

## Lecture 3: Tax incidence

Economics 336/337

What is the *economic incidence* of a tax on a single market – i.e. who really pays the tax? To answer, look at how prices change with the tax.

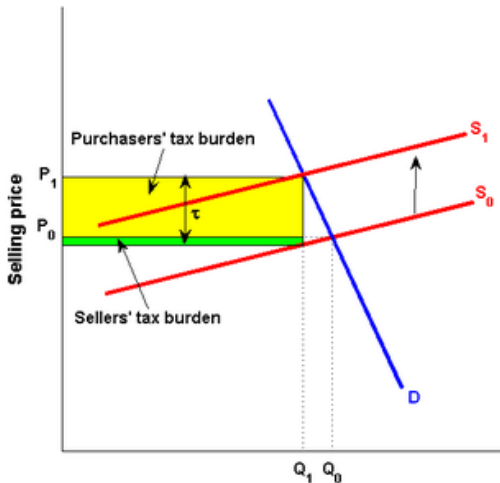


Figure: Tax incidence in a competitive market

In the previous example, supply was relatively elastic and tax was *shifted forward* to purchasers. What if demand is more elastic?

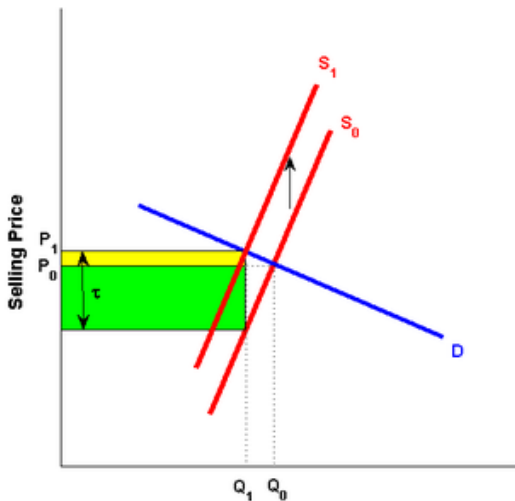


Figure: Tax incidence in a competitive market

## Algebraic approach

We can generalize to any supply  $Q^s(p)$  and demand  $Q^d(p(1 + \tau))$  functions, where  $\tau$  is percentage tax rate.

Equilibrium consumer price solves  $Q^d(p^*(1 + \tau)) = Q^s(p^*)$ . The tax causes percentage changes in demand and supply:

$$\frac{\Delta Q^d}{Q^d} \approx -\epsilon^d \left( \frac{\Delta p^*}{p^*} + \frac{\Delta \tau}{1 + \tau} \right)$$

$$\frac{\Delta Q^s}{Q^s} \approx \epsilon^s \frac{\Delta p^*}{p^*}$$

Solving for  $\Delta p^*$ :

Degree of forward shifting of tax is greater when  $\epsilon^s$  is   or  $\epsilon^d$

  .

- When supply is perfectly inelastic (vertical) or demand is perfectly elastic (horizontal) curve, the entire burden is borne by the supply side regardless of where the tax is applied.

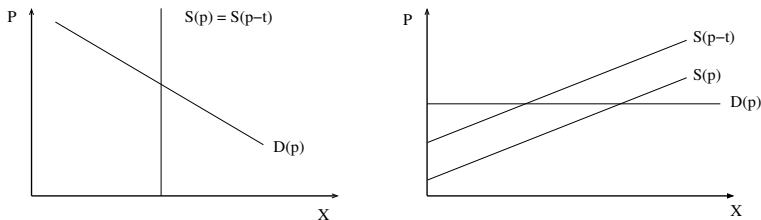


Figure: Full backward shifting

- When supply is perfectly elastic or demand is perfectly inelastic, then tax is fully borne by:  . Exercise: Draw the relevant graphs to show this.

The “big” taxes are on production factors, which tend to have very high or low elasticities, and very strong tax shifting.

### Graded exercise

Is a tax on rental properties in a city borne by renters or landlords? Justify your answer by discussing elasticities.

Other examples:

- 1 A payroll tax on firms in a single city in a metropolitan area. If firms (jobs) can easily move to the suburbs, who pays this tax?
- 2 A tax on capital employed by firms employing capital and labour in Canada, when capital is mobile internationally (and labour is not).
- 3 A withholding tax on dividends paid to foreign but not domestic shareholders in Canada. How does this affect incomes of domestic shareholders and workers?

