



**THE IMPLEMENTATION OF ENVIRONMENTAL
TAX REFORM IN PORTUGAL: HOW DOES IT
COMPARE WITH OTHER EUROPEAN
EXPERIENCES?**

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Biographical Note

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Abstract

This dissertation sought to compare the recently enacted environmental tax reform in Portugal with the reforms in other European countries. The purpose of this is to help inform the critical analysis of the recently implemented reform in Portugal.

The first section of this dissertation is comprised of a literature review of the main contributions to the subject of environmental fiscal reform. Revenue-recycling and the double-dividend will be particularly stressed as they are central concepts in this field of study.

The reform in Portugal was compared with that of other European countries in terms of its scope, of the novelty of the instruments explored in making pollution more burdensome and of the revenue-recycling mechanisms that were put in place.

It is concluded that the reform in Portugal is quite different, at this stage, from other international experiences as it has not detailed any additional exemptions to the taxation measures, as it is premised almost only on new instruments and in that it seems to reject the possibility of lowering social security contributions as a method of revenue-recycling.

Key-words: Environmental tax reform, Double-dividend, Revenue-recycling

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1. Introduction

The subject of the dissertation is the comparison between the implementation of environmental tax reform in Portugal and the one that occurred in other European countries.

The dissertation will draw on an analysis of the countries in Europe, which have already embarked upon environmental fiscal reform and are seen to be at a more advanced stage in the process. The latter began in the early 1990s and was spearheaded by Nordic countries. Several other countries have since sought to carry out their own pieces of environmental tax reform.

An independent commission was tasked, by the Portuguese government, with a presentation of a proposal for an environmental tax reform in Portugal. As a member of the European Union and the United Nations Framework Convention on Climate Change (UNFCCC) and as a signatory of the Kyoto Protocol, Portugal met the target for emissions reductions for 2012, but a substantial reduction in carbon dioxide emissions is necessary for it to meet the more stringent goals for 2030 and 2050.

Within academic accounts on environmental taxation, it is often said that environmental fiscal reform, as an ongoing process, is in need of further discussion and clarification. Specifically, it was observed that while there is a considerable amount of investigation on the conditions in which this kind of tax reform can be implemented in several countries, there is a void in the literature with regards to prospects for the reform in Portugal and other south European countries. This is also a consequence of absence of attempts at environmental tax reform in the same region.

Firstly, a literature review of the main issues and concepts of environmental fiscal reform is carried out. Particular emphasis is given to the concepts of revenue-recycling and that of the double-dividend. Potential consequences of the reform are considered.

Secondly, European experiences in environmental tax reform are analysed in terms of their scope, in terms of whether they relied on old or on new instruments to carry out the reform and in terms of the revenue-recycling mechanisms that were put in place.

Thirdly, prospects for the reform in Portugal are briefly discussed and the recently approved law, which implements environmental tax reform, is analysed also in terms of scope, the novelty of the instruments used and the revenue-recycling mechanisms that were put in place.

2. Literature Review

2.1 Environmental Tax (Reform)

A first conceptual clarification that should be made is that of what is considered an environmental tax. The latter has been defined as a “tax based on polluting emissions... or on disamenities expressed by some appropriate method of measurement... or on other parameters such as inputs” (Määttä, 2006: p.15). Nevertheless, it has also been suggested that taxes only merit the title of environmental taxes when they are treated as such in legislative pieces (Määttä, 2006). This notion, however, is threatened by the fact that some taxes, in spite of being dubbed environmental, have non-environmental objectives, or, similarly, are unrelated to the environment when they are first introduced but end up taking into account a given environmental consideration (Määttä, 2006). The OECD (Organisation for Economic Co-operation and Development) defines an environmental tax as a “tax whose base is a physical unit (or a proxy of it) that has a proven specific negative impact on the environment” (OECD, 2005). For the purpose of this dissertation, only the taxes that are introduced in the context of an environmental tax reform will be analysed.

In the classical Pigouvian framework, environmental taxes were conceived of as an instrument designed to internalize externalities, which means that whoever uses a polluting good or carried out a polluting process should face the social costs that it brings about (Jackson, 2010). The subjection of the externalities to the process of allocative decisions seeks to achieve a more efficient use of environmental resources and, subsequently, to improve welfare (Jackson, 2010). In other words, the Pigouvian approach can be taken to mean that some form of state intervention is necessary to rectify market failures (Määttä, 2006). One of the principal arguments in favour of environmental taxes is that, according to some accounts, unlike other taxes, it is not a distortionary tax and it seeks, in fact, to correct distortions, namely the externalities that are caused by the excessive use of environmental services (Pearce, 1991, Klok et al., 2006).

One of the difficulties of environmental taxes, indeed of environmental economics as a whole, is the quantification of the values of environmental goods that are at stake so that it is possible to have a clearer idea of the benefits and costs of acting

on the matter (Klok et al., 2006). It is difficult to estimate the future impact of greenhouse gas emissions and to ascertain where this impact will occur; it is hard to know the extent to which the emissions released by one particular product will have an impact in surrounding areas (Albrecht, 2006). Taxes aimed at correcting a given allocative distortion require knowledge about the ‘optimal’ level of abatement and this, in turn, warrants an unreasonable amount of knowledge about the costs and benefits that result from such an abatement (Jackson, 2010). Some of these questions cannot be answered within a foreseeable time frame and those that can will still warrant decades of research and so it is probably, preferable to implement environmental taxes at a modest level to begin with and adapt it across time rather than wait many years until it is possible to ascertain its optimal level (Albrecht, 2006). It has been suggested that environmental taxes can take the shape of consumption taxes, as opposed to direct pollution taxes, and that their rates can be based on their environmental impact; the latter, in turn, could be determined through life-cycle analyses (Albrecht, 2006). These are evidently limited to what is known about the eco-toxicity of substances during production and consumption (Albrecht, 2006). As such, an evaluation of the products in the economy could take a long amount of time and a simpler distinction between the sustainability of different products could be made (Albrecht, 2006). Moreover, as a way of trying to mitigate the potentially adverse impact such a scheme would have on private demand, some of the goods and services, perceived to be environment-friendly, could be attributed lower rates (Albrecht, 2006).

Additionally, it is important to clarify the distinction between output and input taxes (Withana et al., 2014). Fuel taxes, for instance, on electricity generation is an example of an input tax, whereas a tax that was levied on electricity itself would be considered an output tax (Withana et al., 2014). Another conceptual distinction, which should be made in the field of environmental taxation, is between explicit and implicit environmental taxes. An explicit tax is one that puts a price on carbon, for example, or on the carbon dioxide content of products (Withana et al., 2013a). An energy tax, on the other hand, is based on the volume or energy content of fuels and is susceptible of being converted into an implicit tax (Withana et al., 2013a).

The carbon tax has been the central element of environmental tax reforms carried out internationally and so the issue deserves particular attention. One of the

great motivations for the introduction of a carbon tax is the mitigation of climate change alongside the increasing concern with the security and quality of the natural environment (Bovenberg, 1999). Carbon dioxide emissions should, indeed, be considered externalities, since they cause damage to the environment, which, in turn, causes reduced output and reduced profits, among other losses to utility (IILS, 2011).

Carbon dioxide emissions have, however, certain singularities which mean that they are an externality that is particularly difficult to internalize: there has been pollution and polluters in both the past and the present – even though most damage is expected to take place in the future –, the parties which are most likely to suffer from the damage are mainly unborn future generations, the nature and scale of future damage is very hard to ascertain and, finally, it is a problem of a global nature whose causers and sufferers are spread across the globe, thus making the problem even harder to solve politically (IILS, 2011). Some of the latter problems also raise questions of justice which fit outside the scope of this dissertation, but which are inescapable when confronting the issue of global climate change.

