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BRIEFING

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INTERNALISATION OF EXTERNAL EFFECTS IN ENVIRONMENTAL POLICY

*The opinions expressed are those of the author
and do not necessarily reflect the position of the European Parliament.*

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Summary

The damage to the economy and the environment caused by external effects is estimated at about 4% of the Gross Domestic Product (GDP). This is reason enough for the European Commission to propose instruments for the internalisation of external effects.

This working document shows the economic basis for this policy and describes how it can be introduced in practice, followed by some recommendations. This paper is intended to help readers without an economic background to understand how people in Europe would benefit from the external effects measures although they would have to pay significantly more e.g. for transport services. We have tried to keep the text intelligible, with sparing use of unexplained economic terms. The statements are explained through graphs without complicated equations or derivations.

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1 INTRODUCTION: THE ROLE OF ENVIRONMENT PROTECTION IN THE EU AFTER AMSTERDAM

The Amsterdam Treaty, which came into force in 1999, made environmental protection one of the main priorities of the EU and integrated it into the entire field of activity of the EU (cross-sectional clause) making it an integral constituent of all EU policies.

1.1 Introduction of Sustainable Development into the Treaties

As hoped, the long awaited principle of sustainable development has been introduced into the foreword of Art. 2 of the EU Treaty¹ and into the axioms of Art. 2 of the EC Treaty. Environmental protection has thus taken a politically relevant place on the same level as economic goals such as the common market and economic and monetary union. This change is very important because the foreword and the principles are taken as guidelines and basic rules when interpreting community law.

The introduction of sustainable development does not mean that there is a legal obligation for the European institutions to create concrete measures. It does, however, show a strong political will to stress sustainable development and to engage the EU in this aim.

1.2 Decisions on Environmental Politics

The strengthening of the European Parliament is an important institutional amendment. The procedure of codecision has been simplified and extended as the legal basis for European environmental protection (Art. 175 EC Treaty). Certain forms of environmental legislation - such as environmental taxes - still require a European Parliament hearing (though without the need for full parliamentary consent) but remain subject to unanimity in the 15 (soon to be 25) Member States of the Council.

1.3 Common Market and Environmental Policy

According to the treaty regulations for the integration of the environmental policy, the legal and common market committee has always considered environmental issues while creating the common market.

Due to the increase of open markets, greater challenges as well as growing awareness of the environment have on the one hand created synergism but on the other hand tensions that automatically occur between the functioning of the common market and the introduction of environment policy measures. Environmental norms are sometimes considered as obstacles for entry into the common market, and open markets are seen as a threat to the environment.

The EU therefore has to find a coherent concept to achieve the aims that the treaty sets for the environment and the common market without neglecting international obligations. The EU has to strengthen the integration of these two political areas.

1.4 Role of Internalisation of External Effects in Environmental Politics

A major part of the damage to the environment in Europe is the result of decisions that individuals or organisations have self interestedly taken without taking into account the impact on others. In the transport sector alone, these impacts are estimated at about 4% of the Gross Domestic Product (GDP) or €290 billion /year. This is about the same amount as the entire economic performance of that sector. If we succeed in making the responsible parties take the costs for others into account; not only the environment but also the whole European economy will benefit.

¹ In the Amsterdam treaty, a Renumbering of the articles of the Treaty for the foundation of the European Community has taken place. The articles in this document refer to the new order after Amsterdam.

The goal of this document is to explain these interrelations. In the following section, the origins of actions that lead to external effects and the resulting inefficiencies are first explained. The core of this work gives an overview of all relevant measures for the internalisation of external effects and their quantification. The third chapter shows the EU-policy for the internalisation of external effects in the transport sector that should also be an inspiration for other policy areas as well as some recommendations.

2 ECONOMIC POLICY INSTRUMENTS TO HANDLE EXTERNAL EFFECTS

2.1 Marginal Cost Calculation as the Base for Rational Behaviour

The basis for all rational economic behaviour is the trade-off between cost (or loss of profit) and benefit. Only if an expected gain from a decision outweighs the expected cost, will an economic participant decide in favour of something: "Is the tram ride worth more than the fare or is it better to walk?"

Whenever the problem being considered is not a Yes/No question, as in the preceding example, but a quantity, which should be fixed, economics uses a marginal cost analysis. As an example (which will be used in the whole paper), we will consider a steel company. This company has costs, even when it does not produce anything. (Capital cost for the plant, real property taxes, wages for the non-productive staff, etc.) These fixed costs are plotted along the y-axis (5 Mio. €/month) in Illustration 1. If the plant now produces steel, it causes variable costs (raw material, energy, production facilities, etc.). The total costs are represented by the increasing curve in Illustration 1. Note that it doesn't increase linearly, but has a rising slope with an increase of output. The reason is that an increase in production causes additional, progressively rising variable costs, e.g. for the acquisition of new customers, higher marketing risks, expensive overtime or the employment of new, inexperienced workers.

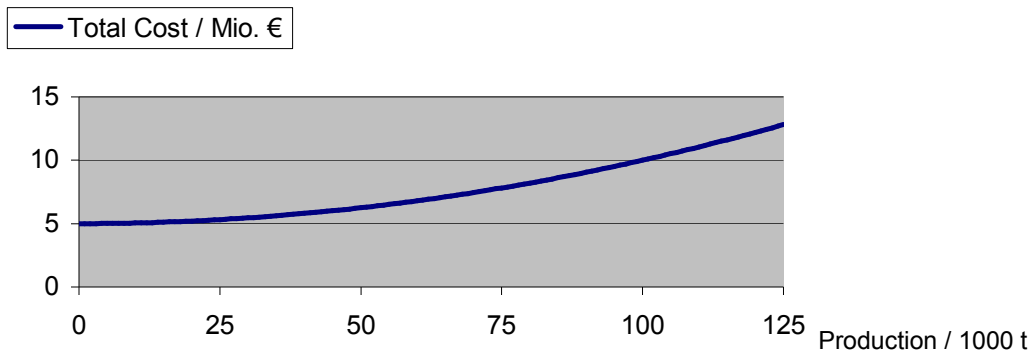


Illustration 1: Production cost of the steel company

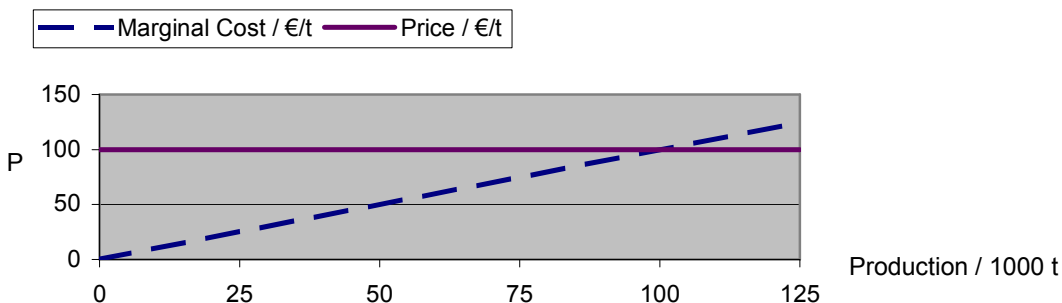


Illustration 2: Marginal cost of the steel company

Marginal costs are the extra costs incurred for an extra unit of output - mathematically, the first derivative (differential coefficient) of the total cost function. It can be calculated for every point on the total cost curve. "How much do I have to pay for an extra ton, if I already produce 50 000 t/month?" Because of the curvature

of the cost curve in Illustration 1, the marginal cost curve appears as a straight line with a positive slope. Provided a perfect output market, the revenue of a ton of steel is, however, constant (e.g. 100 €). In Illustration 2, this is plotted as a horizontal straight line.

If the production output level is now below the two intersecting straight lines, it is worthwhile to expand production, because the extra cost for the extension is less than the extra revenue. Vice versa, it is advisable to reduce output, if the production output level is above the intersection of the lines, because the loss of revenue would be overcompensated by the expected reduction of the cost. Thus, the company would adapt its output level until it reaches the point *price = marginal cost*.

2.2 External Effects

2.2.1 Notion

External effects or *externalities* are effects that do not impinge on the individual who makes the decision causing the effects. They are external to his economic considerations and not taken into account in his decision to maximise his individual benefit.

Pigou defined external effects as "...that one person A, in the course of rendering some service, for which payment is made, to a second person B, incidentally also renders services or disservices to other persons (not producers of like services), of such a sort that payment cannot be expected from the benefited parties or compensation enforced on behalf of the injured parties."

