

OBJECTIVES AND TYPOLOGY OF ENVIRONMENTAL TAXES IN THE EUROPEAN UNION

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1. Introduction

The numerous evidences of the progressive environmental degradation of the planet have given rise to initiatives from ecologist organizations and international institutions (such as the UN or the OECD), to control the most affected environmental variables. That effort has caught on with the political agendas of the developed societies, involving a strong push to the design and application of new environmental policies.

The objectives of those policies were first limited to the most evident and focalized environmental problems (particularly to those easy to be seen and felt, such as water pollution or the release of gases to the air) and to the consequent use of conventional instruments as emissio-standards. However, the limitations of adopting exclusively this approach were evident as time passed. First, because certain environmental problems came to be known (such as the depletion of the ozone layer or the so-called 'greenhouse effect'), which by far exceeded the scene imagined by the traditional policies of regulation-control-sanction. Secondly because, apart from the lack of

effectiveness of conventional approaches (i.e., the incapacity for reaching certain levels of environmental quality), many economists showed their negative effects on economic efficiency.

The subsequent debate left no shadow of a doubt. Modern environmental policies do not give up the traditional control standards, but they count on the so-called market based instruments and, among them, on environmental taxes inspired by the polluter pays principle (PPP). This is the starting point of our exposition. Environmental taxation is effective to control many of the current environmental problems and it does it in an efficient way, i.e., at the lowest possible cost. From here on, our interests will focus on the definition of these instruments and their best possible use.

Therefore, we start with an epigraph devoted to put forward the main aspects of environmental tax design (linkage with the environmental problem, evaluation methods of the damage caused, tax rate, etc.), and to explain the practical operation and feasibility of these instruments. The third epigraph deals with the diverse effects caused by the applications of environmental taxes. We verify here that these instruments have a different incidence in terms of competition, prices and revenue distribution, and that all these questions must be taken into account to avoid errors when using them.

We have also tried to draw conclusions from the compared experiences in the context of the developed countries. The epigraph 4 is concerned with the description of the reality in the use of environmental taxation, including a general typology and its revenue importance. Besides, it emphasizes the operation of practical figures (such as the Swedish tax on sulfur emission or the EC ecotax proposal), which can be useful to potential users.

The conclusions of our work gather the projection of the previous materials in political terms, with an interest that, in our opinion, exceeds what is usual in this kind of exercises. That is because the revision of the experiences allows us to prove that environmental taxes are playing an important role in one of the proposals of tax reform: the recent 'green tax reform'. The main innovation of this reformist model is the idea that environmental taxes can be used both to protect the environment and to offset the cuts carried out in direct taxes (basically in income taxes and social

security contributions), guaranteeing revenues and taking on the role of altering the tax system.

This was the scheme that inspired the tax reforms carried out in the Scandinavia during the first half of the 90's, and which underlies in the recommendations of the European Commission's (1993) white paper on growth and employment. However, these proposals begin to be discussed in the rest of Europe as well. In the same way, Spain is involved in this reformist tide. In any case, such a fiscal transformation requires a previous planning of the changes tax by tax, evaluating their applicability, measuring their effects, and adapting their operation to the tradition, culture and tax system of the country.

2. Environmental taxes: definition and design

2.1. The environmental tax

We can define environmental tax as a compulsory payment that must be carried out by those polluters releasing polluting substances, and which is operated through a tax rate related to the environmental damage. It must be noticed that the definition avoids any reference to the use of the receipts; that is because a tax cannot be labeled as environmental just because of the fact that its revenues will be used to improve the environment. Accepting this would lead us to consider any tax as potentially environmental. That is why we pay attention only to the environmental characteristics of the taxes from the point of view of the revenue, independently from their subsequent use.

Another step in the terminology: a 'pure' environmental tax would measure directly the releasing of pollutants to the environment, i.e., a tax on emissions. However, in practice, many more tax figures collaborate as well in the prevention of the environmental deterioration without that direct measurement. This is the case, for instance, of taxes levied at production or use of goods that have harmful effects on the environment. As we will see afterwards, these 'impure' environmental taxes have important advantages of applicability, collecting efficacy, and a reduced administrative cost, although their environmental rationality may be smaller.

