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Environmental Taxes as a Path to a Green Transition

By Emília Huttmanová[1], Radoslav Mikča[2]

ABSTRACT:
The integration of sustainability elements into all spheres of human activities is one of the primary initiatives of policymakers in individual European countries, but also in a broader international perspective. The transition towards more sustainable production-consumption models is now becoming a challenge for European countries. This shift is an essential part of the commitments and goals that the European Union has set itself in the medium and the long-term horizon. The future economic orientations of European countries will depend not only on the willingness and effort to use classical tools in the process of creating a green future, but especially on the level of knowledge of their appropriate implementation in practice. The paper is focused on the issue of the evaluation of selected economic instruments of environmental policy (environmental taxes) in the European area in the context of the transition to a green economy. The aim of the paper is to evaluate the use of taxes with an environmental aspect across European countries and to analyse the similarities in the process of their application towards green transformation. The need for a deeper knowledge and understanding of this area is essential in the context of the implementation of the Sustainable Development Goals in the countries involved in the 2030 Agenda.

Keywords: environmental taxes, sustainability, energy, transport, green transition.

1. Introduction

The green economy has been a major phenomenon in recent decades, consisting of a complex system with many interconnected elements. There are many definitions, with most definitions tending towards four main areas: environmental problems, environmental risks, human well-being and equity (Telukdarie et al. 2024). The decreasing quality of the environment has recently attracted considerable scientific and public attention. The rapid economic prosperity of countries has been poorly regulated for a long time, causing a number of negative aspects, such as high energy consumption, high emissions, and rapid industrial pollution. There has been a lot of discussion about sustainable growth and development, in recent decades. Achieving sustainable goals presents research challenges for any country that seeks to ensure economic development and environmental sustainability at the same time (Wang et al., 2019). Ghorbani et al. (2024) state that current green transition and decarbonisation efforts present several challenges, namely, an increased reliance on the mineral value chain, technological and infrastructure constraints, socio-economic implications, among others. They recommend the use of beyond-decarbonisation approach, which takes into account economic, environmental and social factors, effectively expanding the definition of 'green' to encompass a broader spectrum of considerations. Research realized by Valencia et al.

[1]Faculty of Management and Business, University of Prešov, Slovakia.
[2]Faculty of Management and Business, University of Prešov, Slovakia.

(2023) investigated the social dimensions of the CE, including proposes a set of socioeconomic strategies that can aid a CE implementation.

Environmental degradation and rapid climate change create significant risks to the Sustainable Development Goals, as well as to energy and environmental sustainability. Automated production models have significantly increased energy intensity and demand. The use of fossil fuels has become a common reality in meeting energy demands and increasing economic growth, but this has led to a huge increase in CO2 emissions (Alola et al. 2023). The excessive consumption of fossil fuels is severely degrading the environment, leading to climate change and global warming. In 2020, the global energy sector was responsible for more than 70% of total greenhouse gas emissions. The extraction and transport of these fuels are also equally dangerous element (Ullah et al. 2024). Rapid economic expansion and excessive energy consumption, together with rising greenhouse gas emissions are significant risks to human populations. The challenge for the scientific community is to transform current energy models into models based on the alternative renewable energy sources. Although fossil fuels are still the primary component of electricity generation in many countries, it is expected that countries will switch to renewable energy sources or use nuclear energy technologies with the clear goal of reducing future emissions to provide a sustainable future (Mehboob et al. 2024). According Shobande et al. (2024) adoption of a circular economy, including green growth and renewable energy, can significantly contribute to reducing carbon emissions. In contrast, domestic economic drivers, and eco-innovation increase carbon emissions.

In the medium term, the European Commission plans to achieve a 55% reduction in greenhouse gas emissions from 1990 levels by 2030 (Ruiz et al. 2023). Energy issues are extensively covered by Goals 7 and 13 of the 2030 Agenda. It is the area of energy and its consumption that is one of the core components that countries are working hard to improve, as energy consumption has been identified as the most serious driver of environmental degradation (Ali et al. 2023). There is an important document in the EU's transformation towards a green future – new growth strategy "the Green Deal", adopted in 2020. It covers eight sectors, including clean energy, sustainable industry, eliminating pollution and improving the climate. Key goals include building sustainable, resource decoupled economic growth and achieving net zero greenhouse gas emissions by 2050. (Ruiz et al. 2023).

