Environmental taxes in the context of the European decarbonisation process and the European Energy roadmap to 2050: A comparison between countries.

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SCHOOL OF ECONOMICS, BUSINESS ADMINISTRATION & LEGAL STUDIES
A thesis submitted for the degree of
Master of Science (MSc) in Energy Law, Regulation, Business and Policy

January 2019
Thessaloniki – Greece

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I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

January 2019
Thessaloniki - Greece
Abstract

This dissertation was written as part of the MSc in Energy Law, Regulation Business and Policy at the International Hellenic University. Environmental taxation is one of the most important tools of European environmental policy and has been integrated gradually in member states from the early nineties, as a response to the increasing environmental degradation. This thesis investigates the contribution of environmental taxes in achieving the goals that were set in COP21. In particular, by implementing a comparative study methodology, it examines and compares current environmental taxation systems around Europe. This way, it casts light on whether environmental taxation is a proper tool that triggers innovation and eliminates environment degradation. Throughout Europe, countries use environmental taxation, in light of their binding reduction targets in GHG gases. This system of taxation, if properly used, can comprise a catalytic tool in reaching those targets. In this respect, in order to approach the topic at hand, our sample is comprised of countries with a long history of using the abovementioned tool. These selected countries are UK, the Netherlands, France, and Sweden. Following, their system is compared against the Greek one, through the use of certain indices. Hence, the overarching research objective of this thesis is to answer the following research question: can Greece ameliorate its tax environmental system, improving it both in terms of annual profitability and durability, benchmarking the successful examples of the aforementioned countries, and whether the use of environmental taxation is the appropriate tool in order to achieve the reduction of GHG.

Keywords: environmental taxation, GHG, EU Roadmap 2050, energy policy

Panagiota Trantza

31 January 2019
Preface

This dissertation is original, unpublished, independent work by the author, Panagiota Trantza.

At this point, I would like to express my gratitude to my dissertation advisor Professor Dr. Enzo Di Giulio of the School of Economics, Business Administration & Legal Studies at International Hellenic University for his guidance, support, help and inspiration, in order to complete this work. He guided me in the best possible way with his knowledge, valuable comments and advices wherever that was needed.

In the end, I would like to express my deep gratitude to my family, friends and classmates for their support.
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<td>EKC</td>
<td>Environmental Kuznets Curve</td>
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<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
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<td>GHG</td>
<td>Greenhouse gases</td>
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<td>ETS</td>
<td>European Trading Systems</td>
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<td>ERU</td>
<td>Emission Reduction Units</td>
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<td>CER</td>
<td>Certified emissions reductions</td>
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<td>COP</td>
<td>Conference of Parties</td>
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<td>INDC</td>
<td>Intended Nationally Determined Contributions</td>
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<td>NDC</td>
<td>Nationally Determined Contributions</td>
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<td>WEO</td>
<td>World Economic Outlook</td>
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<td>EU</td>
<td>European Union</td>
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<td>EC</td>
<td>European Commission</td>
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<tr>
<td>TFEU</td>
<td>Treaty on the Functioning of European Union</td>
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<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<td>USD</td>
<td>United States Dollar</td>
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<td>IEA</td>
<td>International Energy Agency</td>
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Introduction

This thesis focuses on the use of environmental taxation as an economic instrument tool which can be used to make a decisive contribution in the achievement of the goal of mitigating the greenhouse gases emissions. The latter is one of the objectives that were set by the European Union (EU), encompassed within its policy known as the “European Energy Roadmap to 2050”, in the context of EU’s commitments as deriving from the Paris Agreement. According to the analysis that we adopt in this thesis, someone could be able to thoroughly understand the need to impose environmental taxation as a means of combating climate change. In addition, the reader will be able to infer if this used policy can be a catalyst for innovation, economic growth or even technological innovation. Along such lines, the overarching research objective of this thesis is to explore whether Greece can implement some “best practices” from the international experience of other more developed countries, therefore ameliorating its tax environmental system. An array of scientific sources were examined that enhance the insights of this thesis, such as useful documents, academic literature and global bibliography relative to the issue. This dissertation is organized as follows: Chapter 1 outlines a theoretical background analysis regarding the environmental taxation, the interrelationships between the latter economic tool and the European Energy Roadmap to 2050 and a brief overview of the relevant European legislation on the subject. Subsequently, Chapter 2 delineates: (1) the research methodology that will be used, in order to approach the topic at hand and reach valuable conclusions, (2) the appropriate tools and (3) the criteria used to select the comparing countries. Following, Chapter 3 analyses the different cases of Greece, France, UK, Sweden and the Netherlands by comparing certain relevant indices (e.g. Share of Environmental Taxes in Overall Taxes, GDP per capita, Population Density, Annual GDP Growth among others). Chapter 4 discusses the conclusions of the aforementioned comparative analysis. Chapter 5 provides the implications of Greece as to the abovementioned issue and explores the possibility of amelioration of its environmental tax policy. Finally, the thesis completes with the research limitations section, before providing avenues for future research.
1. Theoretical Background

This first chapter will set out: (1) the theoretical framework and the context in which environmental taxes are encompassed, and (2) an analysis of the impact of the environmental taxes implementation. Furthermore, there will be an analytic report on the European Energy Roadmap 2050, while in the end of the chapter there will be a reference on the relevant European legislation.

1.1 Environmental taxation

The main impact of anthropogenic activity that affects the environment is climate change, mainly through the evocation of gases such as combustion of fossil fuels. The extensive use of the latter has led to the greenhouse effect, solely responsible for the global warming of our planet.

The immensity of natural phenomena that are linked to global warming has brought devastating consequences upon many areas of our planet. These consequences, which disturb the normal socioeconomic activity of man, impact the global economy for the same reasons. Under the influence of these disastrous phenomena, the world community has considered it necessary to take measures to reduce the phenomena in different sectors of human activity as well as in the economic field.

In order to identify the level of human impact upon the environment, economists have established theories and mathematical forms with different variables such as the Kaya identity and the IPAT identity. The latter, for example uses different dependent variables and formalizes the measure of environmental impact as an independent variable. In particular the equality relation of IPAT identity is the following: \( I=P \times A \times T \) (\( I \) = impact, \( P \) = population, \( A \) = per capita affluence, \( T \) = technology).

