If there is market failure, government will have to intervene in order to correct the externality.

There are several possible *policy instruments* that can be used:

- taxes on output (pollution)
- standards
- subsidies to the polluter

The three policies can be compared in terms of their effects on pollution and social welfare.
Suppose the government decides to utilize a tax to deal with the steel firm’s pollution, what rate of tax will result in the socially optimal level of pollution $x^*$?

The optimal rate of tax will be one that is equal to the fishery’s marginal pollution cost $\text{MPC}_f$ at the socially efficient level of pollution, assuming a fixed relationship between output and pollution.

The per unit output (pollution) tax, which is often called a *Pigouvian tax*, has two effects:

- It shifts up the steel firm’s marginal production cost curve $\text{MC}_S$ by the amount of the tax to where marginal social costs $\text{MSC}_S$ just cut marginal revenue $\text{MR}_S$ (see panel (a) of Figure 1)

- The marginal abatement cost curve $\text{MAC}_S$ shifts inwards to cut the axis at $x^*$ (see panel (b) of Figure 1)
Figure 1: Taxes

Revenue/Cost

MSC$_{S}$

MC$_{S} +$ Tax

MC$_{S}$

MR$_{S}$

Steel (Pollution)

P$_{S}$

Tax

MAC$_{S}$

MPC$_{r}$

MAC$_{S}$ - Tax

Steel (Pollution)

Rate of Tax

MAC$_{S}$

MPC$_{r}$

MAC$_{S}$

MAC$_{S}$ - Tax

Figure 1: Taxes
Standards and Subsidies

- Instead of imposing a tax, the government could set a standard, i.e. it legislates that the steel firm can only pollute up to point $x^*$

- Alternatively, the government could choose to pay the steel firm a per unit subsidy for every unit of pollution it cuts below $x$, i.e. subsidy should be set at the same level as the per unit tax, $ab$ in panel (b) Figure 1

- Steel firm will cut back output to $x^*$, as it receives compensation for its lost profit; below $x^*$, the subsidy is insufficient to cover its lost profit

- All three policies will have the same effect - they result in the socially optimal amount of pollution $x^*$ - however, the three policies do not have the same effect on social welfare see Figure 2
Figure 2: Taxes vs. Standards vs. Subsidies

MAC_s, MPC_f

MAC_s - Tax

Steel (Pollution)
Social Welfare Effects of Policies

- If tax rate charged is cd:

  - tax revenue is \((abcd)\)
  
  - pollution cost is \((acd)\), which can be compensated for from tax revenue
  
  - even with compensation, tax raises excess revenue \((abc)\)
  
  - polluter bears abatement cost \((cdf)\) as well as paying tax

- If standard is set at \(x^*\):

  - polluter bears abatement cost \((cdf)\), but not pollution cost \((acd)\)

- If polluter receives subsidy at rate cd:

  - polluter does not bear abatement cost \((cdf)\), nor pollution cost \((acd)\), and receives excess compensation of \((cef)\)
Summary of Policies

- All three policies result in the socially optimal level of pollution

- The tax *overcharges* the polluter, however, the surplus revenue could be used to finance research into pollution abatement technology

- The standard fails to make the polluter pay for the pollution cost up to the optimal level, i.e. it violates the *polluter pays principle*

- The subsidy not only fails to make the polluter pay for the pollution cost, but it also over-compensates the polluter for abatement - *also*, taxes have to be levied to pay for the subsidy

- Once there is uncertainty about pollution and abatement costs, it will be difficult to achieve socially optimal level of pollution with any of these policies