Backward shifting may take an extreme form when taxes (or subsidies) affect asset values.

Example: Consider a house that rents for  $\$R_t$  and pays  $\$\tau_t$  in property taxes in year  $t = 1, 2, \dots$ . If the property has no alternative uses, its market value at date 0 is

$$P_0 = \sum_{t=1}^{\infty} \frac{R_t - \tau_t}{(1+i)^t}$$

where  $i$  is the interest rate. (Why?)

## Technical aside: Present discounted value

The formula says the market price of the house equals the present discounted value of rents less taxes. This can be derived from the condition that in equilibrium there can be no arbitrage gains from buying or selling houses.



A permanent increase in taxes  $\Delta\tau, \Delta\tau, \dots$  causes house price to fall by

$$\Delta P_0 = - \sum_{t=1}^{\infty} \frac{\Delta\tau}{(1+i)^t} = - \frac{\Delta\tau}{i}$$

The initial owner bears the full present value burden of the permanent tax increase. *The tax is capitalized into the asset value.*

### Other cases of capitalization

- ① Municipal service differences capitalized into .
- ② Investment tax incentives capitalized into .
- ③ Supply management policies capitalized into .

Notice we have not considered the *statutory incidence* of the tax: i.e. who actually writes the cheque to government.

### Example

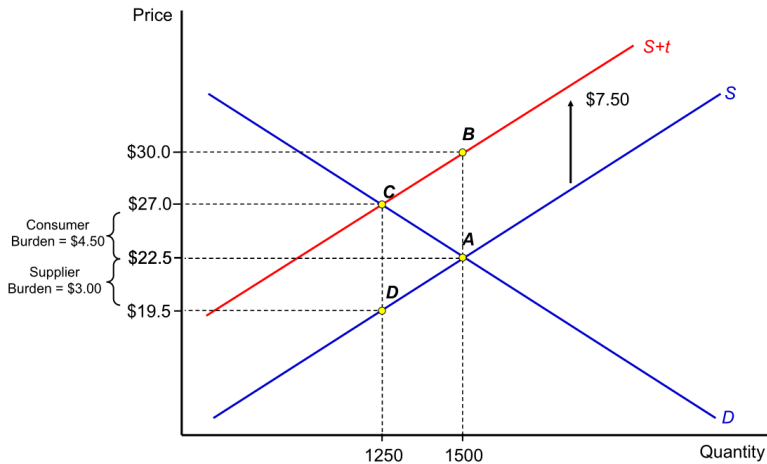
Labour unions lobby hard to have payroll taxes (e.g. for health care) paid by employers, not employees, while business associations want the opposite.

What difference would it make in our model to change the statutory incidence of a tax?

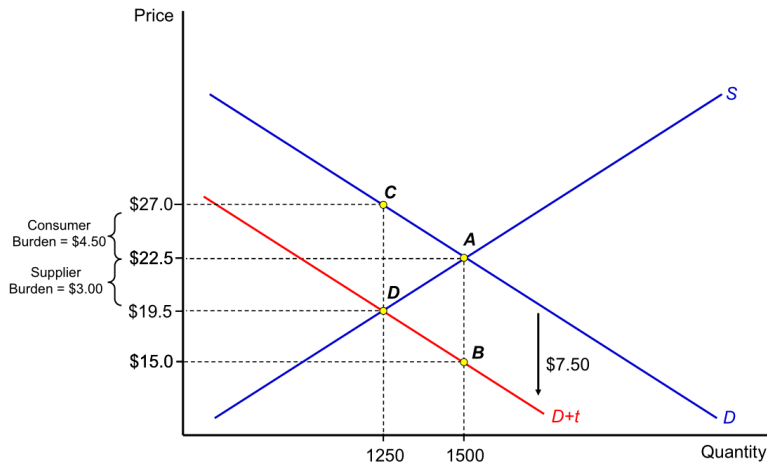
- 1 Tax on seller: consumer pays  $p$  and producer receives  $p - t$  so equilibrium when  $D(p^*) = S(p^* - t)$ .
- 2 Tax on buyer: pays  $p$  to seller and  $t$  to government, and equilibrium when  $D(\hat{p} + t) = S(\hat{p})$ .