Following these theories, the environmentalists widely use from 1991 until today, Simon Kuznets; influential economic theory about the human impact on the environment that was developed in 1950s and 1960s. Through this economic theory, environmental policy today developed the Environmental Kuznets Curve hypothesis (EKC). The Kuznets Curve is a graph that depicts that as an economy develops, market forces first increase and then decrease economic inequality (following an “inverted U
The same theory implies that environmental impact and income are interlinked as the environmental impact is decreased in economies with a high ration of income. A depiction of the Environmental Kuznets Curve is demonstrated in Figure 1.1:

![Environmental Kuznets Curve](figure1.jpg)

*Source: Adapted from Perman, Ma, McGilvray & Common (2003).*

Apart from various economic theories in order to determine the impact of human activity on the environment, there are also economic tools that are used to diminish the environmental degradation in the ongoing war of humanity against global warming. In fact there is a growing agreement among economists that, in defining the best option to control global warming and to fight climate changes, economic instruments allow the achievement of the goal of curbing greenhouse emissions at a lower cost than standards and regulations.¹

There are different kinds of economic instruments used: (1) Pigouvian taxes i.e. environmental taxes, and (2) tradable permits of emissions. Emission trading systems contributes to economic efficiency by giving incentive emission reductions, where it is cheapest to achieve them. There are two main types of trading systems: (1) “Cap-and-trade systems” and (2) “baseline-and-credit systems”. In the first case there is a cap fixed as far as the level of environmental pollution may get and the permissions are auctioned of distributed under specific criteria. In the second case there are some limits

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as far as pollution is concerned expressed in terms of emissions intensity and polluters who reduce their emissions extensively can sell their quota to other polluters who are obliged to follow the same pattern as the original polluters.

As far as environmental taxes are concerned, and according to OECD Glossary of Statistical Terms, environmental tax is a tax whose base is a physical unit (or a proxy of it) that has a proven specific negative impact on the environment. There are four subcategories of environmental taxes: (1) energy taxes, (2) transport taxes, (3) pollution taxes and (4) resources taxes, which are also imposed on the respective sectors of human activity causing environmental contamination in order to prevent the latter.

Enforcing both direct and indirect environmental taxes, inevitably create a burden. For this reason, the imposition of environmental taxes is effective when the contamination is extensive and not removed. One very important element of the mandatory nature of environmental taxation is the acceptability. In the case of environmental taxes, acceptability of taxes rises when the appliance of taxes connects directly with the environmental damages and the return of taxes to the polluter. The acceptability of the appliance of environmental taxes is weak because the polluter-taxpayer does not seem to understand – or trust – the main rationale for Pigouvian taxes.

As far as the rate of the tax is concerned, it is highly important to find the optimal one. A balance should be maintained, because, if low environmental taxes were imposed, then their imposition would have no impact, given that the polluter would not be deterred from his/her offending behavior. If, on the other hand, the tax rate is too high, then it may force the taxpayer to adopt illegal practices. In order to set the optimal tax rate, the price of inflation should also be taken into consideration. Furthermore, on many occasions, the person who pays the tax is ultimately a different person from the taxable person. For this reason, socio-economic impacts should be taken into account in the formation of the tax rate.

The imposition of environmental taxes has, unquestionably, advantages and disadvantages. The analysis of the latter is very important as the legislator, by evaluating

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them, can easily come up with the type of environmental tax he/ she has to impose. According to the relevant literature the *advantages* of environmental taxes are the following:

- **Minimizing cost factors**: Environmental taxes can be used as a tool to abate pollution with the lowest possible cost.
- **Static incitement**: environmental taxes can provide incentives for taxpayers to use technology more efficiently.
- **Dynamic incitement**: Environmental taxes give a stimulus for the use of new technologies.
- **General regulation**: Taxes are general and not specific, in the sense that they are imposed on polluters (e.g. industries, plants etc).
- **Cost-limiting properties**: It is more convenient for the polluter to pay the environmental tax, rather than paying for the cost of eliminating the pollution, which in many cases is large.

Furthermore, the implementation of environmental taxes has certain *disadvantages*. It is vital to establish, recognize and analyze such disadvantages, in order to be able to eliminate them. According to extant literature, the disadvantages of the implementation of environmental taxes are the following:

- **Uncertain environmental impact**: The implementation of taxes does not necessarily mean that there will be a positive impact on abating pollution.
- **Decision making structure**: The implementation of taxes is inherent to the decision making process. For example, in the case of big companies that have to decide on what kind of technology to invest in order to be productive, and in the same time to respect the environment with the lowest possible cost.
- **Lack of experience**: As far as the application of environmental taxes is concerned, the lack of experience sets a great setback. The countries with the greater experience are those of the Organization for Economic Cooperation and Development (OECD) and of European Union.
- **Administrative and enforcement costs**: The enforcement of environmental taxes dictates for extensive and costly mechanisms in place.
Differences between emission sources. Environmental taxes may be implemented in a unified way on different emission sources that create totally different level of pollution and damage.

Activities to avoid pollution. It is possible that the implementation of environmental taxes scopes in the aversion of pollution, but it can also lead to illegal practices if the price to pay is high.

Political consideration. There is usually no widespread acceptance of the imposition of environmental taxes on taxpayers.

The effects of distribution. The usual environmental enforcement areas are transportation and energy. These two sectors are vital for the survival of households, which cannot cope economically.

Attitude. The wrong and unjust enforcement of environmental taxes can cause unlawful behavior to taxable polluters.\(^3\)

Moving beyond the disadvantages and benefits of enforcing environmental taxes, it should be noted that the use of environmental taxes as a tool for reducing environmental pollution creates environmental benefits, as well as economic benefits. This is called the double dividend hypothesis. It is argued that environmental taxation if properly applied can lead to economic growth. It has been suggested in recent literature that revenues from taxation can be used for lowering other taxes that cause distortion, like labor taxes, which negatively affect the economy. On top of that, it has been argued in the early literature that environmental taxation improves social welfare, because the purpose of its enforcement is to neutralize a negative externality.\(^4\)

This socio-economic impact of enforcing environmental taxes contributes to their wider acceptance by the public. As already mentioned, one crucial element of taxes is their acceptance by the taxpayers. According to a certain stream literature, there are four broad factors of acceptance of environmental taxes by the taxpayers: The first is the individual perception of the consequences of the tax to him/her. The second is the individual’s perception of the environmental consequence of taxes. The

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\(^3\) Nagy, Zoltán. "The role of environmental taxation in environmental policy." *Proceedings of Novi Sad Faculty of Law* 47.3 (2013): 515.

third is the individual’s perception of the environmental consequence of taxes to other people. The fourth includes sociopolitical factors.\(^5\) It becomes evident that, without the necessary legitimacy and acceptance by taxpayers, an environmental tax can become unfair in their eyes. This is because its enforcement should be carefully interpreted by the legislator, and indeed within certain socio-economic contexts prevailing at the time of enforcement. The latter claim is corroborated by the recent example of the French government’s annulment of the environmental tax on diesel vehicles, given that the tax was not approved and accepted by the general public of the French taxpayers, and it was seen as a heavy burden.

Having considered the issue of environmental taxes, we move on in examining the context of European Energy Roadmap to 2050.