This formulation is a bit fuzzy, because it also includes ordinary consequences of the price mechanism. If, for example, the demand for paper by a large company rises, the paper price may rise. The increase in demand thus has a negative impact on other customers. This kind of ordinary market mechanism should not be understood as an external effect, because it doesn't disturb the efficiency of the allocation². It is only the result of the shift in scarcity relations (availability) that controls the market allocations. They are known as *pecuniary external effects*. In contrast to this, in the presence of *technological external effects*, there is a direct link between the benefit or the utility function of different economic actors (individuals or companies) that are not seized by the market mechanism and receiving, for example, indemnity. This case is of major importance as a possible cause for market failure. It therefore constitutes the core of this document.

In addition, with this narrow definition, it is not easy to distinguish between external effects and *public goods*. Characteristics of a public good are the jointness of consumption and the absence of the exclusion principle:

Jointness of consumption characterises the relation between two economic transactors when the consumption or the use of a certain good does not spoil the consumption or the use of this good by others. They can profit by it under the same conditions without disturbing each other.

The absence of the exclusion principle means that an economic actor creates a good without the possibility of excluding others from its use or consumption.

A typical example of a public good is military security, financed by government.

Furthermore, external effects can often be characterised by the jointness of consumption or the absence of the exclusion principle. In the absence of a market or a contract relationship, the creator of a public good does not take into account the impact on others of his decision to produce his goods. Moreover, one can conceive of external effects which could apply the exclusion principle, but (consciously or not) do not do so. Individuals usually do not have any motivation to exclude others from negative external effects of their actions. To exclude others, for example, from the impact of the poisonous smoke coming out of my chimney could be

² *Allocation* is the assignment of goods and factors with regard to individuals or production processes, thus the assignment of the resources at the economy's disposal.

expensive. So I don't do it unless I am forced to. Thus, public goods usually are treated as an instance of external effects.

External effects can be *positive* or *negative*. Positive external effects result, for example, from an increase in attractiveness of a tourist region as the consequence of building of a new amusement park. A typical example of a negative external effect is a chemical production plant that releases poisonous industrial waste into a river. The pollution of the water has a negative impact on the fishermen who work downstream. It is also possible that one and the same decision has a positive and a negative external effect at the same time: A gardener who decides to keep bees can, on the one hand, create a positive external effect on a fruit growing neighbour who benefits from the pollination of his plants, while on the other hand, another neighbour has a negative external effect because he is stung by the bees.

External effects can be *monetary* or *non-monetary*. In the presence of monetary external effects, it is possible to calculate, in currency units, the damage or the benefit to the individual who is influenced by the decision of the other. In the presence of non-monetary external effects, one may have solely an increase or a decrease of quality of life that cannot directly be expressed in money terms. The fishermen in the preceding paragraph are an example of a monetary negative external effect, because they have a (possibly total) loss of income. An example for a positive non-monetary external effect is the new year's fireworks of a neighbour that other people in the area also enjoy. As said before though, there are cases which can have both characteristics. When a beach is polluted by a third party, someone whose private ground is part of this beach can regard the pollution as ugly, thus feel a loss in quality of life. To him, it is a negative non-monetary external effect. When his neighbour decides to have his part of the beach cleaned at a cost, it is a monetary external effect to him. While it is the nature of monetary external effects to be directly calculable in money, non-monetary external effects pose the problem of appraising or calculating them. This will be the topic of chapter 2.4.

The most important external effects are the negative ones, especially in environmental policy. Positive external effects play a minor role in reality, as the party responsible for the positive external effect has an incentive to apply the exclusion principle. For example, an inventor will have his invention protected by patents and thus has the possibility of asking the beneficiaries for money. In Europe, external effects stemming from environmental pollution have reached a significant level, so that the necessity to intervene, especially with this type of external effect, is recognised.

2.2.2 Inefficiencies Because of External Effects

External effects cause inefficiencies, because individuals maximising their benefit / profit do not take the external effects of their economic decisions into account. This leads (compared to a functioning market without external effects) to a loss of welfare. As a concrete example, imagine a steel company that emits tons of sulphur dioxide into the air. This harms plants and human health. The steel company also causes losses to itself. It has to be painted more often and the costs due to workers being off sick increase.

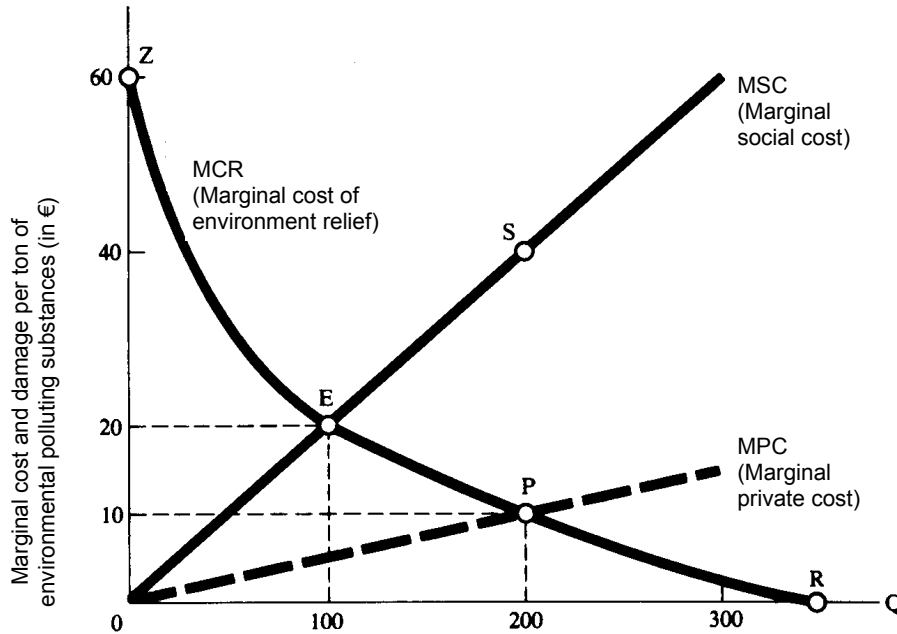


Illustration 3: Inefficient allocation because of external effects

The damage resulting from the pollution is plotted as the two upward curves of the marginal damages in Illustration 3. They show the increase in damage as the pollution rises 1 ton. The dotted line shows the marginal private cost (MPC) to the company. Apart from the steel company, other economic units also incur damages. In this example, we assume that the damage to others is three times higher than that to the steel company. When calculating the total cost of the pollution, these external costs also have to be taken into account. The loss to other economic units and the MPC of the steel company are included in the marginal social cost that is plotted as the upper straight line in Illustration 3. The falling curve shows the marginal cost that is caused by a relief to the environment from pollution (marginal cost of relief - MCR). This is the amount that the steel company has to spend to reduce the pollution of 1 ton of sulphur dioxide at a given quantity of production Q. This cost of relief is small at a high level of pollution, while it increases sharply near the point of zero-pollution Z.

In a Laissez-Faire-Economy, the amount of pollution (or other external effects) will be the point where *the marginal private cost equals the marginal cost of relief*. But - based on the analysis of Illustration 3 - we can tell that the economically efficient amount of pollution is the point E, where the *marginal social cost equals the marginal cost of relief*. Thus, in a *laissez-faire* economy, environmental pollution will be too high. The difference between the social and the private cost function is a measure of inefficiency.

In the case of negative external effects, the divergence between private and social costs leads to the consequence of the external cost being more than the efficient level for the entire society.

2.3 Internalisation of External Effects

2.3.1 Notion

Although external effects lead to inefficiencies, it is not economically sensible to try and entirely eliminate all damage. If those responsible for damage are forced to completely avoid it, the necessary expenditure is probably also too high and inefficient from the point of view of the whole economy. If a person who causes damage is forced to pay compensation to have the damage entirely removed/cleaned up, that effort is also inefficient for the economy as a whole. In the example of Illustration 3 on page 10, this corresponds with the

point Z in which - by incurring high cost - a total relief of the environment from pollution is reached. But this point is not optimal. Therefore, it must be the aim of economic policy to charge the responsible party for the external costs in a way that it is in their very own interest to find measures to produce external effects that are within the scope of economic efficiency. The external effect has to be turned into an internal effect on the part of the responsible party. Thus, this is called *internalisation of external effects*.

2.3.2 Intervention Possibilities of Economic Policy

Economic policy has different ways of defeating the undesired results of external effects: provision by the state, fusion of the involved economic units or collective provision, bans and orders, regulations, internalisation with taxes or subsidies, negotiations, tradeable permissions (certificates), liability law and moral appeals. In the following paragraphs, criteria for the judgement of these instruments are first presented. Then, each instrument for the internalisation of external effects is described and discussed along with the background of these judgement criteria. The examples used and areas examined mostly refer to negative external effects – since these are the main economic policy intervention possibilities. They are however easily transferable to positive external effects.