Fiscal policy and its instruments can play a key role in combating environmental degradation. Well-designed tax models, together with tax instruments, can make a significant difference in reducing greenhouse gas emissions and protecting the environment (Kuziboev et al. 2024). The theoretical basis and the primary ideas of environmental taxes date back to 1920 and originate from Pigou's emission tax, the essence of which was the distinction between the private and social costs of emissions and the internalization of the negative externalities of pollution (Chen et al. 2023). The primary mechanism for achieving the EU's 2030 and 2050 targets is energy taxation. The application of forms of minimum tariffs for energy products is an essential component of the European Green Deal strategy. However, such a legislative intervention in Europe also requires a package of trade-offs, where compensatory measures in support of the green transformation need to be designed, especially in the area of income distribution

(Amores et al. 2023). Environmental taxes are an economic instruments designed to discourage environmentally damaging activities. They are intended to motivate individuals and businesses to adapt to environmentally friendly models and reduce their carbon footprint. However, apart from the positive impacts, the effect of environmental taxes also brings a wave of criticism and opposition because increased taxes place a burden on industrial enterprises that are most dependent on fossil fuels, which can lead to slower economic growth and increased unemployment (Saqib et al. 2023). However, low-income households are also at risk, as they may not have the financial resources to adapt to the higher cost of living resulting from the environmental taxes application (Domguia 2023). The transition of enterprises in the energy industry from traditional models to current green technologies is accomplished through two incentive methods. The positive incentive in green transformation is the allocation of subsidies for research and development and other similar forms of support, and the second method is the negative incentive, such as the increase in the cost of pollution to enterprises and the reduction of fossil fuel use, in the form of tax burdens (Fu, Tang, 2022). The development of the energy tax system in the European area can be divided into four phases, with the first phase dating back to 1917. The most important component for us is the last phase from 1990 onwards, where EU countries have introduced different models and forms of energy and carbon taxes to achieve their stated environmental objectives, especially in the field of fossil fuels and the energy system (Karimu, Swain, 2023). Improving environmental performance along with maintaining economic growth is a current environmental challenge that compels governments to engage in effective policymaking. It is clear, that environmental taxes are one of the alternatives. The application of environmental taxes is a frequent tool in influencing the environmental consumption and behaviour of producers, as well as consumers (Ziolo et al. 2019). Wolde-Rufael & Mulat-Weldemeskel (2023) assessed the effectiveness of environmental taxes in more detail, finding that exists negative and a statistically significant relationship between environment taxes (disaggregated into total, energy and transport taxes) and CO2 emissions on the one hand and also a negative and a statistically significant relationship between environmental policy stringent and CO2 emissions on the other, in a selected EU countries.

2. Policy background in European Union

The European Union is seeking to use several policy instruments to address environmental issues and challenges and to achieve the new climate and environment goals for 2030 and 2050. Specific policy instruments can be identified in two main categories. The first category is market-based instruments, including environmental taxes, and the second category is non-market-based instruments, which include regulatory measures (standards, measures, awareness raising, and information campaigns). In practice, EU countries use a combination of both types of instruments, using the "polluter pays" principle, based on precaution and prevention, the remediation of environmental damage, preferably at the source. (EUR-Lex.europa.eu, 2008). This principle is followed by establishing a price for negative environmental impacts. This tax is structured to reflect the marginal social damage caused by consumers or producers.

