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Environmental Tax Policy in Romania in the Context of the EU: Double Dividend Theory

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Abstract: In the last decade, environment protection gained much more significance in designing the economic policies in the European Union (EU) countries. There are many economic and policy differences between the European countries, despite of the harmonization process inside the EU area. The path of implementation of the environmental tax reforms in the EU countries differs greatly from one country to another and the effects of such taxation in the economic and environmental areas are manifold. The authors of this paper have agreed to undertake the task of testing the double dividend hypothesis of the environmental taxation in Romania (an energy-intensive country) versus the EU area as a whole, using Vector Error Correction Model (VECM) techniques and Ordinary Least Squares (OLS) estimations. Our findings show that this hypothesis is validated neither in Romania (in the economic growth area) nor in the EU area as a whole (in the unemployment area). Therefore, Romania cannot increase the level of the environmental tax for supporting economic growth, but it can grant environmental subsidies for decreasing the emissions and supporting the economic growth. This could be achieved by expanding the tax labor base and by collecting higher budgetary revenues to sustain such environmental subsidies. As far as the EU area is concerned, it is a necessary measure to continue the descending trend for the labor taxation to achieve the goal of improving the employment rate.

Keywords: environmental taxes; Growth Domestic Product (GDP) growth; unemployment; greenhouse CO_2 emissions; Romania; EU area

1. Introduction

As a result of recent concerns relating to the negative effects of global warming, policy makers have become interested in the use of environmental taxation as a means of combating pollution. Most policies regarding the environmental protection were introduced in Europe at the end of 1998–1999. Where the rule of law was strong and policies were properly set, the volume of environmental taxation first increased and then decreased as a consequence of the effectiveness of environmental policies [1].

The idea to shift taxation from labor to pollution started with Sweden's tax reform (1989) when many European countries began cautiously to alter their tax systems in this direction. In a Europe where trade barriers were removed, unilateralism in the environmental tax reform was not a simple task and this has led to some complex tax schemes with many exemptions [2].

Some European countries, such as the Scandinavian countries and The Netherlands, have achieved significant progress in applying such environmental tax policies. Even though the revenue generated

was not the main aim of environmental policy, most of these countries recycle the revenue obtained from taxation back into the economy by reducing the income tax and increasing investments, which contributes to economic performance (double dividend theory). The success of taxation has induced the Environmental Tax Reform. This reform's main goal is to promote economic growth, reduce unemployment and protect the environment [3,4].

Environmental taxation seemed to play a more significant role in Europe (especially in the Scandinavian countries) than in other continents at the beginning of the 2000s. This is partly reflected in higher environmental tax revenue as a share of GDP in the European countries against USA, Canada, Australia, Turkey, Switzerland, and Japan. It is also partly related to a greater reliance on taxes as an instrument of environmental policy and partly due to a greater acceptance of taxes and maybe a larger public sector overall. It may also be due to a more ambitious goal when it comes to reductions in fossil energy use, particularly for transportation. There are still considerable differences within Europe when it comes to the level of taxation, the use of the revenues collected and other issues.

A number of formerly planned economies of Eastern Europe had already implemented a form of environmental taxes under the old political regime. They did not earn revenues on this market but governmental funds were allocated where necessary. This policy raised environmental awareness and it facilitated the introduction of real tax instruments as these economies started their transition process. There has been quite a popular pressure in favor of the environmental tax reform and several countries have officially carried out such important reforms. When it comes to taxes, experience showed that various forms of tax relief appeared, particularly in the energy intensive industries where the incentive effect is most needed [5].

Environmental tax reform has been implemented in several European countries and around the world in the past three decades [6].

Numerous studies confirm the importance of the environmental taxes for pollution reduction [7–9]. The use of environmental taxation is found to produce not only environmental, but also economic benefits such as economic growth or higher employment [10–12]. These findings confirm the importance of environmental taxation.

Social impacts on jobs, equity, distribution, and consumer prices vary across countries and over time and they are strongly related with other taxes that were reduced, how the tax policy is designed, and how these revenues are used [13]. The environmental taxes increase the disposable income, by allowing a reduction of the tax on labor, but, at the same time, the tax on energy products will increase the costs of energy bills for households or enterprises.

Using a panel of EU members and Norway during 1995–2006, some studies proved there is a significant negative relationship between environmental taxes and pollution, but no relationship between taxes and energy consumption. This suggests environmental taxes are not reducing consumption, implying pollution is being reduced through the use of cleaner technologies, so the exemptions for energy-intensive sectors of the economy have had only a limited effect on the efficacy of this policy until 2006 [14].

The tax relative to total taxes is more significant for the pollution decline than the environment tax to GDP [4] because their relationship with other taxes needs to be included, but environmental taxes relative to GDP are important for their impact on economic growth and employment. Most of the studies conclude that increased environmental tax and environment regulations can have beneficial effects on the environment [12]. Grossman and Krueger [15] provided evidence for a non-linear relationship between per capita income and pollution, with an inverted U-shaped relationship. Some studies proved there are differences among old EU members and the new EU members. Former transition countries have not yet reached the turning point of the U-curve, and this probably reflects less stringent institutional context [16] for a full implementation of the environmental policies. In the European countries where environmental taxation has started to decrease, this is mainly due to institutional reforms [1].

However, other studies [17] suggest the relationship could be monotonic. Some studies [18] find the relationship tends to be country specific and dependent on the approach used. Some authors [19] found that the inverted U-shaped relationship between GDP and pollution (Kuznets curve approach) is not validated for all countries and all model specifications. It could also be due to the role of the EU harmonization policy in environment tax and regulation area. However, there is little evidence of fiscal factors being considered in this area of the empirical literature at the macroeconomic level.

A 2009 study empirically showed that CO_2 emissions will decrease in all EU member states, including new EU member states such as Romania up to 2020. In countries with high carbon intensity (such as the new EU member states), environmental tax reforms are higher than in the countries with lower carbon intensity. This study estimated a reduction of CO_2 emissions of 16.7% for the entire EU area and 31.7% for Romania by 2020. Environmental tax reforms represent an important part of the policy mix that will be required to achieve significant cuts in greenhouse gas emissions [16].

Some authors emphasize the importance of fuel taxes in designing the general framework of the energy taxation system [20–22]. For example, Sterner [22] emphasized the long-term positive effect of fuel taxes in Europe and argue that carbon emissions are reduced by more than a half (the content of carbon in the atmosphere is reduced by more than 1 ppm), by introducing high fuel taxes.

Ezcurra and Jessen [23] claimed that environmental taxation can be a more effective tool in promoting economic growth if it is accompanied by a state support system for energy-efficient areas. In addition, in some studies [24], a European energy policy review concluded that there is a contradiction regarding the energy tax system and tax incentives that significantly influences the competitiveness of European industry.

If the altering of industrial competitiveness (by the burden of a higher energy bill) represents a certain short-run effect of environmental taxation, in the long run, the environmental policies have shown different but significant effects on reducing carbon emissions, carbon intensity and energy consumption. Some researches proved that the environmental tax has a direct impact on reduction in emissions, on increasing economic growth and granting social welfare [25]. Same researchers proved that the relationship between investments, economic growth and energy tax rates is not significant after the last crisis [26].

Studies focusing on the European countries found a positive impact of the environmental tax on employment and a weak or even negative effect on output [3,8,12]. In a study on the UK market [27] and most empirical studies for US, the double dividend hypothesis fails [4]. Other studies have empirically analyzed the correlation between the environmental policy and the economic benefits (separately for output effects or for employment effects) and concluded that the results varied according to the tax-type, environmental policy, economic model used or region. For Europe, these studies underlined a negative effect of the environmental taxes on CO_2 emissions, a positive effect of employment rate and a small negative effect on output. These effects were more significant for the Northern European countries than for the Mediterranean ones [28].

For the new EU member states, a study from 2004 has underlined that a harmonization of the energy tax with the EU policy in this area would generate a decrease of CO_2 emissions, of energy demand, but also of GDP [29].

