

# Seminar 2

## Economics of Sustainability 20/21 - Instructor: Daniel Leppert

### Question 1

What incentives do the environmental taxes give to consumers?

Remember what we covered in the last seminar: A tax means that the price of the taxed good increases from the point of view of consumers.

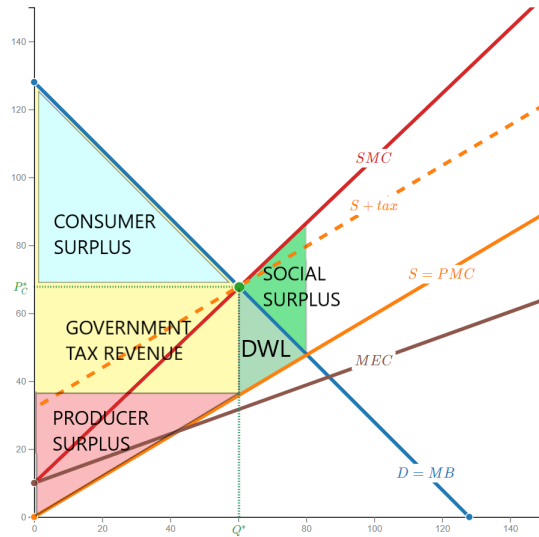


Figure 1: Welfare effect of a tax

Notice that even if the tax is levied on producers of the good, the new equilibrium price for consumers is higher than before the tax. Now we consider that there may be substitutes to the taxed good:

For example, suppose there are two sources of electricity generation; i) burning of fossil fuels like coal and gas, and ii) renewable energy like hydropower and wind. We set nuclear aside for now because realistically it doesn't fall neatly into either bucket.

Households do not care about the source of electricity, only about the price. Assume pollution is an externality! Therefore, fossil fuels ( $F$ ) and renewables ( $R$ ) are perfect substitutes. Household's utility function is:

$$U(F, R) = aF + bR \quad (1)$$

Assume that the government puts a carbon tax  $\tau$  on each unit of electricity produced with fossil fuels. This is to address the reflect the social marginal cost of pollution from burning fossil fuels. We differentiate the utility function w.r.t.  $F$  and  $R$  to get the marginal utility functions:

The marginal utility from electricity from fossil fuels is:

$$MU_F = a \tag{2}$$

and the marginal utility from renewables is:

$$MU_R = b \tag{3}$$

If

$$\frac{a}{p_F + \tau} < \frac{b}{p_R} \tag{4}$$

the marginal utility per £ spent is higher for electricity produced with renewables, and therefore the households will buy renewable electricity. A tax will therefore incentivise households to buy less electricity from fossil fuels and, if renewables is a substitute, more of that instead. Here we also see that if the electricity from renewables is cheaper than fossil fuels, a tax would be unnecessary.

## Question 2

*What is the impact of the tax on pollution?*

If there is less demand for electricity produced by fossil fuels, there will be less of it produced and less pollution. At least if there are non-polluting substitutes.

## Question 3

*What macroeconomic effects can you think of from the above taxes?*

Two key ones:

- a) **Potential changes to tax revenue.** The carbon tax increases government revenue, but the reduction in the fossil fuel-based energy industry because of the tax may reduce tax revenue from lost corporate and income tax. This is avoidable if the fossil fuel companies and jobs are replaced by renewable industry.
- b) **Changes in trade balance.** Let's now consider the environmental tax applied to something more easily traded between countries, such as cars. For example, the UK may impose a tax on manufacturers of petrol- or diesel driven cars operating in the UK. Will UK consumers now buy fewer petrol/diesel cars and, for example, more electric cars? Not if petrol/diesel cars can be imported cheaper from countries that do not have such a tax. The government can get around this by also taxing imports, or by taxing the fuels instead of the vehicles themselves.

However, one common criticism of environmental taxes relating to international trade is that unless the taxes are applied globally, polluting production is simply going to move to countries with relaxed environmental standards and taxes. This is one part of what the Paris climate agreement is trying to address.

## Question 4

*Can you say whether the taxation systems are equitable or not?*

There are certainly inequities that may arise. For example, a tax such as the UK fuel duty on petrol and diesel will favor urban residents who have better access to public transportation. Rural and suburban people are more dependent on their cars and therefore are particularly impacted by the tax, with fewer other options. Together with environmental regulations in agriculture, fuel taxes (both for vehicles and heating) is one reason why environmental economic policies can be controversial in rural communities.

There is also an argument that such a tax may be regressive because low-income households spend proportionally more on petrol and heating than high-income households.

## Question 5

*If you answered no to 4, which additional policies could policy makers adopt to reduce inequality?*

Together with the fuel tax, the government could for example introduce an additional congestion charge applied to drivers in urban centers. Urban congestion not only produces pollution but also noise, delays, road accidents and other costs. Congestion is conversely less of a problem in rural areas. More importantly, the government could invest in improving provision of public transport outside the cities, and introduce subsidies on electric vehicles and charging infrastructure.

## Question 6

*Can the policies you suggested in 5 to deal with the problem of inequality also lead to an efficient outcome? Discuss briefly.*

At least equal level of efficiency is possible. Remember the answer to question 1; if two goods are substitutes, the relative amounts consumed will be determined by the marginal utility divided by the marginal cost. Therefore a subsidy and a tax can have the same effect on substitution. The net social welfare after the implementation of a tax hinges on the preexisting tax rate. When there is a clean and a polluting (dirty) good that are substitutes, Don Fullerton (1997) found that lowering the income tax and taxing a dirty good equates with raising the labor tax and subsidizing the clean substitute product. These two policies create the same effects.

## Question 7

*What can you say about the tax/subsidy issues in developing countries?*

Developing countries may not afford subsidies for clean alternatives for example. Similarly, some of them argue that a global price on carbon as sought in the Paris Agreement is unfair for developing countries that mostly contribute relatively little to global carbon emissions. A common perception is that to mitigate the

rate of climate change while allowing developing countries to grow, foreign aid contributions must increase specifically to develop green industry and infrastructure in these countries.