2.2. Basic elements of the tax design

2.2.1. Linkage with the environmental problem

The first key point in the design of environmental taxes is the existence of a strong linkage between the selected tax and the environmental problem to control. The evaluation method chosen determines the degree of connection between them, with two possibilities:

- a) *'Direct methods'* which determine the tax base through direct calculation procedures of pollutant discharges. Normally, the direct methods facilitate a precise knowledge of the environmental damage generated and allow defining the right incentives. However, that will not always happen, particularly when the discharges are measured at the end of the process. In this situation, it is preferable to study whether the applied technology could produce environmental improvements without being postponed until the end of the process. If this is the case, either the tax modifies its measuring system, or its environmental efficiency will be reduced.
- b) *'Indirect methods'*. Sometimes, the direct measurement may be difficult because of technological reasons, lack of an appropriate measuring point, or because of the large number of sources to be monitored. In those cases, environmental taxes can resort to indirect or objective methods that determine the tax base using physical or economic indicators considered representative of the environmental damage generated. For example, the liquid discharges of a house could be determined through water consumption, which in its turn can be determined by the number of members of the family. In the same way, the volume of discharges of a company could be estimated from its consumption or from other variables such as the number of workers or its sales.

Depending on how these two questions are solved, the connection between the polluting event and the fiscally observed one would be more or less close. Some practical examples would let us understand how this matter could affect the operation of environmental taxes.

Liquid-waste tax. Let us suppose, firstly, that we are trying to draw a tax to reduce the volume of liquid wastes applying the PPP. Being either the families or the companies responsible, a correct adjustment would require that the matter to be taxed should be the sewage itself. So that, there should be applied a direct estimating method, i.e., some procedure that would allow to carry out the measurement in the connection with the drains or in equipped terminals. If this procedure did not exist or its applicability were doubtful, the alternative could be a taxable matter such as water consumption as an indicator of polluting capacity of liquid waste (the more clean water enters, the more used water should come out). It is obvious that, especially in the case of companies, the linkage achieved with the second design would not be perfect, as there might be companies with an intensive consumption of water with a reduced level of wastes and vice versa, and that would limit the capacity of altering the behaviour of polluters.

In case that water measuring were not feasible either, the design of this tax would permit a third option, which could be based on an pure objective method, by calculating the potential wastes through an estimated consumption. The operation of a tax of this kind would be based on two hypotheses: the connection between clean water entering/dirty water refused and the relation between real consumption and estimated consumption. It is obvious that the linkage established in this option is defective and it would reduce the environmental rationality of the tax.

Urban solid-waste tax. In the same way as in the previous example, we can imagine linkages with different degrees of precision. One solution could consist on a measurement in the way out, for example weighting the wastes when collected. If this solution were not feasible individually, another option would be a collection conditioned to the use of a particular kind of trash bags, setting the tax on their purchase. Thus, the more solid-wastes the more trash bags are needed, and more taxes. As a third solution taxes can be linked with the weights in rubbish dumps or incinerators, so that the more volume the more tax payment to be distributed among citizens. In the last case, the individualized incentives are diluted for the change of behaviour in the refuse production, so this linkage would be rather ineffective.

Tax on the emissions of sulfur dioxide (SO₂). The first problem is the amplitude of the facts potentially subjected to tax, including the production of electricity, transportation, etc. Therefore, a first strategy could lay in limiting the field of incidence, taxing

only the most pollutant sectors. From here on, different solutions can be applied, from a pure tax on emissions to an objective design. An intermediate option would be to use the quantitative and qualitative data on the consumption of fossil fuel in order to make an estimation of the emissions produced.

The examples we have dealt with allow us to understand how a series of hypothesis more or less precise give way to environmental taxes more or less effective. These transfers are not extraneous to any tax system, but they warn of the measures that must be taken not to reduce environmental taxes to simplistic arguments and collecting efficacy.

2.2.2. Environmental taxes on emissions and on products

As soon as we decide the matter to be taxed, the base estimation method, and the linkage with the environmental problem, we have to determine the structure of the environmental tax. According to those characteristics, we can classify the environmental taxes as follows:

- a) *Taxes on emissions*, which use direct methods to estimate the tax base, with a good relation between the fiscally observed and the negative environmental behavior. Most times, those figures have a slim relation with the tax system, as they are the result of an 'ex novo' design apart from the traditional indirect taxation and even from the tax administration. They are usually set, decided, and managed by agencies of environmental protection and not by the fiscal authorities.
- b) *Taxes on products*, which use indirect or objective methods to estimate the tax base, differing depending on whether they subject inputs of productive processes or outputs for final consumption. The environmental taxes on inputs subject goods with a harmful effect on the environment. Their design can be based on the input itself or on any of its characteristics; for example, a tax on fossil fuels in the first case, or a tax on the amount of carbon of each fuel in the second case. On the contrary, taxes on outputs are levied on the final consumption that causes negative environmental consequences. They are usually specific taxes, although they can also be defined through differentiated tax rates in the VAT.