Carbon taxation is a form of pricing carbon emissions (Chiroleu-Assouline and Fodha, 2014) Given that climate change is caused by constantly rising greenhouse gas emissions, the carbon tax should also keep rising, in order to attain long-term stabilization and reduction (Ekins and Barker, 2001). According to Ekins and Barker (2001), the nature of the carbon tax means it fulfils the criteria of economically efficient taxation: it tackles an economic problem by seeking to align the private costs of carbon dioxide emissions with the social costs of climate change, its revenues can be expected to grow with income as energy demand tends to grow with the latter, it should be easy to administer given the existing tax structures in place and the potentially regressive side effects can be corrected by compensatory mechanisms. Alongside carbon emissions trading, it constitutes a market-based instrument aimed at fighting climate change.

A distinct advantage of carbon taxation, over a command-and-control approach, is that it may allow for various kinds of gains in the economy as they allow for a flexible response on the part of economic agents, given that they are stimulated to carry out emissions reduction in the most efficient manner, but also to usher in new technology that may present an alternative to existing equipment (Jackson, 2010). Past

research pertaining to the case of the UK suggests that where productive inefficiencies are endemic and entrenched, they can be better addressed through policy packages that include environmental taxation (Jackson, 2010). On the other hand, the prospect of developing energy-efficient technologies is a rather long-term one and can be inaccessible to small or developing economies (Pereira and Pereira, 2010).

The main difference between the policies of emissions-trading and carbon tax concerns the quantity-price adjustment question; the tax means that the price of carbon is fixed and the quantity of carbon emitted in the form of carbon dioxide adjusts (Ekins and Barker, 2001; Harrison, 2012). Conversely, in a framework of emissions trading the quantity of carbon emitted in the form of carbon dioxide is fixed and the price of the emissions adjusts subsequently (Ekins and Barker, 2001; Harrison, 2012). One of the reasons why, politically, the emissions trading solutions has been preferred to environmental taxes is that the distribution of emission permits may be done according to who pollutes the most – this is known as “grandfathering” – and this decision may be made by policy-makers in the hope of obtaining political advantages (Harrison, 2012). Moreover, in comparison to environmental taxes, the costs created in emissions trading solution are indirect and mostly invisible to the consumers, whereas the former entail a very evident transfer to the state (Harrison, 2012). There are, however, several reasons as to why environmental taxes should be preferred. Firstly, a carbon tax can be applied almost immediately (Harrison, 2012). Secondly, it does not require a period of several years to carry out an initial allocation of permits; it is possible for the business community to adapt to it because of a stable price signal (Harrison, 2012). Thirdly, it is moderately simple to apply a tax that captures all fossil fuel purchases in contrast to the need to verify the compliance of individual polluters (Harrison, 2012). Fourthly, its transparency means that it is simpler to implement measures that correct its regressive nature (Harrison, 2012). Moreover, for a long time, taxes have been considered the best mechanism by which prices can match the marginal social costs (Goulder, 1995).

It should be noted, however, that the ability of environmental taxes to correct distortions by making users factor in the social costs of environmental disturbances in their decision-making process is inversely correlated with their ability to raise revenue for the state coffers – this process is known as tax erosion (Jackson, 2010).

One of the central concepts of this dissertation is the notion of environmental tax reform. This should be understood as the process by which the tax burden on either resource consumption or pollution or energy, or on all of these is increased while the burden on either labour or capital or personal income is decreased in a policy combination that is supposed to be revenue-neutral (Bosquet, 2000; Asquith and Speck, 2011; Ekins et al., 2011; Anderson et al., 2013; Withana et al., 2013a; Withana et al., 2014:). The latter term is one of the key aspects of the policy. It is taken to mean that the amount by which environmental taxes are raised must be the same by which taxes are lowered on any other aspect of the economy. In other words, as a result of environmental tax reform, there should be no change to the overall level of taxation on the economy (Bosquet, 2000; Withana et al., 2013a; Withana et al., 2014).

While the issue of environmental taxation has been widely discussed and dates back to classical welfare economic theories, the other half of the issue that is contained in environmental tax reform, that of recycling, is a much more recent one (Ekins et al., 2011). The advent of environmental tax reform occurred in virtue of the rise to prominence of schools of thought in the domain of environmental economics, which sought to reconcile policies that fomented economic growth with others that privileged environmental welfare (Beuermann and Santarius, 2006; Klok et al., 2006). It arose at a point in time in which environmental policy started to be thought of less as an instrument to simply make polluters pay and more of as a manner of making polluting activities shoulder the burden while providing incentives for economic agents to reduce the level of environmentally harmful consumption or effluents (Klok et al., 2006).

More recently, the reforms have shed new interest in the academic and the policy-making community, as the recent economic crises that have erupted in developed countries have meant that many countries now have to face ills such as unemployment while remaining committed to a set of international obligations to cut back in emissions in greenhouse gases, on one hand, and, on the other hand, to meet stringent budget consolidation objectives (Jones, 2011; CBO, 2013; Withana et al., 2013a). Jones mentions (2011) that reform to the European Union's energy policies pursued in the direction of meeting its climate change objectives could yield up to 410,000 jobs and stimulate GDP growth by about 0.25%. As far as revenue-raising is concerned, taxes on energy can be particularly attractive policy candidates as energy products have

generally shown a low elasticity of demand, suggesting that price variation flowing from tax changes has limited impacts on demand and, subsequently, on the stability of revenue entering state coffers (Gago et al., 2013).

2.2 Revenue-recycling and different versions of the double-dividend

One of the suggested means of revenue-recycling is the reduction in personal income tax (Bosquet, 2000; Ekins and Barker, 2001; Clinch et al., 2006). As a result of such an approach, the environmental tax would raise the prices of the affected items and this effect would be mitigated by a reduction in income tax, which would raise the disposable income of employees. Provided that non-employees, such as the unemployed and pensioners, pay higher prices as the employed would benefit from a tax rebate, the substitution would raise the value of the real wage and this could be expected, other things being equal, to increase the labour supply (Ekins and Barker, 2001). Similarly, if government benefits for the unemployed are not subject to labour tax and not indexed to the average rise of prices in the economy, these agents will then not benefit from potential cuts to labour taxes and higher pollution taxes on consumption will depress the real value of their benefits (Bovenberg, 1999). This may further increase the labour supply.

Moreover, a second effect that may be predicted is that both consumers and producers would tend to shift away from the sectors affected by the tax in favour of, probably, labour-intensive sectors (Ekins and Barker, 2001). As such, insofar as there is an inverse correlation between labour-intensity and environment-intensity, this may be expected to satisfy the increase in labour supply explained above and there is, therefore, an expectation that a reduction in personal income tax may yield a double-dividend comprised of both greater employment and a benefit to the environment (Ekins and Barker, 2001).

It has been suggested, on the other hand, that a reduction of progressive income taxes may result in a double-regressive impact as opposed to a mitigation of the distributional imbalances of the environmental taxes (Määttä, 2006). An alternative candidate for revenue-recycling may, therefore, be the reduction of proportional income taxes although this may mean that vulnerable sectors of society, such as students and

pensioners, who tend not to pay income tax, will not benefit from the policy (Määttä, 2006).

Another approach to revenue-recycling is to opt for the reduction in social security contributions. As this reduces the marginal cost of labour, it may increase the labour demand (Ekins and Barker, 2001). It may also allow firms to cut prices, thus compensating for the higher prices that arise out of environmental taxes (Ekins and Barker, 2001).

It has also been postulated that increased employment can more readily be seen, as a result of environmental tax reform, if a country meets a set of conditions, such as a flexible labour market and flexible wage legislation, which makes it possible for a wage-price inflation spiral to be tamed (Bosquet, 2000). Accordingly, the best way to carry out such a reform would be to privilege the reduction of social security contributions levied on employers. With respect to the question of whether a similarly positive effect could be obtained through reductions in the rates of VAT (value-added tax) or personal income tax (PIT), it has been argued that, in most situations, VAT is passed on to the final consumer and so it is not as beneficial when it comes to job creation (Bosquet, 2000). Similarly, PIT falls on individual incomes and so this is not taken to be a particularly effective strategy to create jobs (Bosquet, 2000). Alternatively, it has been suggested that a reduction in social security contributions that is financed by a carbon tax does indeed lead to gains in employment in the short-term, but, given the active role of unions, these are likely to increase net wages and, subsequently, in the long-run, the tax change is likely to be absorbed and employment is likely to return to its baseline value (Carraro et al., 1996).