2.3.3 Criteria for the Assessment

The task of economic policy should be to induce the correct level of externalities in the most efficient way. This generic requirement can be specified with the following criteria which can be the base for the assessment of the different instruments for the internalisation of external effects:

- *Static efficiency*
Static efficiency defines the extent to which a certain means leads to a static optimum, i.e. by how much within a certain framework (especially with a given technique) a specified aim can be reached.
- *Dynamic efficiency (incentive effect)*
Dynamic efficiency defines the incentives associated with a means: to what extent do certain means stimulate efforts to avoid negative external effects from the beginning or to develop and apply methods that reduce or avoid external effects at a lower cost? In the case of external benefits, there should mainly be incentives to achieve the desired positive external effects at low cost.
- *Accuracy*
Accuracy assesses whether a certain level of externality which is politically motivated or economically optimal can be achieved in reality (e.g. a political decision for an environment standard).
- *Transaction cost³*
What level of transaction cost (e.g. administrative expense) does a certain process cause to the enterprises and the public authorities?
- *Political acceptability*
Acceptance of an economic policy by public and private stakeholders is described as political acceptability.

The following chapter describes eight instruments for the internalisation of external effects and scrutinises each one according to the efficiency criteria.

2.3.4 Instruments for the Internalisation of External Effects

2.3.4.1 State Provision

State provision is a good instrument for internalising external effects with the character of a public good. In most cases, it is technically possible to apply the exclusion principle, but this either involves high costs (the cost of exclusion is about the same as the benefit loss avoided by the exclusion) or is not wanted for allocative reasons (e.g. for good "education").

³ *Transaction cost* is every cost caused by a means, that is not part of the wanted reallocation. These can be cost for gaining information, for administration and for the appraisal of taxes.

The state provides the relevant good out of the general budget. However, renunciation of the market as a coordination mechanism for the allocation of the good leads to problems. One of them is the limitation of the amount of the good supplied, thus the *accuracy* of the intervention by the state.

From the point of view of welfare economics it is optimal if the price of a good equals its marginal cost. A supply free of charge is not problematic if the marginal cost of the supply is zero, i.e. an extra user does not cause significant extra cost (e.g. an additional citizen who benefits from military defence"). Where the additional user causes extra cost, it is desirable to be able to charge him. But this is impossible because of the missing exclusion principle. For example, an extra user of an already crowded road causes congestion costs to the other users. A statically efficient allocation of the road would require charging every user with his marginal costs. In consequence, the use of the road would be cheap at times of low traffic density and expensive at rush hours (*Peak-Load Pricing*).

Not only the static but also the dynamic efficiency of state provision is doubtful, because there are only weak incentives for the bureaucracy to put more efficient methods into place. Also, there is little motivation to search for new economically sustainable exclusion techniques. This is because the application of the exclusion principle would mean that the allocation of the good concerned would be left to the market and the influence of the bureaucracy diminished.

Although state provision is probably the most widespread instrument for the internalisation of external effects, it is inefficient for the economy as a whole. Its advantages are simple implementation, low transaction cost and high political acceptability. One should regularly examine whether the state provision cannot be abolished.

2.3.4.2 Fusion of the Economic Units involved

A very simple theoretical possibility for internalising external effects would be the fusion of the economic units involved into one. If the persons responsible for and those affected by damage or benefit fused then previous external dependencies between the production and the utility function would be, by definition, internal. This would lead to strong incentives to optimise the amount of the activity concerned – a statically and dynamically efficient internal allocation.

The problems associated with the above are practical, mainly for four reasons:

- It is hardly conceivable to fuse households with companies. If a company causes social costs that impinge negatively on households (e.g. air pollution in urban regions), a fusion solution is out of the question.
- The merging of different economic actors can lead to a high degree of exploitative market power thus disturbing the allocation. Eventually, the positive effects of the internalisation would be overcompensated.
- The organisation of a fusion involves high *transaction cost*.
- A complete internalisation of an externality requires the involvement all economic units concerned. If not, the problems caused by external effects are just shifted and not solved.

Thus, the main application area of fusion is the merger of persons commonly interested in a certain good (e.g. a tennis club) to a private usage organisation that provides a collective supply of the desired good and that applies the exclusion principle to non-members.

2.3.4.3 Regulations and Prohibitions

Regulations are orders to meet certain standards which, if unobserved, lead to payments to the public authority. This is still the most commonly used method for the internalisation of external costs, particularly in the environmental sector (e.g. as restriction of emissions). These standards seem, at first glance, a very simple way of internalising negative external effects, since they can prevent unwanted behaviour and/or force desired behaviour. However, the correct level of intervention is problematic.

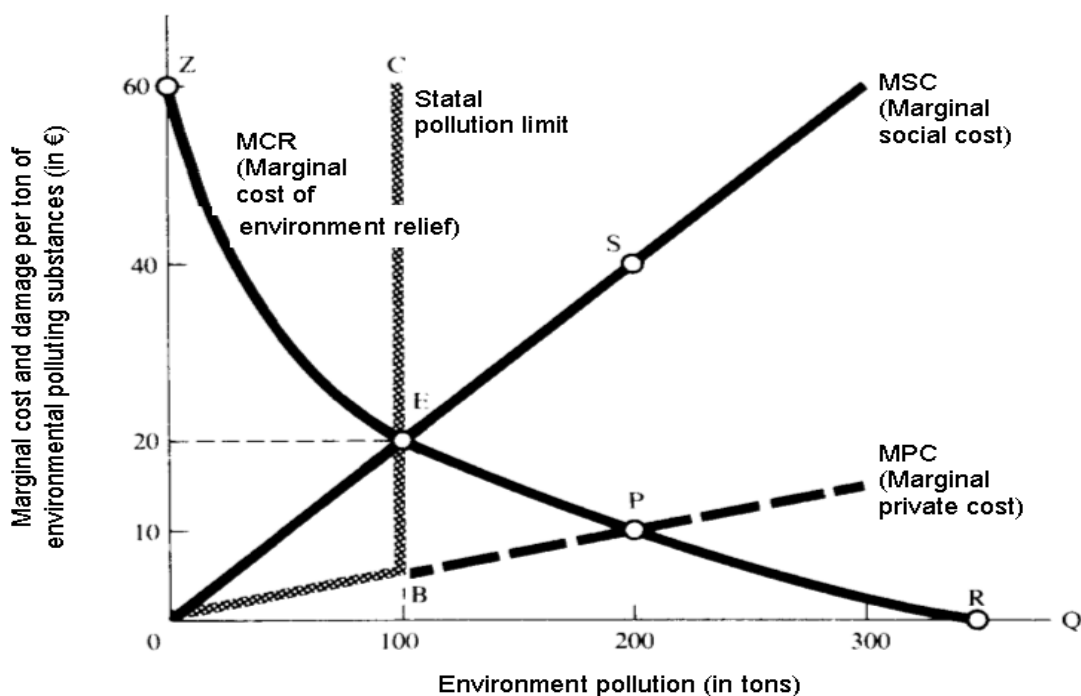


Illustration 4: Effect of a pollution standard determined by the state

As an explanation, we again use the example of the steel company of section 2.2.2 (p. 9): The government sets a maximum emission of 100 tons SO_2 . If the company must pay a very high fine when it exceeds the standard, its MPC curve turns in practice into the grey OBEC curve, and it decides on the more efficient amount of pollution at point E. It might, however, quickly become clear that this optimum is only reached if the emission standard is specified for the optimal level (here 100 t), the punishment for exceeding it is sufficiently high and the adherence to the standard is effectively controlled. Otherwise, the company will try to bypass the regulations and move to Point P.

The practical difficulties with the correct level (How do we know where the optimal level is?) of regulations and prohibitions make this instrument doubtful w.r.t. *static efficiency*. The optimal emission level for the overall economy might, at best, be achieved coincidentally. Generally, it is assumed that the avoidance costs of individual polluters differ from each other. In order to guarantee that damage is avoided wherever reasonably possible, the permitted pollution would have to be specified separately for each plant. If the conditions (e.g. development of the production technology) change in the course of time, the avoidance costs probably also change so that an adjustment of the regulations would be necessary. The necessary information for that would be available to the state only in exceptional cases.

Furthermore, the *dynamic incentive effects* of regulations and prohibitions are doubtful, since any damage is permitted without sanctions as long as one cooperates with the regulation. Thus, there are relatively few incentives to develop or apply innovative avoidance or abolition technologies.

Moreover, the *accuracy* of regulations and prohibitions is problematic if the permissible damage is defined as a damage quantity per basic unit (e.g. SO_2 emission per m^3 exhaust air) or per plant. As soon as additional plants are put into service or the output of existing plants increases, the damage in the region concerned rises, whereby the desired emission quantity is possibly exceeded.