### 1.2 European Energy Roadmap to 2050

The influence of man on nature is unquestionable. This can be noticed more intensively in the last 40 years, as uncontrolled human activity has affected the climate. The latter can be ascertained by the extreme weather phenomena that have taken place over the last few years on earth, the non-rotation of the seasons, etc.

The need to act to reduce these climate change phenomena, led to the signing in 1997 of the first legally binding agreement between 39 states, the Kyoto Protocol. The aim of this agreement was to take active action to reduce the 6 types of gases responsible for climate change and, in particular, in an average rate of 5.2 % and at differentiated rates by each country. For Europe in particular, the rate of GHG abatement was established at the level of 8%.

With the aforementioned agreement, for the first time, methods and tools were introduced for the reduction of GHG gases, such as the ETS (European Trading Systems), the ERUs (Emission Reduction Units) and the CERs (Certified Emissions

Reductions). The appliance of these methods of mitigation resulted in a total drop in emissions by 22.6% than the base year 1990.

Under the agreement, the parties meet each year to discuss the effectiveness of the measures or not, to assess the situation, and to decide whether to take new measures or not. These meetings are known as the COP (Conference of the Parties), each of which has contributed in the adoption of different measures.

One of the most important COP was the one held in Paris in the year 2015, known as COP21. This specific agreement is of great importance because the signatories managed to sign a new legal binding agreement to limit global warming by 2050, inserting new ideas and new legal abiding abating rates.

The European Union paved a new bidding pathway in order to reach its goals. Through the Paris Agreement a novel concept was introduced, as each country publicly and openly agreed what exactly intends to do in order to achieve its goals that were taken over under the new agreement, known as Intended Nationally Determined Contributions (INDCs).

According to the World Resources Institute: “**INDCs pair national policy setting — in which countries determine their contributions in the context of their national priorities, circumstances and capabilities — with a global framework under the Paris Agreement that drives collective action toward a zero-carbon, climate-resilient future. The INDCs create a constructive feedback loop between national and international decision-making on climate change. INDCs are the primary means for governments to communicate internationally the steps they will take to address climate change in their own countries. INDCs reflect each country’s ambition for reducing emissions, taking into account its domestic circumstances and capabilities. Some countries also address how they’ll adapt to climate change impacts, and what support they need from, or will provide to, other countries to adopt low-carbon pathways and to build climate resilience.**”

After the ratification of the Paris agreement from each of the signatories, each country is obliged under the treaty, to submit a revised plan as to what their measured would be in order to reach their targets. That is the moment when each INDC become
NDC, that is, National Determined Contribution. Each country is also obliged to submit a new NDC every five years.

The European Union has undertaken quite a large commitment in the context of the Paris Agreement. In particular, it has committed that it will abate as a whole the GHG at a percentage of 25% until 2020, of 40% until 2030, of 60% until 2040, by emphasizing to a level of 80% domestic reduction, through the use of new technologies and renewables. This commitment is known as the European Energy Roadmap to 2050. At this point, Figure 1.2 depicts the scenario until 2050, that will lead the European Union to the abatement of GHGs.

Figure 1.2

Source IEA
Also, both under the Kyoto Agreement and under the Paris Agreement, the European Union has tried to decouple GDP from GHGs and the results of this effort are depicted in Figure 1.3:

Figure 1.3

One of the most important and positive elements in the treaty is the engagement of large countries-polluters such as China, the US and Russia. These countries committed for the first time to start efforts for abating the GHGs. Moreover, some additional positive elements of the treaty are: (1) the broader engagement of more countries than the Kyoto Protocol, and (2) the commitment of many countries for the use of all the policy tools of the Paris Agreement, such as the carbon tax.

On the negative side, the Paris agreement lacks on the level that it doesn’t commit the countries into the appliance of their goals, as it does not contain sanctions for the parties and the INDCs are not mandatory.

Through the aforementioned INDCs, the countries apply measures and use tools that are necessary to minimize the climate effects. One of these tools are environmental taxes, such as carbon tax that countries such as France have recently tried to insert as a measure against climate change. In recent literature, it is argued that the appliance of
environmental taxes and emission permits should be implemented complementary to one another, resulting in increased revenues.\textsuperscript{6}

The Paris agreement and the relevant European Energy Roadmap 2050 carry within a very optimistic scenario that is to limit the temperature increase well below 2\textdegree C. In order to achieve those goals, scenarios have been devised as to where the appliance of different methods and tools might lead the humanity in the future.

“\textit{Scenarios are descriptions of journeys to possible futures. They reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play}” (UNEP, 2002, p.320).\textsuperscript{7}

A two possible scenarios of how the world could look like have been devised by IEA (International Energy Agency). In particular, there is the \textit{New Policies Scenario} (where current INDCS agreements are included), and the \textit{450 Scenario} (where the world would actually try to reach the UN climate goal of halting climate change at no more than 2 degrees or stabilizing atmospheric greenhouse gas concentrations at 450 ppm CO\textsubscript{2} equivalents). Additionally, there is the WEO \textit{Bridge Scenario} where five opportunities are described (increasing investments in renewable, phasing out inefficient fossil fuel subsidies, reducing methane emissions from oil and gas productions, boosting end-use energy efficiency and phasing out the least efficient coal fired power plants). The WEO \textit{Bridge Scenario}, if fully implemented, could keep a bridge open to the future, in order to keep in line with a trajectory of emissions that would comply with the set goals of abating GHGs.

Figure 1.4 depicts the level and course of greenhouse gas discharges according to each different scenario:

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Beyond these three aforementioned scenarios by WEO and IEA, there are many more scenarios that have been developed in the extant literature. In fact, there are different ways of developing possible scenarios for the future. As Schanes et al. report, *there is a range of different approaches to scenario development and these have been described, for example, by Van Notten et al. (2003), Börjeson et al. (2006) and Rothman (2008). The approaches most relevant to the work reported in this paper are exploratory scenarios and backcasting. Exploratory scenarios look at several plausible futures in order to understand better the implications of current uncertainty about future developments of environmental, social and economic factors (see for example Peterson et al., 2003).*

Whatever the scenario might be, one thing is for certain: That whatever the chosen path may be, every measure and effort that is taken under the European Energy Roadmap 2050 must lead to the aspired and optimistic goals that were set by the Paris Agreement.

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1.3 Relevant European legislation

With regard to taxation, the European Union freely allows states to shape their own tax policy. In particular, tax policy in the European Union (EU) has two components: direct taxation, which still falls under the exclusive competence of the Member States, and indirect taxation, which concerns the free movement of goods and the freedom to provide services in the single market.