Examples from international experiences suggest that if businesses are not informed on the matter, there is a smaller chance that gains in employment may be seen (Clinch et al., 2006; Dresner et al., 2006; Hruška and Dvořáková, 2013).

There are, nevertheless, several channels through which the raising of environmental taxes may be favourable for employment. The raising of environmental taxes may exert a positive pressure on employment as labour demand might increase, given that, within the process of wage determination, workers are forced to moderate wages as a result of a weaker bargaining power, as they have a less attractive option outside of employment (Bovenberg, 1999). Moreover, informal activities, it should be

recalled, are not subject to labour tax, which means that the unemployed are not bearing its burden, but their incomes may bear the burden of pollution levies (Bovenberg, 1999). If an environmental tax reform replaces a tax that is borne only by those in employment for one that is also borne by those in unemployment, the bargaining power of workers is further weakened as it makes their outside options less attractive, inducing them to moderate wages (Bovenberg, 1999). This can also prove a useful tool in providing a disincentive for informal markets, as will be seen later.

Nevertheless, as will be seen, it has been argued that, as a result of policies that seek to alleviate the impact of an environmental tax reform on certain industries, rebates should be given to businesses and certain sectors of the economy, namely the least well-off (Clinch et al., 2006; Klok et al., 2006; Withana et al., 2013a). One could argue that, in such cases, one of the defining aspects of the reform – revenue-neutrality – is, therefore, broken.

This type of policies can throw the efficacy of the reform into question. The losses flowing from exemptions have often been substantial even when the targeted sectors are small (Böhringer and Rutherford, 1997). An additional problem associated with the introduction of exemptions is that their subsequent removal may be very damaging for the profits of industries (Clinch et al., 2006). It has been argued, however, that measures such as the increase of the amount of energy consumption per household, based on income and family size, for example, could contribute to ameliorating the regressive nature of the reform (IILS, 2011).

Another alternative means of revenue-recycling is the spending of the raised revenues on environmental projects as the case studies from different countries in Europe illustrates. It has been maintained that, given the greater visibility of such enterprises, they can be an important instrument in making the reform more socially and politically acceptable (Clinch et al., 2006). The importance of such projects is not confined to their iconic value, however, as these initiatives may themselves address the source of the environmental externality (Jackson, 2010). Having said this, such a consideration must be balanced against the efficiency of such public investments (Jackson, 2010). Given that the economy may find itself in non-ideal conditions, there is a strong chance that the funding for environmental projects is below an optimal state

and, therefore, allocating extra resources for projects may not be a waste of resources (Clinch et al., 2006).

A central question surrounding that of the implementation of environmental fiscal reform is whether it is possible for them to achieve a double-dividend (Bosquet, 2000; Clinch et al., 2006; Beuermann and Santarius, 2006; Skjelvik et al., 2011; Withana et al., 2013; Withana et al., 2014;). The latter can be understood as the simultaneous achievement of environmental gains and gains for economic growth. Economic gains, however, can take the form of growth in the Gross Domestic Product (GDP) of a given territory or of a rise in the employment level of the economy (Clinch et al., 2006). Whether it is fairly uncontroversial that environmental taxes are adequate instruments at attaining the first dividend, that of an improvement in the environment – in spite of discussions about how great these gains are likely to be –, the decisive debate seems to rest on what sort of second dividend can be achieved.

One may obtain a double-dividend of different degrees. It has been postulated that the only double-dividend that one can obtain is one in which cost savings are obtained by virtue of lower distortionary taxes relative to a situation in which taxes are returned in a lump-sum manner (Goulder, 1995; Baranzini et al., 2000; Jackson, 2010; Goulder, 2013). In this context, costs should be understood as a measure of the changes in individual welfare resulting from policy changes, discounting the effects of a change in environmental quality (Goulder, 1995). This has been dubbed the weak double-dividend (Goulder, 1995). The acceptance of a weak form of the double-dividend may still commit policy-makers to introducing an environmental tax reform, for environmental taxes would be more efficient instruments than other policy options that do not render the state any revenues; this is because the revenues can be used to cut distortionary taxes. Furthermore, if the double-dividend hypothesis is verified, even in its weak form, an environmental tax reform would be preferable, from an efficiency standpoint, to other policy instruments such as grandfathered pollution permits or regulation as these are non-revenue-raising mechanisms in which the rents that flow from the reductions of emissions are directed as a lump-sum benefit to the polluters and not to the government (Bovenberg, 1999).

Goulder (1995) also speaks of an intermediate form of double-dividend, in which it is possible to identify a distortionary tax whose revenue-neutral substitution in favour of a carbon tax would involve a zero or negative gross cost.

The strong form of the double-dividend principle is the hypothesis that there are indeed no costs to the process of introducing environmental taxes when accompanied by cuts in distortionary taxes (Goulder, 1995; Bovenberg, 1999). Another way to express this is to hypothesize that the gross efficiency costs of replacing a distortionary tax for an environmental tax are negative (Bovenberg, 1999). This is different from the weak version of the double-dividend; the weak one compares two distinct modes of recycling revenues, whereas the strong version simply compares the equilibrium after a policy change with the status quo (Bovenberg, 1999).

There is, however, some confusion with respect to the meaning of the double-dividend. Goulder (1995) qualifies the strength of the double-dividend in accordance to its ability to achieve economic goals without introducing distortions to the taxation system in the economy. This has been dubbed “the public finance approach” to the double-dividend (Giménez and Rodríguez, 2006). Alternative accounts focus instead on the ability of the environmental tax reform to simultaneously accomplish the two goals of reducing greenhouse-gas emissions and obtaining economic gains (Giménez and Rodríguez, 2006).

The type of double-dividend one believes in or forecasts for a given territory is likely to influence the method of revenue-recycling one advocates. The advantage of accepting the strong version of the double-dividend, in the terms laid out by Goulder (1995), is that it enables decision-makers to assert that, in the absence of environmental benefits, there is still no distortion to the tax system that should discourage the introduction of a new tax. The hope is that, as the deadweight loss or the excess burden of so-called distortionary taxes increases with their tax rates, cutting them is a way of reducing their distortionary effect (Goulder, 2013). As such, these forms of revenue-recycling may fully make up for the cost to the economy of the introduction of new taxes without even having to account for environmental gains (Goulder, 2013). Even if one were to doubt the environmental benefits of the new tax, therefore, it could still well be a desirable course of action.

One of the main arguments in favour of an environmental tax reform is that a reduction of the distortionary taxation level on the wanted activity of employment and an increase of the taxation level on pollution would exert a positive pressure on employment and encourage employers to prefer labour to the detriment of capital and other inputs (Bovenberg and van der Ploeg, 1994). Simultaneously, it is also expected that a lower level of taxation on labour would lead to higher after-tax wages and thus provide a greater incentive to increase the labour supply (Bovenberg and van der Ploeg, 1994). Given that unemployment has been a pervasive problem in European countries, this prospect is especially appealing.

Nevertheless, it has been contended that it is erroneous to think that environmental taxes are not taxes on labour as people use their wages to pay for goods, such as gasoline, which originate the environmental disturbances. (Sterner and Coria, 2012; Goulder, 2013). Moreover, it should be recalled that such implicit taxes on labour, in the real world, are likely to be coupled with pre-existing taxes, such as income, payroll and indirect consumption taxes, thus further reducing the labour supply and exacerbating the efficiency loss; this is known as the tax-interaction effect (Goulder, 2013). Indeed, Gago et al. (2013) maintain that the current dominant view is that, on account of this tax-interaction effect, one should not expect the fulfilment of a strong double-dividend and that revenues should be fully recycled in an attempt to obtain a weak double-dividend.

