INTRODUCTION

ENVIRONMENTAL ECONOMICS IN THE EUROPEAN UNION

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When referring to environmental economics we often think of a new form of economics making a breakthrough in areas normally reserved to other fields of scientific thought, such as biology, chemistry, or even sociology. However, environmental economics is the simple (or complex) application of some instruments-- proved to be efficient in the economic analysis of various problems affecting humanity-- to a sphere hardly envisaged until recently.

What is most outstanding about economics as a method for analysing reality is its anthropocentric approach, meaning taking human beings, their needs and capacities as a reference point. In this way, a problem will only be analyzed insofar as it constitutes a problem for humans.

This explains why the people's view is the sole and exclusive criterion for determining the optimum situation. Of course, and here is where the difference lies in relationship with exact sciences, there are many people with many different needs that may come into conflict. This explains the need to define mechanisms which allow the allocation of available resources in a generally acceptable manner.

Traditional neoclassic economics uses the market as a reference mechanism, which under very strict theoretical circumstances leads to the efficient allocation of resources. This means that it is not possible to have either an alternative allocation which generates greater production with the resources available, or a better aggregate utility for consumers given the volume of available goods (Debreu, 1953). The generation of the maximum net profit implies that there is a greater potential for allocation in society, independent of its later distribution. In a situation where markets function efficiently, the role of the public sector is restricted to supplying an

adequate legal framework for preserving free competition, and for avoiding disturbances affecting the correct functioning of markets under perfect competition.

This mechanism, as is well known, has been questioned from various perspectives (see Azqueta, 1996, in this publication). Firstly, because "market failures" exist, which means that a "natural" (automatic) tendency towards the optimum allocation does not spontaneously and easily appear in reality. Secondly, because by not taking into account income distribution, social welfare criteria are not included.

In this sense, environmental economics is specifically in charge of analysing market failures. This is because, insofar as the market does not fulfill its theoretical objectives, it will be necessary to analyze the reasons preventing this and to design corrective instruments. Amongst the most outstanding market failures for environmental economics, externalities may be pointed out on the one hand, and public goods on the other, as a particular case of the former.

I. EXTERNALITIES

The problem of externalities-- which can be simply described as the consequence of the activities of certain agents which affect the utility of other agents, without the latter having any decision-making capacity whatsoever or any compensation for possible damages (in the case of negative externalities)-- is particularly relevant when analysing pollution.

The fact that manufacturers using polluting productive processes do not compensate society in general, or agents in particular, for the damage caused by pollution, and consequently do not include this damage into their costs structure, implies that their levels of production following strict criteria for private income are higher than what would be socially desirable. The analysis of welfare economics about the problem of externalities allows us to distinguish between the private optimum (which does not take into account external costs associated with externalities) and the social optimum (which incorporates into costs structures "all" those which are relevant to society). The market does not efficiently allocate its resources not because its own theoretical perspective is wrong, but because there are externalities, which are "market failures". Thus it will be necessary to find

instruments which allow us to correct these failures and reach the social optimum.

These instruments are based on two main theories, Pigou's and Coase's. Pigou worked on the basis that it was necessary to have a regulating agent able to perceive and value the existence of externalities and to force those liable to pay according to external cost (damage). This payment would take the form of a tax, which, unlike existing taxes, does not have the aim of a simple fiscal instrument. It is rather a corrective measure that penalizes the damage caused and solely to the extent of the damage. The payment of this tax will force the producer to reduce production, and consequently, pollution, and will also raise the price of the polluting good, thus reducing its demand (Pigou, 1920).

Furthermore, it has subsequently been proven that Pigouvian taxes incentivate the introduction of less polluting technology (if it exceeds the crucial level). This is because, by lowering levels of pollution, the company will pay a lower tax, and costs after taxes will fall, thus compensating to some extent its investment in clean technology.

The practical application of the Pigouvian tax has turned out to be much more complex than what was foreseen in theory. Nevertheless, the idea of using the tax approach to control pollution still remains a topic of discussion (see San Juan, 1996, in this publication). In fact, at the present time, taxes are markedly the most applied economic instruments from amongst those designed by environmental economics, but are nearly always a complementary tool to other regulating measures (see Martin and Velazquez, 1996; Anton and De Bustos, 1996 in this publication).

