

### LECTURE OBJECTIVES

The object of this lecture is to stress the importance of the allocation of environmental property rights. Initially, the Coase theorem will be presented and defined. Then, different allocations of property rights will help to define whether it is the Victim-Pays-Principle or the Polluter-Pays-Principle that applies. Finally, an illustrative example, the case of Algeria will be examined.

2006 BOOK IN FRENCH BY GONZAGUE PILLET | ENGLISH VERSION BY KAREN MAYOR

## 1 | THE COASE THEOREM: DESCRIPTION AND RELEVANCE

### CONTEXT

As seen in the previous lecture the relevance of the victim-pays-principle or the polluter-pays-principle will depend on the allocation of property rights for environmental goods. As environmental goods are not market goods the ownership of their rights tends to be undefined and by default it is the polluters that tend to be favoured. Indeed, if no proper regulation is put in place to ban polluting activities and property rights are indeterminate, polluters will implicitly have the advantage.

As polluting activities get worse and society's welfare is more and more affected, the victims of these activities will band together to claim their right to a protected environment. This will then lead to regulation being implemented which will shift the property rights towards victims until equilibrium (between optimal pollution and optimal pollution abatement) is reached. This equilibrium will be the intersection between the marginal abatement cost and the marginal damage cost schedules.

### ILLUSTRATION OF THE COASE THEOREM

Coase illustrates this result by using the example of a farmer cultivating his land and another who breeds cattle that needs land to graze on. Both individuals have adjoining land which is not enclosed. There are two possible consequences depending on how property rights are allocated.

→ Case 1: the law is in favour of the farmer breeding cattle. Nothing prevents the cattle from grazing on the other farmer's land. The latter will have an incentive to bargain with the former and try and get him to reduce the damage done to his crops by reducing the herd.

→ Case 2: the law is in favour of the farmer with crops. In this case the farmer with the cattle is responsible for the damage his herd causes to the other's crops and must pay for these damages. It is in his interest to negotiate to try and reduce his costs.

### EXTENDED PROPERTIES

The effectiveness of this bargaining process rests on a number of assumptions regarding the economic definition of environmental property rights. Tietenberg (1992) states that the structure of property rights is characterised as follows:

- 1 Universality: all existing resources are allocated;
- 2 Exclusivity: all costs and benefits resulting from the possession or use of resources are attributed to the holders of the rights either directly or indirectly;
- 3 Transferability: all rights are transferable through voluntary exchange between agents;
- 4 Protection: property rights are protected from voluntary or involuntary expropriation.

#### THE COASE THEOREM: A SUMMARY

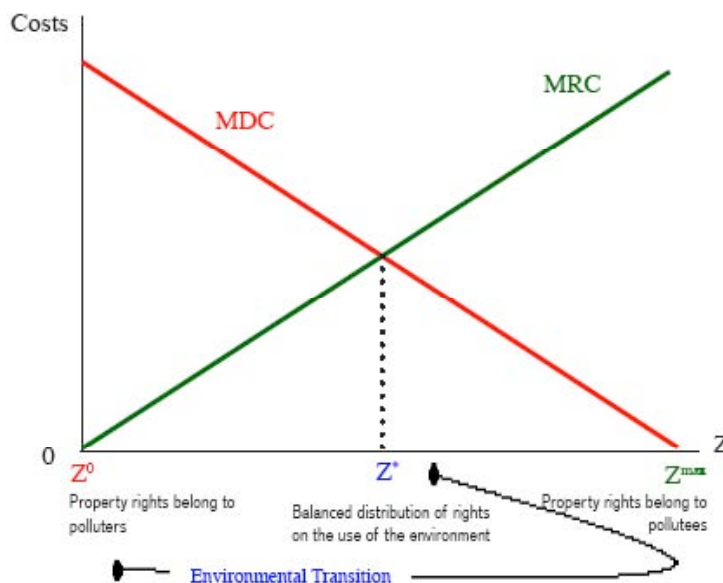
*Assume a world in which some producers or consumers are subject to externalities generated by other producers or consumers. Further assume (1) everyone has perfect information, (2) consumers and producers are price-takers, (3) there is a costless court system for enforcing agreements, (4) producers maximise profits and consumers maximise utility, (5) there are no income or wealth effects and (6) there are no transaction costs. In this case the initial assignment of property rights does not matter for efficiency. If any of these conditions does not hold, the initial assignment of rights does matter.*