Furthermore, in the presence of a large wage elasticity of labour supply, employment and output may fall rather drastically as a result of greener preferences, in the event that a cleaner environment brings a lower level of economic activity (Bovenberg and van der Ploeg, 1994). This is due to the fact that a higher environmental tax that is associated with greener preferences is shifted towards labour and, with an elastic labour supply, a resulting lower wage rate in the economy would exert a strong downward pressure on the labour supply (Bovenberg and van der Ploeg, 1994).

The potential harms to employment also have the consequence of narrowing the tax base of pollution taxes and, therefore, it is suggested that the lowering of distortionary taxes and increase in pollution taxes would indeed yield positive gross distortionary costs, thus failing the strong hypothesis of the double-dividend

(Bovenberg and de Mooij, 1994; Bovenberg, 1999). Furthermore, the erosion of the tax base of the labour tax caused by environmental taxes means that it amplifies pre-existing tax distortions, such that the greater these pre-existing distortions are, the greater the gross distortionary costs originated by the pollution taxes (Bovenberg, 1999). In fact, from a revenue-raising point of view and from the point of view of what has least negative impact on after-tax wages, this does seem to suggest that an environmental tax is less favourable than a labour tax (Bovenberg, 1999). It has been contended, therefore, that an environmental tax reform replaces explicit labour taxes by higher implicit labour taxes in the form of environmental taxes (Bovenberg, 1999).

It has been concluded that there is a trade-off between beneficial environmental effects and employment, in which the more successful the policy is from an environmental standpoint, the less probable it is that an expansion of employment will be seen (Bovenberg, 1999). Subsequently, if pollution taxes are successful in their aims to change behaviour, less revenue is generated and the margin for reducing distortionary taxes is also reduced (Bovenberg, 1999). The tax on environmentally pernicious commodities has also been said to have the effect of distorting the commodities market, which means distorting the choice between alternative commodities (Bovenberg and de Mooij, 1994). The combination of these two effects – the distortion of the labour and of the commodity markets –, could mean a reduction of the non-environmental component of welfare (Bovenberg and de Mooij, 1994). In fact, the combination of the two effects could diminish the revenues yielded by the environmental tax and so limit the extent to which a reduction in the labour tax could be financed (Goulder, 1995). Given the existence of various labour taxes in the economy, it has been contended that the tax-interaction effect is likely to prevail over the reduction of distortionary costs that result from the reduction of the labour tax (Goulder, 1995).

This should not detract from the fact that there are contrary accounts that present simulations, which forecast gains in employment as a result of the lowering of labour costs (Bossier and Bréchet, 1995). A study by Bossier and Bréchet (1995) suggests that this is very much possible in the presence of a wage moderation scheme.

It has been argued that in order for a double-dividend to be achieved, the economy has to find itself in a non-optimal state to begin with (Ekins and Barker, 2001; Jackson, 2010). Deficiencies in the tax base, in distribution or market failures in labour

and other markets must exist, to some extent, so that the double-dividend may come into effect (Ekins and Barker, 2001). Indeed, it has been maintained that in order for a double-dividend to be seen, it is necessary that the existing tax system is inefficient with regards to its non-environmental component and that revenue-recycling reduces this inefficiency (Baranzini et al., 2000; Goulder, 2013). In other words, if the initial tax structure is not optimal as far as its non-environmental component goes, then an environmental tax reform may be capable of reducing distortionary costs. It is, therefore, essential that the environmental tax reform drives the fiscal system to a point that is closer to its non-environmental optimal point, for this would mean that the welfare gains flowing from a more efficient tax system – in its non-environmental component – could finance improvements in the quality and security of the environment (Bovenberg, 1999).

Not only, however, must it reduce the existing inefficiency, it must also reduce its immediate distortionary effect as well as the aforementioned tax-interaction effect (Goulder, 2013). One of the possible existing inefficiencies in the economy is that of informal labour markets. A simulation concluded that environmental taxes cause an increase, via taxation, of the production factors and, subsequently, an increase in the general price level of the economy (Markandya et al., 2013). In other words, the system moves from in which only the formal sector pays such contributions to one where both sectors contribute (Markandya et al., 2013). If revenues are then recycled in a manner in which only the real wages of those in the formal sector are increased, inefficiency will have been reduced (Goulder, 2013).

An inefficiently low taxation of resource rents is another circumstance that, according to Goulder (2013), is conducive to the realisation of the double-dividend. Provided that a significant portion of a newly introduced carbon tax falls on resource rents and its revenues are used to finance cuts in labour taxes, the burden of taxation is shifted from labour to resource rents (Goulder, 2013). As these resources are inelastically supplied – they generate rents –, this change in the burden of taxation contributes to an improvement in the efficiency of the tax system (Goulder, 2013).

Alongside the already mentioned pre-requisites for the fulfilment of a double-dividend, it is most likely that this goal will be attained when the tax burden stemming from environmental taxation is exerted on tax bases which have low efficiency costs

and when the environmental tax base is broad to the extent that the burden will be sufficiently spread so that low rates may be applied (Jackson, 2010). It is also important that the base of the environmental tax is broad so that the distortions generated in the commodity markets may be small (Goulder, 1995). A joint discussion by the European Commission and the International Institute for Labour Studies (IILS) (2011) holds that the focus of environmental taxes has, in general, been too confined to households' energy consumption and that it should also include production. This could be one way of ensuring a broad tax base.

In spite of the fact that pessimistic approaches in relation to the hypothesis of a strong double-dividend predominate within academic circles, there does seem to be, within the policy-making community, an alternative conviction that if a reform is well-designed and balanced, it may indeed achieve a double-dividend, comprised of reduced carbon dioxide emissions and reduced unemployment (IILS, 2011). It has been argued, additionally, that a reduction of labour costs throughout the entire economy would be disproportionately favourable to the low-carbon sectors as these are the ones that would benefit from the greatest increase in employment (IILS, 2011). The IILS has also presented a study (2011), which evidences that the use of carbon tax revenue to decrease taxes on labour has the effect of increasing employment in all sectors. Targeted initiatives aimed at improving the equity of the reform could also play an important role in terms of employment through the implementation of specific measures, such as the cutting of taxes on labour on low-income earners (IILS, 2011).

Moreover, the gains of the first dividend – an improvement in the environment – may have the desirable consequence of increasing output and employment on a global scale by their own volition (IILS, 2011). The thought is that, through the improvement of the environment, it may be possible to make workers healthier and more productive to the extent that these gains in the labour market may supersede the costs to the tax system (Goulder, 2013). It is not clear, nonetheless, which part of the globe would benefit from such gains and at what point in time (IILS, 2011).

It has also been maintained that expectations about the double-dividend have in general been exaggerated. (Klok et al., 2006; Gago et al., 2013). Subsequently, it may be maintained that any environmental project whose benefits can reasonably be shown to outweigh costs should be pursued (Klok et al., 2006). Indeed, the fact that the double-

dividend may not be verified is not an all-powerful consideration against the principle of environmental tax reform as the environmental gains can be shown to outweigh the non-environmental costs (Goulder, 2013).

Furthermore, there is discussion as to whether environmental tax reforms are able to satisfy other macroeconomic objectives, such as possible improvements in the income distribution of a country or reductions in public debt (Jones, 2011; Pereira and Pereira, 2014b; Sahlén and Stage, 2012; Withana et al., 2013). These subsidiary goals have been referred to as a triple and fourth-dividend and are the subject of disputed empirical analyses.

The connection between energy prices and budgetary consolidation has been increasingly studied, as of lately, and it has been postulated that rising fuel prices lead to contracting tax bases, thus reducing revenues and worsening public debt levels (Pereira and Pereira, 2013). On the other hand, provided the endogeneity of public sector decisions are assumed, one can reasonably predict that the contraction of the tax base would incite the public sector to optimally curtail public expenditure (Pereira and Pereira, 2013). In a similar vein, it has been projected that if fuel prices are believed to exert a negative pressure on public finances, a less favourable environment for public investment-based climate policies might be created; the opportunity costs of public funds are greater (Pereira and Pereira, 2013; Pereira and Pereira, 2014a; Pereira and Pereira, 2014b).