Coase, on the other hand, developed his theory on the basis that negotiation between affected parties would lead to the attainment of the social optimum. The role of an environmental agency would be necessary to create a system allowing this, but would not be necessary to directly solve the problem. Coase particularly worked on the problem of property rights, pointing out that for the parties to reach a socially optimum agreement, it would be necessary for each and every good-- including environmental goods such as air, water or land-- to have perfectly allocated property rights. This way, the owners of these rights could exchange them for other rights, e.g. money, thus reaching a bargaining process agreement

satisfactory to all. In other words, if the agents who bear the externality were to own property rights over air, the agents producing the externality could "purchase" these rights from them, and thus pollute to a certain extent; and if the owners of the rights were the agents producing the externality, the agents bearing it would "purchase" these rights and maintain the air unpolluted. Coase proved that in both cases the same level of pollution was reached, which was the socially optimum level (Coase, 1960).

As in the Pigouvian case, the practical application of Coase´s theory has revealed many limitations. Nevertheless, environmental economics has designed instruments which, to some extent, are based on the idea that negotiation between parties can permit the achievement of satisfactory agreements with non-interventionist pollution control policy (see Philp, 1996 in this publication).

Amongst these instruments, Transferable Emission Permits (TEPs) can be noted. These grant their owners the right to issue a certain volume of pollution -- forcing them to control any additional amount-- which may be negotiable. In this case, TEP owners can sell their emission quotas, as long as they receive a price to compensate (or exceed) the costs of putting additional procedures of control into practice, in order to reduce their levels of emission to the volume allowed. Likewise, agents who do not have a sufficient number of TEPs, can purchase more Permits if the price paid for them is lower than the costs of controlling emissions to their adequate level. The TEP market has proved to be a feasible economic instrument in environmental policy, but it is still not very widely used (Pearce and Turner, 1990).

The instruments used to reach certain levels of pollution are currently drawing the attention of economists who are concerned by the outcome of some experiences in pollution control, revealing that the existence of a wish for intervention to improve levels of pollution is not enough. It is well known that a one-rate tax or the regulation by law of environmental quality standards for certain productive systems which generate emissions in water or air, may, in some cases, turn out to be economically inefficient. Furthermore, they do not always generate incentives for technical progress towards less polluting systems in the future.

Concerning the instruments based on property rights, they have generated a zeal, which is sometimes excessive, amongst supporters of liberal (non-interventionist) standpoints for solving environmental problems. However, we must remember that despite the fact that they are an alternative to taxes (and in this sense they are instruments which protect citizens from the tax hunger of the modern State), they are actually another method of intervention. In fact, emission permits are nothing more than quotas which give a right to a certain level of pollution, and it is thus necessary to organize a market which has quantity rationing and freedom for fixing prices. Moreover, experiences so far have revealed that the existence of a regulatory agency, which ensures market transparency and fixes technical standards or globally tolerable levels of pollution, is indispensable.

II. ENVIRONMENTAL PUBLIC GOODS

Public goods are defined as those goods or services with a non-rival consumption-- one agent's consumption of the good does not reduce its availability to anyone else-- and which may not be excluded by pricing, meaning that it is difficult or impossible to deprive an agent of using it or forcing him to pay a price equivalent to the satisfaction he obtains [1].

Public goods, as previously stated, are another of the most common market failures and are particularly important for the study of environmental economics. These goods have a joint offer and their consumption may not be excluded by pricing.

Certain open spaces or landscapes, or the enjoyable contemplation of certain species of animals and vegetation, have the features of public goods, and their management requires the solution of very complex problems. The main one is to know the value consumers give to these goods in relation to others. This information is required to make the right allocation of necessary resources to produce them, or, in this case, to protect them.

In other words, if a value is given to the public good which is higher than the real one, more resources than necessary will be allocated. This will

[1] The extreme, or "polar", case of a "pure" public good has been defined by Paul A. Samuelson as a good which is: 1) non rival in consumption, and 2) has the characteristic of non-excludability, that is, if the good is provided the producer is unable to prevent anyone consuming it.

logically affect the availability of financial resources for production-- or protection-- of other goods. A non-existent price and the lack of incentives-- due to joint supply-- to indicate individual valuation, renders the market useless as an instrument for allocation. This makes it necessary to find alternative means for the environmental agency managing these goods to know the position they in fact occupy on the scale of social preferences, bearing in mind that society does not generally have incentives for a sincere response (Bohm, 1971).

In any case, it must be stressed that valuations made by citizens or certain consumers need not reflect the "total" value. For instance, the leisure use of a certain natural landscape (and its valuation) does not necessarily include the value it may have from a scientific, farming or agricultural point of view (see Azqueta, 1996, in this publication).