Considering the inadequacies of using regulations and prohibitions as an instrument to internalise external effects, their wide distribution is surprising. It is only explainable by the comparatively small *transaction costs* and the relatively simple *political applicability*.

2.3.4.4 *Price Solutions (Taxes)*

At present, the most important practical alternative to traditional political regulation is the market-oriented price solution. Fiscal charges, taxes and subsidies fall into this category. This instrument, suggested by Arthur Pigou in 1920, is called *Pigou tax* or *Pigou subsidy*. The basic idea consists of taxing (subsidising) the causers of external cost (benefits) so that the social and private marginal costs are identical with the overall economic optimal quantity. For the achievement of an optimum allocation, it is not necessary to transfer the tax revenue to the damaged parties or to have the people who benefit from the extra social utility pay the subsidy.

For the steel company example in section 2.2.2 (p. 9), a Pigou tax would have to be levied. Its amount would be the difference between the social damage MGS shown in Illustration 3 as a continuous line (here 0.2 €/ton emitted SO₂) and the private damage MPS (0.05 €/t) of the steel company. The cost of the emission for the company added to the Pigou tax (of 0.15 €/t) is a total charge for the steel company in the same amount as the social damage MGS. The steel factory will lower its emission until its marginal costs (which now also contain the Pigou tax) from the environmental pollution are as high as the costs of the environmental relief MKU. This is the case in the optimal point E.

Internalisation by taxes or subsidies leads—provided that the extra social costs are known (MGS in Illustration 3 on p. 10) – to *statically efficient* allocation. In contrast to regulations, in which only the optimal point is determined, the Pigou tax solution is immune to changes of the marginal costs of damage avoidance (MKU in Illustration 3 on p. 10) w.r.t. static efficiency. Additionally, it is immune to differences in the damage avoidance cost curves MKU of different culprits/offenders. Internalisation from the use of taxes or subsidies is furthermore *dynamically efficient*, since it offers incentives for the development and application of innovative avoidance or abolition technologies: each marginal decrease of the damage leads to a marginal saving of the amount of the reduced private damage MPS and the reduced Pigou tax.

W.r.t. *accuracy*, the problems of using Pigou taxes efficiently are however considerable. For the implementation of an optimal tax solution, the authorities must know the marginal damage function MGS. They will always have a (quite imprecise) estimated value, because it contains numerous factors that are hardly expressible in money terms, such as the repair costs of buildings damaged by SO₂, the hospital costs of allergic people or the reduced enjoyment of walkers in the forest. However, this problem of accurately estimating the damage or benefit functions occurs for all instruments used to internalise external effects. Whereas in finding the required solution you also need knowledge of individual cost functions of damage avoidance, knowledge of the agreed social marginal costs function is sufficient for obtaining the price solution. Thus, approximation of efficient damage avoidance is easier with the tax solution than with regulations.

Using taxes or fiscal charges can help to produce efficient internalisation of external effects; in particular if their practical implementation is associated with small transaction costs. Their weakness is the need to calculate the social marginal costs for efficient and accurate implementation. Nevertheless, broader use than in current economic policy seems sensible.

2.3.4.5 *Negotiation solutions*

The commonality between the instruments for the internalisation of external effects described so far is that they require state intervention or at least a regulating organisational structure. Ronald Coase made a proposal in 1960 on the internalisation of external effects for the fixing of property rights and negotiations. This became known as the *Coase Theorem* and works without such structures.

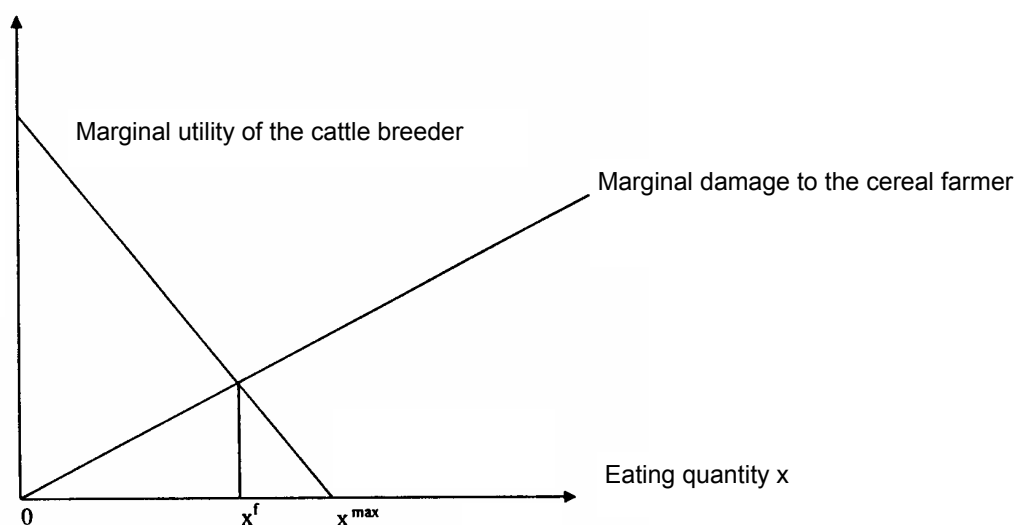


Illustration 5: Internalising external effects by property rights

The Coase Theorem is described using an example by Coase himself: There is a cattle breeder, whose herds trample on the fields of a cereal farmer. They constitute a negative external effect, because the cereal farmer incurs costs - for example for recultivation measures or lost turnover. The more they eat, the higher is the damage. Therefore, the curve of the marginal damage (the costs of the cereal farmer in Illustration 5) is rising.

The cattle breeder has a benefit from the grazing of the animals, e.g. by saving feed. The marginal utility (benefit) decreases because if the animals eat beyond saturation, they can, for example, become ill. The maximum eating quantity x^{\max} , which he would allow without intervention from the farmer or another force, is achieved whereas the marginal utility has sunk to zero.

Again, the efficiency condition *marginal utility of the cattle breeder = extra costs of the cereal farmer* is considered here, so x^f represents an optimum. If now the property rights are given to the cattle breeder and the cereal farmer has no possibility of restraining the voracious animals, they eat until they are overfed, i.e. up to x^{\max} . Thus, inefficiency is caused by the fact that the animals continue eating even when the marginal utility caused thereby is already smaller than the marginal damage to the cereal farmer.

If the property rights are specified as described above and negotiations become possible, the cereal farmer will offer compensation payments to the cattle breeder for restraining his animals. For the farmer, paying this is only beneficial if the payment he offers corresponds at least to what he saves by restraining the animals. The cattle breeder will vice versa accept this offer only if the compensation payments are at least as high as the sum he loses because of the reduced grazing of his animals. The negotiations between the concerned individuals thus proceed completely without state interventions up to the point at which the marginal utility of the cattle breeder corresponds to the marginal costs of the cereal farmer - the optimum x^f .

It is interesting to note that an efficient allocation is also produced if the property rights are assigned not to the cattle breeder, but to the cereal farmer. Without compensation payments, the cereal farmer will prevent the activity of the animals so that the cattle consume none of the cereal, which is just as inefficient as the quantity x^{\max} . Similar to the situation described in the paragraph above, the cattle breeder now has a motivation to offer payments to the cereal farmer for an expansion of the amount of grazing. Again, it comes down to the efficient internalisation of external effects, with the only difference being that this time the participants move to point x^f beginning from Zero and not from x^{\max} .

Since, under Coase's assumptions, negotiations lead to the optimum, this instrument for the internalisation of external effects is *statically efficient*. If each case is negotiated individually, each case's optimum is achieved in the end; if the negotiations refer to groups of cases, there is an incentive for those responsible for a damage to implement the agreed reduction at the plants with the lowest reduction cost.

The dynamic incentive effects for the application and/or for the development of techniques which are associated with smaller marginal avoidance costs, depend substantially on the concrete arrangement of the contract. It is important that the agreement can be terminated and be adapted to the new technology.

Since the internalisation negotiations lead to an optimum, then the *accuracy* is also perfect: The optimal state of the whole society is achieved by decentralised decisions without state interference.

Theoretically, the Coase Theorem (at least without the competing intervention of other instruments⁴) is the perfect method for the internalisation of external effects. The problem however is its numerous *conditions*:

- It must be known *who* causes a certain external effect and *who* suffers/benefits from it.
- The *Number of actors* must be small, otherwise it is not possible that they can even enter into negotiations with one another and problems appear, as with public goods.
- *Property rights* do not only have to be *definable*, but also *enforceable*. This means that a violation of the law can be proved and assigned clearly.
- *Transaction costs* (implementation of the rights, conduct of the negotiations) must be small compared to the total extent of the procedure.
- The participants must (at *little cost for information*) be able to *determine* their own *marginal costs or marginal utility functions*. Even under this condition, the negotiations probably do not lead to the optimal result if the parties negotiate strategically or bluff. In order to prevent this, each party also has to know the opposing marginal cost or marginal utility functions.