Under the above framework, the European Union leaves the Member States free to define their own tax policy, which undoubtedly embraces environmental tax policy. For this reason, each EU member state imposes environmental taxes as it considers appropriate within the framework of its fiscal targets. However, in order not to risk the functioning of the single market, the European Union sets out a general framework of taxation. The main legislative act is the Energy Taxation Directive (Directive 2003/96/EC). Relevant legislation can be found in the articles 110 and 113 TFEU that regulate a ban on tax-related discrimination in order to avert distortions in the free market.  

In addition to the above legislation, the European Union has a legal framework as far the Emissions Trading Scheme (EU ETS) is concerned. In particular, the Directive 2009/29/EC is in force, which amends the ETS Directive 2003/87/EC. The latter is classified under the market base instruments, and is used in parallel with environmental taxation as a tool of abating GHGs. *The scheme operates on a cap-and-trade approach. It limits emissions of greenhouse gases by all emitters and permits individual emissions on the basis of tradable allowances.*

In the transport sector the European Union has established the Directive 2009/33/EC for the promotion of clean and energy efficient transport vehicles. Moreover, the European Union has passed legislation in relevance to carbon capture and geological storage (CCS). In particular, the latter issue has been regulated under the Directive 2009/31.EC (CCS Directive) that deals with the storage of CO₂ in an environmentally friendly way.

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10 Ibid p.193
Synthesizing the abovementioned information, we conclude that the regulation of environmental taxes within the European Union is at the discretion of state members, since under the European law such regulation is their competency. The only issue regulated by European Union is restrictions on taxes that relate to the smooth functioning of the free market (such as Articles 110 and 113 above).

2. Research methodology

Having provided the theoretical backdrop of this thesis, we proceed with listing the accepted methods of research on the issue of the effectiveness of the environmental taxes. In particular, we examine certain indices, proposed by extant literature, to help us analyze the effectiveness of environmental taxation.

2.1 Tools of methodology used to determine the effect of environmental taxes on the environment and their success on abating the effects of climate change.

It is a fact that environmental taxes have been used as an economic tool for achieving the goals of reducing the effects of climate change. The importance of environmental taxes is defined by their ability to contribute to reducing environmental pollution and limiting its causes. To measure the latter, researchers use comparable tools to investigate the impact of these taxes on reducing environmental pollution, so they can safely reach the conclusion whether they are effective or not.

A limited number of studies and debates have dealt with the issue of seeking a tool for assessing the impact of environmental taxes. The most commonly used tool by studies is mere comparison of revenues from environmental taxes with the indicators of environmental pollution, such as national CO2 or GHG (greenhouse gas) emissions. The authors Miceine, Ciuleviciene, Rauluskevicene, Sreimikiene, in their article “Assessment of the Effect of Environmental Taxes on Environmental Protection”, argue that: «... there are researchers who advocate application of environmental taxes as a dependent

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variable for identification of indicators that have the greatest effect on variation of these taxes, while other researchers argue that the environmental protection indicator should be used as a dependent variable, while environmental taxes should be an independent variable, claiming that this is the only way to determine how environmental taxes effect on reduction of environmental pollution. In our opinion, the effect of environmental taxes on environmental protection indicators should be assessed by taking an integrated approach...». Other scholars such as Morley, Grossman and Krueger suggest a more empirical approach of using a model of economic measures that use the GHG emissions as a dependent variable. On the other hand, Castiglione et al. (2014), support that we should be examining environmental tax revenues as a dependent variable. Other key factors that were suggested and used by other studies are the scope of investments into environmental protection, the share of environmental revenues in the total tax revenues (even if there are exemptions applied on certain energy industries), population growth (based on increasing consumption).

Despite all the aforementioned tools, GDP remains until today the main tool of assessment, as it is an indicator of economic growth. It is an established tool of assessment used by OECD in its annual environmental assessments of its member countries. So it appears methodologically reasonable to analyze GDP per capita as a very important tool of assessment.

At this point Table 2.1 contains all the parameters, dependent or independent, of assessment factors of reduction of environmental pollution.
According to recent theoretical sources, the imposition of environmental taxes is directly influenced by the rule of law and the strong institutions of a country. In fact a strong institution and law enforcement in a country has a direct impact on per capita income, element that contributes to pollution abatement.\(^\text{12}\) In the present thesis, in order to reach a safe conclusion, we will use the tools proposed above to obtain valuable and valid indications of the impact of environmental taxes on reducing environmental pollution in the sample countries. Then we will compare the aforementioned results in order to reach a secure conclusion on the imposition of environmental taxes within the concept of European Energy Roadmap 2050 and use these results in order to propose necessary ameliorations.


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**Table 2.1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Unit of measure</th>
<th>Authors</th>
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<tbody>
<tr>
<td>Pollution index</td>
<td>GHG amount</td>
<td>thou. tons as CO(_2) equivalent</td>
<td>Morley (2012); Abdullah and Morley (2014)</td>
</tr>
<tr>
<td>GDP</td>
<td>GDP per capita</td>
<td>EUR</td>
<td>Im and Wonhyuk (2010); Morley (2012); Castiglione et al. (2014a; 2014b); Valles-Gimenez, Zarate-Marco and Trueba Cortes (2010); Abdullah and Morley (2014); Soderholm and Christiernsson (2008)</td>
</tr>
<tr>
<td>Investments</td>
<td>Investments into environmental protection</td>
<td>EUR</td>
<td>Castiglione et al. (2014a; 2014b); Kaufmann (2014); Soderholm and Christiernsson (2008)</td>
</tr>
<tr>
<td>Environmental taxes</td>
<td>Share of environmental taxes in overall taxes</td>
<td>%</td>
<td>Im and Wonhyuk (2010); Morley (2012); Soderholm and Christiernsson (2008)</td>
</tr>
<tr>
<td>Population</td>
<td>Population density in the country</td>
<td>People per sq. km</td>
<td>Morley (2012); Valles-Gimenez, Zarate-Marco and Trueba-Cortes (2010)</td>
</tr>
<tr>
<td>Economic growth</td>
<td>Annual GDP growth rate</td>
<td>%</td>
<td>Im and Wonhyuk (2010); Abdullah and Morley (2014)</td>
</tr>
<tr>
<td>Production</td>
<td>Annual industrial production growth rate</td>
<td>%</td>
<td>Im and Wonhyuk (2010)</td>
</tr>
</tbody>
</table>

*Source: Astrida Miceine, Vida Cileviciene, Jolanta Rauluskevicene, Dalia Sreimikiene “Assessment of the Effect of Environmental Taxes on Environmental Protection”, Ekonomisky Casopis, 66, 2018, c 3, s 286-308*
At this point we will mention which countries we will use as sampling units and the criteria that justify the selection of these countries.