All EU countries will see an increase in employment by 2020 (with some differences between the European countries) and the great majority also see an increase in output. Introducing environmental tax reforms will inevitably lead to winners and losers among different economic sectors and different households. There has been important research into the effects of the environmental tax reforms [30]. In some countries, the negative effects of the higher energy and gas costs (affecting especially the households that pay almost 44% of the total energy costs) outweigh the benefits of the environmental tax reforms. Exports are expected to decrease in many countries. This means that countries that rely on exports tend to lose out more (Spain, Romania, and Hungary). In addition, lowering the tax on labor does not always lead to significant rise of employment. This tends to happen in countries with

more highly regulated labor markets (Sweden). In Romania, GDP is expected to slowly increase by 0.9% by 2020, against 0.6% on average for the entire EU as a result of applying the environmental taxes, while employment is expected to increase by 6% in Romania (the highest increase among EU countries, Romania being followed by other Central and Eastern European (CEE) countries such as Slovakia, the Czech Republic, and Estonia) against 2.2% for the entire EU. The impact of the environmental tax on GDP is quite modest, but its impact on employment is substantial. Still, the environmental tax reforms lead to technological innovation, employment and the creation of new industries (which can contribute significantly to long-term economic development). These are substantial benefits for the public policy in the long run [31].

Romania relies on the traditional energy sources to satisfy its energy needs and experienced important changes in the environmental tax policy. The econometric analysis presented in some studies (using annual data during 2000–2011) showed a negative relation between GDP per capita and environmental taxes for energy as percent of GDP, environmental taxes for pollution as percent of GDP, but an overall small positive impact of the total environment taxes to GDP on the GDP per capita [32].

The expected result of an environment tax reform (ETR)—a decrease of the labor taxation-to-GDP ratio and an increase in the environmental tax-to-GDP ratio—was achieved in those EU countries which implemented explicitly the ETR: Denmark, Finland, Germany, Austria and The Netherlands (especially those related to energy products). In France and Italy, although they adopted ETR in the late 1990s, this program never actually took place at that time. CEE countries have revised their tax policies as well as implemented changes in the overall public finance systems during the years following their accession to EU (especially those related to transport first, and, over time, those related to energy products). The Baltic states doubled their environment tax, while in Hungary and Czech Republic, tax level was much lower than the average of the CEE region, but similar to some of the old EU member states. However, on average, the level of the environment tax in CEE region was lower in 2006–2007 than the level of the EU-25. A feature of the environmental tax and charge system in CEE region is represented by the fact that these countries gain revenues from environmental taxes and charges, in particular from pollution and resource taxes to special parafiscal environmental funds [33]. Environmental funds play a significant role in co-financing environmental investment infrastructure. The new EU member states negotiated temporary exemptions and transitional periods for the full compliance with the environmental regulations for not creating important economic and social difficulties in view of the economic transition process they faced [34].

Although the actual number of environmental taxes implemented in EU member states has increased, the environmental revenues as a proportion of GDP has decreased. Trends for the labor tax revenues during 2002–2014 reveal an even larger increase than for GDP and environmental tax revenue at EU-28 level. This trend does not fit the idea of implementing tax-shifting programs. The growth of environmental tax revenues in the EU-28 has exceeded the development of GDP and labor tax revenues only after the economic and financial crisis of 2008/2009. During 2000–2009, the situation was just the opposite, but once the crisis erupted, the unemployment rate started to increase, so the labor taxation related to GDP decreased and in many European countries (where the environmental taxes relative to GDP had increased before the crisis). The developments in EU countries were rather diverse, with increases in environmental tax revenues exceeding GDP growth and labor taxation revenues in a number of countries including Bulgaria, Estonia, Greece, Latvia, Poland and Slovenia, between 2000 and 2015. A sharp increase in environmental tax revenues in the post-crisis years could be seen in France, Greece, Finland and Italy, while in Estonia, Poland and Slovenia there was a continuous rise in environmental tax revenues during 2000–2015 [35].

During 1996–2015, Romania displayed an environmental tax as a share of GDP of 1.75–3.8%, while, in the entire EU, it ranged from 2.28 to 2.87% of GDP [35]. After 2002, the level of the environmental taxation in Romania decreased below the EU average level. In 2015, this level is quite similar for Romania and EU, although Romania ranged among the EU countries with a low share of environmental tax of GDP (around 2%, similar to Spain, France, Lithuania and Slovakia).

Currently, environmental taxes account for around 6% of total tax revenues in the EU area [34]. Environmental tax for the energy products are valid in all EU member states, while for transport products there are some exemptions in Bulgaria or the Baltic States, the Czech Republic, Germany or Sweden. In Romania, there is a tax for pollution, unlike some other EU member states such as Bulgaria, Italy, Finland, Ireland, Germany or Greece. This tax can be seen only in several Central and Eastern European countries (Estonia, Latvia, Lithuania, and Romania).

During 2001–2015, the growth path of the total environmental tax (2.4%) was quite similar to the growth of GDP (2.7%) in EU-28. The crisis caused a severe contraction of the economic activity in the EU, leading to lower tax revenue, but starting with 2010, environmental tax revenues returned to an ascending path. Taxes on pollution and environmental transport taxes remain quite the same during 2001–2015, while environmental energy taxes increased in the EU-28 during the same period, after a small decrease in 2008–2009, during the crisis. Relative to GDP, in 2015, environmental tax revenues in the EU reached the highest value in Croatia (4.1%), followed by Denmark (4.0%), Slovenia (3.9%) and Greece (3.7%). The lowest ratios of environmental tax revenues to GDP (below 2%) were recorded in six EU Member States (Slovakia, Lithuania, Luxembourg, Spain, Ireland and Germany). The proportion of environmental taxes in total revenues from taxes and social contributions also varied significantly: Croatia (10.9%), Slovenia (10.6%), Greece (10.3%) and Bulgaria (10.0%). Four other EU Member States recorded a share of at least 9%: Latvia (9.3%), Malta (9.1%), Cyprus and The Netherlands (both 9.0%). Romania has a share of near 8.5%. At the opposite end of the scale, Belgium (4.7%) and France (4.8%) had the lowest shares of environmental taxes, followed by Luxembourg (4.9%), Germany (5.0%) and Sweden (5.1%). In 2015, the highest share of the environmental tax of total tax revenues was recorded in Serbia (11.0%) [36].

The structure of the environmental taxes in EU-28 in 2015 shows that tax on energy products displays a share of around 76.7% of the total environmental taxes; the tax on transport displays a share of around 19.8% of the total environmental taxes; and the pollution tax has a share of around 3.5%. (This is a tax on fossil fuels such as oil, coal and natural gas. The purpose of an energy tax is to give enterprises and consumers a stimulus to use alternative energy sources—solar and wind power—and to raise public revenues. Energy taxes are necessary to reduce the greenhouse gas emissions. Opponents of energy taxes claim there are also negative consequences, such as an increase in the general prices level that will reduce consumers' disposable income.) Total environmental tax displays a share of 2.4% of GDP and a share of 6.3% of the total revenues from compulsory levies. In Romania, the tax on energy products displays a share of almost 90%; tax on transport displays a share of almost 8%; and the tax on pollution has a 2% share of the total environmental taxes [36].

Energy taxes were high in the Czech Republic, Lithuania, Luxembourg and Romania, where they accounted for more than 90% of total environmental tax revenues. Energy taxes slightly exceeded 50% of the revenues from environmental taxes in Malta (51.3%), and accounted only for 55–56% of the total tax in Norway (55.4%), Denmark (55.5%) and The Netherlands (55.9%) [34]. Energy taxes of GDP in Romania are lower than the average level of the Central and Eastern European area [36].

Transport taxes represented 19.8% of the total environmental taxes in EU-28 in 2015. (The EU Energy Tax Directive sets a minimum tax level for different kinds of fuels, including diesel, petrol and heating fuel. The most important for the environment protection is the diesel tax minimum rate.) They were high in Austria (35.5%), Ireland (38%), Denmark (38.7%), Malta (40.3%) and Norway (40.6%). The smallest shares of transport taxes in total revenues from environmental taxes were in Estonia (2.2%) and in Lithuania (2.5%) [34]. Transport taxes of GDP in Romania are quite similar with the average level of the Central and Eastern European area, but, during the crisis, they were a little higher in Romania [36].