## 2 | THE VPP VERSUS THE PPP: THE IMPORTANCE OF THE ALLOCATION OF PROPERTY RIGHTS

### OPTIMAL POLLUTION AND POLLUTION ABATEMENT

As we have seen, when property rights are allocated to polluters (emitters), the victims of pollution will be motivated to bargain. If property rights are held by the victims (receptors) then the polluters will initiate negotiation. However, this is not an absolute reciprocity. Indeed, optimal pollution and optimal pollution abatement must be taken into account in order to determine the situation where rights are optimally allocated.

Figure 1 illustrates this process. The horizontal axis represents pollution abatement ( $Z$ ). It is zero at  $Z^0$  and total at  $Z^{\max}$ . The equilibrium is at  $Z^*$ . The vertical axis shows the associated costs. MDC depicts the marginal external (or damage) costs — they are at their highest when abatement is nil and at their lowest when there is total pollution abatement. MRC depicts the marginal abatement (or remediation) costs. They follow an inverse trend.



**Figure 1 – The Importance of the Allocation of Property Rights**

This figure relates back to the previous two cases regarding the allocation of property rights. The Victim-Pays-Principle (VPP) applies in the case where rights are assigned to polluters — at  $Z^0$  pollution is at its maximum level and there is no abatement. The Polluter-Pays-Principle (PPP) is relevant when rights are given to victims — at  $Z^{\max}$  abatement is at its maximum level and there is no pollution. So how is  $Z^*$  reached?

#### THE BARGAINING PROCESS AND RESULTS

If the polluter has exclusive property rights, the MDC line will represent the victim's marginal willingness to pay to abate the pollution. He will negotiate pollution cutbacks as long as  $MDC > MRC$ . However, if the victim holds the rights, the MRC will correspond to a willingness to pay to pollute on the polluter's part and he will negotiate with the victim so long as  $MRC > MDC$ . The equilibrium will be reached when MDC and MRC intersect, i.e. at  $Z^*$ .

#### LINK TO THE CHARACTERISTICS OF PROPERTY RIGHTS

We have seen that the conditions characterising the VPP can be easily shifted to those of the PPP by allocating property rights to victims and consequently banning pollution. However, if Tietenberg's third property, that of transferability, is accounted for then a complete ban of pollution will depend on if and how these rights are exchanged.

Mathematically, in the typical 2 agent model, if  $i$  pays  $j$  a sum  $\tau$  for each unit of  $x_{i1}$  he is considering buying on the market, then we get the following adjusted budget constraints:

$$\sum_{k=1}^n p_k x_{ik} + \tau x_{i1} \leq \bar{Y}_i \quad \text{Equation 1}$$

$$\sum_{k=1}^n p_k x_{jk} - \tau x_{i1} \leq \bar{Y}_j \quad \text{Equation 2}$$

And the results of the maximisations are:

For  $i$ :

$$\frac{1}{\lambda_i^*} \frac{\delta U_i}{\delta x_{i1}} \Big|_{x_{i1}^*} - (p_1 + \tau) = 0 \quad \text{for } |x_{i1}^* > 0 \quad \text{Equation 3}$$

For  $j$ :

$$\frac{1}{\lambda_j^*} \frac{\delta U_j}{\delta x_{i1}} \Big|_{x_{i1}^*} + \tau = 0 \quad \text{for } |x_{i1}^* > 0 \quad \text{Equation 4}$$

The VPP has been replaced by the PPP.