It can be noted that internalisation by negotiations represents a theoretically attractive solution, but is associated in practice with such difficult problems that it is rarely applicable.

2.3.4.6 *Quantity solutions (certificates)*

The idea of *certificates* and *licences* consists of specifying the total permissible extent of an external effect (for example the total permissible emission of an air pollutant in a region) and dividing it into negotiable certificates. Analogously to price solutions (fiscal charges and taxes), certificates are thus called *quantity solutions*. While with price solutions a *price* for the production is given and it is up to the companies to decide how much they want to require from the production factor ("Emission"), with certificates, the total permissible *quantity* is fixed. The price for the production factor then is set on the market. The damage rights can be introduced by an auction (Auction Procedure) or be distributed free of charge to those already creating damage, according to the volume of damage previously created (Grandfathering). It is of crucial importance that these rights are transferable and negotiable, since a market can develop only under this condition. A balance certificate rate (CR in Illustration) develops by the interaction of supply and demand, and thus constitutes a scale for the scarcity of these emission rights.

⁴ It can be proven that a combination of Pigou-taxes and Coase-negotiations is inefficient again.

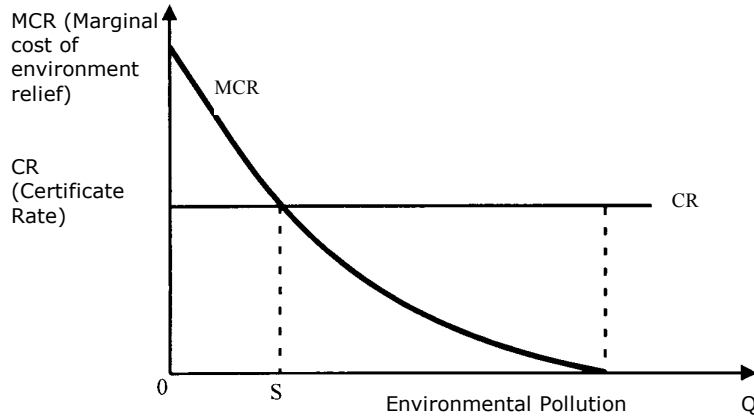


Illustration 6: Principle of the certificate solution

For an explanation, we again use the example of the steel company from section 2.2.2 (p. 9) loading its environment with SO₂-emissions: Given the certificate rate "CR", the steel company will reduce its environmental pollution until the marginal costs of the environmental relief (MCR) corresponds to the price of the certificate CR. It then emits S units of SO₂ and must buy the necessary rights in the form of emission certificates on the market to be within the legal limit. If their emission S is smaller than the total emission amount specified on the certificates, they will sell the surplus emission certificates on the market.

The effects of certificates are to be judged similar to those of a tax under the aspect of *static efficiency*. In the optimum, the emission quantity S is reached (e.g. in Illustration). Similar to the tax, the largest emission quantity is avoided where this is most economically possible. Since the owners of the rights and the potential damagers have the same certificate rate, the marginal costs of damage avoidance for the last avoided unit are the same.

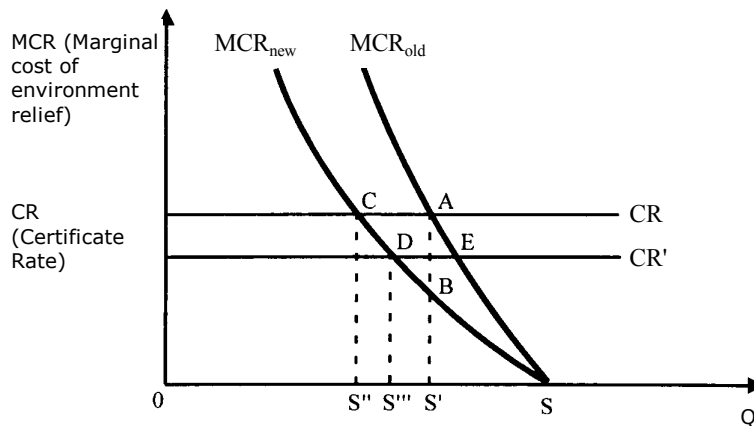


Illustration 7: Dynamic efficiency of the certificate solution

Furthermore, the *dynamic incentives* for the development or implementation of technologies, which are associated with smaller marginal avoidance costs, are similar to those of a tax. With conventional avoidance technology, in Illustration represented as MCR_{old}, and the certificate rate CR, the company will avoid the emission quantity SS' and will buy OS' of certificates to cover the emission quantity. If it introduces new technology, associated with smaller marginal avoidance costs MCR_{new}, the optimal emission level sinks to OS''. Just like taxes, certificates lead to dynamic incentives for development or implementation of superior technology. These relatively strong dynamic incentives are however only achieved if the certificate rate does

not fall in consequence of the introduction of the new technology. If it drops, the common implementation of the new technology results in a lower rate CR' for the emission certificates, because the demand for these certificates decreases and the dynamic incentive is accordingly smaller. To guarantee a relatively high dynamic efficiency of the certificate solution, it would be sensible if the issuer of the rights (e.g. by buy-back of some rights) ensures that the rate of the certificates does not fall in the long run.

Since the sum of the certificates directly prescribes a certain maximum permissible load, *the accuracy* of the certificate solution can be classified as very good. There is however, as with regulation, the problem of ascertaining the overall economic efficient emission quantity. The scope of the total permissible damage volume should thus be examined from time to time for possible revision. It would be wise to provide damage rights only for a limited time, to specify a continuous decrease or to buy them back until the certificate rate is at the desired level.

Given its advantages as an instrument for internalising external effects, why is the certificate solution so rarely used? The most important application up to now is the world-wide establishment of national air pollutant emissions in the Kyoto Protocol.

2.3.4.7 Internalisation by Liability Law

The basic idea of the use of liability law as an instrument for internalising of external effects is the following: If the responsible party has to pay for the damages caused by his economic activity to the injured party, he will consider these costs when deciding on the type and scope of his productive activity. Ideally, he will only emit that quantity of pollutants for which the marginal indemnification matches the marginal avoidance costs.

Using the example of the steelworks of paragraph 2.2.2 (p. 9) loading its environment with SO₂-emissions: If the steel company is made liable for all damage it causes, it must pay for any health cost of the injured parties, for the protection or the replanting of the vegetation, etc. itself. This means that it does not only have to pay (in Illustration 3 on p. 10 outlined as a broken curve) its own marginal private damage (MPD), but the entire marginal social damage (MSD) in Illustration 3 represented by the upper intersecting curve. The marginal social costs thus become marginal costs of the company (MPD = MSD), so that it is interested in reducing its emissions until the marginal social costs correspond to the costs MCR for a relief of the environment (MSC = MCR). Thus, the optimal point E is reached.

The focus of this analysis of liability law is its ability to affect the behaviour of potential damagers in a suitable way (efficiency effect). If there is definite understanding about the consequences of actions, comprehensive liability legislation leads to an overall economic optimum: If the negligent party's benefit from social costs is smaller than the costs of compensation of the injured parties, he will be inclined to omit the activity; in the reverse case, he will continue to carry out the damaging activity and will compensate the injured parties.

In reality, so-called *risk externalities* are observed: the individual responsible for the potential damage does not control the extent of the damage completely, but has a substantial influence on the probability of the occurrence. A driver, for example, can substantially affect the probability of causing an accident by the way he drives. One can usually assume, in relation to such risk externalities, that the probability of damage decreases, if the potential damager behaves more carefully. Damage can, however, only be excluded with absolute certainty, if the activity concerned is completely stopped. Since a complete omission or a prohibition of many of these risks would be associated with disproportionately high benefit losses, one must try to weigh benefit against potential damage and realise an optimum.

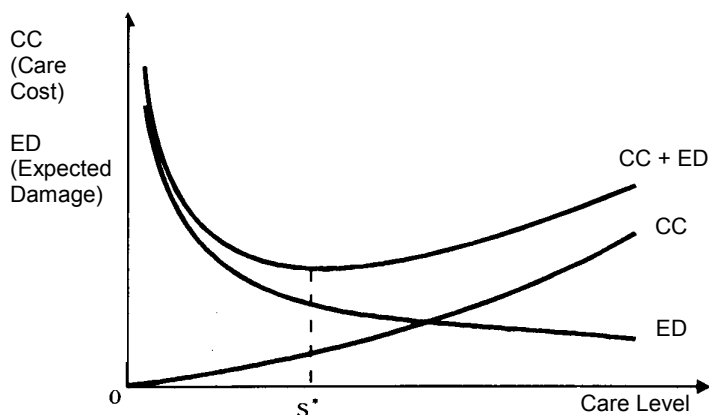


Illustration 8: Optimal care level and liability law

Illustration 8 shows an easy derivative of the optimal care level, which results from the care-costs (CC) and the expected damage (ED). The expected damage is the multiple of the probability of damage and its potential extent. In the expected damage curve, it is assumed that the potential damager can lower the probability of damage by appropriate precautions, although not completely to Zero. The higher the care level (CL), the higher the corresponding care costs. Under a comprehensive liability law, the potential damager must pay both for the care costs and for resulting damage. Since he must take both cost categories into account, the optimal care level (CL*) lies where the total costs (=CL+CC) are minimum. This represents an optimum for the economy as a whole. Thus the internalisation of external effects by liability law is (at least in the form of the absolute liability) *statically efficient*.