Pollution and resource taxes represented a relatively small share (3.5%) of total environmental tax revenues in the EU-28 in 2015. (Pollution tax is designed to reduce pollution negative effect on the environment. It stimulates the polluters to reduce emissions and use cleaner alternatives. Many European countries use pollution taxes—taxes on emissions of common air pollutants

(sulfur dioxide and nitrogen oxides) This category of environmental taxes groups a variety of taxes levied (on waste, water pollution). In many European countries, such taxes were introduced more recently. However, a much higher share for pollution and resource taxes was observed in Croatia (16.9%), and in The Netherlands (13.7%). In Greece, there is no such tax and in Germany, Cyprus and Romania marginal amounts of the pollution taxes were recorded [37].

The trend of population ageing in the EU countries shows a more or less stable level of labor supply in the EU up to 2023 (age group 20–64) followed by a decline of about 6% between 2023 and 2050. Thus, the forecast of the employment level shows a decline of about 3% up to 2050 under these specific circumstances. The trend of a diminishing of the revenue base may have consequences for the budgets of countries that rely heavily on labor taxation (Sweden and Germany) [35].

Moreover, in the long run, a OECD report and some studies conclude that with much lower CO_2 emissions anticipated in the second half of the century, and therefore lower fossil fuel use, the question of important and stable budgetary resources will become increasingly significant for many countries [38–40], but, currently, the CO_2 emissions rise every year in the EU area as a whole and in Romania, so there is enough potential in rising the environmental tax (especially in an energy-intensive economy such as the Romanian one) that could better support the budgetary revenues.

Romania's environmental tax revenues have increased continuously since 2011 and there is still scope to increase the use of environmentally-related taxes on an overall EU level (except the Scandinavian countries, The Netherlands, Cyprus or Italy). The implicit tax rate on energy remains lower in Romania than the EU average (136 versus 233), indicating an energy-intensive economy and scope for improving energy efficiency in Romania as in many other EU countries. A 2016 study suggests that there is considerable potential for shifting taxes from labor to environmental taxes at EU level (these could generate an increase by 1.26% and 1.7% of GDP in 2018 and 2030, respectively). The largest potential source of revenue would come from increases in vehicle taxation (0.6% of GDP against 0.25% of GDP from energy tax or 0.21% of GDP from pollution tax). The suggested increase of vehicle taxation could account for 1.26% of GDP. On average, for the EU area, estimated benefits of reduced environmental impact would be of 0.07% of GDP and, in Romania, this impact would be greater than 0.24% of GDP by 2030 (among the highest in the EU area, together with Bulgaria, Croatia, Estonia or Latvia) [41].

CO_2 emissions are a major contributor to global warming and account for around 80% of all EU greenhouse gas emissions. According to Eurostat, CO_2 emissions rose in 2015 in a majority of EU Member States, with the highest increases being recorded in Slovakia (9.5%), Portugal (8.6%), Hungary (6.7%), Belgium (4.7%) and Bulgaria (4.6%). In Romania, CO_2 emissions rose by 2.4% in 2015. Largest emissions (as share of the total EU CO_2 emissions) come from Germany (23%), UK (12.5%), Italy (10.6%), France (9.9%), Poland (9.2%), Spain (7.4%) and The Netherlands (5.1%). Romania's contribution to the total CO_2 emissions in EU is 2% [36].

The aim of this paper is to empirically analyze the relationship between the environmental tax, GDP growth, unemployment and greenhouse CO_2 emissions in Romania (an energy-intensive country) against the entire EU area. The authors of this paper undertake to empirically test the double dividend hypothesis of the environmental tax reform for Romania against the EU area. This analysis supports some policy recommendations for Romanian environmental policy in the frame of the EU harmonization process in the environmental area. CEE countries gradually implemented the environmental tax policy and allowed some temporary exemptions in this specific area (especially for energy products). There were few studies (mentioned above) on the Romanian case analyzing the effects of the environmental taxes on GDP, but there is no study analyzing the effects of the environmental taxes both in the GDP, employment and the reduction of the CO_2 emissions areas.

Section 2 presents some of the main current challenges for Romania in the environment protection area. Section 3 presents the data and the research methodology the authors used in their analysis. Section 4 discusses the results. Section 5 draws the conclusions to this study and comes up with some policy recommendations for Romania.

2. Challenges for Romania in the Environment Protection Area

As a member of the European Union, Romania is required to implement the environment acquis and to adopt EU regulations into Romanian law. The main national target, and part of Romania's 2020 objectives, is to improve the environment and the standard of living while ensuring resource efficiency. The National Sustainable Development Strategy 2013–2020–2030 recognizes these goals. Romania has underperformed in terms of following all the EU Directives for the environment. Insufficient treatment of wastewater, relying on landfills for solid waste, and high air pollutant concentrations remain the biggest challenges to the national environmental program and the technology should be improved [42].

Environmental legislation was first introduced in 1991. Since then, it has been developed up to the standards imposed by the European Union. Some of the Romanian environmental norms (e.g., the quality of wastewater discharged into surface water sources) are stricter than the EU rules, to protect the already existing polluted environment. However, the Romanian Government negotiated and obtained the EU's approval for transition periods (3 to 12 years from Romania's accession to the EU in 2007) in relation to some Directives on the environment [43].

The revised Emission Trading Scheme Directive from 2003 establishing a scheme for greenhouse gas emission allowance is applicable also to Romania as an EU Member State. For the third trading period (2013–2020) auctioning of allowances is a general rule in the EU rather than an exception. No free allowances are allocated for electricity production (except electricity based on combustion of waste gases). However, Romania is one of the ten Member States (Bulgaria, the Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Malta, Poland, Romania and Hungary) which benefit from limited and temporary derogation from this rule (related to modernization processes or clean technology improvement). Thus, electricity production partly received a free allocation of certificates, but these will be gradually eliminated until 2020 [43].

Right after the crisis, Romania was situated in the lower part of the list of the EU states if we consider the share of the environmental tax on GDP (on the 23rd position in the EU area in 2011). However, the revenues collected from the environment fund have constantly increased since then. Still, the sums obtained at the Environmental Fund represent a very low share of GDP. The revenues from pollution taxes were really small, so the real available revenues for environmental protection programs placed us among the last in Europe's ranking. The situation proves that a major change in the fiscal strategy for the environmental area is necessary in our country. A gradual growth of the total environmental taxes, as well as the introduction of some new tools used in different EU countries represent some necessary measures in Romania. The existence of the budgetary crisis developed in the last years, the recommendations of the EU to modify the taxing scheme (Romania records a high fiscal burden), with a special focus on increasing the consumption and pollution taxes, a more efficient collecting system of the environmental taxes should represent a priority for Romania. The environmental taxes have had an important role in the context of the crisis. If we consider their increase, this could create the possibility of reducing the taxes on the working force, thus stimulating employment and improving the quality of the environment at the same time. In the period 2000–2013 there were modifications in the composition of the environmental taxes at the level of the EU. There is no ideal tax, all the taxes have both pros and cons. Major difficulties may appear in getting a unanimous approval from the states that are EU members [44].

Romania has significantly improved its environmental performance since its EU accession in 2007. While Romanian legislation clearly reflects the environmental requirements agreed at EU level, their implementation on site remains, in general, a challenge. Romania's environmental tax revenues have increased continuously since 2011. The implicit tax rate on energy remains lower than the EU average, indicating an energy-intensive economy and scope for improving energy efficiency. Given that Romania faces problems with achieving environmental goals for water, waste and air, further actions in the area of environmental taxation are justified due to the considerable potential for increasing revenue from environmental taxes. In Romania, the emission of several air pollutants has decreased significantly. Romania needs to make more efforts to meet EU air quality standards [45]. In the context

of the most robust economic growth in the EU area, Romania should focus on achieving the economic development goal, which means improving the environment and the standard of living and ensuring the resources efficiency as well.

3. Research Methodology and Data

3.1. Data

We have used yearly data-series from the Eurostat database (1996–2015) for Romania and EU-28 area for real GDP growth (percent increase from previous year), the unemployment rate (%), the share of the environmental taxes of GDP, the greenhouse gas emissions (in CO_2 equivalent), with base year 1990 (%) (data series are presented in the Appendix A and the description of variables is presented in Table 1).