III. VALUATION OF NATURAL RESOURCES

The above becomes particularly complex when economics approaches the environment, an undefined collection of very specific resources-- natural resources-- and very abstract goods-- environmental resources-- the characteristics of which prevent a definition of the scope of the valuation made by individuals.

Environmental goods, in the widest sense of the term, incorporate values which the market, insofar as it is studied by traditional economic theory, is not always able to assimilate into pricing or for which there is no market. This explains the need for alternative methods which, without losing the theoretical importance supplied by the market in its purest form, may overcome its many limitationes. The values associated with environmental goods are of three kinds: use value, option value and value of existence. Use value may be direct- purely commercial-- or indirect-- associated with certain services the good provides. Only direct use value is always reflected in exchange value (price). Taking a tree as an example, the value of its cut wood or its collected fruit would be the case (Pearce, 1993).

Indirect use value can be reflected in exchange value, although its incorporation depends on factors which are much more subjective. This makes it questionable from a stricter perspective. In the case of a tree, its indirect use value would be the shade it gives, its aesthetic value, etc.,

which means it is conditioned more by the circumstances of the individual making the valuation, than by the good itself.

Nevertheless, even if we were able to design a very subtle market which can place a value on this type of service, some elements and characteristics valued by individuals would be excluded, especially in the case of environmental goods. The option value is granted to a good for the mere possibility of being the object of a direct or indirect use at some future moment. In other words, it would be a deferred use value: the subject gives it a value insofar as the good offers some utility.

However, this value cannot be assimilated to the market price- it is not reflected because it is not an object for present transaction. Likewise, the immanent value (value of existence), the value given to an environmental good for merely existing (its disappearance is valued as a loss) is totally subjective, and yet cannot be ignored when measuring the total value a certain good has for society.

Neither must we forget that the existence of certain resources, such as animal or vegetation species, have a proven or provable scientific value. In this respect we may affirm that they should be valued as "future options", since they have a future exchange value.

We shall have to, therefore, search for means which allow us to find approximations to the option value and value of existence. If we only use the information supplied by the market, we may be giving certain goods a value lower than their true value, and, consequently, allowing an incorrect allocation of available resources.

On the other hand, the option value and, above all, the value of existence, are so intangible as to make it very difficult for individuals to express them in a common parameter. Even if this were the case, these values may be manipulated- e.g. the value of existence given to a certain species of bird which lives on a remote island we shall never able to visit, and is therefore unknown, may be zero, until a publishing campaign presents it as an emblematic animal which stirs our emotions.

Consequently, environmental economics should be concerned with creating adequate instruments so that this total value, effectively reflected, is not the

result of simple ideological behaviour lacking any foundation. In other words, if an individual says he greatly values whales, environmental economics will have to find the means of proving to what extent this is true and if he/she would be willing to give money to defend them.

IV. METHODS FOR VALUATING CHANGES IN WELFARE

The methods that have been developed to value changes in individual welfare are of two kinds:

Firstly, those which take into account market restrictions for this type of resource and use markets related to them to indirectly estimate their price. Amongst these we have to point out the travel costs method and the hedonic prices approach, which use the behaviour of subjects in markets related to environmental goods, such as the tourism market or the real estate market, to indirectly estimate its demand-- this would exclude the option value and the value of existence.

Secondly, those which "create" the necessary theoretical conditions for subjecting the individual to market restrictions and for forcing him to make a pronouncement on the valuation he gives to environmental goods "as if" these goods were the object of market transaction- of relevance is the method of contingent valuation.

These methods, with a relatively recent formulation- not more than fifteen years- have been applied above all to the valuation of natural spaces, and have proven to be particularly useful as instruments supporting environmental policy decisions, by trying to reflect the value society gives to these spaces as opposed to other alternative services the State supplies its citizens. Of course, they are questionable and controversial methods, but they represent a very important progress in the study of environmental problems (Freeman, 1993).