There is no optimal pricing setup, caused by the complexity of the relevant EU policies, as well as the differences between member states. Depending on the tax base to which the environmental taxes apply, they can be applied in four areas: energy, transport, resources, and pollution. The energy sector accounts for the largest share of environmental tax revenues (Ziolo et al. 2019). Total revenues from environmental taxes in the EU amounted to €331.3 billion, in 2021, ultimately representing 2.2% of EU GDP. Energy taxes in the EU accounted for 78% of the total revenues from environmental taxes, which is a significant difference compared to other types of environmental taxes. Transport taxes accounted for 18%, and resource and pollution taxes accounted 3.6% (Eurostat 2023). A more detailed view at environmental taxes shows that taxes on energy, transport, resources and pollution contributed to around 5.6% of total EU tax revenues in 2020. The increasing trend of this indicator was has been visible from 2002 to 2019, when revenues from environmental taxes increased steadily. We have observed a slight stagnation and decline in 2019-2020, where we have to take into account the impact of the effects of pandemic restrictions, which, however, in the short term led to a reduction in pollution and, consequently, in the tax base. In the context of the impacts of the Covid-19 pandemic on transportation and air pollution, we can align with the views of the authors Smieszek et al. (2021), who conducted research on changes in traffic intensity in the Polish city of Rzeszow. During the pandemic measures, there was a 30% decrease in car traffic compared to normal levels, the number of vehicles in public transportation decreased by 35%, and public transportation usage itself dropped by nearly 80%. The positive impacts are also confirmed by the measured pollution levels at the studied locations, where reduced traffic intensity resulted in lower air pollutant concentrations. The relationship between air quality and economic performance in the form of labour market impacts is also discussed in more detail by Valentiny et al. (2019). The European Union is offering comprehensive systems and strategies to achieve the goals in the upcoming decades, but still there is a wide diversity of EU countries, which are trying to adapt their own programs to achieve progress and positive results on environmental issues, in addition to the measures adopted by the EU. The individual programs of EU countries are not only for the benefit of their own citizens in that country, but also offer the opportunity for inspiration for improvement for other countries that can map the results and subsequently adapt the program to the needs and specificities of their own country. Denmark, for example, has introduced a temporary increase in the tax deduction for companies in relation to investments in reducing greenhouse gas emissions, or in the transport sector it has introduced a reduction in registration tax for low-emission vehicles, or a reduction in the electricity tax for zero- and low-emission vehicles. A reform of energy taxation to take account of technological developments and reduce industrial emissions is implementing in Finland. The tax reform for sustainable transport and the reduction of tax tariffs for electric vehicles and tax-free benefits for employees who use a bicycle for transport have also been successful. Ireland is increasing carbon tax rates by €7.5 annually between 2021 and 2035, where it is projected that the rate per ton of CO2 emissions would exceed the €100 limit. Italy has also increased efforts to initiate various forms of tax incentives, specifically to encourage recycling activities and revisions to waste taxation to make circularity and recycling more attractive options than landfilling and incineration across

the country. Romania wants to implement an identical tax reform as Italy for improving waste management in the form of a landfill tax. Another interesting element is the new charging system for heavy industrial and heavy goods vehicles, which is calculated on the basis of distance travelled, or an increased tax for the most polluting passenger vehicles. The inspiration for the introduction of these new tax systems was the 'polluter pays' principle (European Commission 2022). These measures reflect the heterogeneity of national approaches to effectively pursuing the same sustainability goals.

3. Material and Methods

The main objective of this paper is to evaluate environmental taxes (on energy and transport) in EU countries in the last two decades (2002-2021). We will focus on environmental taxes from energy and transport, which are the dominant component of total tax revenues. Environmental taxes from energy generate more than 70% of all environmental tax revenues each year. In the assessment process we use data from the Eurostat, OECD, and EIA databases. Cluster analysis has been used to assess the similarities between EU countries in the field of environmental tax revenues. A complementary part of the analysis is an assessment of the development of environmental taxes in Slovakia in comparison with the average of the EU-OECD countries using the regression analysis. There are some limitations of our research, which lie mainly in potential biases in data selection and the limited scope of tax types considered. A significant limitation is also the abstraction from other (economic, social etc.) factors (ceteris paribus) that may have influenced the overall environmental tax revenues (e.g. the tax payment efficiency).

4. Results

The transition to the green is evident in all spheres and activities of people and businesses. The integration and adaptation of green elements into established practices is an issue of high interest to policy makers. The sector of energy is a very sensitive topic, especially because it has a significant negative impact on the environment, and the transformation in this sector is evident. Table 1 illustrates primary energy production and consumption in EU countries decomposed into different energy sources. Many legislative strategies have focused their attention on the energy sector and we can identify early successes in a significant change and shift towards a greener approach to energy production and consumption. The EU has established a number of goals, but in particular, achieving zero greenhouse gas emissions by 2050 seems a very optimistic milestone, but we are already seeing significant changes in the way energy is handled, which on the one hand is down to the strategies themselves, but environmental taxes have played a significant role in this transformation towards sustainability. And renewable energy sources are the path for the EU how to solve the energy issue.