Table 1. Description of the variables.

Variable	Description
env_tax_gdp_eu	Total environmental taxes as share of GDP in EU (%)
env_tax_gdp_rom	Total environmental taxes as share of GDP in Romania (%)
gdp_eu	Real GDP growth rate in EU—year to year (%)
gdp_rom	Real GDP growth rate in Romania—year to year (%)
greenhou_emis_eu	Greenhouse gas emissions (in CO_2 equivalent), base year 1990, in EU (%)
greenhou_emis_rom	Greenhouse gas emissions (in CO_2 equivalent), base year 1990, in Romania (%)
unemploy_eu	Unemployment rate in EU (%)
unemploy_rom	Unemployment rate in Romania (%)

Source: authors' own selection based on [10–12].

3.2. Research Methodology

We have tested those series for unit root and found out that all these data-series are I(1) (see Appendix B). We have also tested the co-integration (Johansen co-integration test) between the environmental taxes and the unemployment rate, GDP growth rate and greenhouse CO_2 emissions growth rate. The co-integration tests revealed there is a long-term relationship between the environmental taxes and the other three variables. Finally, we have built two Vector Error Correction Models for studying the inter-correlations of the environmental taxes with the unemployment rate, GDP growth rate and greenhouse CO_2 emissions growth rate in the EU area and in Romania.

The VECM equation is:

$$\Delta Y_{1,t} = \alpha_1 x(Y_{2,\,t-1} - \beta\, Y_{1,\,t-1}) + \varepsilon_{1,t} \quad (1)$$

$$\Delta Y_{2,t} = \alpha_2 x(Y_{2,\,t-1} - \beta\, Y_{1,\,t-1}) + \varepsilon_{2,t} \quad (2)$$

where Y_t is a vector K dimensional of endogenous variables, α and β are the coefficients measuring the speed of adjustment of the endogenous variable towards the equilibrium and ε_t is a innovation vector, which is not correlated with the previous values and with the variables from the right part of the above equation.

The linear regressions we have built (using OLS estimations) display the following equation:

$$Y = \beta_1 x X_1 + \beta_2 x X_2 + \ldots\ldots + \beta_k x X_k + \varepsilon \quad (3)$$

where Y is a N-dimensional vector (dependent variable), X_t is a matrix N × K of independent variables, β_t is a K dimensional vector of the regression coefficients and ε is a N dimensional vector representing the innovations associated to the equation, unexplained by the independent variables X. N is the number of observations, and K is the regressors number.

4. Results and Discussion

Because all the used data-series were I(1) (see Appendix B, Tables A2–A9), we have performed the Johansen co-integration test. From these tests it can be stressed that between environmental taxes, greenhouse CO_2 emissions growth rate, unemployment rate and GDP growth in EU there are at most two correlations in the long run (Table 2) and this is exactly the same situation for Romania (Table 3).

Table 2. Co-integration test for EU area (greenhouse CO_2 emissions growth rate, GDP growth rate, unemployment rate, environmental taxes as share of GDP).

Unrestricted Co-Integration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob. ****
None *	0.937561	85.65254	47.85613	0.0000
At most 1 *	0.716023	38.50195	29.79707	0.0039
At most 2	0.546229	13.10132	15.49471	0.0584
At most 3	0.194102	3.668575	3.841466	0.0554
Unrestricted Co-Integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob. ****
None *	0.937561	47.15059	27.58434	0.0001
At most 1 *	0.716023	21.40063	21.13162	0.0458
At most 2	0.546229	13.43275	14.26460	0.0673
At most 3	0.194102	3.668575	3.841466	0.0554

Note: Trace test indicates two co-integrating equation(s) at the 0.05 level; Max-eigenvalue test indicates two co-integrating equation(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; ** MacKinnon–Haug-Michelis (1999) *p*-values; Source: the authors' own calculations using E-views

Table 3. Co-integration test for Romania (greenhouse CO_2 emissions growth rate, GDP growth rate, unemployment rate, environmental taxes as share of GDP).

Unrestricted Co-Integration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob. ****
None *	0.899569	95.85268	47.85613	0.0000
At most 1 *	0.866393	56.78184	29.79707	0.0000
At most 2	0.583388	13.56340	15.49471	0.0536
At most 3	0.363428	2.678191	3.841466	0.0656
Unrestricted Co-Integration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob. ****
None *	0.899569	39.07084	27.58434	0.0011
At most 1 *	0.866393	34.21844	21.13162	0.0004
At most 2	0.583388	14.18521	14.26460	0.0598
At most 3	0.363428	2.678191	3.841466	0.0756

Note: Trace test indicates two co-integrating equation(s) at the 0.05 level; Max-eigenvalue test indicates two co-integrating equation(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; ** MacKinnon–Haug-Michelis (1999) *p*-values; Source: the authors' own calculations using E-views.

It can be inferred from the VECM analysis performed for the EU area (Table 4) and Romania (Table 5) that the impact of the environmental taxes on gas emissions is much more significant in the EU area than the weak impact of the gas emissions on the environmental taxes. There is an inverse correlation between those two variables in the EU area. In Romania, the results show there is a strong

negative impact of the environmental taxes on greenhouse CO_2 emissions and a very weak impact of the greenhouse CO_2 emissions on the environmental taxes.

Table 4. VECM statistics for EU area.

Error Correction:	d(env_tax_gdp_eu)	d(gdp_eu)	d(greenhou_emis_eu)	d(unemploy_eu)
cointeq1	−0.149343 (0.13650) [−1.09407]	−2.869764 (2.98918) [−0.96005]	−4.066114 (3.77778) [−1.07632]	1.980110 (1.10001) [1.80008]
cointeq2	−0.056421 (0.05391) [−1.04660]	−1.464888 (1.18052) [−1.24088]	0.394988 (1.49196) [0.26474]	0.224178 (0.43443) [0.51603]
d(env_tax_gdp_eu(-1))	−0.087262 (0.31575) [−0.27636]	0.531011 (6.91437) [0.07680]	−7.545868 (8.73850) [−0.86352]	0.950808 (2.54447) [0.37368]
d(gdp_eu(-1))	0.016670 (0.01772) [0.94099]	0.373730 (0.38794) [0.96337]	−0.122138 (0.49028) [−0.24912]	−0.157700 (0.14276) [−1.10465]
d(greenhou_emis_eu(-1))	−0.009047 (0.01494) [−0.60574]	−0.263542 (0.32708) [−0.80574]	−0.362840 (0.41337) [−0.87776]	0.129456 (0.12036) [1.07553]
d(unemploy_eu(-1))	−0.093646 (0.09895) [−0.94641]	−1.130435 (2.16680) [−0.52171]	0.751152 (2.73843) [0.27430]	0.945059 (0.79737) [1.18522]
c	−0.026499 (0.02521) [−1.05118]	−0.332981 (0.55204) [−0.60319]	−1.354184 (0.69767) [−1.94100]	0.112281 (0.20315) [0.55271]

Source: the authors' own calculations using E-views.

Table 5. VECM statistics for Romania.

Error Correction:	d(env_tax_gdp_rom)	d(gdp_rom)	d(greenhou_emis_rom)	d(unemploy_rom)
cointeq1	−0.133544 (0.12829) [−1.04096]	1.188836 (0.89605) [1.32676]	1835.105 (333.307) [5.50574]	0.141232 (0.17931) [0.78766]
cointeq2	0.016244 (0.03919) [0.41448]	−1.065409 (0.27373) [−3.89214]	−144.7871 (101.822) [−1.42196]	−0.048853 (0.05478) [−0.89187]
d(env_tax_gdp_rom(-1))	0.428339 (0.36762) [1.16515]	−0.653257 (2.56771) [−0.25441]	−3468.971 (955.125) [−3.63195]	−0.220500 (0.51382) [−0.42914]
d(gdp_rom(-1))	−0.014810 (0.02562) [−0.57811]	−0.007388 (0.17893) [−0.04129]	36.76542 (66.5568) [0.55239]	−0.016019 (0.03580) [−0.44739]
d(greenhou_emis_rom(-1))	-5.70×10^{-5} (6.8×10^{-5}) [−0.83461]	−0.000149 (0.00048) [−0.31230]	−0.057208 (0.17735) [−0.32258]	−0.000145 (9.5×10^{-5}) [1.52023]
d(unemploy_rom(-1))	−0.034168 (0.27763) [−0.12307]	−3.223087 (1.93914) [−1.66212]	−232.0214 (721.315) [−0.32166]	−0.198812 (0.38804) [−0.51235]
c	−0.033277 (0.10119) [−0.32885]	0.552084 (0.70678) [0.78113]	119.2362 (262.905) [0.45353]	0.048615 (0.14143) [0.34373]

Source: the authors' own calculations using E-views.