On the other hand, it should be noted that the reduction in public investment activities may aggravate the eventual economic damage caused by environmental taxation by exacerbating output losses. There seems, therefore, to be a trade-off between policies geared towards budgetary consolidation and the increase in standards of living that public expenditure has been used for (Pereira and Pereira, 2013; Pereira and Pereira, 2014b; Pereira and Pereira, 2014c).

It should be noted that the assumptions on which the forecast of lower public debt relies are of a second-order nature; the materialisation of the third dividend depends on ulterior tax revenue effects and public sector decisions (Pereira and Pereira, 2014b).

2.3 Potential additional consequences of environmental tax reform

Regardless of whether the different potential environmental gains have sufficient force to merit the status of a further dividend, it should be noted that there are various non-economic motives for the deterring of environmental damaging activities, namely the pursuit of better public health, higher standards of living and the protection of natural resources and systems (Asquith and Speck, 2011).

The innovation that one can expect to be stimulated by environmental taxation may be beneficial to the enterprise that brings it about, but also to the state of the environment itself as it can be improved by a more efficient use of environmental resources (Jackson, 2010).

The expectation that the reduction in carbon emissions may be followed by a reduction in local pollution in what could constitute an environmental double-dividend in its own right has also been expressed (Clinch et al., 2006).

Another important question surrounding the introduction of environmental tax reform is that of its distributional impacts. Environmental taxes are not, however, always regressive in their nature (Määttä, 2006). This depends largely on energy expenditures as a fraction of total expenditure or income of households (Bosquet, 2000). Nevertheless, a generic assessment of the distributional impact of environmental tax reform does suggest that it disproportionately hurts the worst-off households (Asquith and Speck, 2011; Chiroleu-Assouline and Fodha, 2004). Analysis carried out by Leipprand et al. (2007) on the impacts of environmental taxes and charges suggest that they would be regressive in the Czech Republic, Germany, Spain and the United Kingdom and that no significant impacts were found in Sweden. Most empirical exercises, it has been found, specifically 77% of them, have concluded that negative impacts should be expected with respect to distributional impacts (Gago et al., 2007).

Another means by which distributional concerns may be addressed is through their inclusion in the actual conception of the tax – for instance, the implementation of a fertilizer tax which would consist of a threshold tax that would only be imposed on purchases that went beyond a given basic quantity per hectare (Määttä, 2006). This solution can, however, be quite challenging from an administrative standpoint (Määttä, 2006).

The other conventional policy aimed at mitigating the regressive impacts of the reform is the direct attribution of grants to the sectors which are perceived to be unevenly targeted, although this may subvert the original idea behind environmental tax reform as the margin for revenue-recycling may be severely curtailed (Määttä, 2006).

Indeed, a study has been published about the potential for environmental fiscal reform in combating poverty in Namibia, should it adopt its own version of the reform. The results of the simulation point to the greatest GDP growth in the scenario in which the revenue from the environmental taxes are used to finance unskilled labour; this scenario is also the one which creates the most jobs among the unskilled labour force (Sahlén and Stage, 2012). In spite of these potential gains concerning GDP and employment, it still benefits the households with the most income disproportionately. It is, therefore, concluded that there is no evidence of a “triple dividend”, which would mean that the distributional profile of a country would become more equitable (Sahlén and Stage, 2012).

One of the discussed potential risks is that of carbon leakage where it is understood as the process in which goods are imported and so the carbon dioxide emissions that are associated with a particular product purchase are outside the country; the other potential form of ‘carbon leakage’, which concerns policy-makers is simply that of relocating industries as a result of burdensome taxation (Withana et al., 2013a). On the whole, despite conflicting accounts, evidence suggests that if these two forms of carbon leakage are occurring, it is not happening on a particularly great scale (Withana et al., 2013a). There are several reasons for this, namely the fact that costs resulting from environmental regulations may not be sufficiently burdensome and the fact that the environmental conditions of OECD countries are generally comparable (Withana et al., 2013a). Nevertheless, some of the ex ante modelling predicts that there is an effective risk of carbon leakage (Barker et al., 2007; Withana et al., 2013). It has also been suggested, however, that this is attributable also to labour costs and that carbon tax policies would only contribute to a fraction of the problem (Withana et al., 2013a). Tax exemptions, refunds, discounts and reduced rates constitute a series of mitigation measures that may help reduce the risk of carbon leakage (Barker et al., 2007; Withana et al., 2013).

Ideally, however, the best way to address the risk of carbon leakage is to pursue a policy of international harmonization. Policy options aimed at limiting the prospects of capital and production moving away seem reduced, however, as chances of fiscal harmonization look small (Bosquet, 2000). It is also worth noting that otherwise potentially good options such as recycling revenues through cuts in VAT are very difficult given the European nature of the tax and the fact that unilateral cuts to its rates are seen as a way of providing an unfair advantage to a country (Bosquet, 2000). Nevertheless, suggestions have been made to tackle obstacles to fiscal harmonization, such as the introduction of a minimum level of taxation as opposed to full-blown coordination (Jones, 2011). In spite of the obstacles facing it, one of the best ways to counteract the concerns relating to the competitiveness of the economy is to implement environmental tax reforms across all Member States of the European Union (IILS, 2011).

International experience of environmental fiscal reform informs us that another less desirable consequence is political dissatisfaction on the part of the public (Clinch et al., 2006). Various suggestions are often made to counter this problem: making it very clear to the public that the tax shift that will occur in order to reassure the public that the rationale behind the reform is not simply that of obtaining greater revenue, making the tax increase gradual – according to a progressive timetable perhaps (Määttä, 2006; Jackson, 2010) – and ensuring that the increase in energy prices is no greater than 4% per year (Dresner et al., 2006).

Nevertheless, with regards to environmental fiscal reform in the United Kingdom, it has been suggested that the scenarios in which the greatest reductions of greenhouse gas emissions could be achieved are those that involved a combination of an increase in energy prices and the implementation of environmental fiscal reform (Ekins et al., 2011).

Other suggestions aimed at making environmental fiscal reform a more palatable project for the public include the selection of tax bases in which consumers have environmentally reasonable alternatives, the funding of these very alternatives through the revenues of the environmental taxes, the timely announcement of the areas which are to be targeted by taxation as well as those which will be exempted, in order to allow

for dynamic gains as enterprises make their decisions accordingly (Jackson, 2010).

3. Experiences of Environmental Tax Reform

Environmental fiscal reform has been carried out in a number of European countries and the first examples began in the early 1990s. The countries that have implemented fairly complete pieces of reform with clear examples of revenue-recycling are Denmark, Sweden, Norway, Finland, the Netherlands, Germany and the United Kingdom. In order to better analyse the reforms in each country, they will be scrutinised in terms of their scope, whether the reforms were carried out through the introduction of new instruments or pre-existing ones and the nature of the revenue-recycling that took place. Scope is an aspect of the reform which may hard to account for in that it can be interpreted in different ways. For the purposes of this project, however, scope will be understood in terms of the exemptions that were attributed and the percentage of emissions that were covered.

3.1 Scope

One element, which seems to be common to the scope of all the reforms in the countries in question, is the attribution of exemptions or compensations of some degree to certain sectors of the economy, motivated by fears of damage to competitiveness. This issue limits the application of whatever taxation measures were put in place in each case and so directly influence the scope of the reform.

In the case of Denmark, the exemptions that were in place for the energy tax were initially transposed to the carbon dioxide tax (Hoerner and Bosquet, 2001). Companies that use electricity for heavy industrial processes may receive a rebate of only 57,3% with respect to the carbon dioxide tax applied to electricity (Withana et al., 2013a; Bragadóttir et al., 2014). With regards to the CO₂ tax, there are several exemptions in place for fuels used in transportation and for electricity used in businesses that carry out energy-intensive processes (Withana et al., 2013b).