V. THE IMPORTANCE OF FUTURE GENERATIONS

Lastly, another element that environmental economics has given great attention to is the temporal importance of decisions affecting environmental goods. The fact that future generations may suffer the consequences of

current decisions, forces us to take their opinion into account. Since future generations cannot participate in the current market, it will be necessary to somehow incorporate their interests. The method used by environmental economics for solving this problem is the intertemporal discount rate, of which the definition is not problem-free. The fact of updating the interests of future generations in a "discounted" way, i.e. giving them less importance than the interests of present generations, makes many groups uncomfortable. On the other hand, if future interests were valued in the same way as current ones, it would be necessary to reach the infinite ("all" future generations) and to design these future interests-- a rash exercise, since these do not have to coincide with current interests. It is obvious that intergenerational solidarity must be present in all decisions, especially those concerned with environmental policy which affect the natural heritage of Mankind. But it is also necessary, to the same extent, to carry out intragenerational solidarity, i.e. to grant the present generation the right to define its interests, although these may be an aberration from an environmental point of view, e.g. felling a forest of unique value to sell its wood for food (see Johnson, 1996 in this publication).

Future generations must be particularly taken into account when studying the management of natural resources. When resources are not renewable, it is necessary to manage a total stock in an efficient manner, which means administering it in such a way that all generations-- present and future-- may share its scarcity to the same extent. This has led to the formulation of rules for the price behaviour of these resources-- particularly the Hotelling Rule (Hotelling, 1931)-- the objective of which is to make the extinction of the resource coincide with the moment its price is high enough for its demand to be equal to zero. In other words, the price will slowly increase in such a way as to reflect the progressive increase in the resource and the cost this entails for future generations, and thus the demand will gradually decrease. In this way, the extinction of the resource will not occur suddenly, but will instead be a sufficiently long process as to give rise to the appearance of substituting products with competitive prices. In short, it is a matter of administering what is scarce, throughout time, bearing in mind that this "time" should include all generations.

The efficient management of renewable resources-- animals and plants-- from an economical point of view, is the management of a flow, administered in such a way that it does not run out. In this case, the

environmental problem to be avoided is the extinction of species: contrary to the case of non-renewable resources, this extinction is in fact avoidable. Environmental economics establishes behavioural rules for the management of renewable resources, which allow one to determine the optimum level of exploitation from an economical point of view (Krutilla and Fisher, 1985).

When the interests of future generations are introduced, environmental economics faces ethical problems and, as opposed to the sciences mentioned at the beginning of this introduction, it cannot appeal to the objective coldness of biology or chemistry, nor to the moral criteria which feed sociology. Environmental economics, therefore, has the challenge of applying and developing its analytical instruments to problems which, though not new, may seem to be so. Environmental economics is sometimes accused of being commercial, when in fact it is attempting to place the theoretical instrument known as the market-- and not the social and ideological system, as many may think-- at the service of new interests and concerns. A new form of economics has appeared in contrast to environmental economics, known as "ecological economics", which attempts a much more global approach to environmental problems, studying the systems as a whole of which economic relationships are only part of the general ecological framework. Ecological economics has provided a very important contribution to the study of environmental problems. However, it is still a philosophical approach which is particularly interesting because of its aspirations, but which is also very limited from a practical point of view (Christensen, 1989).

Environmental economics, possibly with a more limited perspective, uses instruments which are already proved and enables a predominantly practical approach to environmental problems. This provides support, both fundamental and as an essential complement, where other regulating instruments may be unsuccessful: to consider human behaviour as a collection of continuous decisions, often contradictory, in which we may take part-- for better or for worse (a value judgment which in principle is not a matter for the economist as such)-- by using the mechanisms the individual is familiar with, i.e. prices or incentives which force or help him to administer a limited budget for covering needs which may be unlimited.

As Pearce and Turner (1990) have already pointed out, environmental economics tends to be more holistic than conventional economics, by attempting a wider view of how economics works. Because it is more holistic there is the temptation to think that environmental economics is somehow "better" than traditional economics, which has led some to regard environmental economics as an "alternative" form of economics, as something which is to some extent in competition with the main body of economics doctrine. This is the wrong approach. Rather than searching for a different economic theory we are trying to widen the horizons of economic thought.

The development of theoretical perspectives, as a consequence of an economic approach to the environment, affects the basic concepts upon which economic theory itself has been built. In particular, there are two fields of economic thought which are undergoing profound changes and which are particularly interesting.

Firstly, accounting normalizations, and, National Accounts in particular, which face the challenge of altering macromagnitudes so that they may reflect, together with exchange values, other contributing values to a country's wealth or decay. Thus, the so-called Natural Accounts have appeared, which, though still in a preliminary phase, are making very valuable contributions with clear political consequences.