The impact of the environmental taxes on GDP growth is positive for the EU area (Table 4), while in Romania there is a significant negative impact (Table 5). The impact of the GDP growth on environmental taxes is weak both in the EU area (weak direct correlation) and in Romania (weak inverse correlation) (Table 5). In the EU as a whole, the impact of the environmental taxes on the unemployment rate is significant and positive, similar to the impact on GDP growth (Table 4). In Romania, there is a negative impact of the environmental taxes on the unemployment rate, while the impact of the unemployment rate on the environmental taxes is greater in the EU area (inverse correlation) than in Romania where there is a very weak negative impact (Tables 4 and 5).

The VECM built for the EU area analyzing the inter-correlations of the variables (greenhouse CO_2 emissions, share of environmental taxes of GDP, unemployment rate, GDP growth rate) shows that environmental taxes are very significant for EU economic growth and they are positively correlated with GDP growth (this correlation respects the double dividend hypothesis showing that environmental taxation promotes economic growth). The greenhouse CO_2 emissions are negatively correlated with GDP growth, and positively correlated with unemployment rate, in the case we consider one lag for the greenhouse CO_2 emissions (Table 4).

Greenhouse CO_2 emission are weakly and negatively correlated with GDP growth in Romania. The environmental taxes have a negative impact on the GDP growth in Romania (in Romania the double dividend hypothesis regarding to economic growth is not validated) and this negative impact is strong, while the unemployment rate is positively and strongly correlated with GDP growth in Romania. In the EU area, its effect on GDP growth is strong and negative (Table 5).

The impact of the environmental taxes with one lag on the greenhouse CO_2 emissions is strong and negative in Romania (much stronger than in the EU area), while the impact of GDP growth with one lag on greenhouse CO_2 emissions is positive both in Romania and the EU area (there is a much stronger impact in Romania than in the EU area). The impact of the GDP growth and the environmental taxes is much weaker in Romania than in the EU area. In Romania, the impact of the unemployment on the greenhouse CO_2 emissions is significant and negative, similar to in the EU area, but there is a much more significant impact on greenhouse CO_2 emissions in Romania. Both in the EU area and in Romania, an increase of the environmental taxes determines a decrease of greenhouse CO_2 emissions, which validates the double dividend theory. The higher impact of the environmental taxes on greenhouse CO_2 emissions in the EU area can be explained by a much higher negative impact of the burden of higher energy bills for households and firms in Romania than in the EU area, where the incomes and the purchasing power are much higher than in Romania (Tables 4 and 5).

The impact of the environmental taxes on the unemployment rate is negative in Romania versus the EU area where there is a positive impact (so the double dividend hypothesis is not validated for the EU area when the impact of the environmental taxes on the employment rate is considered). The impact of the GDP growth on unemployment is negative in the EU area, similar to in Romania, but, in Romania, there is a much weaker impact. The impact of the greenhouse CO_2 emissions on unemployment in the EU area is positive, similar to in Romania, but very weak for both Romania and the EU area (Tables 4 and 5).

Thus, in Romania, an increase of the environmental taxes determines a decrease of the greenhouse CO_2 emissions, improves employment, but it does not promote economic growth. In the EU area, an increase of the environmental taxes promotes economic growth and reduces the total greenhouse CO_2 emissions, but it does not reduce unemployment rate. This can be explained by a high level of labor taxation in the EU area against Romania. Greenhouse CO_2 emissions are weakly correlated with the environmental taxes, unemployment and GDP growth in Romania. They are weakly correlated with the environmental taxes and the unemployment rate in the EU area (there are many tightly regulated labor markets in the EU area, such as the Northern European countries or Germany), but they are significant for GDP growth in the EU area. The double dividend theory is validated neither in the EU area nor in Romania. In EU, an already high level on environmental taxes helps targeting the reduction of the greenhouse CO_2 emission and supports the economic growth, but a simultaneous

high level of labor taxation does not support the improvement of employment. In Romania, a still low level on environmental taxation allows some further increases of the environmental taxes in order to support the GDP growth, by developing a real industry for the environment protection and thus, supporting much more the employment process. The public budget can further rely on the increase of the environmental taxes, while the labor taxation can decrease, so all three aims of the double dividend theory can be achieved in the future in Romania (a higher economic and employment growth and a reduction of the greenhouse CO_2 emissions). An explanation for the different situation in Romania against the EU area as a whole can be represented by the fact that in Romania the purchasing power is much lower against EU average and by the great dependence of the Romanian GDP on exports that represent the main incentive of the economic growth in Romania, at present. An increase of the gas and energy bills negatively affects the households and firms more than in the EU area. Thus, this can reduce the greenhouse CO_2 emissions, but can negatively affect the economic growth in Romania, because it reduces the disposable income for households and firms. It can also reduce exports and thus negatively affects GDP. The environmental taxes cannot reduce much the energy consumption (in an energy-intensive economy, such as Romania) as the study of Morley (2012) has already stated, and a higher cost of energy affects the disposable income and, consequently, the economic growth.

The linear regression built for the EU area (using OLS method) for estimating GDP growth according to the other variables (greenhouse CO_2 emissions, share of environmental taxes of GDP, unemployment rate) shows that environmental taxes are very significant for EU GDP and they are positively correlated with GDP growth (this correlation respects the double dividend hypothesis showing that environmental taxation promotes economic growth). The greenhouse CO_2 emissions are negatively correlated with GDP growth, similar to unemployment (Table 6).

Table 6. OLS regression for EU GDP.

Dependent Variable: dgdp_eu				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
dunemploy_eu	−1.430457	0.393475	−3.635444	0.0046
denv_tax_gdp_eu(-1)	16.51069	4.683467	3.525313	0.0055
dgdp_eu(-1)	−0.620992	0.092958	−6.680341	0.0001
dgreenhou_emis_eu	−0.547257	0.124481	4.396326	0.0013
dgdp_eu(-2)	−0.321939	0.143790	−2.238948	0.0491
dgreenhou_emis_eu(-2)	−0.466813	0.221340	−2.109033	0.0511
ma(2)	0.986759	0.089294	11.19857	0.0000
R-squared	0.929821	Mean dependent var.		−0.041176
Adjusted R-squared	0.887713	Standard deviation (S.D.) dependent var.		2.357186
Standard Error (S.E.) of regression	0.789874	Akaike info criterion		2.659014
Sum squared resid	6.239005	Schwarz criterion		3.002102
Log likelihood	−15.60162	Hannan–Quinn criter.		2.693117
Durbin-Watson stat	2.020184			

Source: the authors' own calculations using E-views.

Greenhouse CO_2 emissions have a weak and negative impact on the GDP growth in Romania. The environmental taxes have a negative and strong impact on the GDP growth in Romania (in Romania the double dividend hypothesis regarding economic growth is not validated), but in the EU area this impact is much more important than in Romania, while the unemployment rate is negatively and much more strongly correlated with GDP growth in Romania than in the EU area where its effect on GDP growth is also negative, but weaker. In addition, the impact of the environmental taxes and greenhouse CO_2 emissions on GDP growth is more rapid in EU than in Romania if the lags of those variables used for estimating the above regressions are taken into consideration (Table 7).

The OLS regressions built for estimating the variables influencing the unemployment rate in the EU area and in Romania confirm the findings presented above (Tables 8 and 9). In the EU area, the environmental tax is positively correlated with the unemployment rate, while, in Romania, the environmental tax support the reduction of the unemployment rate. It is worth mentioning that,

in Romania, both the share of the environmental tax of GDP and the unemployment rate were lower than the EU average during the analyzed period. The labor tax is also much lower in Romania than in the EU area and this can explain these results.