The advantages of the environmental taxes on products are associated with reduced application costs because they calculate the tax bases using accessible information for the public sector, they use preexistent administrative-liquidating procedures, and they are simpler and cheaper than the environmental taxes on emissions¹. On the other hand, their valuation will essentially depend on their environmental efficacy and rationality, i.e., on the correlation they can establish between the use of the products and the environmental problem we are dealing with. If there were not a close link, the taxes on products would fail, with the extra risk of introducing distortions in the behaviour of agents.

2.2.3. Tax Rates

The rate of an environmental tax can be defined considering the environmental standards (that is, minimizing the costs of each level of environmental quality), or depending on the amount of pollutants emitted by the taxpayer.

Uniform tax rate for all the polluters. In uniform environmental taxes, in which the location of the polluter is not important², economic efficiency calls for the use of a single taxation. Single taxation guarantees an appropriate distribution of the responsibility to abate among the polluting agents, and it facilitates the application and management of environmental taxes.

Variable tax rate for polluters depending on their location. Following efficiency reasons, an exception to the use of single environmental taxes would occur in non-uniform environmental problems where the polluters cause different damages depending on their geographical location³. In this context, the polluters that cause the most negative environmental damages must bear more larger tax rates, and vice versa. The problem is that the application of these individualized taxes involves high administrative and calculation costs, so the expected profits in terms of efficiency can be greatly reduced.

¹ The application costs of the taxes on emissions depend basically on how complex is the measurement in the sources, on the number and dispersion of the existing emission sources, and on the possibility of integrating the measurement in the usual economic and regulatory activities.

² This is the case of CO₂ releases to the atmosphere, whose damage is independent from its geographic source.

³ An example of this kind of problems is that of the acid rain, in which the geographic location is essential in order to determine the environmental damages, as they will depend on the dispersion conditions of the pollution.

Variable tax rate according to the emission levels. Now other criteria determine the definition of the environmental taxation. Normally, it is used in to favour the social acceptance of the tax, as it burdens more, in absolute and relative terms, that who causes more environmental damage, and it can protect key economic sectors. Obviously, this method implies an inappropriate distribution of responsibilities of polluting control among the different agents, so it is inefficient both from an optimum perspective and from a second best approach. In this case, the rate can be defined as:

- a) *Increasing tax rate according to the level of emission*, which pretends to charge more to those polluting more and to stress the incentives to reduce gradually the environmental deterioration.
- b) *Decreasing tax rate according to the level of emission*, which normally reflects secondary environmental objectives in relation with others of an economic kind that can be related with questions of international competitiveness, defense against unemployment, and protection of a particular sector or region.

2.2.4. Allocation of the environmental revenues

The receipts obtained by environmental taxes can have or not a predetermined destination within the public budget. Therefore, we can make a distinction between:

- a) *Earmarked environmental taxes*, in which the revenue has a prearranged application to a particular environmental objective, such as purification of urban liquid waste. The allocation clarifies the relation revenue-expenditure, emphasizing the environmental nature of the tax and probably achieving a higher social approval⁴. However, the main problem is the risk of over-investment or under-investment derived from the assumption of specific objectives, especially when the revenues are not known and stable, and when it predominates a financial purpose that can work to the detriment of the environmental effectiveness of the tax.

⁴ Not only the affected by pollution may favor these kind of solutions; also the polluters themselves normally agree because they can partially or totally substitute their own expenditure related to environmental questions.

- b) *Non-earmarked environmental taxes*, in which the advantages and difficulties operate in the opposite sense, with a certain proviso. Now, the environmental receipt could be used with the objective of a fiscal reform, replacing in fact distorting taxes by environmental ones. In any case, that strategy could make taking objectives to have priority over environmental objectives.

2.2.5. Applicability of environmental taxes

It seems to be obvious that the level of practical feasibility of environmental taxation has a close connection with the design aspects we have already dealt with. Nevertheless, environmental taxation makes its applicability conditional on other factors of an administrative and institutional nature, which are very important to the success of any fiscal change.

Administrative integration in the tax system. The first thing to consider is the integration possibilities of the environmental taxes in the tax system in force. The bigger is the use of the current fiscal techniques and mechanisms, the smaller are the problems derived to their calculation, clearance, and management procedures. From this point of view, it is better to work with simple taxes, which use indirect methods of estimation and which have a fixed tax structure and are geographically uniform.

High collecting capacity. This principle is in a way in opposition to those of environmental effectiveness and economic efficiency (externality internalization), especially when the introduction of an environmental tax depends on its revenue amount and on its temporal stability. The search for environmental taxes with a marked collecting profile may facilitate the definition of more intense control policies, but it works deliberately against the design of efficient taxes from an environmental and economic point of view.