2.2 Criteria for selecting countries

In the present dissertation we will examine the foregoing tools of assessment for each country separately. The criteria for choosing the sample countries are these countries that have a long-standing and generally acknowledged successful history of enforcing environmental taxes, in order to abate the results of environmental pollution. Therefore, these countries could comprise success stories and benchmarks for Greece. Such countries are the Netherlands, France, UK and Sweden.

3. Analysis

In this chapter we will systematically analyze and list for each country the parameters mentioned in the above chapter.

3.1 The case of Greece

According to figures drawn from the OECD electronic library, the European Statistical Authority, the European Commission and the European Environment Agency, Greece has a population 11,100,000 million people with annual growth rate of -0.3%. Out of this population, 35.4% live in urban areas, making the country the 20th more urbanized between the OECD countries (actual population density 82 inhabitants per km²). This means that the population density in urban areas might not seem to be very thick, but it must be noted that approximately half of the country’s population resides in the region of Attica, where the capital Athens lies.

GDP per capita reaches the amount of 28.544 US dollars per capita, ranking the country 33th among OECD members with a predicted annual growth rate of 2.1 % (it
must be noted that the *government’s debt is 188.7% of GDP*). The annual industrial production sales growth rate is 3.1% in the last year (2018).

GHG emissions are 5.9 tonnes per capita, with a tendency to decrease. It is characteristic that GHG emissions decreased dramatically after 2008 because of relevant measures that were taken by the government, under the pressure of the European Committee. Tax revenues depict 39.4% of total GDP, ranking the country 7th between OECD members, and well above OECD average. Only approximately 2.8% of them come from environmental taxation. As a share of GDP, Greece has the 8th highest environmentally related tax revenue among OECD members. In 2014, environmentally related tax revenues were at the level of 2.79% of GDP, well above OECD average. Taxes on energy represented an amount of 76% of total environmentally related tax revenue, and the other 30% derive from fuel and transport taxes.

As far as environmental investment is concerned, under EU law, the member countries promote environment and climate objectives in order to achieve sustainable development through investment. Unfortunately, the country has virtually no private initiative in terms of investment in the environment. This is partly due to the existence of many and complex laws, the constant change of legislation in this region, and the great corruption of the Public Administration. Also, the lack of investment can be attributed to the fact that the country was subject to a special regime of financial consolidation of its finances, as in the year 2010 was close to bankruptcy. The country is trying to turn that climate around through its participation in the European investment framework through which European projects are co-funded to attract investors. The country is also in the process of introducing innovations that will make the country more attractive but results are not yet visible. According to the European Commission EU Environmental Implementation Review Country Report, for the period 2014-2020, Greece has received 20 billion euros from European Structural and Investment Funds (ESIF) of which 6 billion would be invested on the environment. The results are yet to be seen.\(^\text{13}\)

Furthermore, Greece is a country of just 200 years of turbulent history. The country has enjoyed parliamentary democracy for the last 45 years, but has passed a seven-year dictatorship between 1967 and 1974 and a civil war 70 years ago. These detrimental events have deeply left their mark on Greek society and the institutions of democracy. It is indicative that the country is ranked 80th among 182 countries in the global list of corruption. The latter has a direct effect on the rule of law as it is characterized as weal alongside the weak institutions of the country.

3.2 The case of France

France is one of the leading countries within the European Union and has the second most important economy in the European Monetary Union. As depicted in Figure 3.1, it has a population of 64.000.000 people who enjoy a high standard of living and is predominantly urban (according to OECD statistics 35% of the population lives in urban areas) and has a population density of 117 people per km$^2$. Its GDP per capita is 39 USD. Its GDP growth rate in the last five years is 1%. The small economic growth is mainly due to the financial crisis of 2008, during which the French economy has withstood, but has not escaped from it.

According to Figure 3.2, environmental protection expenditure is only 2% of GDP and environmental taxes vary at the same level of GDP, whereas the taxes represent 4.4 % of total tax revenue (0.7% below OECD average).

![Figure 3.2](image)

**Figure 3.2**

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>57 (46)</th>
<th>Education expenditure</th>
<th>6 (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>54 (43)</td>
<td>Environment protection expenditure</td>
<td>2</td>
</tr>
<tr>
<td>Gross financial debt</td>
<td>119 (88)</td>
<td>Health expenditure</td>
<td>8 (7)</td>
</tr>
<tr>
<td>Net lending/net borrowing</td>
<td>-4 (-2)</td>
<td>Environmental taxes: (% of GDP)</td>
<td>2.0 (1.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(of total tax revenue)</td>
<td>4.4 (5.1)</td>
</tr>
</tbody>
</table>


The annual industrial production sales growth rate decreased 2.1% last year (2018). France has a relatively small share of environmental taxation which has a tendency to decrease within a framework of economic pressure. The country has managed to cut out any harmful subsidies such as exemption of taxes in biofuels. The country’s tax rate lies on taxes on fuels and transport vehicles, and less on incorporating environmental externalities. Vehicle tax is much lower than the OECD average. This low tax on fuels and vehicles has given an incentive for the wide purchase of diesel vehicles. The latter has contributed greatly to the fact that most of the secretions of GHG derive from the transport sector and 75% of them are CO₂.

As far as GHG emissions are concerned, the country has managed to stay true to its targets set under the Kyoto Protocol Agreement, and has declined the emissions even in the transport sector, though the latter remains the main pollutant sector of the country. In general, the country enjoys one of the lowest levels of GHG emissions in the European Union, due to the fact that nuclear energy plays important role in the energy mix of the country (nearly 50% of the total primary energy supply). Figure 3.3 depicts the GHG emissions per capita in France.
It is worth noting that France is a place that has a long democratic history and powerful institutions. Even though its administrative system is governed by bureaucracy, has become an archetype for many countries. Within this framework, the rule of law and law enforcement are strong. The deeply democratic tradition of France and the democratic consciousness of the French people is now revealed by a recent fact: In 2015 the French President, operating under the framework of the Paris Agreement, took the initiative to introduce tax on diesel vehicles, with the ultimate objective of withdrawing them from the market. The application of this high tax was set at 1.1.2019. However, the application of this tax was suspended, because it was not accepted by taxpayers. Indeed, the French people have carried out large and widespread protests against the application of the law, which forced the French President to retreat.\(^\text{14}\)

3.3 The case of United Kingdom

According to figures drawn from the OECD electronic library, the European Statistical Authority, the European Commission and the European Environment Agency, United Kingdom has a population of 63,500,000 million people with an annual growth rate of 1.1%. Out of this population, 70.1% live in urban areas making the country the third more urbanized between the OECD countries (actual population density 265 inhabitants per km²). In other words, the population density in urban areas is very thick. GDP per capita reaches the amount of 44,909 US dollars, ranking the country 17th among OECD members, with a predicted annual growth rate of 1.1% (it must be noted that the government’s debt is 116.9% of GDP). The annual industrial production sales growth rate decreased 1.5% last year.