Secondly, traditional models of growth and development are also developing at the same rate as new concepts in environmental economics. This has given rise to alternative models such as Sustainable Development (see Redclift, 1996, in this publication), associated with the problem of globality and intergenerational solidarity. These new models are on the dividing line between that which is purely scientific and ethical, making their practical consolidation difficult and encouraging manipulation; but, at the same time, they allow an approach to international reality and to the distribution of powers between countries. This will doubtless be a topic of deeper analysis in the next decades (see Montalvo, 1996, in this publication).

Therefore, a very odd transformation process in economic thought is taking place, arising from the approach to environmental phenomena and gradually extending to a global economic vision of the reality of mankind.

VI. ENVIRONMENTAL ECONOMICS: THE PERSPECTIVE OF APPLIED ECONOMICS

For the editors of this publication, environmental economics means the use of instruments supplied by economic theory for solving environmental problems.

Therefore, what is at issue here is a vision of applied economics aimed at the efficient solution of environmental problems in European economies.

By using the terms "efficient solution" we wish to stress that the common approach of the contributions published is to propose means of achieving a technical objective (usually a standard of environmental quality) and an economic objective (usually the achievement of this "technical" objective by minimizing the resources used and by maximizing social welfare).

An efficient solution is therefore not the achievement of environmental objectives by using more resources than necessary, at our present level of knowledge, nor at the expense of losing private or social welfare benefits which could be saved by using more adequate instruments.

In order to distinguish between different levels of success, in programmes for achieving objectives or specific environmental standards, we shall refer to technical effectiveness-- when the environmental objective is reached-- and to economic effectiveness when available resources are used in the most productive manner to reach these goals.

In some cases there are no alternative techniques, but just a possibility of using economic resources to reach the environmental objective. In this case the economic problem and our role as economists are of little importance. In any case, our role would consist, for example, in proposing alternatives to encourage a process for technological innovation allowing the choice of technology which is economically more efficient.

In other cases, the range of "technical" options is very wide. This usually means that there are possibilities for making a choice amongst various environmental technologies, while affecting production choices (production techniques), the amount of output, and the consumption of inputs per unit of output produced. Furthermore, these alternatives may entail a significant

variation in levels of employment and income amongst the citizens of a region.

In these cases, "various techniques" not only means different engineering solutions but also different forms of management or economic organization. Therefore, alternatives exist for fulfilling the ensemble of objectives proposed. These entail a simultaneous attainment of the best "technical" and "economic" solution, thus maximizing social welfare(see Beers, 1996, in this publication).

VII. ECONOMIC EFFICIENCY AND NATURAL RESOURCES

The efficiency of various instruments for attaining environmental quality objectives should be valued from a two-fold economic point of view:

1) Instrumental technical effectiveness for attaining the environmental quality objective proposed by the environmental agency.

2) Paretian economic efficiency in the action programme, understood as the best possible allocation of resources used for attaining the environmental objective proposed.

Market instruments for controlling pollution levels appear in economic literature as a result of affirming that uniform regulation (legislation)- both for levels and productive technologies- is inefficient as a means of achieving a reduction in pollution until it reaches the target desired. This conclusion was first obtained by Baumol and Oates (1971; 1988) by pointing out that the marginal cost of pollution control, or marginal abatement cost, is always different between various polluting companies.

If the objective the environmental agency wishes to control is defined in terms of a certain pollution level, e.g. water quality, another source of significant inefficiency- due to the different economic value of environmental impacts caused by discharges- also arises: the so-called marginal damage costs.

If the marginal abatement cost and/or marginal damage costs differ according to various sources of emission, then efficiency (defined as the achievement of the objective at minimum resource cost) requires a flexible control. The greater part of controls are defined in terms of low marginal

abatement cost and high marginal damage cost for the sources of emission (polluting companies).

The market instruments operate by fixing a price for pollution, and subsequently letting companies fix their levels of emission according to (in the simplest case) their equivalent marginal damage costs, thereby adapting their method of marginal abatement cost to the price fixed for pollution.

If the price is unique, the result is equal to the marginal abatement costs of all polluters-- this is a necessary condition for efficiency.

If marginal damage costs vary within a tax system following the "polluters pay" principle, like the one proposed in Europe, the tax rate should differ between companies according to their marginal damage costs. In a perfectly differentiated tax system polluting companies minimize costs and will act in such a way that, on balance, the marginal cost of reducing pollution (as opposed to reducing emissions) is equal in all polluting companies. Once again, the result of the model's simplest form is efficiency.