Social acceptance. A relevant factor in the success of environmental taxes is the response of the socio-institutional sphere which it must affect. On the one hand, claimants and addressees of the environmental policy can adopt strategic attitudes against its introduction: the governments using environmental taxes to its own advantage through political marketing; the

ecologists claiming more intensity in the applied instruments; and the tax payers exerting an influence as an interest group. In any case, the environmental taxes will probably have more social acceptance in the moment they contribute to remedy the degradation of the environment without generating an increase in the tax burden. Sometimes these two phenomena are clearly connected; for instance, when the collection of a tax are used to finance environmental actions that should have been undertaken by the charged agent.

Feasible jurisdictional assignment. As a rule, the jurisdictional assignment of environmental taxes should correspond to the spatial effects of the environmental deterioration. That conclusion infers from the results of the theory of fiscal federalism, which states that the public goods (in this case, the environmental quality) must be assigned preferably by jurisdictional units able to exhaust their effects. However, in many cases it is not possible to apply this prescription because of institutional restrictions (lack of a global jurisdiction for global environmental problems, impossibility to decentralize on a large scale for its high management costs, etc.). In this context, the best solution is to assign the specific environmental taxes to the closest jurisdictional level among the existing ones.

Compatibility with the tendencies in tax reform. Finally, another institutional constraint that must be taken into account refers to the connection of the environmental taxes with the tax system in force.

Most of the arguments we have dealt with reveal the existence of a certain incompatibility between the enviroeconomic efficiency criteria and those of practical viability. The solution to this trade-off will have to be determined by policy makers, making explicit the nature of the used taxes: essentially environmental when the environmental efficiency prevails, and essentially financial and pragmatic when feasibility guides the tax.

3. Evaluation of the effects from environmental taxation

3.1. Microeconomic effects

We are referring here, essentially, to the behavioural changes derived from the use of corrective instruments via prices in environmental policies.

The rationality of environmental taxes requires the polluters to react to the modification in the relative prices they are facing, producing an increase of the economic efficiency due to a market failure correction (negative externality).

The modifications in the behaviour have to do, basically, with the legal incidence or impact of the tax and with the shifting process of the tax burden. When that shifting is not possible it is likely that, with an accurate design, the tax works in an effective way, modifying environmentally harmful habits in consumption, stimulating operative changes in the production, or motivating to choose new technologies. That will also occur if the shifting does exist but it was anticipated and provided by the regulator. All the effects listed above can affect both companies and consumers, as it occurs in the modification of certain intermediate or final consumption, in the operation of polluting processes (e.g. uses of machinery or transportation vehicles) and in the adoption of technologies environmentally more favourable (e.g. use of more efficient devices from an energy point of view).

When the tax aims at reducing the consumption of a certain pollutant, the size of behavioural change will depend on the shifting of the tax to prices. Obviously, the magnitude of this flexibility is connected with the presence of substitute goods and with the considered temporal extent. For example, a tax charging the emissions in the electric sector would bring about an increase of the electricity price, would lead to a lower consumption of electricity as there exists substitutes as natural gas, and the reaction will be higher in the long term through technological change.

Therefore, in this case, the effects on the agents behaviour would be appropriate when the tax increases the price of a pollutant good with high price elasticity. In order to do that, the tax must be applied as close as possible to the product whose price is going to be increased, and its action must be specific (to stimulate substitutability) and prolonged.

When the tax aims at stimulating the development and introduction of clean technologies, its success will depend on the possibilities of development and availability of these technologies, on the tax design, and on the shifting possibilities of the tax burden. In any case, the increasing cost of the products due to the environmental taxation (forward shifting) can

also lead the producers to search for new clean technologies, or to adopt them, in order to avoid the loss of market share, especially in the medium and long terms. Finally, although the development of clean technologies must be achieved in the corporate sector, the technological shift can be fiscally induced both on companies and on final consumers.

3.2. Macroeconomic effects

From a macroeconomic perspective, environmental taxes can generate effects on basic economic variables. Firstly, increase in the price level is likely. Such a price modification can be explained by the necessary corrective nature of environmental taxes, although the consideration of the social costs derived from the economic activity can bring about tensions and inflationary spirals in the short term. In a situation in which price control is a basic objective from economic policy, it is recommended to introduce environmental taxes gradually, and to avoid any abusive shift to prices.

