is to produce Q_{100} , because if it sells Q_{100} for \$12 and pays \$2 to the government then it keeps \$10, which just covers the MC of producing the Q_{100} th unit; the firm's WTA, the lowest price that it will accept to produce the Q_{100} unit, is now \$12. *The tax raises the WTA by \$2 at each and every Q , not simply at Q_{100} , and so **the supply curve shifts upwards by \$2 at each Q .** The supply curve with the tax is now $S_T = WTA_T = MC + T$. That upwards shift is *equivalent to (not equal to) a leftwards shift of the supply curve.*²*

4. In a perfectly competitive market, each unit is sold for the same price and so total revenue increases by the price each time a unit is sold. Marginal revenue (MR) is the change in total revenue when output increases by one unit. Therefore, under perfect competition $MR = P$. The firm is attempting to maximize profit, which requires it to set **MC = MR**.

If the government imposes a lump sum tax of \$2 on the good or service then the amount of revenue the firm keeps after it has paid the tax to the government is \$2 less than the price; that is, the effective marginal revenue from selling a unit of the good or service is the price (P) minus the tax ($T = \$2$), so that the firm's effective $MR = P - T$.

3.3 THE MARKET LEVEL

1. In Figure 3 we show the market demand curve for the good or service, which is also the MB curve for the good or service. The demand curve does not shift *when the tax is imposed on the firms because sales taxes are not demand shifters; a sales tax is a component of the GOVT supply shifter.* Before the tax was imposed there was a market equilibrium at (Q^e, P^e) where $MC = MB$ and so the equilibrium was efficient and Pareto Optimal.

² How much the supply curve shifts to the left depends on the slope of the supply curve.

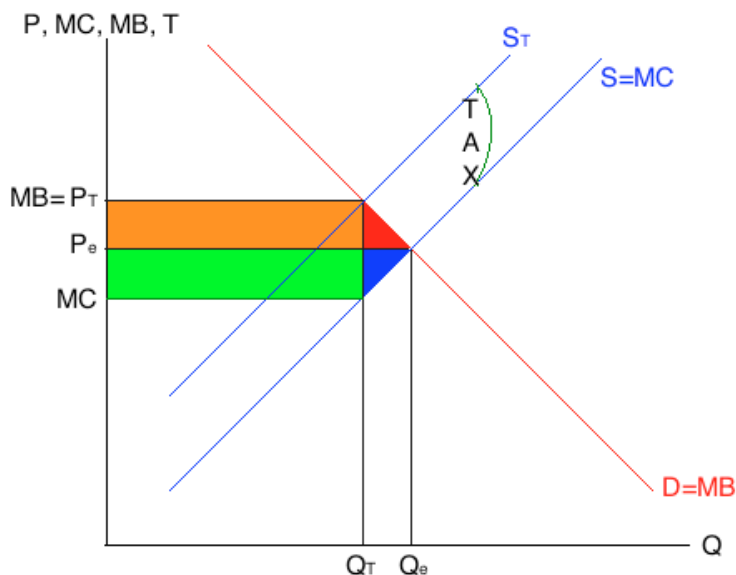


Figure 3

The tax causes a DWL equal to the two small triangles. The orange and green areas are the transfers of CS and PS to the government.

Note that at Q_T MB is greater than MC and so the new equilibrium is inefficient.

2. What is true for the firm is true for the industry in this model and so *the tax also causes the market supply curve to shift from S to S_T* . The market supply curve now includes the \$2 that has to be paid to the government.³ S_T intersects the demand curve at the new equilibrium (Q_T, P_T) . P has increased from P_e to P_T . **Because P has increased** the consumer pays part of the tax, even though it is levied or imposed on the seller/producer.

The government receives \$2 for each unit sold. The firm now charges P_T for each unit and so its revenue from the sale of the unit is higher by $P_T - P_e$. The firm pays the government \$2 but it passes some of that \$2 on to the consumer in the form of a price increase; the firm (industry) recoups some of the tax from the consumer if it can charge a higher price.⁴ Therefore, *the burden of the tax on the firm is the tax minus the change in the price of the good or service* i.e. $T - \Delta P = T - (P_T - P_e)$. The consumers pay a part of the tax equal to the change in the price of the good or service, that is, *the consumers' tax burden is $\Delta P = P_T - P_e$* .