GHG emissions are 5.7 tonnes per capita with the tendency to decrease slowly but steadily over the last 20 years. Tax revenues depict 35% of total GDP. Approximately 2.5% of them come from environmental taxation. According to Eurostat data dating back to 2016, 72% of United Kingdom’s environmental tax revenues comes from energy taxes, 26% from transport taxes and only 2% from pollution/resource taxes. Total expenditure on environmental protection in the years 2017 and 2018 has reached the amount of 11.8 million british pounds (annually 5,800,000,000 billion pounds, that represents 0.002% of GDP). The majority of the investment was put upon waste management. Approximately 8 billion british pounds went on waste management.

According to IEA, Great Britain has taken the hard task of decarbonizing its energy sector by 80% until 2050. That will call for extended investment on the energy sector and new infrastructure, but the country is a leading example as far as finding sound solutions for low carbon investment is concerned. The country has adopted an ambitious plan of Electricity Market Reform that will be implemented in the next few years.

With regard to environmental taxation, special reference should be made to the special tax on vehicles imposed in the center of the capital in 2003. This tax led to a
sharp reduction in the use of vehicles, which in turn has led to a significant reduction in greenhouse gas emissions, especially in the wider London area.

According to Zoltán (2013), the literatures’ data clearly shows that the UK is one of the most significant tax revenue-producing countries in the EU, where all types of environmental taxes have been introduced: waste tax, climate change levy, raw materials’ tax, and excise duty on fuel, vehicle tax, London’s congestion charge.\textsuperscript{15}

As regards the rule of law, Great Britain is one of the oldest democracies in Europe with a parliamentary history of around 400 years. The rule of law is strong, as extensive experience exists. The long-standing democratic history has given the country powerful institutions.

Special mention should be made at this point of the UK’s exit process from the European Union (widely known as Brexit), that has begun in 2016 and is expected to be completed in March 2019. Brexit had a negative impact on the country at an economic level. To elaborate, the exchange rate of the British pound has declined significantly in the last two years, and has reached almost the same level as the euro. Many global companies and organizations based in London have left the country for Ireland and Germany, while before that, London was considered the Europe’s financial capital. It is only interesting to watch closely in the future how the British will face the challenges posed by leaving the EU.

\textbf{3.4 The case of Netherlands}\textsuperscript{16}

The Netherlands are the sixth largest economy in the euro zone and has a population of 16,800,000 million with a growth rate of 0.3%. Out of this population, 85.1% live in urban areas, making the country the first more urbanized among the OECD countries (actual population density 488 inhabitants per km\textsuperscript{2}). It appears reasonable to assume that there is high population density in the cities. This fact takes place due to

\textsuperscript{15} Nagy, Zoltán. "The role of environmental taxation in environmental policy." \textit{Proceedings of Novi Sad Faculty of Law} 47.3 (2013): 515. P.526.

\textsuperscript{16} OECD (2015), \textit{OECD Environmental Performance Reviews: The Netherlands 2015}, OECD Publishing
the geographical location and the territorial specificity of the country, which is below sea level.

The GDP per capita of the country is 54.436 USD dollars ranking the country seventh among OECD members. The annual growth rate of GDP is 2.1%. It must be noted that the government’s debt is 70% of GDP. The country has not escaped from the financial crisis of 2008. The latter is reflected in the severe fall of GDP at a rate of 3.9% in just one year in 2009. The annual industry production sales growth rate increased 0.40 in the last year (2018).

GHG emissions are 9.2 tonnes per capita with the tendency to decrease slowly but steadily over the last 20 years. 85% of GHG emissions come from CO2 and the bulk of them from the energy sector. Figure 3.4 depicts the GHG emissions per capita of Netherlands and other European countries.

![Figure 3.4](image)


Tax revenues depict 38.8% of total GDP. Approximately 3.5% of them come from environmental taxation, significantly above OECD average that is 2%. They consist mainly by energy taxes, transport taxes and a high amount of pollution taxes (for example, a tax pollution of surface of waters and sewerage tax has been implemented). Total expenditure on environmental protection in the years 2000 until 2013 has reached the level of 2% of GDP, well above OECD average.
Special mention should be made in the fact that, since the year 2000, Netherlands has managed the absolute decoupling of GHG emissions from GDP and economic growth. According to the OECD 2015 Environmental Performance Report, the Netherlands has the characteristic that since the 1980s it implements innovative practices in all sectors, resulting in the fact that it has exhausted most possible innovations. Hence, today it has only short term incremental and not radical plans.

The Netherlands is a country with a long democratic history. The main feature of the country is respect for human rights, the protection of minorities, and tolerance. These circumstances have an impact on society as well as on democratic institutions, which are powerful.

3.5 The case of Sweden

Sweden is classified as one of the Nordic countries which are generally recognised as the most successful countries of the European Union, in terms of quality of life. Sweden has a population of 9,600,000 million, with a growth rate of 0.9%. Out of this population, 22.3% live in urban areas. Thus, only 2% of the country is urbanized, making 98% of the country rural. Population density is 21 inhabitants per square km, lower than the OECD average that is 109 inhabitants/km².

The GDP per capita of the country is 51.405 USD dollars, ranking the country 12th among OECD members. The annual growth rate of GDP is 1.9 %. It must ne noted that the government’s debt is 57.9% of GDP). The country has not escaped from the financial crisis of 2008. The latter is reflected in the severe fall of GDP at a rate of 5% in just one year in 2009. The annual industry production sales growth rate increased 3.4% in the last year (2018).

GHG emissions are 3,8 tonnes per capita, with the tendency to decrease slowly but steadily over the last 14 years. Road transport is responsible for 31% of GHG emissions, while 25% of GHG emissions come from industry.

Tax revenues depict 44% of total GDP, ranking the country third among OECD members and well above OECD average. Approximately 5.7% of them come from

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environmental taxation. They consist mainly 80% of energy taxes, 19% of transport taxes and 1% of other environmental related taxes. Total expenditure on environmental protection has reached the level of 1% of GDP.

Sweden belongs to the group of the most innovative countries on the planet, in terms of environmental legislation and the use of environmental economic tools, such as environmental taxes. It has adopted a very optimistic and innovative plan for the European Energy Roadmap 2050, according to which it plans to cut off all of greenhouse gas emissions by 2050. It is the only country that has managed to apply the double dividend hypothesis: the country has increased the CO2 tax, making it one of the highest taxes in the world, and managed to lower the taxes on labor thereby neutralizing the potentially negative impact of environmentally related taxes on income distribution.\(^\text{18}\)

The above determination, as far as the goals of the country are concerned, reveals a deep democratic country that respects its citizen’s future and plans for it. The country is also known for its respect of human rights, the protection of minorities and tolerance. One of the country distinctive characteristics is the extremely low levels of crime, which reveals a deeply educated and conscious society. The latter are testaments of strong institutions and rule of law.