Environmental taxation can also affect economic growth and, in fact, the analysis of these effects is a preferential subject for economists and regulators. In this sense, it has been especially analyzed the changes induced on competitiveness and employment, which are potentially important questions on traditional economic sectors with poor environmental indicators.

The processes of cost internalization will probably bring about an output reduction of certain economic sectors because of the competitiveness loss with regard to other activities or foreign products. The latter can be particularly pernicious as it causes an economic cost without environmental benefits⁵. It is obvious that this fact will bring about negative effects in the level of employment and investments, although the increasing importance paid to environmental questions provides the emergent economic activities with new opportunities, which may partially or totally balance the previous losses.

⁵ We call 'emission leakage' the re-assignment of pollutant activities between countries, which is stimulated by different existing environmental regulations.

In general, the macroeconomic considerations have limited the scope of environmental taxation. Particularly, for fear of losses of economic growth, competitiveness, and employment, policymakers have acted cautiously: firstly, promoting the use of environmental taxes to improve the economic growth and employment, in the sense indicated by the of double dividend from environmental taxes⁶ ; secondly, minimizing the economic risks of the environmental taxation through generous exemptions and compensations to those sectors which have intensive pollutant emissions, by addressing taxation to modify the habits of final consumers with environmental influence.

3.3. Distributive aspects

Despite the little attention paid to this matter so far, there are many reasons that make us to worry about the effects of environmental taxes on income distribution. Firstly, the nature of some of the goods susceptible to be charged by environmental taxes, make the distributive aspects play an important role in the definition of policies. For instance, it is normal that these taxes increase the prices of necessary goods (water, electricity, etc.) originating, in this way, negative effects from a distributive point of view. In the same way, the very introduction of environmental taxes in the tax system can generate distributive risks. In fact, it is usual for environmental taxation to be introduced neutrally, replacing progressive direct taxes by indirect taxes.

Therefore, measures to remove or to minimize the regressive effects of the environmental taxation are needed. Those measures can make the application of environmental taxes more feasible; furthermore, they allow to keep the objectives of social justice that public policies defend.

The reduction of the negative distributive effects of environmental taxes can be put into effect through different alternatives. The measures can operate on the internal structure of environmental taxes, selecting those in which there is a certain connection between the tax payment and the economic ability of the taxpayer. There can be also established individual,

⁶ They state that, besides a first dividend or environmental benefit, the application of those instruments brings about excess dividends (fiscal, in terms of growth, job creation, etc.) because of the replacement of the distorting taxes by environmental taxes.

direct compensations to the interested party, by means of direct income transfers or by means of a reduction in other taxes. Finally, the compensations can be direct on generic, for example charging the pollutant activity and granting clean alternatives.

3.4. Evaluation of incidence

Firstly, we have to distinguish between the evaluation of the effects of the environmental taxation from an 'ex-ante' perspective and an 'ex-post' one. Obviously, it is preferable the second option because we know the reported results. However, the need of these evaluations usually appears in the moment of discussion and design of environmental taxes, so the 'ex-ante' approaches are needed.

The main objective of these economic evaluation exercises should be to contrast, in practice, the theoretical advantages of environmental taxes. In order to do that, we have to estimate the achieved environmental profits (in terms of reduction of emissions and their subsequent valuation), the environmental revenues, and its distribution among the agents.

There are many methodological alternatives to calculate the 'ex-ante' incidence of environmental taxation, being part of the regular instruments in Economics. Here we make an abridged account of the most commonly used methods in this field, particularly of the input-output and general equilibrium models, and of estimations with microeconomic data.

- a) *Input-output models.* From the input-output tables, with detailed information of the intersectorial dependencies that exist in an economy, it is possible to extract the effects originated by the introduction of an environmental tax applied in a productive phase or a particular economic sector. The input-output models are especially suitable for estimating price modifications and environmental effects (new emissions) caused by environmental taxes.

The great advantage of the input-output methods is their sectorial disaggregation, although they require using fitted technological coefficients. This is a strong assumption, especially when we analyze the effects of

instruments that intend to influence on the technological structure of the economy which, in practice, limits its applicability to the calculation of impact effects in the short term.

- b) *General equilibrium models.* These models permit to overcome most of the previous problems. Their objective is to analyze effects determined exogenously over the equilibria of the different markets that make up the economy, reporting on the main economic variables. Once we have the balanced values of the structural parameters of the model, it is possible to calculate the new equilibrium under tax policies of environmental control.

Within this approach we can distinguish between applied general equilibrium models, which usually use data from social accounting tables (input-output data and on final consumers), and dynamic general equilibrium models. The first permit a high disaggregation but they do not give an account of the transitional costs to the equilibrium; however, the dynamic specifications make the disaggregation complex but they give an account of the transition process.