Internalisation of external effects by liability law is likewise *dynamically efficient*, since it offers incentives for the negligent parties to look for new methods to lower care costs. With the implementation of new methods, the damage risk decreases along with the expected costs to be paid by the damager.

Usually there is no collective instance to determine the optimal level of economic care. The establishment of a duty of care at a certain care level is the business of the independent courts. In practice the main problem is proving the guilt of the negligent party or the neglect of the duty of care. So, a high *accuracy* of liability law rarely seems achievable.

Theoretically, the internalisation of external effects through liability law is an attractive solution. However, an enforceable damage claim must be present, it must be possible to bring the damager to court under acceptable legal fees, and finally, the cost of the damage must be known in monetary units and be dependent on the emission level. Furthermore, in many cases, the damager can evade his personal liability by being insured. The less the insurance is differentiated into risk groups and the less cases of damage affect the insurance premium, the more this point is valid.

2.3.4.8 Moral Appeals, Ethical Standards

In environmental politics in particular, moral appeals are used occasionally to encourage the actors to adopt the desired "eco-ethical" behaviour. This usually aims at an avoidance or reduction of negative external effects. There are doubts as to the suitability of moral appeals and ethical standards for the internalisation of external effects. If the ability of a company to be competitive worsens because of voluntary reduction of external effects (because its competitors do not react to the moral appeals), profit reduces and the continued existence of the company may be threatened. Moral appeals can only be expected to work in the area of private free time activities or consumption.

Measured by evaluation criteria for the different internalisation procedures, moral appeals perform relatively poorly. Since the effects of moral appeals are very uncertain and difficult to predict, their *accuracy* must be classified as outstandingly poor. Moreover, *dynamic incentive effects* can hardly be expected from moral

appeals. Only those actors who are relatively sensitive to moral appeal (those who are affected by a "bad conscience") avoid negative external effects. Since this factor is independent of the appropriate avoidance costs, the *static efficiency* appears doubtful, too.

Moral appeals and ethical standards are obviously unsuitable as an applicable instrument for the internalisation of external effects. Their effectiveness is frequently seen only in exceptional cases or in small groups in which an offence against the standard is easily identifiable and can be outlawed.

2.3.5 Summarising Comparison of the Instruments

It is clear that instruments differ significantly w.r.t. static efficiency, dynamic efficiency and accuracy, as well as practical applicability.

It was shown that the instruments used most often in current economic policy to internalise external effects, namely; provision by the state, regulations and prohibitions as well as moral appeals are most unsuitable according to efficiency criteria. Above all, it is ease of political applicability and ease of implementation, often associated with low transaction costs, which has made them the most common instruments. In the case of regulations, the problem of knowing the optimal point applies in order to be (at least in the short run) statically efficient. Actually, this is only possible by ascertainment of the social marginal costs and the marginal costs of decreasing the external effect. This is associated with high information costs, which are likewise for the implementation of market-oriented instruments/certificates and fiscal charges / taxes. In the case of fiscal charges / taxes, knowledge of the social marginal costs alone is already sufficient for efficient implementation. In the case of suitable fixing, these two instruments are very efficient under the three assessment criteria. Nevertheless, the fact that they are used so little in practice is probably due to existing political resistance and the relatively high transaction costs for some cases. Regarding the central efficiency criteria, the instruments comprising fusion of the participants, as well as internalisation by negotiations or by liability law are theoretically still more suitable. However, this usually fails because of practical problems, so that they can only be used in a few areas. In some cases, the combination of different internalisation strategies can lead to better practical results.

Table 1 shows to which extent the different instruments correspond to the three criteria of assessment and contains an overall judgement.

	Static Efficiency	Dynamic Efficiency	Accuracy	Overall estimation
Provision by the state	usually reduced	usually Reduced	usually reduced	To be implemented only if not possible differently.
Fusion/collective provision	potentially high; eventually problem market power	potentially high; eventually problem market power	potentially high; eventually problem market power	Fusion suitable only in specific cases; collective provision only if exclusion possible and sensible.
Regulations and prohibitions	usually small	small	reduced	Suitable only in exceptional cases.
Taxes (Pigou)	high	high	reduced	Suitable; Problem of adequate base factors.
Negotiations (Coase)	high	high	potentially high	Theoretically the best means for Internalisation; only with difficulty convertible <i>implentable?</i> in practice.
Negotiable permissions (Certificates)	very high	high (in the case of maintenance of the rate)	high	Conceptionally suitable means; problems with the practical application.
Liability law	high	relatively high	reduced	In principle suitable; practical application internalisation is usually only partly achievable
Moral Appeals	doubtful	small	very uncertain	Significant effects only in small groups.

Table 1 : Overall estimation of the instruments for internalisation of external effects

2.3.6 Advantages of the Economic Policy Measures

The main application of the economic policy measures described in this chapter is the internalisation of negative external effects, especially in environmental policy. In particular, the most efficient market-oriented instruments force the causer of an external effect to reduce the effect, in most cases by having to pay for it. For the effectiveness of the measures, a direct transfer of these sums to the injured parties is unnecessary and frequently also not practicable. It is thus possible to use the charges from economic policy measures as follows:

- *Removal of the damage caused by the external effects*
Particularly with pollutant emissions, funds can be used for the removal of the damage (which is now smaller, but not lowered to zero), for example for the reforestation of damaged forests.
- *Financing infrastructure*
In order to establish a connection in particular between the payment for the use of a good and its financing, it seems obvious to use economic policy funds for the infrastructure involved. If for example a road tax for traffic routes is levied, the roads can be maintained with the revenue or new traffic routes can be built.
- *Integration into the general budget*
Using economic policy funds in the general public budget gives scope to reduce taxes and ancillary wages or can provide public goods. This also serves the development of the economy.

Citizens thus profit from an efficient internalisation of external costs in two ways:

1. *The decrease of external costs that were once borne by the individual:*
e.g. no necessity for noise protection measures, smaller health insurance contributions, more enjoyment of a walk.
2. *Benefits from economic policy measures:*
Damage repair, infrastructure financing and reduced individual contributions to the public budget.

2.4 Quantification of External Effects

Nearly every economic activity causes external effects. The main problem in the discussion of their internalisation is not *whether* a certain economic activity causes a certain externality, but *to what extent*. In the case of the evaluation of external effects and public goods, however, we normally have neither the information on individual demand curves nor on market prices. Nevertheless, in view of this deficiency, procedures have been developed in practice that makes the desired evaluation of the benefit and the costs of a public project possible. Below, an overview of the most common procedures is given.

For some goods, for which no market prices exist, we need a suitable means of valuation, i.e. artificial internal prices. Hence we close with remarks on the special difficulties of ascertaining such artificial internal prices for environmental damage, time and human life.

2.4.1 Determination of Preferences by Survey

The obvious way to evaluate in money terms the external effects is to simply ask the economic subjects about their willingness to pay and interpreting the answers as evaluation of their potential benefit. If the output of the project to be evaluated has the character of a public good or is connected to a positive external benefit, it is possible to inquire from the people receiving the benefits the maximum amount they would be ready to pay for the potential advantages. If the output has the character of a public "evil" in the eyes of those concerned or if it goes hand in hand with negative external effects, one can investigate what minimum monetary compensation would be accepted, in order to bear all the negative effects. However, this survey would encounter practical problems such as finding all affected individuals and the difficulty for them of estimating the consequences of, for example, the greenhouse effect. A further difficulty is that those individuals may not express their preferences truthfully.

2.4.2 Evaluation by Market Prices for Damage Compensating Goods

The evaluation by market prices for damage compensating goods aims at quantifying the measures which the individuals affected must take in order to compensate the external effect.

If, for example, a new airport is to be built which will cause noise for the local residents, it can be assumed that those concerned will try to decrease this impairment by installing double glazing in their houses. In this case, it seems plausible to add the costs, which result from the noise-reducing measure, to the costs of the public project. They can be evaluated monetarily since market prices exist.