However, from various experiences in developing a tax system for controlling pollution, based on the original model proposed by Baumol and Oates, three kinds of problems arise:

1) Great levels of information on the marginal abatement costs of company pollution are required in order to fix correct differentiated (efficient) tax rates. Furthermore, the "correct" type may vary with time when the aggregate function of the marginal abatement cost changes to current prices. When marginal damage costs change, the EPA should point out how they are distributed amongst companies: a one-rate tax in these circumstances could be very costly in terms of resources used, perhaps even more costly than a single quality standard.

2) A simple tax system, where funds obtained from taxes are not used to finance environmental measures, may minimize social costs, but may be very expensive for companies in terms of distributing the impact amongst themselves. This could lead them to press for the use of fixed quality standards for all, instead of taxes.

3) As long as the environmental agency has no "correct" tax rate and companies minimize their costs, the desired pollution level is not reached.

Tradable discharge permits allow us to overcome these problems under certain conditions (see Hanley, 1993). For example, if they are grandfathered, the transfer of funds to the environmental agency (included in the tax system with no compensation) is then eliminated, and the agency need not know all the functions of marginal abatement cost for polluting companies. In this way, discharge permits become a quantitative restriction with a fixed price in the discharge permits market. Therefore, if companies do not act fraudulently and the agency is right in its calculations, the levels of pollution foreseen are achieved.

However, if marginal damage costs vary, as usually happens in many cases of environmental quality control of water, exchanges of discharge permits are carried out, at the price (exchange rate) of one for one in the total area controlled, leading to violations of programmed quality levels.

In practice, it is complicated to solve this problem with a system of environmental rights. We need to fix working rules for the market of tradable discharge permits which reduce the number of cost-saving transactions and mean that the TDP system does not exactly reach a minimum cost solution. And, lastly, discharge permits markets may face problems of imperfect competition in their agents' behaviour, especially when the number of potential agents is reduced (few companies with TDPs). Although this implies that the cost of attaining the objectives increases, the majority of available studies (Maloney and Yale, 1984) point out that this effect is relatively weak.

In practice, TDP markets are expected to efficiently allocate multi-attribute assets. In other words, the "discharge permit" includes attributes such as water quantity (river flow), reliability and timing, since users demand water for different uses and periods, and therefore have a different willingness-to-pay for the resource (see Howe, 1996, in this publication). But even when we consider one use alone, such as irrigation which in Spain represented 80% of water quantity demand, problems arise as to how to ration the resource amongst irrigators (see Garrido, 1996, in this publication).

VIII. FROM THEORY TO PRACTICE

Most of the papers in this publication are dedicated to this type of problem. In other words, we are presenting a selection of papers which show the progress that has been recently made by environmental economics, in solving the environmental problems of European economies.

The range of environmental problems is very wide. The growth of existing problems has increased in the last few years, together with society's concern for these problems.

The European Union has developed a specific environmental policy, based on the cross-border nature of pollution and the potential danger of processes for global environmental change on a world scale which seem to require supranational solutions.

The fact that environmental policy in the EU was developed before most norms in member countries, and the pressure of green or environmental groups in the European Parliament, have favoured the development of a specifically European environmental policy.

However, one could affirm that environmental measures in Europe are more recent, and in many cases are a legacy of U.S.A. or Scandinavian experiences.

IX. THE ORIGINS OF EUROPEAN ENVIRONMENTAL POLICY

The origin of European environmental policy is the Paris Summit of 1972, where a supranational environmental policy was adopted for the first time with the slogan "pollution has no borders". However, the First Programme for Environmental Measures had great difficulty in obtaining the necessary funds for its fulfilment, since the economic crisis triggered by the rise in oil prices in 1973, led European governments to adopt drastic measures for budgetary cuts.

Once the first reaction to the economic recession was over, environmental policy, until then a mere statement, was reactivated.

In 1977, the Second Programme for Environmental Measures was adopted. At first, the environmental measures proposed had the aim of contributing

to reduce the most acute pollution problems by means of corrective measures.

Consequently, these measures focused on enabling the introduction of corrective techniques at the point source.

To a large extent, the programmes were directed at financing or subsidizing the introduction of end-of-pipe technology.

Since a significant part of these problems was present in large industrial installations and urban concentrations, the programmes were "technically" successful (objectives of air or water quality standards were reached). They were also a political success for the EU, given the great visibility of results.

However, in most cases, there is no approach which allows us to evaluate the economic efficiency of intervention. The technology used is usually presented as the sole alternative, and there is only discussion as to how to cover the necessary expenses of investment and the later upkeep of installations.