The removal and reduction of dependence on fossil fuels, coal and natural gas are also evident in the data we have analysed. Energy production from coal has almost doubled in 2022 compared to 2002, which is also the same for the use of oil or natural gas. The decrease in energy consumption over the period under analysis was equally

marked, with EU countries reducing consumption by 10 quads Btu. Despite this, many businesses are still heavily dependent on fossil fuel consumption and currently do not have alternatives to continue to work without it. Because of the various economic damages in economic growth, it is necessary to be very sensitive to this issue, but we can still see, for example, a decline in the use of coal and oil and other liquids of around 5 quads Btu over a twenty-year period. Throughout the analysis period, we have seen year-on-year progress in both the production and consumption of renewable energy. This trend is a positive signal in the process of meeting sustainability goals.

Table 1: Primary energy in the European Union (in quad Btu) 2002-2021

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total energy production	25,11	24,98	25,86	25,33	25,08	24,54	24,56	23,37	24,09	23,77	23,76	23,61	22,92	22,06	21,35	21,08	20,74	19,83	18,12	18,84	17,36
Coal	7,73	7,70	7,64	7,41	7,22	7,09	6,69	6,26	6,11	6,31	6,38	5,95	5,67	5,61	5,23	5,17	4,90	4,23	3,51	3,79	3,72
Natural gas	4,94	4,76	5,14	4,96	4,86	4,68	4,80	4,51	4,73	4,41	4,30	4,34	3,68	3,13	3,09	2,91	2,60	2,29	1,82	1,68	1,55
Petroleum and other liquids	1,80	1,82	1,91	1,81	1,67	1,61	1,49	1,35	1,31	1,26	1,21	1,18	1,16	1,12	0,98	0,95	0,93	0,86	0,86	0,82	0,77
Nuclear	8,86	8,90	9,12	9	8,98	8,57	8,70	8,12	8,40	8,24	7,99	7,93	8,00	7,75	7,56	7,48	7,51	7,55	6,71	7,23	6,03
Renewables and other	1,78	1,80	2,04	2,15	2,35	2,58	2,88	3,13	3,55	3,55	3,88	4,21	4,41	4,46	4,50	4,57	4,81	4,90	5,22	5,32	5,29
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total energy consumption	63,6	64,8	65,8	66	66,4	65,6	65,3	61,1	63,2	61,3	60,2	59,4	57,4	58	58,4	59,7	59,1	58,1	52,7	56	53,1
Coal	11,4	11,7	11,7	11,3	11,4	11,7	10,8	9,66	9,98	10,1	10,3	10,2	9,76	9,73	9,34	9,39	8,86	7,25	5,91	6,6	6,76
Natural gas	14,1	14,6	15,2	15,7	15,9	15,5	15,9	14,8	15,9	14,8	14,4	14,1	12,5	13,1	13,8	14,5	14,3	14,8	14,2	14,9	12,7
Petroleum and other liquids	27,4	27,6	27,8	27,8	27,9	27,4	27,3	25,7	25,7	25	24,1	23,5	23,2	23,5	23,8	24,3	24,2	24,2	21,3	22,6	22,9
Nuclear	8,86	8,9	9,12	9	8,98	8,57	8,7	8,12	8,4	8,24	7,99	7,93	8	7,75	7,56	7,48	7,51	7,55	6,71	7,23	6,03
Renewables and other	1,91	1,89	2,02	2,15	2,2	2,41	2,65	2,75	3,14	3,12	3,44	3,73	3,86	3,91	3,94	3,95	4,22	4,27	4,61	4,71	4,7

(Source: own elaboration by data from eia.gov)

We analysed the EU-27 countries using the cluster analysis (Ward method) and we present the results in the form of hierarchical dendrograms in Figure 1 and Figure 2. Figure 1 presents a dendrogram of the similarity of EU countries' environmental taxes on energy as a percentage of GDP.