### 3 | ENVIRONMENTAL TRANSITIONS: THE CASE OF ALGERIA

A country's environmental transition is characterised by the shift from a regime of property rights held exclusively by polluters to one typified by rights allocated to victims. Algeria has had to redistribute property rights relating to environmental uses over the last few years due to its economic transition. Indeed, in order to secure sustainable development, environmental standards have had to be re-evaluated as part of the country's national action plan for the environment.

Relating back to figure 1, this involved Algeria moving from  $Z^0$  towards  $Z^{\max}$  but only reaching  $Z^*$  for efficiency reasons. This shift is illustrative of the willingness, on the part of the local population, the State and the international community, to move towards optimal pollution abatement strategies.

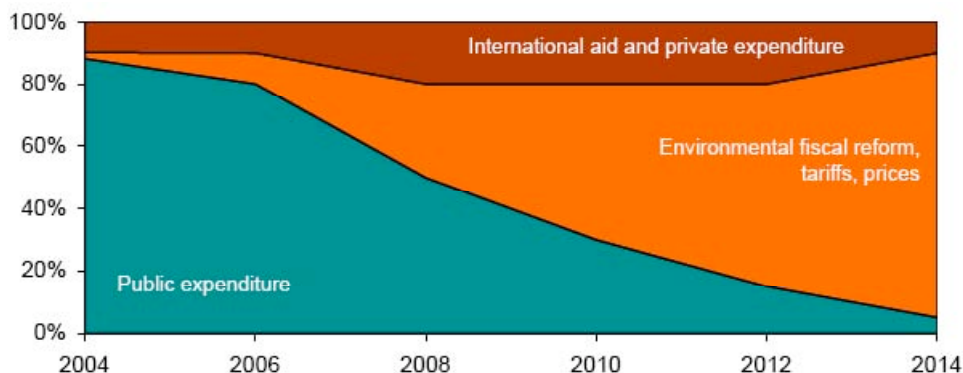
#### FINANCING AN ENVIRONMENTAL TRANSITION

Moving from  $Z^0$  to  $Z^*$  involves a certain amount of costs which were discussed previously (payments for pollution abatement or the right to pollute). These will inevitably have an impact on the State budget. It is important that all expenses, in the short and medium terms are efficient and supplemented by ecological taxation in order to reduce the costs of any investments in the long term. Environmental expenditure in Algeria was approximately 0.6% of GDP in 1999 whereas environmental damage and inefficiency costs amounted to 6% of GDP in 2000 with associated remediation costs of 3.8% of GDP.

A financing strategy was developed and followed the subsequent principles:

- The public sector must reinforce and more efficiently manage its environmental expenses.
- This does not necessarily imply an increase in Algerian public expenditure. Better use of regulatory instruments and ecological taxation will actually result in a closer link between expenditure and the origin of environmental damages (polluters-victims) and hence lighten the budgetary load.
- During this environmental transition, international aide and private expenditure are necessary.

The long term effects of these new policies are visible on Figure 2 below which illustrates the forecasted evolution of the structure of Algerian environmental expenditure between 2004 and 2014.



**Figure 2 – Forecasted Evolution of the Structure of Environmental Expenditure**

Source: PNAE-DD 2000

#### SUMMARY

This lecture has aimed to stress the importance of the allocation of property rights on the polluter-victim bargaining process. It was shown that determining which party will pay compensation to the other will depend on which party was initially allocated the rights and will hence influence which of the VPP or the PPP is relevant. The Coase theorem was defined and the assumptions necessary for its application were underlined. Finally, a real world example of property rights being reallocated was highlighted using recent policy changes in Algeria.

**ADDITIONAL REFERENCES**

- COASE, R. (1968), “The Problem of Social Choice”. In W. Breit and HM Hochman, Eds., *Readings in Microeconomics*, New York: Holt, Rinehart and Winston.
- PNAE-DD [Algerian NEAP – National Environmental Action Plan] (2000), Algiers, MATE [Environment Ministry].
- TIETENBERG, T (1992), *Environmental and Natural Resource Economics*, New York, Harper Collins.