The total costs will be *underestimated*, if the disturbance is not completely avoided by the measures, if the number of those concerned is not completely known or if the scope of the compensation measures made cannot be accurately determined. In our case, some of those concerned might not install double glazing if they do not want to, or are unable to afford it. Likewise, costs are neglected with those households which evade the whole process by moving away.

On the other hand, the procedure can also *overrate* the scope of the negative effects, i.e. if it includes costs which do not only serve as damage compensation, but also other completely independent purposes. The installation of double-glazing could also be done in the course of general reconditioning work or for insulation purposes.

2.4.3 Evaluation by Value Changes of Personal Property

External effects often affect the personal property of private individuals, which reflects in changes of capital assets. For example, the value of an apartment is, among other criteria, determined by access to public transport, the extent of noise disturbance as well as the proximity to private or public institutions such as supermarkets, schools, swimming pools, theatres and parks. Such value changes can be quantified with the help of market prices for personal property, because they reflect an evaluation of the effects of the external effects themselves.

To illustrate this, we use the example of the airport construction from section 2.4.2 with the negative impact of the aircraft noise: Because of the establishment of the airport, the value of the adjacent properties will decrease. In the case of residents who decide to move away, moving expenses as well as expenses which result from the change of their previous surrounding area, are to be added to the depreciation of their property. Such costs can be at least approximately tracked down with the help of representative inquiries and estate agents.

2.4.4 Further Evaluation Methods of External Effects

Beside the evaluation methods described in the three preceding sections, there are other evaluation procedures. The first two are the resources approach and the avoidance cost approach. These are so transparent and easily understandable that they are not treated here with the same depth as the three preceding evaluation methods, although they are of high practical relevance. The main application area of the methods outlined is the evaluation of public goods. This plays only a subordinate role in environmental politics.

- *the resources approach*
In this case, the costs of the replacement or the repair of a damage caused by an external effect are determined. What does one have to pay, for example, to replant a forest that perished because of SO₂-emissions?
- *the avoidance cost approach*
In this case, the sums which would be necessary in order to avoid the impact of an external effect are calculated. How much does it cost, for example, to place lime on the forest ground in such a quantity that the trees withstand the SO₂-emissions?
- *complementary private expenses*
In this case, one investigates (in the instance of positive public goods), how much expense individuals are willing to incur in order to enjoy the use of a public property that is provided free of charge. How high are the travel costs, for example, which are paid in order to visit a suburban recreation area? The sum of all complementary private expenses for the use of a certain public property represents a lower value for its appreciation.
- *comparable or substitutive expenses*
In this case, the demand curve for an already existing property is consulted for the evaluation of the comparable public property planned. If, for example, a new swimming pool is to be built, the visitor numbers and entrance prices of comparable privately-operated swimming pools are taken into account.
- *cost avoidance*
In this case, the sum, which the private households save for the use of a public property, is taken as a basis for the evaluation of the public property. How great, for example, are the savings for private travel when an underground railway is built?
- *the alternative cost method*
In this case, redundant expenditure is determined, which would be necessary from the private sector in order to obtain comparable effects. For example, if the building of a noise protection embankment along a major road is considered, the sum of the costs of the installation of double glazing in all surrounding houses could be considered for its evaluation.

2.4.5 Evaluation of Environmental Damage

Damage to the environment because of external effects is the focus of this paper. The aim of economic policy should not be to achieve a complete preservation of the environment by preventing all economic activities,

but an optimum should be attained by considering the accompanying damage and benefit. However, special problems occur for the quantification of the impact:

- *Determination of the natural condition*
Without the existence of human beings, there would, for example, still be greenhouse gases and forest fires. To what extent should this be accepted as natural?
- *Uncertainty about the causal relations*
Estimation of environmental pollution impact is characterised by a high level of uncertainty. "Is it really SO₂-emissions which have caused damage to coniferous forests or is it perhaps a different gas or a natural forest disease?"
- *Uncertainty about the long-term impact of environmental pollution*
The consequences of much environmental damage will not be seen for decades or centuries. "Will the CO₂-concentration really lead to a global warming and to the melting of the polar ice-caps?"

These special difficulties in evaluating environmental damage make the quantification of ecologically important external effects very difficult and fragile, set against objections by political groups not interested in internalising these external effects.

2.4.6 Evaluation of Time

Especially when quantifying external effects in the transport sector, the value put on time is of major importance. There are two substantial methods regarding the evaluation of time. A first approach measures the value in a certain time of producible goods; the second procedure judges the subjective value of time by the observable behaviour of individuals.

The production-oriented approach gives a monetary value to time gained on the basis of the value of goods which could be produced in that time. In the labour market, this corresponds to the wage rate. An hour spent in a traffic jam by a worker who usually earns €20 should be assessed at this amount.

The subjective approach is based on observation of individuals' behaviour in situations in which they are forced to decide between more costs and less time or vice versa. Travellers are frequently in a situation in which they must choose whether they want to achieve a desired aim quickly, regardless of expense (taking a taxi), or slowly, but cheaply (taking a bus or tram). Their preferences for the time factor become clear in the pollings made. If, for example, someone spends €10 to reach his destination an hour earlier by taxi, but prefers to take the bus for €1 if the taxi charges €11, he assesses his (lost) hour of travel at 10 €.

2.4.7 Evaluation of Human Lives

When evaluating the consequences of accidents in particular, evaluation of human lives creates a problem. For ethical reasons, one is easily inclined to the opinion that human life is of immeasurably great importance and thus a monetary evaluation is not possible at all. If, however, we attach an infinitely high value to human life, accordingly large sums would have to be spent e.g. for road safety or cancer research. Furthermore, no production processes might take place which can result in an accident with the consequence of death. From this point of view, an infinitely high priority of the value of "life" makes normal economic development in a society impossible.

The evaluation of human lives within the framework of cost-benefit-analysis is essentially based on two approaches: The first evaluates human lives from a production-oriented point of view. The second examines which value the individuals themselves attach to a rise or a fall in the probability of their death.

The production-oriented approach associates probability of death with economic output measurements. For this reason, it estimates the future incomes of the persons concerned with the help of wage rates and projects them up to the end of their life expectancy. Thus, the procedure implies that the life of an elderly person – as well as the life of persons with low income – has an accordingly smaller value. The approach therefore represents in total only a rough indication of the minimum value of a human life.

The subjective approach is briefly outlined in the following paragraph with the known danger when building a tunnel in the Alps: The workers participating in the project are first made aware of the risk associated with their employment. It is then enquired how high a wage increase could nevertheless induce them to accept the danger. With the extra pay, the increased risk of death can be evaluated monetarily. Fundamental conditions for this procedure are the fact that all participating workers have sufficient information about the risks and alternative possibilities of employment. (They do not feel forced into the acceptance of the risk for example because of the threat of unemployment.)

In view of ethical doubts concerning evaluation of human lives and the inadequacy of the procedures, an investigation containing an evaluation of human lives should clearly refer to the amount attached to the value of human life. The political agents and the public should then decide whether they accept this procedure.

3 PRACTICAL APPROACHES: THE EU TRANSPORT POLICY

3.1 Introduction

The first time that a publication of the Transport Directorate-General of the Commission demanded the internalisation of external effects as an integral part of the European transport policy was the 1989 report of the group called "Transport 2000 plus". This was followed by the Green Paper about the "Consequences of Transport for the Environment" and the White Paper entitled "Development of the Common Transport Policy" (both in 1992). With the Green Paper "Towards Fair and Efficient Pricing in Transport" in 1995 and the White Paper "Fair Payment for Infrastructure Use" in 1998, the internalisation of external effects was then made the core topic of a legislative process. Their central integral parts are briefly introduced here.

3.2 Approaches of the EU Commission for internalising external costs of transport

3.2.1 Efficiency and Fairness

The Commission declared the aims of efficiency and fairness as being of the highest principles. This is already expressed in the title of the Green Paper of 1995: "Towards *Fair and Efficient* Pricing in Transport". The notion of efficiency used is the one characterised in Chapter 2.3.3. The principle of fairness is applied in three regards:

- *Fairness in the sense of equal treatment*
- *Fairness by the application of the "polluter pays" principle*
- *Fairness in the sense of social compensation.*

3.2.1.1 Subject to Internalisation

External Costs and Benefits

The White Paper and Green Paper attempts to internalise external effects are limited to *technological* external costs. This relies on numerous studies which do not identify any considerable technological external benefit of Transport. In particular, the economic benefit presented by representatives of the automobile industry and the road freight transporters is regarded as a pecuniary external effect of traffic.

Type of the External Effects to be Internalised

The Commission has selected some external effects of transport, whose internalisation is set as a goal. These are first, and nearly undisputed, the significant impact of accidents and environmental nuisance. Beyond that, the costs for infrastructure and overloading are to be charged to the users of transport services. Thus it aims at a comprehensive internalisation of all external effects – including those whose affect does not extend outside the transport sector.