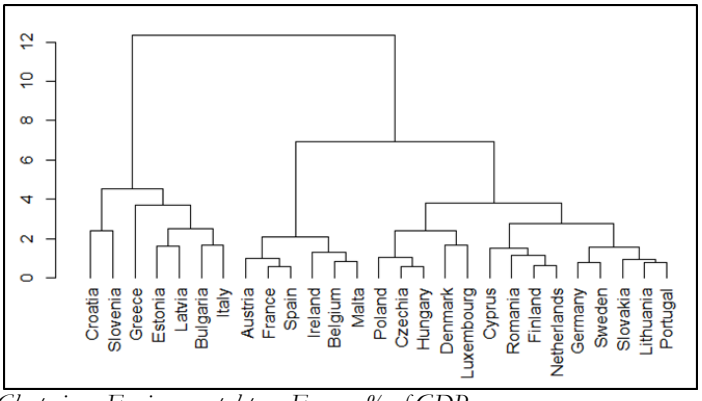

Figure 1 Hierarchical Clustering - Environmental tax -Energy, % of GDP
(Source: Own elaboration by data from OECD)

The EU countries are divided into two separate clusters in Figure 1. The first main cluster includes Croatia, Slovenia, Greece, Estonia, Latvia, Bulgaria and Italy. The

second main cluster is the larger group of the remaining EU countries. After a deeper decomposition of this cluster, it can be further subdivided into 2 lower order clusters, where the first is represented by Austria, France, Spain, Ireland, Belgium and Malta. The second cluster consists of Poland, Czechia, Hungary, Denmark, Luxembourg, Cyprus, Romania, Finland, Netherlands, Germany, Sweden, Slovakia, Lithuania and Portugal. Slovakia also belongs to this cluster and shows the greatest similarity in this area with Lithuania and Portugal.

Environmental transport taxes are essential tools for countries to manage and control the reduction of negative environmental impacts. The most fundamental causes of environmental degradation in the context of transport include greenhouse gas emissions, air pollution, noise, etc. The main objective is to stimulate and promote environmentally sustainable behaviour among citizens and enterprises, in the European countries. The most common forms of environmental transport taxes include taxes on CO2 emissions and pollutants, and vehicle taxes. Electrification in particular, and the transition to electric forms of transport, has been a very popular topic of recent times, bringing with it supporters but also a significant number of critics. Vehicle taxes are differentiated according to various characteristics, such as weight, emissions, power or year of manufacture. An equally interesting aspect in this sphere is the implementation of an access tax to the main centres of European cities. Such procedures and taxes are also the subject of considerable debate, so in promoting sustainable mobility and transport in general, a very sensitive approach is needed, and implementation requires a considerable amount of expertise, testing and consideration of various factors. In the next step, we focused on the assessment of environmental transport taxes. Although different EU countries are using different instruments in the sphere of transport-oriented environmental policy, as well as different approaches to setting the base and size of transport taxes, there are also similarities between them in this sphere, which are presented in the dendrogram (Figure 2).

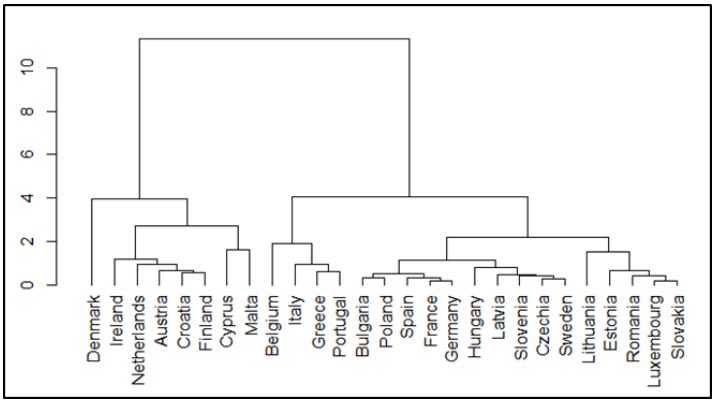

Figure 2 Hierarchical Clustering - Environmental tax - Transport, % of GDP (Source: Own elaboration by data from OECD)

In Figure 2, it is possible to identify significant similarities between the EU-27 countries. From the dendrogram, it is clear that the EU countries formed 2 base clusters.