The main problem with this approach is that it cannot guarantee that the environmental objective has been covered without using more financial resources than necessary. Therefore, given that the funds are in fact limited, there is no guarantee that more projects could have been undertaken with an efficient use of the same resources.

The idea of the EU as a financial source for solving environmental problems has made European environmental policy both popular and strong.

As environmental policy has become more popular, a great number of environmental problems needed to be solved. Apart from point sources of pollution, diffuse sources appeared, i.e. pollution produced by consumer goods, mobile sources (transportation) or chemical inputs.

In 1983, the Third European Programme for Environmental Measures tried to introduce the concept of pollution prevention at its source. Therefore, a move is made from impulsing palliative technology to non-polluting technology, which in practice is only less polluting.

From an economic point of view, this opens a field for developing environmental economic instruments, which is quite important for economic incentives which try to impulse a change towards pollution-saving techniques.

By using prevention at the source, we can discuss which preventive measures are most efficient from an economic point of view.

Furthermore, this approach leads us to the conclusion that environmental objectives should be taken into account when elaborating other economic policies.

This viewpoint is reflected in the Directive of July 3, 1983, which integrates environmental objectives in all sectors, particularly agriculture, the oil industry, transportation and tourism. Later, in 1992, the Single European Act, which amends the Treaty of Rome, reinforces the obligation to include environmental aspects in supranational European policies. Amongst other important consequences, this has forced all projects financed by European funds to include environmental impact valuations.

The Fourth Environmental Programme of the Community (1987-1992) includes two essential features which imply a change of direction in Community policy on environmental protection: in the first place, the principle that a Community environmental policy should be developed at the heart of other Community policies, and, secondly, the acknowledgement that environmental protection policy may contribute to increasing economic growth and job creation.

Environmental Community Measures (ACE) propose four objectives:

I.-Developing clean technology.

II.-Implanting techniques for recycling and reusing materials.

III.-Locating and restoring areas polluted by residues and dangerous substances.

IV.-Elaborating methods for controlling environmental quality.

The novelties introduced are the civil responsibility of the pollutant and the prevention of pollution at its source.

However, from an economic point of view, the main problem with this technical and scientific approach towards the measures is the non-contemplation of the economic efficiency by the programmes. In fact, the programmes only contemplate economic aspects from the point of view of quantifying the necessary subsidies for introducing corrective measures (e.g. in heavy oils and traditional power stations).

The Fifth Programme for Environmental Action, with the motto "towards sustainable development", reinforces the idea of an equilibrium between natural resources and economic activity.

Along these lines, "sustainable" development or, to be more precise, development sustained by the natural environment, is characterised by:

- Maintaining the quality of life.
- Permitting continuous access to natural resources.
- Preventing more damages to the natural environment.

Amongst the objectives, there is a new emphasis on:

A.-Focusing on the agents and activities which harm the environment and use up natural resources.

B.-Preventing instead of remedying.

C.-Inducing changes in behavioural and consumption habits.

The European Environmental Agency may play an important role in consolidating this process, and it has begun to evaluate the results of the Fifth Environmental Action Programme.

One of the first results clearly revealed in the evaluation of the Fifth Environmental Action Programme is that the lack of statistical data prevents us from carrying out an analysis of the economic efficiency of a large part of the environmental programmes of the EU.

As a result, the report (European Environmental Agency, 1995) tries to determine the possibilities of attaining the "technical" objectives

(environmental quality standards proposed as an objective in the Fifth Environmental Action Programme).

However, it does not even approach a discussion on the economic efficiency of these measures. It is clear that, in order to enable this approach, it is necessary to make a greater effort in the realm of statistics. In particular, it seems essential to try and avoid physical data (which often contain the main economic statistics) being lost in the aggregation process or only being gathered in the first years of the series.

In other cases, statistics require a total methodological revision and a new reelaboration. This seems more difficult to carry out, particularly since Eurostat should oversee that the historical series of the main magnitudes are not damaged.

The problem becomes even more complicated when we take into account that the objectives, laid down for a EU of only twelve members, are currently being applied to fifteen. This entails many problems of aggregation, evaluation and homogenization of methodologies.

As regards the objectives proposed at an aggregated level, we must also point out that environmental problems (excluding problems of climate change and/or global scale) have a very different effect on each country, or even on a certain region within each country. In these cases, it seems very possible that the objective may be reached at a EU global level, but that serious problems will remain at a local level.