So  :

## Tax Levied on Producers



## Tax Levied on Consumers



Our result on the irrelevance of statutory incidence requires that prices can fully and immediately adjust in response to the tax. So in cases with imperfect adjustment, statutory incidence can matter:

- ① regulated prices
  - e.g. minimum wage, rent control
- ② long-term contracts
- ③ “menu costs” of price adjustments

### Exercise

If workers are paid the minimum wage, how does economic incidence of a payroll tax change with the statutory incidence?

Some markets are not perfectly competitive, so incentives to pass on tax changes may differ. If sellers have market power, how does incidence change?

### Example

Markets for cigarettes and gasoline appear to be non-competitive – and highly taxed.

There is some evidence that these taxes are *overshifted*: prices on average rise by more than 100% of the tax increase.

A monopolist has constant marginal cost and  $q$  inverse demand curve  $P(Q)$ . Profit is

$$P(Q)Q - (c + t)Q$$

The profit-maximizing quantity solves

$$MR(Q^*) = P(Q^*) + P'(Q^*)Q^* = c + t$$

If we write

$$MR(Q) = P \left[ 1 - \left( -\frac{Q}{P} \frac{\partial P}{\partial Q} \right) \right] = P(Q) \left( 1 - \frac{1}{\epsilon^d} \right)$$

then we have

$$P(Q^*) = \frac{c + t}{1 - 1/\epsilon^d}.$$

A competitive firm sets  $p = MC + t$ , but a monopolist sets  $MR = MC + t$ . The degree of tax shifting then depends on the relationship between demand and marginal revenue, as well as on elasticities.

What does our condition

$$P^* = \frac{c + t}{1 - 1/\epsilon^d}$$

imply for tax shifting?

Example: Constant elasticity

If  $\epsilon^d$  is a constant, then we have the **Lerner rule**:

- price is set at a **constant markup** over marginal cost  $c + t$ .

Notice denominator is less than one. So price rises by

[Redacted]

We say there is **overshifting**



### Graded exercise

Suppose demand is linear:  $P(Q) = A - bQ$  (so  $\partial P/\partial Q = -b$ ). Write down the first-order condition and solve for  $P(Q^*)$  as a function of  $t$ . What is tax incidence in this case?

Quantitative incidence analysis estimates how tax burdens vary by income class – a full measure of *progressivity* of the tax system.

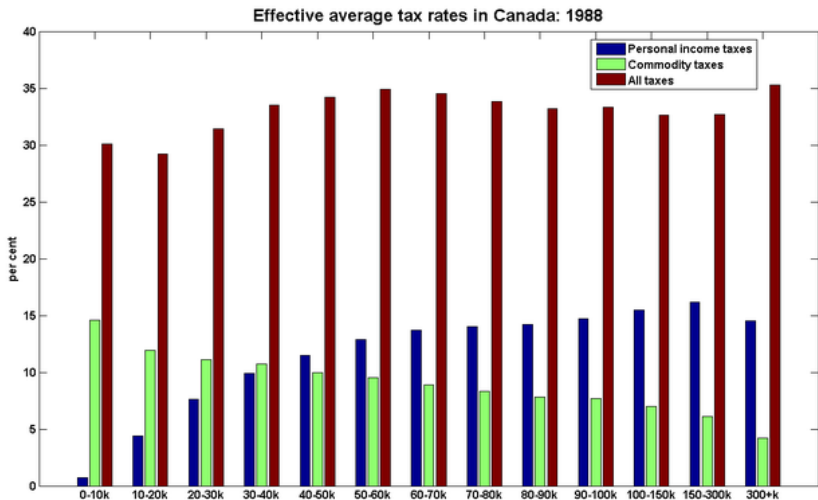
Standard approach uses:

- data on statutory tax rates on income, sales, property, etc.
- data on ownership of capital and labour, expenditure patterns by income group
- a theory of economic incidence of various taxes

Simulates effects on each income group of removing all taxes.

How progressive is the Canadian tax system overall?

## Average tax rates by income group, Canada, 1988



# Key concepts

forward and backward shifting  
statutory and economic incidence  
tax capitalization  
Lerner rule  
overshifting and undershifting