- c) *Estimations with microeconomic data.* The calculation of the effects of environmental taxes is relatively limited by the lack of reliable and continuous information. However, the surveys on familiar expenses existing in many countries allow estimating the response of the final consumers to the changes in the relative prices induced by environmental taxes. These estimations can refer to the consumption of a single good (with the calculation of the respective price elasticities), or can inform on the cross-relations between the prices (complete demand system). The second alternative is, obviously, more complex but it guarantees results more consonant with reality.

There are multiple advantages in the estimation with microeconomic data. It models the behaviour of the agents, so the motivating effects of the tax can be explicitly analyzed. Moreover, welfare measures can be delivered and the distributive effects of the tax can be analyzed. As limitations, we can mention the partiality of the analysis, which is only valid for a short period of time and for one group of agents, and the impossibility of calculating some effects from environmental taxes

4. Environmental taxes in practice

4.1. Environmental taxes in the OECD

From the beginnings of the 80s, environmental taxes have not stopped to spread within the developed countries. The list of figures is larger and larger.

Thus, the tax on CO₂ emissions, which is normally instrumented in the consumption of fossil fuels, is an essential issue in the discussions on environmental policies in most OECD countries from the beginnings of the 1990's.

Charts 1 and 2 provide an account of the diversity of these experiences by summarizing part of the contents of the OECD Revenue Statistics (OECD 1994,1995). Chart 1 enumerates some specific environmental taxes that have been used by OECD countries to illustrate the great possibilities permitted by this intervention mechanism, without exhausting, of course, the alternatives that could be used. Chart 2 gives an account of the utilization of the most important environmental figures, leaving aside taxes with a more general profile and with a less precise environmental profile (for instance, taxes that charge electricity consumption or transportation vehicles).

Chart 1
SOME SPECIFIC ENVIRONMENTAL TAXES IN THE OECD

Lubricant oils	Finland, The Netherlands
Batteries	Belgium, Canada, Denmark, Portugal, Sweden
Plastic bags	Iceland, Italy
Non-returnable empties	Belgium, Canada, Denmark, Finland, Norway
Fertilizers	Austria, Finland, Sweden
Halons and CFC's	Australia, Denmark, USA
Raw or unrefined material	Denmark
Tires	Austria, Canada, Portugal
Non-recycled paper	Belgium, France
Pesticides	Belgium

Chart 2
EXPERIENCES OF ENVIRONMENTAL TAXES APPLIED IN THE OECD
COUNTRIES

	SO ₂ , NO _x	CO ₂	Noise (planes)	Liquid releases	Solid wastes	Differentiation of petrol
GERMANY			●	●	●	●
AUSTRIA					●	●
BELGIUM			●	●	●	●
CANADA				●	●	●
DENMARK	●	●		●	●	●
USA			●		●	
SPAIN				●		
FINLAND	●	●		●	●	●
FRANCE	●		●	●	●	●
THE NETHERLANDS	●	●	●	●	●	●
IRELAND				●	●	●
ICELAND					●	●
ITALY				●	●	
JAPAN	●		●			
NORWAY	●	●	●			●
NEW ZEALAND						●
PORTUGAL			●	●	●	●
SWEDEN	●	●			●	●
SWITZERLAND		●	●			●
UNITED KINGDOM			●		●	●

The first five groups of chart 2 refer to taxes on emissions, which were calculated directly or indirectly. In the first two columns, there figure the taxes on sulphur, nitrogen, and carbon oxides (SO₂, NO_x e CO₂), precursors of acid rain and climate change, respectively. The third column deals with taxes on the noise caused by airplanes in areas close to airports; in the fourth column, water pollution; and in the fifth column on the disposal of refuse in rubbish dumps and incinerators. The last column refers to the tax

differentiation of petrol, to benefit a cleaner alternative (unleaded petrol), subjecting it to a lower tax rate.

What it seems to be unquestionable at the sight of that information is that environmental taxes are not something new in our institutional environment, and that they allow any country to choose among a large number of instruments to be applied in environmental policy, apart from the additional resources that they provide. Chart 3 summarizes the evolution of environmental revenues in relation with the whole of the fiscal revenues in the OECD countries. As we can see, the relative importance of the environmental taxation has largely increased in the last years, both in average and in most countries.