3. The **incidence** of the tax is the *proportion* or *percentage* of the tax paid by the buyer or seller. The firms' share of the tax is given by $[T - (P_T - P_e)]/T$ and the

³ Although the market supply curve shifts upwards it is usual at the principles level to say that *the effect of the tax is to shift the market supply curve to the left* – which is “sort of” true. Remember the vertical and leftward shifts will only be equal if the slope of the supply curve is 45° .

⁴ Individual perfectly competitive firms cannot change the price of the good or service they sell; the price is set at the market level. Because the tax is imposed on *all* of the firms in the industry, the market/industry supply curve shifts *up* and to the left.

consumers' share is given by $(P_T - P_e)/T$ (in both cases multiply by 100 to get a percentage). I will refer to the tax incidence as the part of the tax paid by the consumer in the form of a higher price.

3.4 THE DEAD WEIGHT LOSS (DWL) OF THE TAX

1. Notice that the tax has driven a "wedge" between the consumers' demand (MB) curve and the firms' supply (MC) curve; this means that MB and price are greater than MC and so *the new equilibrium is not economically efficient*; the benefit to society of consuming the marginal unit is less than the cost to society of producing the last unit. The equilibrium after the tax is imposed is also not Pareto optimal in aggregate because both consumers and producers would be better off, have larger consumer and producer surpluses, if we removed the tax and allowed them to return to Q^e .

2. The terminology "dead weight loss", "driving a wedge" between consumers and producers, and the tax "burden" all suggest that the tax must be a bad idea. However, although textbooks seldom mention this, *whether consumers and producers are actually better off depends on what the government does with the tax dollars it raises*. Which may mean that the equilibrium with the sales tax may be a Pareto optimum if there is at least one person who loses more from the repeal of the tax than they gain. For example, you may value the benefits of reduced potholes in the roads more than the tax you pay to have them repaired.

The Federal government imposes a tax on the sale of gas. Now if the government uses the revenues to improve the road system that will cause our welfare or "Happiness" to increase. And the gas tax will cause us to conserve on gas by reducing the number of miles that we drive, which will have beneficial environmental effects including reducing greenhouse gases. The traditional textbook discussion of indirect taxes emphasizes the costs of the tax associated with the lower private consumption of those paying the tax, but this ignores any benefits that arise from the tax expenditures. The textbook accounts tend to encourage the view that taxes are always "bad" in the sense that they reduce our welfare.

3. Clearly consumers lose part of their CS, the red triangle (Figure 3). Part of that area, the orange rectangle, is transferred to the government and so the government gains at the expense of consumers, but economists will not make value judgments about the merits of transfers between different constituents of society. However, the income represented by the red triangle is not received by anyone and so it is actually lost to society. Similarly, the producers lose part of

their PS equal to the area made up of the green rectangle and the blue triangle. But part of that area (the green rectangle) is transferred to the government and so only the blue triangle is a pure loss to society. *The dead weight loss (DWL) of the tax is the sum of the areas of the two small triangles; no one (households, firms, or the government) gets the dollars associated with these areas.*