In the case of Sweden, for instance, energy taxes on fossil fuels were reduced at one point and so were the excises on oil and motor fuels (Heine et al., 2012). Manufacturing also became totally exempt from the energy taxes – excluding the tax on carbon dioxide – in 1993 and from 2004 onwards became liable to only 21% of CO₂ tax rates (Hoerner and Bosquet, 2001). The taxes on fuels levied on manufacturing plants

covered by the EU ETS (European Union Emissions Trading Scheme) were reduced to 15% and compensation was attributed to the horticultural and industrial sectors (Hoerner and Bosquet, 2001). Several exemptions aimed at protecting the competitiveness of the energy-intensive industry were removed in 2009 (CRFV, 2014a; CRFV, 2014b). In a similar vein, several exemptions from the carbon dioxide tax are in place, particularly related to the use of fuels in transportation, manufacturing, production of combined heat and power (CHP), agriculture, forestry, aquaculture and industrial operations, as a result of the 2009 reform (Bragadóttir et al., 2014).

In Norway, certain exemptions were attributed to air transport, international shipping and water fishing (Withana et al., 2013a; Bragadóttir et al., 2014). Other sectors are compensated to a lesser extent by reduced rates of the tax, such as pulp and paper, fish meal, national air transport and the coastal goods transport industries (Withana et al., 2013b). In a similar vein, the use of petroleum products on the continental shelf benefits from large reductions (Lindhjem et al., 2009). The use of natural gas on the mainland is not taxed (Withana et al., 2013a). LPG that is used in domestic shipping is also exempt from the tax (Withana et al., 2013a). Additionally, no CO₂ taxes are levied on industrial processes (Withana et al., 2013a). Until 2013, fishing and catching within the confines of inshore waters were exempt from the CO₂ tax on mineral oil products, but this is no longer the case (Bragadóttir et al., 2014). Moreover, installations such as pulp and paper, covered in the EU ETS, are exempt from paying the tax on heating oil (Withana et al., 2013b).

In the case of Finland, the final tax on electricity does not come into play if electricity is produced from wood, wood-based fuels, wind or waste gases that stem from metallurgical processes (Hoerner and Bosquet, 2001). A refund scheme has also been in place for companies whose total burden of excise duties represents 0,5% of their value-added – firms can then request a refund of up to 85% for the portion of the burden which exceeds EUR 50,000 (Withana et al., 2013b; Bragadóttir et al., 2014).

In the Netherlands, the supply of heat through district heating and the electricity that is produced with natural gas or renewable energy was originally exempt from the taxation measures (Hoerner and Bosquet, 2001). Since 2003, however, the exemption for the electricity coming from renewable sources has been removed and has been replaced by lower rates (Withana et al., 2013a). Solar and wind power that is used for

own use continues to be exempt from the energy tax and from 2013 onwards, the renewable power generated by citizen cooperatives for consumption within the same postal code is exempt (Withana et al., 2013a). Crude oil, moreover, is only taxed after the refinery process has taken place via the taxation of refined mineral oils, namely gasoline (Vollebergh, 2008). As such, the emissions and energy consumed in the process of refining does not fall under the tax (Vollebergh, 2008). This evidently means that certain products, such as petrocokes, liquid and gaseous residuals are excluded from the tax base (Vollebergh, 2008). Electricity flowing from renewable sources benefits from lower rates with respect to the regulatory tax on energy (Withana et al., 2013b).

With respect to Germany, firms in the manufacturing, forestry and agricultural sectors pay a mere 25% of the standard rates, as long as spending on electricity, gas and heating oil exceeded a basic amount of EUR 1000 (Withana et al., 2013b). Moreover, the industrial sector is only taxed 10% of the standard electricity tax (Withana et al., 2013b). This scheme is only available in the event that a voluntary agreement between the industry and the government is in place, on the basis of which companies must set up an energy management and auditing system (Withana et al., 2013b). Energy-intensive processes are also completely exempt from energy taxes (Withana et al., 2013b). Additionally, if a co-generation plant is used to 70% of its capacity, it is not due to pay any tax on petroleum products (Knigge and Gorlach, 2005). Moreover, highly efficient CHP plants, as defined by the European Commission, are fully exempt from the energy tax (Withana et al., 2013b). Additional compensation measures include the fact that electricity meant for the producer are exempt from electricity tax, that electricity that is purchased in the form of contracting is also exempt from taxes, that public transport in several cases enjoy of reduced rates and that a reduced rate applies to natural gas until 2018 (Knigge and Gorlach, 2005; Withana et al., 2013b).

In the case of the United Kingdom, some exemptions were attributed for electricity that was to be generated from renewable sources and in CHP (Withana et al., 2013a). Energy users in the transport sector are also exempt from the Climate Change Levy (CCL) (Withana et al., 2013b).

Another aspect in which some of the reforms were similar is the attribution of some kind of compensation to firms which voluntarily agree to commit to further

environmental-friendly goals. In the case of the United Kingdom, for example, agreements can be signed between firms and the authorities, the Climate Change Agreements (CCA), contemplating discounts from the CCL in return for the meeting of energy-efficiency standards. (Withana et al., 2014). In the Netherlands, large industrial electricity customers, for instance, are eligible for a refund from energy tax in the event that they enter long-term efficiency agreements with the authorities and provided they pay on average more than the European rate (Withana et al., 2013a). In Germany, partial refunds were made available to the manufacturing sector; these were previously contingent upon the celebration of voluntary agreements that included climate-mitigation measures, but they are now dependent on the company's implementing an energy management and auditing system (Withana et al., 2013a). In Denmark, furthermore, a part of the carbon dioxide tax may be refunded to a company if it celebrates a voluntary agreement with the authorities, in which the former commits itself to increasing energy efficiency (Withana et al., 2013a).

Another factor that should be taken into consideration when evaluating the scope of the reforms is the extent to which the carbon dioxide emissions were covered by the environmental taxation regimes that were put in place. This exercise cannot be applied to Germany given that the energy tax in that case does not possess a carbon component (Withana et al., 2013a). As of 2013, the estimated proportion of carbon dioxide emissions covered by carbon tax for the other countries are as follows, however: 59.1% in Denmark, 41,2% in Sweden, 75.2% in Norway, 32.6% in Finland, 58.5% in the Netherlands and 35,4% in the case of the United Kingdom (Withana et al., 2013a; CRFV, 2014a; CRFV, 2014b).

3.2 Novelty of instruments

Another aspect of the reforms that is worthy of analysis is the novelty of the instruments that were put into place. Most of the reforms combined the introduction of new instruments of taxation with the raising of rates for existing taxes.

The central element of the environmental fiscal reform in Denmark, as far as taxation is concerned, was a new instrument, the carbon dioxide tax, which was originally set at DKK 100 metric per tonne of carbon dioxide and was applicable to

households and the commercial and industrial sectors (Clinch et al., 2006; Lindhjem et al., 2009; Withana et al., 2013). Not only was the carbon dioxide tax a new instrument, but it also replaced some energy taxes in place at the time (CRFV, 2014a; CRFV, 2014b). The second stage of the reform also advanced a new instrument, the sulphur dioxide tax and it was applied to the sulphurous content of fossil fuels that contained more than 0,05% and on the sulphurous content of wood, straw, waste and other fuels that burn in plants, which have an output of more than 1 megawatt (Hoerner and Bosquet, 2001; CRFV, 2014a; CRFV, 2014b). The existing tax capital rate was broadened and several existing green taxes were raised, however (Hoerner and Bosquet, 2001). A separate carbon dioxide tax is levied on electricity and it is unrelated to the tax on carbon dioxide from production, as it is not dependent on how electricity is produced (Bragadóttir et al., 2014).