Denmark, Ireland, Netherlands, Austria, Croatia, Finland, Cyprus and Malta belong to the first one. The second, more numerous cluster can then be divided into 2 lower-order clusters, with Belgium, Italy, Greece, Portugal representing the first cluster and Bulgaria, Poland, Spain, France, Germany, Hungary, Latvia, Slovenia, Czechia, Sweden, Lithuania, Estonia, Romania, Luxembourg and Slovakia representing the second cluster. In the next step, we focused on assessing the development trend in Slovakia in relation to EU countries. Second-order polynomial regression analysis (Figure 4) examining the relationship between years and the values of the environmental energy tax revenue for Slovakia demonstrated that the coefficients of the model are statistically significant: the intercept has a value of 1.70150 with a p-value of less than 2e-16, which is highly statistically significant. The first stage of the polynomial has a negative coefficient of -0.73931 (p-value = 4.07e-06), indicating that the linear component has a negative effect on the values. The second degree of the polynomial has a positive coefficient of 0.41155 (p-value = 0.00176), indicating a positive influence of the quadratic component. The residual standard error of the model is 0.1111, which indicates a low average prediction error and supports the accuracy of the model. The overall statistical significance of the model is confirmed by an F-statistic of 28.99 with a p-value of 3.323e-06, which indicates that the model as a whole is statistically significant. Based on the coefficient of determination, we conclude that the model explains 77.33% of the variability in the values. The presented model suggests that in Slovakia, revenues from environmental energy taxes will increase in the next period (in relation to total GDP).

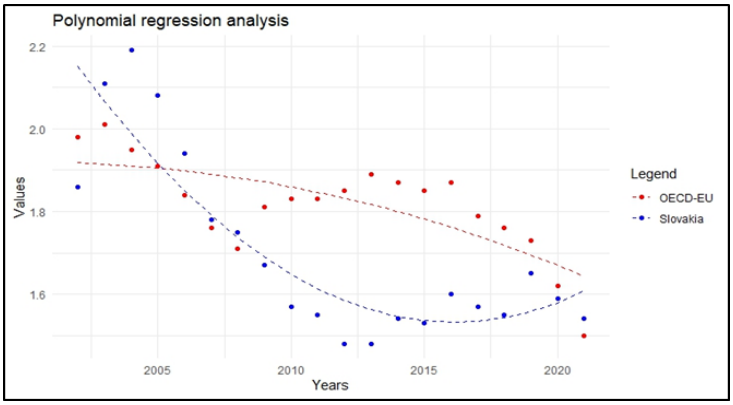

Figure 3 Polynomial regression analysis of Slovak and OECD-EU revenues from environmental taxes on energy (2002-2021) % of GDP
(Source: Own elaboration based on data OECD)

Analysing the OECD-EU data (Figure 3), the model explains only 53.47% of the variability in values, which is lower compared to the model for Slovakia. The first stage polynomial has a negative coefficient of -0.36995 with a p-value of 0.000479, indicating that the linear component has a statistically significant negative effect on the values. The second stage of the polynomial has a coefficient of -0.08574 with a p-value of 0.332360, indicating that the quadratic component is not statistically significant. The F-statistic is 9.766 at 2 and 17 degrees of freedom with a p-value of 0.0015, indicating that the model as a whole is statistically significant. The relatively low value of the

coefficient of determination suggests that the model may not adequately represent the relationship under investigation and will not provide us with enough information on the trends of the indicator across time.

The time series analysis was also realized for the indicator revenues from environmental transport taxes in Slovakia, as well as in the EU countries. The results are presented in Figure 5. Second-order polynomial regression analysis for the Slovak values (Figure 5) of environmental tax revenues from transport provided interesting insights into their trend over time. The model explains the variability of values to 74.79%, which indicates that it can express the dependence between years and monitored indicators. The intercept of the model is significantly positive (Estimate = 0.184, $p < 0.001$), indicating a stable baseline in the first year examined. The linear component has a strong negative effect on the values (Estimate = -0.07174, $p < 0.001$), while the quadratic component adds a more complex aspect (Estimate = -0.03668, $p = 0.00489$). These results suggest that initial declines stabilize later and may even evolve into slightly positive values in later periods. The residual standard error of the model is low (0.01134), supporting its ability to accurately predict values. The overall statistical significance of the model is confirmed by a high F-statistic (25.22, $p < 0.001$), indicating that the model is robust and well suited to describe the monitored data. The model indicates the decreasing trend of environmental transport taxes, on the total GDP, in Slovakia.