Chart 3
EVOLUTION OF ENVIRONMENTAL TAXATION IN THE OCDE¹

	1990	1996	Difference
GERMANY	5,44	6,08	0,64
AUSTRIA	4,00	5,19	1,19
BELGIUM	3,83	5,10	1,27
CANADA	7,17	9,01	1,84
DENMARK	2,27	2,43	0,16
USA	4,79	6,75	1,96
SPAIN	4,91	4,91	0,00
FINLAND	7,46	10,78	3,32
FRANCE	6,26	8,88	2,62
THE NETHERLANDS	10,54	9,54	-1,00
IRELAND	7,63	6,07	-1,56
ICELAND	5,13	6,12	0,99
ITALY	0,73	2,32	1,59
JAPAN	9,51	10,47	0,96
NORWAY	4,74	3,95	-0,79
NEW ZEALAND	10,74	11,35	0,61
PORTUGAL	7,00	7,90	0,90
SWEDEN	5,77	6,15	0,38
SWITZERLAND	4,64	5,00	0,46
UNITED KINGDOM	1,32	1,61	0,29
Mean OCDE	5,69	6,49	0,80

Notes:

1 All digits indicate percentage over the total revenues of the country.

Source: Gago and Labandeira (1999)

4.2. Some representative taxes

In order to analyze the practical operation of environmental taxes we have chosen some experiences which are illustrative, among the large possibilities available. The selection was determined, basically, by the high of feasibility of these figures, apart from the fact that they cover the most significant applications.

4.2.1. Taxation against acidification: Sweden

Since January 1991, Sweden has a product tax levied on certain fossil fuels with sulphur content and that are used to generate energy. The existence of a stable relation between the fuel characteristics and actual emissions, together with the existence of a refund mechanism to those agents that reduced the emissions using clean technologies, allow us to define this figure as a tax on emissions with indirect estimation. This tax aims at the reduction of sulphur oxide emissions, decided by the Swedish government, at the lowest possible cost.

The Swedish tax on SO₂ emissions pursues the reduction of acid rain phenomena that cause important ecological damages to forests, lakes and vegetation, as well as harmful effects on buildings and other human edifications. The difficulties to obtain information on environmental costs lead to determine the rate from the desulphurizing costs of the fuel at issue, and from the market price of fuels with less sulphur contents. As the tax was put into force as a part of a reform package for the Swedish tax system, its receipts are not earmarked.

This tax seems to be deeply influenced by the markets. The average content of sulphur in fuels has decreased and the efficiency of emission reduction mechanisms has improved. Therefore, the tax revenue has fallen significantly below the government's predictions on revenues. Finally, the tax administration is very simple because it uses the same systems as those of the environmental regulation in force.

4.2.2. Tax on water emissions: The Netherlands

The taxes and duties used in The Netherlands to control the quality of the waters are in operation since 1969. The environmental management is divided between the central government (sea and river waters, and principal canals), and the so-called Water Local Councils; even though all these institutions use similar economic instruments. The difference lies on the fact that the revenue collected with these instruments by the Councils must bear the expenses of the water sanitation, so it acts as a duty. The state agency must also assign its revenue to certain uses as grants for investments in the pollutant companies, and payments for the victims of pollution.

Polluters must pay taxes in accordance to the number of equivalents of pollution emitted. The pollutants included in the system are those that impose an extraordinary demand of oxygen in the waters, although heavy metal emissions are also considered. The system sets fixed fees to families and small companies. Medium-sized firms can ask for a direct measurement, or they can pay according to an indirect estimation. Finally, companies with great emissions pay from actual measurements of quantity and emission concentration.

In comparison with other European countries, the Dutch taxation in this field is relatively high and it doubled between 1980 and 1992. In fact, it is presumed that the improvement in the levels of environmental quality was caused by this. As a sub-product, considerable revenues of these taxes seems to have provided with excessive processing plants.

4.2.3. Taxation on solid wastes: Denmark

The Danish tax on solid wastes was put into effect in 1987, undertaking modifications in the definition of the gross tax base and a rise in the tax rates by the beginnings of the 1990'. It aimed to reduce the volum of the generated wastes, to promote recycling and the use of products with a longer life. The gross tax base is determined by the weight of the wastes carried to rubbish dumps and incinerators, although what is recovered from these facilities is deduced from the tax base. Taxation is different depending on the reception by dumps or incinerators, and the revenue is not affected.

The incentive effects achieved with the tax are remarkable, as it brought about a significative fall in the amount of refuse carried to the rubbish dumps and incinerators, and a rise in recycling. As negative results, we can emphasize the increase of illegal dumps.