Sweden introduced new taxes on oil and natural gas, on carbon dioxide and sulphur dioxide and it also introduced a charge on nitrogen oxide (Lindhjem et al., 2009; Withana et al., 2013). It also rose, however, existing energy and environmental taxes (Hoerner and Bosquet, 2001). Moreover, pre-existing taxes on diesel, electricity and on electricity produced from nuclear power were increased (Hoerner and Bosquet, 2001). In 2011, the energy tax on industry both within and outside the EU ETS was increased (Withana et al., 2013a; Withana et al., 2014). Throughout the reform, however, existing excise taxes, duties and value-added taxes were also increased as a means of broadening the tax base (Hoerner and Bosquet, 2001). In 2006, Sweden introduced, furthermore, a vehicle-based CO₂ tax in 2006 (Withana et al., 2013b). An important part of environmental tax reform in Sweden consists, moreover, of the pre-existing energy tax, which works in tandem with the CO₂ tax, as they are both levied on fossil fuels used for heating purposes (Withana et al., 2013b).

In Norway, similarly, a new carbon dioxide tax was created and was levied on the combustion of fossil fuels (Lindhjem et al., 2009; CRFV, 2014a; CRFV, 2014b). As was the case in Sweden, Norway also introduced a tax on sulphur dioxide (Hoerner and Bosquet, 2001). A new carbon dioxide tax was also introduced in 2010, which was levied on gas for heating purposes in buildings (Lindhjem et al., 2009; Withana et al., 2013b).

In the case of Finland, the central element of the reform, on the taxation side, was the introduction in 1990 of a tax on carbon dioxide (Withana et al., 2013a; CRFV, 2014a; CRFV, 2014b). Upon joining the European Union, Finland, in line with European directives, abolished its taxes on the fuels that are used to produce electricity and, instead, adopted taxation of electricity itself (Lindhjem et al., 2009). The latter was reformed in 1997 when production taxes were removed and a consumption tax was put in place (Skjelvik et al., 2011). The latter, in turn, branches out into two categories: a lower one, to be paid by industry and professional greenhouse gases, and a higher one that is levied on consumers (Lindhjem et al., 2009; Skjelvik et al., 2011). The main instruments of the reform were, therefore, new ones. There were, nevertheless, examples of increases in existing taxes such as the increase in taxes on landfill (Hoerner and Bosquet, 2001).

The case of the Netherlands does not fall into this pattern in the sense that the new instruments are quite different from the ones seen in the aforementioned examples and because increases in the rates of existing taxes were largely absent. It started as a general fuel charge introduced in 1988 as part of a system that was designed to finance environmental policy expenditures and it evolved into a full-blown tax in 1992, levied on all fossil fuels (Withana et al., 2013b). The second major element of the reform is a regulatory tax on energy that came into place in 1996 after the European Commission failed to introduce a EU-wide carbon tax and it is levied on electricity; tax rates for the various fuels are based on their CO₂ and energy content (CRFV, 2014a; CRFV, 2014b). It is levied on energy products used in heating and electricity generation by households and small business, having been reformed so that it now encompasses intermediate firms (Withana et al., 2013b). Recently, a small surcharge on electricity has been put in place (Withana et al., 2013b).

The reform in Germany was carried out through the habitual mix of both new instruments and reformed existing ones. Increases in taxes on gasoline, heating oils and natural gas were carried out, but the government also created a new tax on electricity (Agnolucci, 2009; Heine et al., 2012; CRFV, 2014a; CRFV, 2014b). Rates of existing taxes were increased in 2003 and 2006 (Withana et al., 2013a). Specifically, increases in motor fuel taxes of EUR 0,03 per litre and in electricity taxes by EUR 0,025 per kWh were carried out (Hoerner and Bosquet, 2001). More recently, in January 2011, an air

passenger duty came into force that is levied on airlines for all consumers who depart from airports that are located in Germany and the rates depend on the zone in which the final destination is located (Withana et al., 2013a).

The reform in the United Kingdom was quite singular in terms of the novelty of the instruments and the other areas that they addressed, such as landfill and waste. Indeed, the first main element of the environmental fiscal reform in the UK was the introduction of the landfill tax in 1996, whose tax rate was set at GBP 2 per tonne of inactive waste and GBP 10 per tonne on all other forms of taxable waste (Hoerner and Bosquet, 2001). Another new instrument that was approved as part of the reform in the UK was the British road fuel escalator system that was introduced in 1993 as a means of raising road fuel duties automatically on an annual basis; initially, it increased at an automatic 3% and, later, at 5% above inflation per year from 1993 onwards and, in 1997, it was set at 6% above inflation (Hoerner and Bosquet, 2001). The escalator system was eliminated in 1999 (Withana et al., 2014). Another instrument that was part of the tax reform in the UK was the Climate Change Levy (CCL) (Agnolucci, 2009), which, can be understood, effectively, as a carbon dioxide tax to be levied on commercial and industrial use of natural gas, LPG and electricity (Withana et al., 2013a; CRFV, 2014a; CRFV, 2014b). It was also levied on other gaseous hydrocarbons and petroleum coke that is used by industries, business and the public sector (Withana et al., 2013a; CRFV, 2014a; CRFV, 2014b)

3.3 Revenue-recycling mechanisms

The other aspect in terms of which the reform should be analysed is the different ways of recycling the revenues raised by environmental taxes.

In Denmark, the recycling of revenues began in 1994 when Denmark reduced the marginal tax rates on all income brackets and social security contributions were also lowered by about 2,2% of GDP (Hoerner and Bosquet, 2001). In a second stage of the reform, revenues were channelled into the following: subsidies for up to 30% of investments in energy efficiency, a fund that was aimed at shoring up small companies and reductions to social security contributions to be paid by employers by 0,53% of

gross salary between 1997 and 2000 (Hoerner and Bosquet, 2001; Withana et al., 2013b).

Sweden, for example, lowered personal income taxes and subjected the highest ones to a maximum value of 50% (Hoerner and Bosquet, 2001). In 2001, the government launched a ten-year green tax shift programme that would start on that very year and that would lower low and medium income taxes in the first four years (CRFV, 2014a; CRFV, 2014b). The basic deduction for wage earners and pensioners was increased (Hoerner and Bosquet, 2001). Employees' pension contributions and the equivalent charges for the self-employed were lowered by 0,1% (Hoerner and Bosquet, 2001). Reductions in labour taxes between 2005 and 2010 were also carried out (Hoerner and Bosquet, 2001). Revenues have also been set aside, however, to compensate for revenue losses produced by the reduction of income tax rates (Withana et al., 2013b).

When Norway introduced the principle of revenue-neutrality, it also lowered personal income taxes. The burden of taxation on labour was also reduced in 1992, but it was not strictly coupled with carbon taxation (Hoerner and Bosquet, 2001). Capital income taxes have also been lowered (Withana et al., 2013b). Revenues flowing from the CO₂ tax on the petroleum sector have been transferred to a fund whose job is to support government savings in financing expenditure on pensions (Withana et al., 2013b). A fund that addresses climate change mitigation and promotes renewable energy has also been established and is to be financed by the increase of the CO₂ tax on the petroleum industry's offshore operations (Withana et al., 2013b).

In Finland, the revenue-recycling that occurred was comprised of reductions of personal income tax, local personal income taxes and employers' social security contributions (Withana et al., 2013a). Taxes on labour were also reduced in 1998 and 1999 (Withana et al., 2013b).

In the Netherlands, personal income tax was cut by 0,6%, the standardised income tax-free allowance was raised and the tax-free allowance for senior citizens was also increased (Withana et al., 2014). Reductions in employers' social security contributions have also been carried out, as well as reductions in corporate taxes and small and medium-size businesses have seen their tax-free allowance increased. (Withana et al., 2013b). A tax credit worth around EUR 319 has also become available

as a lump-sum refund on households' electricity bills (Withana et al., 2013a; Withana et al., 2014;). The surcharge on electricity that has recently come into place aims to finance renewable energy subsidies (Withana et al., 2013b).