Table 7. OLS regression for Romanian GDP.

Dependent Variable: dgdp_rom				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
dunemploy_rom(-2)	−5.168291	1.896087	4.835376	0.0013
denv_tax_gdp_rom(-5)	−8.204235	3.221547	−2.546675	0.0344
dgreenhou_emis_rom(-5)	−0.001419	0.000466	−3.047435	0.0159
dgdp_rom(-4)	−0.361085	0.132497	2.725233	0.0260
dgdp_rom(-1)	−0.749095	0.121551	−6.162800	0.0003
ma(1)	0.931509	0.064735	14.38959	0.0000
R-squared	0.845325	Mean dependent var.		−0.121429
Adjusted R-squared	0.748653	S.D. dependent var.		4.758503
S.E. of regression	2.385654	Akaike info criterion		4.874351
Sum squared resid	45.53078	Schwarz criterion		5.148233
Log likelihood	−28.12046	Hannan–Quinn criter.		4.848998
Durbin-Watson stat	2.007319			
Inverted MA Roots		−0.93		

Source: the authors' own calculations using E-views.

Table 8. OLS regression for EU unemployment rate.

Dependent Variable: dunemploy_eu				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
dgdp_eu	−0.341143	0.044334	−7.694892	0.0000
denv_tax_gdp_eu(-2)	3.640054	1.116029	−3.261612	0.0086
dgreenhou_emis_eu(-5)	0.101360	0.041463	2.444581	0.0346
dunemploy_eu(-1)	1.274040	0.156575	8.136941	0.0000
R-squared	0.890524	Mean dependent var.		0.050000
Adjusted R-squared	0.857681	S.D. dependent var		0.792998
S.E. of regression	0.299160	Akaike info criterion		0.659280
Sum squared resid	0.894967	Schwarz criterion		0.841867
Log likelihood	−0.614957	Hannan–Quinn criter.		0.642378
Durbin-Watson stat	1.980207			

Source: the authors' own calculations using E-views.

Table 9. OLS regression for Romanian unemployment rate.

Dependent Variable: dunemploy_rom				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
dgdp_rom(-1)	−0.087393	0.013221	−6.610000	0.0000
denv_tax_gdp_rom(-1)	−0.843727	0.207055	−4.074892	0.0013
dgreenhou_emis_rom(-2)	-8.48×10^{-5}	3.47×10^{-5}	−2.441709	0.0297
ma(2)	0.979330	0.038101	25.70346	0.0000
R-squared	0.732850	Mean dependent var.		0.029412
Adjusted R-squared	0.671200	S.D. dependent var.		0.597667
S.E. of regression	0.342709	Akaike info criterion		0.898453
Sum squared resid	1.526842	Schwarz criterion		0.884503
Log likelihood	−3.636852	Hannan–Quinn criter.		0.917941
Durbin-Watson stat	2.103434			

Source: the authors' own calculations using E-views.

Hence, there is enough room for continuing the environmental tax reform in Romania. These results, according to a forecast of IEEP [39], show that a further increase of the environmental taxes could lead to benefits of 0.07% of GDP in the EU area, while the benefits in Romania (0.24% of GDP) will be much larger than the EU average. In addition, our results for Romania could be explained by the results of other authors [12,29,31] that showed a strong correlation between the environmental tax and unemployment, but a weak or even a negative correlation with the output. Romania depends on exports and an increase of the environmental taxes determines a decrease of the Romanian exports and this will negatively affect the GDP growth [31]. The double dividend hypothesis is not validated for USA or UK as many other studies have already showed before [4,27]. In addition, results of the analysis performed for EU countries so far showed different results for the national economies [3,25]. For the EU area as a whole, some studies [26,30] have reported solely economic and environmental benefits of increasing the environmental taxation in the last decade, but after the crisis, the results have changed at some levels (the unemployment rate has increased in the EU area and the level of labor taxation decreased). In the EU area, the unemployment rate strongly increased during the crisis, at much higher levels than in Romania and that generated a decrease of the average labor taxation in the EU area during the crisis period.

5. Conclusions

In Romania, the results indicate that there is a strong correlation between the environmental taxes and greenhouse CO_2 emissions, but a negative correlation with the GDP growth. These results can be explained by a much lower share of environmental tax to GDP in Romania, against the EU area. In Romania, this share was much lower than the average share of the environmental tax of GDP in the EU area for many years during the period analyzed in this paper. For the EU area, the results regarding the correlation between the environmental taxes and their main economic and environmental benefits are also mixed. For the EU area, the double dividend theory of the environmental tax does not hold for achieving the employment goal (the EU unemployment rate is almost twice as much as the Romanian unemployment rate). This could be explained by a much higher labor taxation in the EU area against Romania and a much higher labor taxation against the environmental tax in the EU area (although starting in 2014 the labor taxation in the EU area displays a strong descendent trend). The double dividend theory does not hold for Romania or for the EU area. For achieving the goal of increasing GDP by using the environmental taxes, the Romanian government should focus on using the environmental subsidies, especially when the public budget situation allows it. Increasing the environmental taxes represents a great burden for households and firms and diminishes the disposable income. The actual Government's aim in Romania is to increase the wages in the public sector, the tax base will increase, and so granting subsidies for the environment seems feasible. Granting subsidies in addition to the environmental taxes would help stabilizing a negative impact on greenhouse CO_2 emissions in Romania in the near future and would support economic growth and employment at the same time. This direction of the economic policy would target improving employment, GDP growth and reducing greenhouse CO_2 emissions. For the moment, in Romania, the environmental taxes support the employment process and the protection of the environment as can be inferred from the VECM applied to Romania's case, and this could imply a further increase of GDP, especially if a stronger and a real industry for the environment protection were developed, if the labor taxation decreased and if the Romanian public budget afforded granting public subsidies for the environment protection in the near future. In the long run, after Romania fully complies with the EU Directives in the environment protection area and when energy allowances are no longer granted, Romania will have to focus on developing a real industry for the environment protection with EU technical and financial support. This industry will both support environment protection and create new jobs. Consequently, in the long run, this could be the only solution Romania has for achieving the benefits of the double dividend theory (employment–economic growth–environment protection). This is also

feasible if we consider that, currently, Romania displays the most important and robust economic growth in the EU area.

As a conclusion to this study, in Romania, the environmental taxes support mainly the greenhouse CO_2 emissions reductions (they also support environment protection, but they do not have significant economic benefits), while, in the EU area, they support both the environment protection and economic growth.

A drawback of this study and a direction for further research would be to analyze the correlation between each type of environmental taxes (energy tax, transport tax, and pollution tax) relative to GDP or between the environmental taxes relative to total taxes (with a special focus on energy tax in the case of Romania) and greenhouse CO_2 emissions, energy consumption, GDP growth and unemployment rate.

In addition, a limitation of this study may be represented by the small dataset we have used in our analysis (20 yearly observations). Currently, these are the only available data on Eurostat, but a further research could be performed by adding more yearly observations in the analyzed dataset and the results could be more and more interesting and robust or a panel approach can be used to include more observations.