4. Conclusions

Continuing the logical flaw of this thesis, in this fourth chapter we will analyze and compare the results of the parameters/variables we used in the sample countries and listed in the previous chapter. In order to better describe the basic data analyzed, and to guide our discussion, Table 4.1 summarizes the values of the main variables used for each country in a handy mode.

\(^{18}\) Ibid p.66
As far as investments on environmental protection are concerned, it is clear from the above-mentioned data that all countries, except Greece, give a significant percentage of their GDP for this purpose. It is generally accepted that the investment to protect the environment can stimulate the use of new technologies, that are environmentally friendly and that will lead to subsequently mitigating the GHG emissions. The Netherlands has been applying the investment for environmental protection since the 1980s and has introduced many new innovations. Together with Sweden they are considered as innovator countries. Not far behind is United Kingdom especially in the region of waste management. Greece has nothing to demonstrate in this field, given that, there is no evidence to show that the country is consciously investing money out of its state budget for environmental protection. On the contrary, it only uses a funded budget from the European Investment Fund.

As far as the GHG emissions per capita are concerned, Netherlands with a high urbanized population of 16,500,000 million people is ranked first, with 9.2 tons per capita followed by Greece with 5.9 tons per capita (population 11,100,000 million), then UK with 5.7 tons per capita (population 63,000,000 million), France 4.4 tons per capita (population 64,000,000 million) and last Sweden 3.8 tons per capita. The above parameter should be interpreted in relation to population density and the urbanization of a country. In particular, the three most urbanized countries are Netherlands, Greece and UK, which have the highest rates of GHG emissions of all 5 sample countries.

Table 4.1 - Overview of variables

<table>
<thead>
<tr>
<th>Selected Countries</th>
<th>Investments on environmental protection (% of GDP)</th>
<th>GHG emissions per capita (tonnes of CO₂)</th>
<th>GDP per capita (USD)</th>
<th>Annual GDP growth rate (%)</th>
<th>Annual production sales growth rate (%)</th>
<th>Share of environmental taxation in overall taxes (%)</th>
<th>Population density in the country (people per km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>0 %</td>
<td>5.9</td>
<td>28.544</td>
<td>2.1 %</td>
<td>3.1 %</td>
<td>2.8 %</td>
<td>82</td>
</tr>
<tr>
<td>France</td>
<td>2 %</td>
<td>4.4</td>
<td>39</td>
<td>1 %</td>
<td>2.1 %</td>
<td>2 %</td>
<td>117</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.002 %</td>
<td>5.7</td>
<td>44.909</td>
<td>1.1 %</td>
<td>-1.5 %</td>
<td>2.5 %</td>
<td>265</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2 %</td>
<td>9.2</td>
<td>54.436</td>
<td>2.1 %</td>
<td>2 %</td>
<td>3.5 %</td>
<td>488</td>
</tr>
<tr>
<td>Sweden</td>
<td>1 %</td>
<td>3.8</td>
<td>51.405</td>
<td>1.9 %</td>
<td>3.4 %</td>
<td>5.7 %</td>
<td>21</td>
</tr>
</tbody>
</table>

As far as investments on environmental protection are concerned, it is clear from the above-mentioned data that all countries, except Greece, give a significant percentage of their GDP for this purpose. It is generally accepted that the investment to protect the environment can stimulate the use of new technologies, that are environmentally friendly and that will lead to subsequently mitigating the GHG emissions. The Netherlands has been applying the investment for environmental protection since the 1980s and has introduced many new innovations. Together with Sweden they are considered as innovator countries. Not far behind is United Kingdom especially in the region of waste management. Greece has nothing to demonstrate in this field, given that, there is no evidence to show that the country is consciously investing money out of its state budget for environmental protection. On the contrary, it only uses a funded budget from the European Investment Fund.

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specifically, both the United Kingdom and Greece have extremely densely populated capital cities (for example, there are 5,000,000 people living in Athens, half of the country's population). In this case, London, in order to solve the issue of particularly elevated greenhouse gases, introduced an environmental tax on the circulation of vehicles which was implemented with great success and greatly reduced GHG gases in the London area and greatly improved air quality.

In the case of the percentage of environmental taxes in general taxes the ranking between the five sample countries is as follows: First is Sweden with 5.7% of environmental taxes on overall taxes, then Netherlands with 3.5%, then France with 4.4%, then Greece with 2.8% and UK with 2.5%. This ranking is not accidental, as it demonstrates the will and rationale of each country and its investment in economic tools in order to combat climate change. Especially with regard to the latter, it should be noted that even if the United Kingdom is the last to be ranked, it has the widest range of environmental taxes and is not limited to only three types like all other countries (i.e. energy, fuel and transport). For this reason, it is not possible to have high environmental taxes in all fields, as this would have a problem with the acceptance of taxes by citizens. If we compare that to GHG emissions per capita in each country, we can safely conclude that the higher the environmental taxes are, the higher the reduction of GHG emissions are. This is the case especially with Sweden where there is a combination of high environmental taxes and the lowest level of GHG emissions (3.8 tons /per capita).

As far as GDP per capita is concerned, the ranking is as follows: the first country is Netherlands with 54.4 USD/capita, then Sweden with 51.4 USD/capita, then UK with 44/capita, then France with 39/capita and last Greece with 28.5 USD/capita. If we compare these numbers with the GHG emissions, we can arrive safely to the conclusion that in the case of Sweden the relationship between economic growth and greenhouse gases is inversely proportional. The bigger the economic growth, the fewer gases are released. The same principle applies to Greece, which has little economic growth but large gas emissions. The ranking changes in the case of Netherlands which, even though it is the most economically developed country of all, it has high rates of greenhouse gas emissions. This case should be considered in conjunction with other factors such as the fact that the country has managed to completely disassociate
greenhouse gases from economic growth, the intense urbanization and the fact that the specific country has a lot of mineral wealth that it exploits.

As far as the annual industry production sales growth rate parameter is concerned, the ranking of the countries is as follows: first is Sweden with an increased growth rate of 3.5%, then comes Greece with an increase of 3.1 %, then Netherlands with an increase of 0.40 %, then the UK with the decrease of 1.5% and last France with a decrease of 2.1 %. If we compare this parameter with the GHG emissions, we cannot conclude safely that it contributes somehow to the abating of GHG emissions. But we can compare this indicator with the ratio of the percentage of environmental taxes to the GDP of each country, and we can notice that in all countries with high environmental taxes, Sweden, Greece and the Netherlands are increasing their business activity without being hampered from the imposition of taxes. In the United Kingdom with low environmental taxes, the index is low. The logic, however, is broken down in France where, despite the fact that environmental taxes are high, industrial production is declining.