4. WHO REALLY PAYS THE TAX?

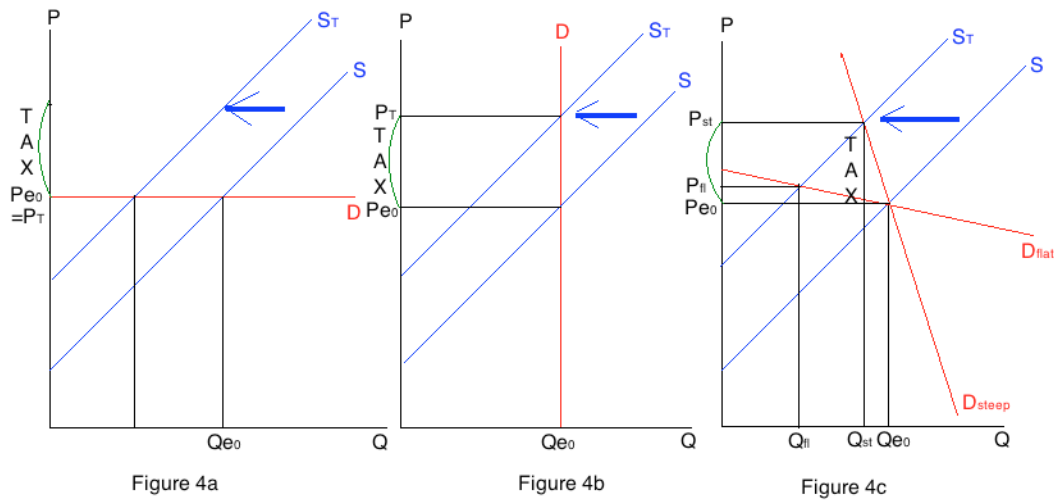
1. The true *economic* incidence of the tax (who **in practice** pays the tax to the government), as opposed to the *legal* incidence (whom the tax is levied on), depends on the responsiveness of quantity demanded and the quantity supplied to changes in price (you will learn the formula if you ever take ECON 306). To make your life easier I will simply analyze the demand side and ignore supply side effects. This is technically incorrect, but only the shadow knows so what the heck.

To give you a taste of what is involved there are three different scenarios illustrated in Figures 4a - 4c.

2. The two extreme theoretical cases (**not** what we would observe in real economies) are shown in Figures 4a and 4b. In Figure 4a there is a **horizontal demand curve** and since consumers will not buy at all if the price rises above P^e_0 , *the price cannot change and the whole tax would be paid by the supplier; the tax incidence would be 100% on the seller and zero for the consumers.* In 4b the **demand curve is vertical** over the "relevant range" (insulin) and *the price change is exactly equal to the tax and so the consumers pay the whole tax and the producers only have the administrative burden of collecting and passing on the tax for the government, firms do not pay any of the tax.* In this case the **tax incidence for suppliers is zero and for consumers it is 100%.**

3. Figure 4c shows that *the "flatter" the demand curve (D_{flat}) the smaller the price change and the less the consumer pays* and the more the producer pays (the tax burden is greatest on the producer). A flat demand curve means that consumers are very responsive to price changes and if the firms' raise prices then they lose a lot of sales. It is difficult to pass the tax on to consumers.

If the demand curve is relatively "steep" (D_{steep}) the quantity demanded is not very responsive to price changes and firms can raise prices more easily and can therefore pass on a lot of the tax to consumers. In this case the price change is larger and the incidence of the tax is greatest on the consumers and the producers pay less of the tax.



4. This sort of analysis is very important. Unemployment insurance is levied on employers, but if they can reduce wages and benefits (or increase them more slowly over time) then the employees will end up paying some or even all of the tax, how much depending on how responsive the demand and supply of labor are to changes in wages and benefits. Similarly, if employers are required to pay higher medical premiums for their employees, this may cause them to pay lower wages and benefits, thus shifting some of the burden of the medical expenses onto their workers.

5. THE IMPACT ON OUTPUT

1. Unless the demand curve is vertical (Figure 4a), or the supply curve is vertical, the tax will lower output below Q^e_0 . In the extreme case of a horizontal demand curve (Figure 4a) the tax would almost wipe out the industry. How much output and price change when a sales or indirect tax is imposed on an industry depends on how responsive demand and supply are to changes in the price of the good or service (economist call the responsiveness of the quantity demanded to changes in the price of X the "elasticity of demand", something that we will discuss in CM23).

2. Therefore, *governments impose sales taxes on goods and services that have relatively low responses of quantity demanded to changes in price*, classically the Federal gas tax, unless the government wants to discourage the use of the good or service – "sin" taxes on alcohol and tobacco (and perhaps marijuana or even heroin). However, if taxes (or tariffs) are high then that will encourage black markets and smuggling. (3,152 I actually reduced the word count by 9 words!)

The first two links provide an excellent explanation of sales taxes.

<http://www.env-econ.net/2008/04/env-econ-101-wh.html>

<http://www.env-econ.net/econ-101-tax-burden-part2.html>

Two more interesting links on sales taxes

<http://online.wsj.com/news/articles/SB10001424053111904772304576468753564916130>

http://www.nytimes.com/2012/02/12/us/cities-turn-to-a-crop-for-cash-medical-marijuana.html?_r=0