In Germany, the initial elements of the reform were used to help pay for reductions in the social security contributions for both employers and employees by an equal amount – 0,8% in total – and it, should be noted, that throughout the reform, 85% of raised revenues have been recycled into the pension system (Agnolucci, 2009; Heine et al., 2012). In the second stage of the reform, social security contributions were reduced by 1,0% - half with regards to employers' contributions and the other half with regards to employees' contributions (Hoerner and Bosquet, 2001). A small portion of revenues was also used, however, in a programme to promote renewable energy (Withana et al., 2013b).

In the United Kingdom, reductions to social security contributions to be paid by employers by 0,3% to 0,5% were carried out (Agnolucci, 2009). The revenue has also been used to support several energy efficiency initiatives (Withana et al., 2013b).

4. Portugal

4.1 Portugal: Prospects of Reform

The Portuguese government tasked an independent commission with the elaboration of a proposal for a national environmental tax reform. The Commission for Environmental Tax Reform (CRFV) (2014a; 2014b) called for a carbon tax to be levied outside of the sphere of the EU ETS. It maintained (CRFV, 2014a; CRFV, 2014b) that carbon taxation is an ideal policy in virtue of the importance of achieving emissions reductions and of the fact that the technological viability of capturing such emissions is still very much in question. Moreover, it argues that, unlike what happens in regard to the taxation of NO_x and SO_x emission – where there are clear alternatives to their use –, taxation on carbon seems to have a slow but steady effect (CRFV, 2014a; CRFV, 2014b). The pertinence of environmental tax reform in Portugal relates, moreover, to its obligations as a member of the EU, of the UNFCCC and as a signatory to the Kyoto Protocol to reduce greenhouse gas emissions in 40% with respect to the 1990 baseline by 2030 and to reduce them in 80% by 2050 (CRFV, 2014a; CRFV, 2014b). These are expected to prove significantly harder tasks than the fulfilment of the objectives for 2012, given that the economy is expected to embark on a recovery, thus putting greater strain on resources (CRFV, 2014a; CRFV, 2014b).

Although discussion on the issue is clearly wanting in the literature on environmental fiscal reform, several public policy proposals have already been ventilated regarding the Portuguese case. Pereira and Pereira have suggested (2011), for instance, Portugal introduce a carbon tax of about €16,5 per total carbon dioxide content, in order to be able to meet its international obligations with respect to curbing carbon dioxide emissions (Pereira and Pereira, 2014b).

A study has contended that if the policy to tax carbon dioxide emissions is chosen and a rate below 50 euros per tonne of carbon dioxide is set, then no reduction in the 1990 levels of carbon dioxide emissions can be expected by 2050 (Gerbelová et al., 2014). If, on other hand, the tax is set at a level between 50 euros per tonne and 100 euros per tonne, the gains are indeed more substantial; if they are set at the former value, for instance, it has been predicted that the CO₂ emissions may fall up to 7% whereas if they are set at the latter value, the emissions may reduce by 79% (Gerbelová

et al., 2014). For carbon prices above 100 euros per tonne of carbon dioxide, the expected marginal gains are somewhat weak, as a price of 300 euros per tonne would only yield a reduction of 87% in emissions (Gerbelová et al., 2014). The factors that are expected to contribute to this are the increase of share of electricity that is being produced by renewable energy sources and the increased investment in carbon capture and storage (Gerbelová et al., 2014). It has also been suggested that, in order for Portugal to achieve a 60% reduction in CO₂ emissions against the levels of 1990, the CO₂ tax should be set at 70 euros per tonne of carbon dioxide (Gerbelová et al., 2014).

4.2 Reform in Portugal

In Portugal, the piece of legislation that implements environmental fiscal reform came into effect on 1 January 2015 (Assembleia da República, 2014) and it addresses several issues such as energy and emissions, transportation, water, waste, forestry and biodiversity and territory management. This law is the principal source of information of this section.

It is debatable whether all aspects of the law can be considered to be a part of the substantive environmental fiscal reform. For example, urban buildings that are used for the production of energy flowing from renewable sources have seen a 50% cut in the municipal tax on property and local authorities have obtained the prerogative of cutting the same municipal tax on property by 15% on buildings that meet stipulated energy efficiency standards. Moreover, the law also introduces tax reductions, within the Personal Income Tax and Corporate Income Tax frameworks, for the purchasing of vehicles running on liquefied petroleum gas and natural gas. Similarly, with respect to Value-Added Tax, the law also allows for the deduction of expenditures with electric or hybrid plug-in cars when these are deemed to be tourism vehicles. Within the framework of the tax on vehicles, moreover, a new intermediate tax rate, lower than the existing one, has been created for vehicles with hybrid motors and cars with that use liquefied petroleum gas or natural gas as fuels. These measures and others are formally part of the legislative package which contains the reform but are not conceptually subsided within the notion of environmental fiscal reform as they will be most probably be financed by existing revenue; it does not respect the premise of revenue neutrality.

The central part of the reform, however, is Portugal's version of the carbon dioxide tax which comes in the form of a new set of tax rates within the Tax on Petroleum and Energy products and is levied on gasoline, petroleum, diesel fuel, coke, liquefied petroleum gas, natural gas, fuel oil and coal. The set rates will be indexed to those at which carbon is traded in the previous year in the EU ETS. The government is empowered by the law, however, to set a minimum value per tonne of carbon dioxide. Formerly, carbon content was not the target of any taxes on energy in Portugal (CRFV, 2014a; CRFV, 2014b). It was only in the taxes on circulation and on vehicles that the emissions of carbon dioxide were taken into consideration as points of reference (CRFV, 2014a; CRFV, 2014b). The taxation of carbon content constitutes, therefore, a clear new instrument as part of the reform.

The other very important part of the reform, on the taxation side, addresses the issue of waste by setting a charge on plastic bags at a rate of 8 cents per item.

With respect to revenue-recycling, the piece of legislation in question has not detailed which mechanisms will be put in place, but it does maintain that, taking into account the evolution of the revenue that pours into state coffers, the application of the law should allow for the reduction of some other taxes, such as Personal Income Tax and Corporate Income Tax and for increased fiscal benefits for energy-efficiency projects. It does seem, therefore, to exclude the possibility of reducing social security contributions.

5. Conclusions

It is hard to compare the scope of the reform in Portugal with that of other countries, given that it only came into effect on the 1 January 2015. This means that it is not yet possible to ascertain the percentage of the carbon emissions that are covered by the new instrument that taxes carbon dioxide. The scope of the reform already seems to be quite different from the other European experiences in that it overtly addresses the issue of waste through the introduction of a charge on plastic bags with the intention of severely reducing the number of plastic bags used in the country in one year.

The other criterion that was used to evaluate the scope of the reforms is the attribution of exemptions. In the case of Portugal, the exemptions that were already in place for certain entities subject to the European Union Emissions Trading Scheme have been kept with respect to the new mechanism for taxing carbon emissions. No additional exemptions have, however, been introduced and this also represents a marked difference in relation to other European experiences.

With respect to the novelty of the instruments, Portugal included the new instrument of taxation of carbon dioxide within the existing framework of the Tax on Petroleum and Energy Products. The rates at which the tax will be set - their indexation to the value at which carbon is traded in the previous year - constitutes a new set of rules. It may be said, therefore, that it is a new instrument in the context of an existing framework. Moreover, it should be noted that carbon content was not taxed, under the Portuguese fiscal system, before the introduction of the reform.

The tax on plastic bag is an unequivocally new instrument in the Portuguese context. In a certain sense, therefore, the environmental tax reform in Portugal is, thus far, particularly singular given that it has relied almost exclusively on new instruments.

Revenue-recycling mechanisms have not yet been put in place. The wording of the Law, which came into effect on 1 January 2015, mentions several possible policy routes but does not include the lowering of social security contributions. If this does turn out to be the case, Portugal will again differ markedly from the other European countries, as they all carried out reductions of social security contributions as part of their policy mix.

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