As far as the parameter of rule of law is concerned this cannot be measured in figures but only by concrete examples from the sample countries, that is only abstract and subjective. First of all, all the countries have parliamentary and / or presidential democracy. The legitimate representative of the state, whether called prime minister or president, is directly elected by the people. However, all countries examined in this thesis have a different level of political will and law enforcement. For example, the Netherlands and Sweden that have achieved the greatest reduction in greenhouse gases have begun to take action since the 1980s, even before the Kyoto Protocol, have strong democratic governments with high respect for human rights. It is remarkable that in either of the Netherlands, the United Kingdom or Sweden, citizens do not complain about the imposition of environmental taxes and have accepted them. This is justified by their belief that the state will do the right thing. However, this is not the case with France and Greece. In the case of France, an illuminating example was that of the tax on fuel, which was imposed without taking into account the acceptance of the tax by taxpayers. In the case of Greece things are even worse. The country has no fiscal system stability due to the ten-year austerity. It holds the 80th place among 182
countries in the OECD corruption index, and taxes are imposed not with the scope to prevent climate change, but to purely collect revenues. The result is that the citizen does not embed trust in the rule of law, and the latter is weak. It is indicative of this situation that the country does not comply with its own commitments to the European Commission, for example by failing to take appropriate measures to reduce air pollution. The European Commission has issued a warning to Greece that NOx has exceeded the permitted limits in the Athens area during the period 2010-2014. The country faces severe implications due to its delinquent behavior.19

Grounding in the above information, we can conclude the following: there can be no objectification of the indicators, as they are empirical and most of them are dynamic (such as the index of population density which changes with the passing of time). However, they show the general trend. Moreover it is very ambitious to derive any hard evidenced conclusions based on such a small sample of countries. Therefore the following conclusions are limited to the countries that were studied in this thesis.

According to the comparison between the indices of population density and GHG emissions of each country, in combination with the factor of urbanization, it becomes evident that the sample countries that have a high density of population in urban areas produce more GHG emissions. In such cases, the imposition of environmental taxes can be as efficient as in the case of London, as described above. The combination of the indices of annual industry production sales growth rate and GHG emissions can lead us to the conclusion that the imposition of environmental taxes on the specific countries cannot hold back economic growth. In fact, the cases of countries like Sweden and Greece support the latter. The same applies for the comparison between the indices of GDP per capita and GHG emissions. We can hereby arrive to the conclusion that the relationship between economic growth and reduction of greenhouse gases is inversely proportional in the compared countries, as in the case of Sweden. Simply put, the bigger the economic growth, the fewer gases are released. In Sweden, the percentages of environmental taxes that have been imposed are 5.7% of the overall imposed taxes of the country. This fact demonstrates that the specific

countries that have high economic growth are more environmentally conscious and impose higher environmental taxes. On the contrary, in the case of the United Kingdom where the imposition of environmental taxes is lower in percentage, the reduction of GHG emissions is steady but lower the last 20 years. As to the parameter of the rule of law, we can only monitor a general trend according to which countries with respect for human rights, who prioritize their citizens with opaque processes and greater political will, have a tendency to apply more rigorously the environmental legislation, a policy which leads to the reduction of greenhouse gases (the example of Sweden versus Greece).

It is important to stress out that we cannot conclude with certainty that there is an evidenced connection between taxation and CO2 emissions as well as between high levels of GDP and low GHG emissions as there are countries like Canada, US and Australia that the per capita CO2 emissions are very high. So the conclusions can only be limited in the sample countries that already have been mentioned.

5. Implications for Greece

Having discussed the key conclusions of this thesis, in this chapter we will analyze what Greece can gain from the above information, improving the wrongs. Building upon the insights of both the theory on the topic at hand, and the best practices of the developed countries described above, a number of intriguing implications for Greece can be derived.

By contrasting the indices of Greece against those of the other 4 developed countries, it becomes evident that Greece is lagging behind both in the areas of environmental and economical indices. As described in the theoretical section of this dissertation, there is a direct interrelationship between GDP growth and a reduction in GHG. Therefore, the country has a lot to gain from the examples of the countries cited above. Without a doubt, there is a great need to improve its economic growth. Even though it is already in the process of correcting its fiscal indicators, as evidenced by the per capita GDP growth, further improvement is needed. Thereupon, an appropriate fine-
tuned environmental taxation policy could comprise a powerful tool towards this desired direction.

Also, as demonstrated from the international comparison of the “investments for the protection of environment” index, Greece was lagging behind again. This index appears to be another crucial driver for reducing GHG emissions. In this regard, the attraction of investments from private capital and the investment of public money by the Greek state itself for the protection of the environment will probably further improve the fiscal indicators.

Also, another potentially useful implication of this thesis regards the nature and the scope of the imposition of environmental taxes. The latter should be combined with the introduction of a new philosophy in relation to Greece’s tax system. Until now, taxation even in the environmental sector has been applied solely on the basis of collectability. On the contrary, from now on, this philosophy will have to change in the field of the environment, and should be directly linked to the GHG reduction performance.

Another challenging area where the country needs to significantly improve is the issue of the rule of law, the applicability of its laws, and the respect for its commitments to the European Union. This would greatly help the country to optimize the rule of law, a concept that needs to be reinforced in the country. Furthermore, Greece needs to address the spectrum of widespread corruption. These factors cumulatively have been found to optimize the environmental laws and accordingly reduce the GHG emissions.

If the country is able to successfully implement all of the above, it will be able to fully exploit environmental taxation as an economic tool, in order to make immediate use of its benefits, with the ultimate goal of improving the environment for its citizens.

6. Research Limitations and Suggestions for Future Research

As with all research endeavors, this study is subject to certain limitations and boundary conditions. In the present thesis, the parameters detailed in the chapter of
the research methodology were used, and they are the ones most commonly proposed in the literature. However, there is no grouping or specific objectification of the parameters in the literature. Indeed, in the literature, various schools of thought exist, no strict consensus exists, while there is a debate, as regards the effectiveness of the parameter of investment in environmental protection and carbon tax (such as that applied to France and which the EU intends to implement). The parameter of research and development of new, environmentally friendly technology is considered by some scholars to be more effective than the investment of environmental protection.

In addition, for the needs of the present thesis, 5 countries of the European Union were used as sampling units in order to compare the results of the respective parameters and to draw conclusions. However, this sample is very limited and future research could use additional countries in order to assess the effectiveness of environmental taxes. Unfortunately, this cannot be done in the context of this thesis, because of space constrictions. Therefore the conclusions must be limited in the countries that were studied in the present thesis.
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Articles:


**Online articles:**