Author Contributions: This paper is the result of a joint work from all authors. Radulescu Magdalena wrote the research methodology part and dealt with the econometric results and discussions. Sinisi Crenguta Ileana wrote the literature review. Popescu Constanta and Silvia Elena Iacob collaborated on presenting the economic developments and environmental tax developments in Europe, supervised the project and provided funding. Luigi Popescu double-checked the English writing and wrote the conclusions part. All authors have discussed and agreed to submit the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Data series of the variables, 1996–2015.

	env_tax_gdp_eu	env_tax_gdp_rom	gdp_eu	gdp_rom	greenhou_emis_eu	greenhou_emis_rom	unemploy_eu	unemploy_rom
1996	2.64	1.73	1.9	3.2	96.12	74.55	10.7	6.6
1997	2.69	2.77	2.9	−4.9	94.44	69.68	10.4	6.1
1998	2.86	3.03	2.9	−2.1	93.77	61.75	9.9	6.3
1999	2.87	3.83	2.9	−0.4	91.94	54.56	9.7	7.1
2000	2.68	3.38	3.9	2.4	92.21	56.91	8.9	7.6
2001	2.64	2.34	2	5.7	93.15	5975	8.7	7.4
2002	2.54	2.11	1.3	5.1	92.35	59.2	9	8.3
2003	2.56	2.32	1.5	5.2	93.89	61.09	9.2	7.7
2004	2.54	2.34	2.6	8.5	94.04	60.56	9.3	8
2005	2.49	1.98	2.2	4.2	93.51	59.43	9	7.1
2006	2.42	1.92	3.4	7.9	93.39	60.03	8.2	7.2
2007	2.35	2.04	3.2	6.3	92.61	61.22	7.2	6.4
2008	2.28	1.75	0.4	7.3	90.61	59.19	7	5.6
2009	2.36	1.86	−4.5	−6.6	84.03	51.41	9	6.5
2010	2.37	2.09	2	−1.1	85.89	49.14	9.6	7
2011	2.40	1.93	1.6	2.3	83.25	51.58	9.7	7.2
2012	2.43	1.97	−0.4	0.6	82.1	50.52	10.5	6.8
2013	2.45	2.04	0.2	3.5	80.45	46.91	10.9	7.1
2014	2.46	2.34	1.6	3	77.39	46.97	10.2	6.8
2015	2.44	2.43	2.2	4	77.88	47.68	9.4	6.8

Source: Eurostat database (2017), http://ec.europa.eu/eurostat/data/database.

Appendix B

Table A2. Unit root test for the share of the environmental tax of GDP in EU.

Null Hypothesis: denv_tax_gdp_eu Has a Unit Root			
Exogenous: Constant			
Lag Length: 0 (Automatic—based on Schwartz Criterion (SIC), maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−3.151999	0.0405
Test critical values:	1% level	−3.857386	
	5% level	−3.040391	
	10% level	−2.660551	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A3. Unit root test for the share of the environmental tax of GDP in Romania.

Null Hypothesis: denv_tax_gdp_rom Has a Unit Root			
Exogenous: Constant			
Lag Length: 1 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−3.098008	0.0459
Test critical values:	1% level	−3.886751	
	5% level	−3.052169	
	10% level	−2.666593	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A4. Unit root test for the GDP growth in EU.

Null Hypothesis: dgdp_eu Has a Unit Root			
Exogenous: Constant			
Lag Length: 1 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−4.921823	0.0013
Test critical values:	1% level	−3.886751	
	5% level	−3.052169	
	10% level	−2.666593	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A5. Unit root test for the GDP growth in Romania.

Null Hypothesis: dgdp_rom Has a Unit Root			
Exogenous: Constant			
Lag Length: 0 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−6.282519	0.0001
Test critical values:	1% level	−3.857386	
	5% level	−3.040391	
	10% level	−2.660551	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A6. Unit root test for the greenhouse emmissions in EU.

Null Hypothesis: dgreenhou_emis_eu Has a Unit Root			
Exogenous: Constant			
Lag Length: 0 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−4.686032	0.0019
Test critical values:	1% level	−3.857386	
	5% level	−3.040391	
	10% level	−2.660551	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A7. Unit root test for the greenhouse emissions in Romania.

Null Hypothesis: dgreenhou_emis_rom Has a Unit Root			
Exogenous: Constant			
Lag Length: 0 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−6.927821	0.0000
Test critical values:	1% level	−3.857386	
	5% level	−3.040391	
	10% level	−2.660551	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

Table A8. Unit root test for the unemployment rate in EU.

Null Hypothesis: dunemploy_eu Has a Unit Root			
Exogenous: Constant			
Lag Length: 1 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−3.010229	0.0500
Test critical values:	1% level	−3.886751	
	5% level	−3.052169	
	10% level	−2.666593	

* MacKinnon (1996) one-sided *p*-values. Source: E-views estimations.

Table A9. Unit root test for the unemployment rate in Romania.

Null Hypothesis: dunemploy_rom Has a Unit Root			
Exogenous: Constant			
Lag Length: 0 (Automatic—based on SIC, maxlag = 3)			
		t-Statistic	Prob. *
Augmented Dickey—Fuller test statistic		−4.688761	0.0019
Test critical values:	1% level	−3.857386	
	5% level	−3.040391	
	10% level	−2.660551	

* MacKinnon (1996) one-sided *p*-values; source: E-views estimations.

References

1. Castiglione, C.; Infante, D.; Smirnova, J. Is There Any Evidence on the Existence of an Environmental Taxation Kuznets Curve? The Case of European Countries under Their Rule of Law Enforcement. *Sustainability* **2014**, *6*, 7242–7262. [CrossRef]
2. Andersen, M.S. An Introduction to environmental tax reform and the competitiveness issue. In *Competitiveness Effects of Environmental Tax Reform*; COMETR Project; National Environmental Research Institute, University of Aarhus: Aarhus, Denmark, 2007; pp. 6–18. Available online: http://www.dmu.dk/Pub/COMETR_Final_Report.pdf (accessed on 20 April 2017).
3. Ekins, P.; Summerton, P.; Thoung, C.; Lee, D. A major environmental tax reform for the UK: Results for the economy, employment and the environment. *Environ. Resour. Econ.* **2011**, *50*, 447–474. [CrossRef]
4. Goulder, L. Effects of carbon taxes in an economy with prior tax distortions: An intertemporal general equilibrium analysis. *J. Environ. Econ. Manag.* **1995**, *29*, 271–297. [CrossRef]
5. Sterner, T.; Köhlin, G. Environmental Taxes in Europe. *Public Financ. Manag.* **2003**, *1*, 117–142.
6. Andersen, M.S.; Ekins, P. *Carbon-Energy Taxation: Lessons from Europe*; Oxford University Press: Oxford, UK, 2009; pp. 320–345. ISBN 978-0-19-9570-683.
7. Simeonova, V.; der Valk, V. The role of an area-oriented approach in achieving environmental policy integration in The Netherlands, and its applicability in Bulgaria. *Eur. Plan. Stud.* **2010**, *18*, 1411–1443. [CrossRef]
8. Ekins, P.; Barker, T. Carbon taxes and carbon emissions trading. *J. Econ. Surv.* **2002**, *15*, 325–352. [CrossRef]
9. European Environment Agency. *Market-Based Instruments for Environmental Policy in Europe*; EEA Technical Report, No. 8; European Environment Agency: Copenhagen, Denmark, 2005; Available online: http://www.eee2006.org/presentations/EEA_technical_report_8_2005.pdf (accessed on 17 June 2017).
10. Scrimgeour, F.; Oxley, L.; Fatai, K. Reducing carbon emissions? The relative effectiveness of different types of environmental tax: The case of New Zealand. *Environ. Model. Softw.* **2005**, *20*, 1439–1448. [CrossRef]
11. Bovenberg, L.A.; de Mooij, R.A. Environmental tax reform and endogenous growth. *J. Public Econ.* **1997**, *63*, 207–237. [CrossRef]
12. Bosquet, B. Environmental tax reform: Does it work? A survey of the empirical evidence. *Ecol. Econ.* **2000**, *34*, 19–32. [CrossRef]
13. Institute for European Environmental Policy. Environmental Tax Reform in Europe: Opportunities for the Future, IEEP Final Report for The Netherlands Ministry of Infrastructure and the Environment. Government of The Netherlands, 30 May 2014. Available online: http://www.ieep.eu/assets/1397/ETR_in_Europe_-_Final_report_of_IEEP_study_-_30_May_2014.pdf (accessed on 15 June 2017).
14. Morley, B. Empirical evidence on the effectiveness of environmental taxes. *Appl. Econ. Lett.* **2012**, *19*, 1817–1820. [CrossRef]
15. Grossman, G.; Krueger, A. Economic growth and the environment. *Q. J. Econ.* **1995**, *110*, 353–377. [CrossRef]
16. Infante, D.; Smirnova, J. Rent-seeking under weak institutional environment. *Econ. Lett.* **2009**, *104*, 118–121. [CrossRef]
17. Stern, D.; Commons, M. Is there an environmental Kuznets curve for sulfur? *J. Environ. Econ. Manag.* **2001**, *41*, 162–178. [CrossRef]
18. Deacon, R.; Norman, C. Does the Environmental Kuznets curve describe how individual countries behave? *Land Econ.* **2006**, *82*, 291–315. [CrossRef]
19. Harbaugh, W.; Levinson, A.; Wilson, D.M. Re-examining the empirical evidence for an environmental Kuznets curve. *Rev. Econ. Stat.* **2002**, *84*, 541–551. [CrossRef]
20. Bruvoll, A.; Larsen, B.M. Greenhouse gas emissions in Norway: Do carbon taxes work? *Energy Policy* **2004**, *32*, 493–505. [CrossRef]
21. Liang, Q.M.; Fan, Y.; Wei, Y.M. Carbon taxation policy in China: How to protect energy-and trade-intensive sectors? *J. Policy Model.* **2007**, *29*, 311–333. [CrossRef]
22. Sterner, T. Fuel taxes: An important instrument for climate policy. *Energy Policy* **2007**, *35*, 3194–3202. [CrossRef]
23. Ezcurra, M.V.; Jessen, P.W. *Energy Taxation and Key Legal Concepts in the EU State Aid Context: Looking for a Common Understanding*; No. 50; CEU Ediciones: Madrid, Spain, 2015; pp. 1–37. ISBN 978-84-16477-26-5.