3.2.2 Target group of the internalisation

Since, in the opinion of the Commission, *road transport* causes over 90% of the external costs of transport, it pleads for a concentration on these. In order not to distort the competition, the principles for the internalisation of external effects are, nevertheless, to be applied equally to all modes of transport. However, *Private car transport* is excluded – with reference to the subsidiarity principle and the justification that it has little impact across borders. The Member States are asked to apply the same principles.

3.2.3 Instruments of the Economic Policy

The emphasis of the Green and the White Paper analysed here is the selection and implementation of economic policy's instruments for the internalisation of external effects in the transport sector. The Commission puts the emphasis on road taxes. Additionally, it pleads for legal measures and differentiated insurance premiums.

Road Taxes

The Commission regards a levy of taxes according the social marginal costs in the spirit of Pigou as the most suitable for the internalisation of external effects. In the White Paper of 1998, a gradual introduction of a tax system for the use of traffic routes is suggested which is characterised by the following principles:

- payment directly by the causer of the external effect related to social marginal costs,
- levy of these fees as a function of the social marginal costs,
- levy of these fees with regard to time and place as well as pollutant output,
- charging of taxes by means of electronic (e.g. GPS) tax collection systems,
- abolition of competition distortions within and between the individual modes of transport and between the modes of transport because of the present, heterogeneous charges for infrastructure,
- equal burden principles for all traffic sectors and for all Member States,
- decision about the disposition of the funds by the Member States,
- decision about new infrastructure investments on the basis of comprehensive cost-benefit-analysis.

Insurance Premiums and Regulatory Measures

The Commission demands a stronger consideration of the risks of the different user groups, in order to achieve a closer relation of the fees for the single user and his personal risk. So, for example, a more prudent handling could be obtained with the help of differentiated insurance premiums and a larger bonus for safe driving. Vehicles with a higher comprehensive security are to be rewarded with a lower premium.

The Commission also pleads for direct regulation measures in some cases.

3.2.4 Calculating Marginal Social Costs

The Commission specifies the principles to carry out an evaluation of the social costs of Transport:

Evaluation of costs for	Evaluation principle
Infrastructure	Evaluation by the resources approach
Time in traffic jams	<i>For occupational travel:</i> Wage rate and work overhead costs (production-oriented approach) <i>For leisure travel:</i> Evaluation by readiness to pay (subjective approach)
Environment costs	Evaluation by the resources approach Determination of preference by survey
Accident costs	<i>For medical treatment, etc.:</i> Evaluation by the resources approach <i>For loss of health and life :</i> Determination of preferences by survey through evaluation of a risk change (subjective approach)

Table 2 : Suggested evaluation principles for external effects

3.3 Summarising Assessment

3.3.1 Evaluation of the EU Commission's Approaches

The publications of the Commission dealing with the internalisation of external effects of transport – in particular the Green Paper "Towards Fair and Efficient Pricing in Transport" – seem, in parts, like a textbook of economics. Both the criteria for choosing the economic policy measures to be used and the resulting selection of the instruments are suitable to significantly increase the efficiency of the European transport system.

The Commission's emphasis is on the introduction of road charges, which can only be welcomed from the economic point of view. The supplementing of this instrument with internalisation by liability law seems sensible. The proposal to additionally maintain a part of the system of regulations is however not theoretically understandable. This suggestion is however only a marginal aspect. Likewise, the Commission dealt thoroughly with suitable evaluation methods for social marginal costs, which are the basis for calculating the road charges. With the choice of all significant technological external costs being subject to internalisation, without deducing pecuniary external benefits, the policy of the EU represents a stringent economic policy. This attitude has been demanded by economists for decades, but has never been implemented.

The main point of criticism w.r.t. the policy outlined here is the exclusion of private car transport in reference to subsidiarity. This exception creates the potential for lasting competition distortions between modes of transport and threatens to destroy a large part of the efficiency increases achievable through the instruments suggested by the Commission.

3.3.2 State of Implementation

Suspension of the policy process

With regard to the preceding section, it is unfortunate that so few of the concepts in the Green Paper "Fair and Efficient Prices - Political Concepts for the Internalisation of External Costs of Transport in the European Union" and in the White Paper "Fair Payment for Infrastructure Use" were actually converted into practical policy. One gets the impression that the policy of consistent internalisation of external effects – because of the change at the top of the Directorate-General Transport to Loyola de Palacio and because of the resistance in the Council – has come to a halt. Recently, the measures taken by the EU are rather influenced by the approach of average-cost-calculation and of subsidising "positive" transport systems than the concepts of internalising external effects.

The Gothenburg Council

The subject of internalisation regained importance in the Gothenburg European Council in June 2001, which committed the EU to sustainable development in the transport system.

Headline Objectives are:

- Decouple growth in transport significantly from growth in Gross Domestic Product.
- Bring about a shift in transport use from road to rail, water and public passenger transport

This should explicitly be achieved by:

- Getting prices right through market reforms to give signals to individuals and businesses.
- Removing subsidies that encourage wasteful use of natural resources, and putting a price on pollution.
- Encouraging use of more environmentally-friendly modes of transport.

Measures at EU level to be taken are:

- A framework for transport charges to ensure that by 2005 prices for different modes of transport, including air, reflect their costs to society.
- A framework ensuring, through the use of intelligent transport systems, the interoperability of payment systems for road transport; promote further technological progress enabling the introduction of road pricing.
- To give priority to infrastructure investment for public transport and for railways, inland waterways, short sea shipping and intermodal operations.

Internalisation Measures in Practice

The most important legal internalisation measures at the end of 2003 are the Eurovignette Scheme, restricted admission to city centres and road charges

- *Eurovignette*

The oldest and the most widespread measure triggered by the internalisation policy is the Eurovignette Scheme. This imposes charges to road users in function of the emission values of the vehicle type and of time. An owner of a certain means of transport typically pays a yearly fee. This is not compliant with the concept of internalisation according to the social marginal costs. Seven European countries have adopted it.

- *Restricted admission to city centres*
The law based on the EU policy to internalise external effects offers the possibility for city councils to impose charges for the admittance to their centres. Various cities in Europe impose these fees, including London, Rome and Copenhagen.
- *Road charges*
Dir 99/62 gives the possibility of levying road charges (only) on lorries. It grew out of a desire to internalise transport costs, but is only oriented at the costs for the route itself. Some European Countries, e.g. Germany, are transforming this directive into road pricing acts.

3.3.3 Outlook: European Transport Policy for 2010

In September 2001, the Commission published a new White Paper entitled "European transport policy for 2010: time to decide". It makes reference to the White Paper on Fair Pricing of 1998 and to the Gothenburg Council communication, but does not go as far. The new paper provides a very broad framework for the future of transport policy in Europe. It focuses on the users' needs and proposes 60 measures. But internalisation of external effects only plays a minor role in this document. The measures suggested are mainly based on regulatory means and subsidies.

The initiative "A Single European Sky in 2004" considers cost efficiency only within the air transport sector.

3.4 Proposals: A Stronger Consideration of External Effects in Environmental Policy

The internalisation of external effects can make a substantial contribution to efficient environmental policy. It allows for the effective protection of the environment and for increasing the efficiency of the economy at comparatively little expenditure. This not only applies to the transport sector, but also to practically all areas of economic activity.

Looking at present economic policy in Europe, the following measures seem advisable:

- *More restrictive provision of public goods*
It should be examined which public goods should be supplied by the state: Do distributional policy effects really justify the inefficiencies resulting from a free provision? Would the transaction costs really be so high if the users of the good had to pay for (just) its marginal costs themselves? Would the traffic route, the airport, the power station also be needed, if the users had to completely accept its costs and risks for themselves?
- *Significant dismantling of regulatory measures*
Regulations and prohibitions, which at the moment are the most common element used by economic policy, should be cut back drastically and be replaced by instruments more adequate for the market such as price solutions and certificates.
- *More frequent use of charges and price solutions oriented towards marginal social costs*
Especially with activities of many particulars which cause an external effect which is significant in the sum, it seems advisable to charge these along with fiscal charges or taxes oriented towards the marginal social costs.
- *More frequent use of certificates*
At large-scale plants, in particular, attaching the extent of external effects to negotiable certificates is an alternative to price solutions. The success of the US-Clean Air Act of 1990 lets us assume that such a solution could also be sensible in Europe.
- *Expansion of absolute liability*
For nearly all forms of risk externalities (which are not inevitable, but probable) the legal systems in the Member States should easily permit an injured party to receive indemnities for damages from the causer of an external effect. Insurance companies should be given the possibility of differentiating their premiums significantly according to the risk represented by the policyholder.

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