In this respect, we could question whether the objective of noise level not exceeding 65dB (stabilizing in 1990 the level existing in 1980) is in fact being achieved, since it is not difficult to find a lot of housing bearing higher noise levels due to air or vehicle traffic. Furthermore, the measures for improving this situation are neither cheap nor easy to carry out.

This would lead us to question if defining problems at such an aggregated level is the most suitable way of solving them. It seems reasonable that problems should be first arranged by order of priority, and that we should analyze the social profitability of taking on the various programmes in order to establish their priority.

Even while recognising that final decisions for facing and financing problems will be political, this should not ignore the need for seriously analysing alternatives in terms of economic efficiency. Without this analysis, environmental policy becomes a series of technical and environmental obligations which hope to gather enough support to cover the necessary expenses of the programme. The U.S.A. experience is that this type of approach often deteriorates into a squandering of resources and a growth in environmental bureaucracy (see Viladrich, 1996, in this publication).

Therefore, it is necessary to state that "command and control" programmes (direct management by an environmental agency) are not the only alternative. Other instruments, such as markets for tradable discharge permits or taxes on added pollution, may have a wide scope of application according to the particular type of environmental problem. This need for awareness of the possibilities offered by other instruments is partly the reason for the publication of this book.

At present, European environmental policy needs to improve its quantitative knowledge of existing problems (by reforming statistics), in order for evaluations to reflect the levels of economic efficiency attained by policies.

Secondly, it is necessary to specify which is the relationship between the wide list of problems- included under the title "environment"- and the resources used for solving them.

The problems European economies frequently face are very similar to this type of complex reality, of which an approximation can only be found in introductory texts to environmental economics: models or policies. Here we are focusing on real problems which, in case studies, intend to show how practical problems can be approached from an environmental economics perspective- learning by doing, while trying to maintain the strictness and clarity of the instruments studied. Only a few selected problems are presented, to avoid falling into a range of problems which is too large, thus avoiding the superficiality which is unfortunately so abundant in the treatment of many of these problems (see Alba, 1996; Petrella,1996; Saez, 1996 about employment and the enviromental; Decimavilla, 1996; Garrido,

1996; Howe, 1996; Naredo, 1996; Sumpsi, 1996 about water Management.)

Some problems are not considered at all, but we prefer to wait until adequate studies exist, of which the economic perspective may be used as a model. Fortunately, texts such as those of Turner ed., 1993, already exist, which present interesting case studies. Furthermore, progress in the environmental application of economic instruments is currently quite rapid.

On the other hand, the evaluation of the Fifth Environmental Action Programme highlights that some environmental objectives are being reached and others may reach the standards laid down for the year 2000. In this respect, we can mention:

A. On a global scale:

1. CO2 emissions (with some reservations, we could reach the objective of 102% of the 1985 volume by the year 2000).

2. Reducing CFC emissions to zero.

B. On a European scale:

1. Objectives related to traffic (NOx emissions and noise level).

2. Conserving the abstraction of marine and underground waters (particularly pesticide pollution), but the objective of reducing nitrate in ground water to zero seems unattainable.

3. Freezing CO2 emissions after the year 2000.

4. Managing urban solid waste, where a large part of public and private investments have been focuses. However, the evaluation of the Fifth Environmental Action Programme points out that the objective of stabilising rubbish from inhabitants at the 1985 level in the year 2000 will not be fulfilled.

6. Improving the discharge of residual waters. Here too important investments are being carried out, which will possibly have an effect in the medium term on the improvement of the quality of continental and coastal waters. However, pollution due to the use of pesticides is

a problem with no probabilities of being solved in the medium term, and is thus a matter of concern.

Amongst the environmental quality objectives, which will not be reached unless new and more efficient programmes are executed, we can point out:

The stagnation in the volume of CO2 emissions after the year 2000.

Pollution problems due to traffic (noise, NOx emissions).

Management of chemical emissions.

Environmental management of coastal areas, and

Solving erosion and deforestation problems.

X. FINAL COMMENTS

The magnitude and width of European environmental problems, as well as the volume of resources already being used to reduce them (estimated at 63 bn ECU in 1992 for the EU12), require a perspective of the programmes' economic efficiency. Environmental economics is developing and perfecting tools for contributing to solve environmental problems, taking into account social welfare and the restrictions of available resources.

We hope the papers included in this publication will assist in providing environmental solutions, without losing sight of essential economic problems, such as employment and the balance of public finances in European countries.

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