24. Kanellakis, M.; Martinopoulos, G.; Zachariadis, T. European energy policy—A review. *Energy Policy* **2013**, *62*, 1020–1030. [CrossRef]
25. Nanthakumar, L.; Muhammad, S.; Roshaiza, T. The link between green taxation and economic growth on CO_2 emissions: Fresh evidence from Malaysia. *Renew. Sustain. Energy Rev.* **2014**, *38*, 1083–1091. [CrossRef]
26. Sterner, T.; Lozada, A.L. *Income Distribution Effects of Fuel Taxation*; Gaceta de Economica INE-ITAM; Environmental Economics Unit, Department of Economics, University of Gothenburg: Gothenburg, Sweden, 2009; pp. 1–32.
27. Schob, R. *The Double Dividend Hypothesis of Environmental Taxes: A Survey*; CESifo Working Paper Series No. 946; Freie University, Center for Economic Studies and Ifo Institute for Economic Research: Berlin, Germany, 2003; pp. 1–65.
28. Patuelli, R.; Pels, E.; Nijkamp, P. *Environmental Tax Reform and Double-Dividend: A Meta-Analytic Performance Assessment*; Tinbergen Institute Discussion Papers, No. 02-095/3; Tinbergen Institute: Amsterdam/Rotterdam, The Netherlands, 2002; pp. 1–25. Available online: https://papers.tinbergen.nl/02095.pdf (accessed on 28 July 2017).
29. Kohlhaas, M.; Schumacher, K.; Diekmann, J.; Schumacher, D.; Cames, M. *Economic, Environmental and International Trade Effects of the EU Directive on Energy Tax Harmonization*; Discussion Papers 462; German Institute for Economic Research: Berlin, Germany, 2004; pp. 1–25. Available online: http://www.diw.de/documents/publikationen/73/diw_01.c.42775.de/dp462.pdf (accessed on 28 July 2017).
30. Organization for Economic Co-operation and Development(OECD). *The Political Economy of Environmentally Related Taxes*; OECD: Paris, France, 2006; pp. 1–200. ISBN 978-9-26-402552-3.
31. Ekins, P. *Resource Productivity, Environmental Tax Reform and Sustainable Growth in Europe*; Anglo-German Foundation for the Study of Industrial Society, Druckerei Hermann Schlesener KG: Berlin, Germany, 2009; pp. 1–74. ISBN 978-1-900834-53-7. Available online: http://www.petre.org.uk/pdf/FinRepFin.pdf (accessed on 10 May 2017).
32. Andrei, J.; Mieila, M.; Popescu, G.H.; Nica, E.; Cristina, M. The impact and determinants of environmental taxation on economic growth communities in Romania. *Energies* **2016**, *9*, 902. [CrossRef]
33. Speck, S.; McNicholas, J.; Markovic, M. *Environmental Taxes in an Enlarged Europe*; Regional Environmental Center for Central and Eastern Europe: Szentendre, Hungary, 2001; pp. 1–87. ISBN 963-8454-97-0. Available online: http://www.rec.org/REC/Programs/SofiaInitiatives/SI_taxes.pdf (accessed on 16 June 2017).
34. Speck, S. Overview of the environmental tax reform in EU member states. In *Competitiveness Effects of Environmental Tax Reform*; COMETR Project; National Environmental Research Institute, University of Aarhus: Aarhus, Denmark, 2007; pp. 19–83. Available online: http://www.dmu.dk/Pub/COMETR_Final_Report.pdf (accessed on 20 April 2017).
35. European Environment Agency. *Environmental Taxation and EU Environmental Policies*; EEA Report No. 17; European Environment Agency: Copenhagen, Denmark, 2016; pp. 5–46. ISBN 978-92-9213-755-7. Available online: https://www.eea.europa.eu/publications/environmental-taxation-and-eu-environmental-policies (accessed on 2 April 2017). [CrossRef]
36. European Commission, Eurostat Database 1996–2015. Available online: http://ec.europa.eu/eurostat/data/database (accessed on 15 June 2017).
37. European Commission, Eurostat Environmental Tax Statistics, Statistics Explained. March 2017. Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics (accessed on 16 June 2017).
38. Organization for Economic Co-operation and Development. *Aligning Policies for a Low-Carbon Economy*; OECD: Paris, France, 2015; pp. 19–234. ISBN 978-92-64-23326-3. Available online: https://www.oecd.org/environment/Aligning-Policies-for-a-Low-carbon-Economy.pdf (accessed on 20 June 2017).
39. OECD & IEA. *World Energy Outlook 2015*; Organization for Economic Co-Operation and Development: Paris, France, 2015; pp. 1–12. Available online: http://www.iea.org/publications/freepublications/publication/WEB_WorldEnergyOutlook2015ExecutiveSummaryEnglishFinal.pdf (accessed on 10 May 2017).
40. Vollebergh, H. *Green Tax Reform: Energy Tax Challenges for The Netherlands*; PBL Netherlands Environmental Assessment Agency: The Hague, The Netherlands, 2014; pp. 1–54. Available online: http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-green-tax-energy-tax-challenges-for-the-netherlands-1501.pdf (accessed on 23 April 2017).

41. Institute for European Environmental Policy (IEEP). *Study on Assessing the Environmental Fiscal Reform Potential for the EU28*; Eunomia Research and Consulting, Aarhus University & IEEP & European Commission: Bristol, UK, 2016; pp. 322–325. ISBN 978-92-79-54701-0. Available online: http://ec.europa.eu/environment/integration/green_semester/pdf/Eunomia%20EFR%20Final%20Report%20MAIN%20REPORT.pdf (accessed on 17 June 2017). [CrossRef]
42. Export.gov, Romania—Environmental Technologies. Available online: https://www.export.gov/article?id=Romania-Environmental-Technologies (accessed on 5 October 2017).
43. Klynveld Peat Marwick Goerdeler (KPMG). *Investment in Romania*; KPMG: Bucharest, Romania, 2016; pp. 122–127. Available online: https://assets.kpmg.com/content/dam/kpmg/pdf/2016/04/ro-investment-in-romania-2016.pdf (accessed on 5 October 2017).
44. Chitiga, G. Environmental Taxes: Pollution/Resources. Romania's Situation as Compared with Eu Member States. In *Financial Studies*; Institute for Economic Forecasting: Bucharest, Romania, 2017; pp. 234–238. Available online: ftp://www.ipe.ro/RePEc/vls/vls_pdf_jfme/vol1i1p234-238.pdf (accessed on 5 October 2017).
45. European Commission. *EU Environmental Implementation Review: Highlights, Romania*; European Commission: Brussels, Belgium, 2017; pp. 1–4. Available online: http://ec.europa.eu/environment/eir/pdf/factsheet_ro_en.pdf (accessed on 5 October 2017).