4.2.4. Tax on CO₂: the European Union proposals

The most ambitious project for the installment of an European environmental tax was first proposed in 1992 by the European Commission. The tax would charge energy and carbon dioxide emissions, and it was designed to control the European emissions of CO₂ in order to achieve the objectives established in the Rio summit that year. The proposal provided that the tax would be a combination, in the same proportions for the reference framework [a crude oil barrel of standard quality (SCB)], of a tax on the carbon contents of fossil fuels and of a tax on all the non-renewable energy resources. In this way, fuels as coal would be subjected to two taxes, while nuclear energy would be subjected only to the energy component.

The Commission sought to introduce this tax in 1993, reaching a rate equivalent to ten USS per SCB in the year 2000, revenue to be received directly by the governments of the member States. The proposal also considered the suitability of using the fiscal revenues to reduce other taxes, instead of increasing public expenditure, with the possibility of exempting a number of sectors energetyc intensive in order to protect the international competitiveness of the Union. In any case, the disagreement of some memberly with the rise of the Union's fiscal power or with its potential negative effects on the economic growth blocked, until now, the introduction of this tax.

5. Conclusions: the green tax reform

Taking into account all the facts we have dealt with, we can state that environmental taxes are instruments with a future in modern tax policies. However, it is necessary to insert the environmental taxes in a model of the tax reform. In fact, environmental taxes are part of a new proposal of fiscal

change, called 'green tax reform', which proposes a general incorporation of them to the tax system, adopting the referential role of compensating the cuts carried out on direct taxation and on social security contributions.

In fact, the previous examples of environmental taxes are part of ambitious programs for a complete tax reform. Particularly, a number of countries of the North of Europe [Sweden (1990), Norway (1992), Denmark (1994), The Netherlands (1995) and Finland (1997)] have put into effect green tax reforms during the last decade. Those ambitious proposals open, without doubt, a path of great interest for all the European countries.

In short, there are many and different common elements in these experiences. Firstly, they insist on reduction of the direct taxes through fall in marginal income taxes. Secondly, they share a tendency to soften the taxation on labour with diverse proposals to lower the social security contributions. Finally, the loss in the revenues motivated by the cuts in direct taxation is recovered with environmental taxes through a number of procedures. Firstly, with the adaptation of the traditional energy taxes to the environmental argument and the increase of their amount. Also with the incorporation of new 'pure' environmental taxes, with more or less specificity. Finally, with the correction of the preferential treatments of traditional direct taxation to avoid behaviours that are environmentally harmful.

Thus, there is a triple goal after this reformist scheme. First, an economic-fiscal objective, which intends to reduce the efficiency losses caused by the high marginal taxes and by the lack of neutrality. Second, a strictly environmental objective with to the use of new environmental figures. Finally, a labour objective to help job generation through a reduction of its taxation.

To sum up, this is the way we can define the so-called green tax reform model. Chart 4 anticipates how this model could be expressed in phases and contents. We can distinguish a first phase in which the proposals of reducing direct taxation are complemented by an adaptation of indirect taxes in environmental terms. In a second phase, there is a progressive incorporation of new taxes with environmental purposes. The third phase defines the compensating systems that must solve the distributive, competitiveness, and activity delocalization problems caused in the reformist process.

In conclusion, we are dealing with new taxes that assume, as a priority, the objective of modifying harmful environmental behaviours. Nevertheless, as we have seen, these are not specific and apparent figures, but powerful instruments of public intervention. Moreover, they can be part of a new proposal of tax reform (the green tax reform), marking a new path, which is very close to the tax schemes currently in force in the developed countries.

Chart 4
THE GREEN TAX REFORM MODEL

General outline

Assignment of an strategic role to environmental taxation. Apart from the environmental objectives (environmental dividend), it takes the fiscal objective of altering the 'tax mix' as a substitution of direct taxation, in a model of stable revenue devoted to reduce the tax distortions (fiscal-economic dividend). .

Phases and contents

I. Revision and clean up of the tax system in force, incorporating environmental taxes:

- With proposals to substitute the highest marginal rates in the personal income tax and/or social security contributions for environmental taxes able to maintain the revenues.
- Readapting the indirect tax burden, especially energy taxes, to the new environmental arguments (tax burden according to the level of pollutant emissions)
- Removing traditional, negative fiscal solutions in environmental terms (basically reinvestment exemptions, accelerated depreciations, and allowances for acquisition of devices that do not take into account the environmental effects of the applied technology)

II. Progressive introduction of new 'pure' environmental taxes in the area of direct taxation (taxes on pesticides, fertilizers, oils, non-returnable empties, etc.)

III. Simultaneous establishment of compensation systems for taxpayer groups and the most damaged industrial sectors, using fiscal instruments (exemptions) and programs with grants or fiscal incentives for investments in clean technologies, regeneration.

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