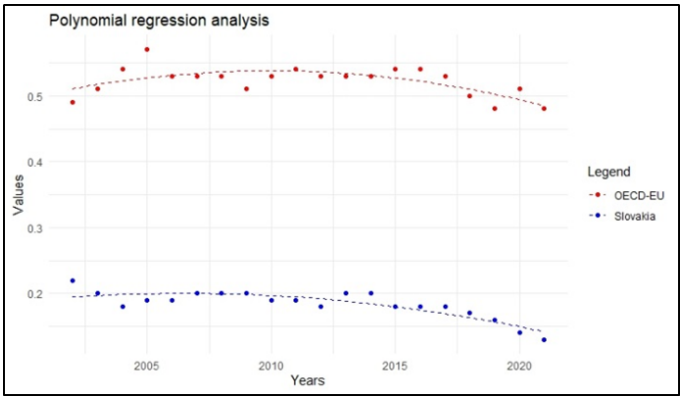

Figure 4 Polynomial regression analysis of Slovak and OECD-EU revenues from environmental taxes on transport (2002-2021) % of GDP
(Source: Own elaboration based on data OECD)

The OECD-EU model (Figure 4) explains 46.84% of the variability in values, which is significantly lower than the model for Slovakia. The F-statistic is 7.489 at 2 and 17 degrees of freedom with a p-value of 0.00465, indicating that the model as a whole is statistically significant, however, similar to the assessment of the indicator (revenues from environmental taxes on energy), we have to conclude, considering the demonstrated variability, that the interpretation of this model would be not adequate.

5. Conclusion

Whatever our individual relationship with our environment, it is clear that the way we have operated in the last century will not provide future generations with an environment suitable for peaceful and harmonious living. Change and the transition to sustainable models (both in production and consumption) have become urgent priorities. Achieving sustainability requires a fundamental transformation in the way we operate, with overlap into socio-economic life. Enterprises are being pushed to change their thinking and concepts through the legislative strategies offered to us by the European Union or other global organisations. Various actions and interventions that help to change people's thinking and actions are necessary, and in our paper, in the theoretical part, we also discussed several ways in which people can be changed and stimulated to change. Primarily, we have focused on the most popular method, environmental taxes, where we have analysed in more details the revenues from environmental taxes on energy and transport in the EU-27 over the years 2002 to 2021. Despite the wave of criticism and opposition, which environmental taxes bring with them, they are essential to achieving a sustainable society and green, prosperous economies. There has been a significant increase in progress on this topic, and individual EU countries are trying to adapt to the current most serious problems in society. Policies in some developed member states present opportunities for us to learn from and to take forward their workable alternatives in different areas such as the economy, the social or the environmental environment. Scandinavian countries are making a strong effort to unify their trends, especially in renewable energy sector, which represents the future of energy questions. There has already been an increased effort to take fossil fuels out of circulation and replace them with green and environmentally beneficial energies. Despite this, there are still many companies that are dependent on the use of those fossil fuels, and the replacement and transition to alternative models is still very complicated. Environmental taxes in particular offer an opportunity for countries to raise funds from the most environmentally concerned companies and to motivate them to change their corporate concepts towards a sustainable future. Wolde-Rufael & Mulat-Weldemeskel (2023) mention, that the positive impact of environmental tax on improving environmental quality should encourage policy makers to increase environmental tax as the current level of environmental tax is believed to be low relative to levels required to achieve climate change objectives and is also low relative to the social cost of carbon and relative to the prices of taxed fuels.

Our analysis reveals varying levels of revenue from energy-related environmental taxes across the EU. Countries that were close to each other in the hierarchical cluster analysis: Croatia, Slovenia, Greece, Estonia, Latvia, Bulgaria and Italy, can be ranked as countries where the intensity and emphasis on the topic is very high, indicating a heightened interest in progress and a willingness to reorient the actions of people and enterprises. Enterprises should be incentivized to change, including through various incentive packages and financial injections, to implement strategic plans such as the 2030 Agenda or Green Deal. Slovakia's example highlights potential for more efficient energy mix adjustments towards green energy. The time series analysis has demonstrated that Slovakia's revenues from environmental taxes on energy will increase over the next time horizon. We see potential here for a more efficient adjustment of the country's energy mix, with an emphasis on green energy. Progress in the transformation to green

alternative models in the energy sector is evident, and EU countries have a strong interest in distancing themselves from the use of fossil fuels, which produce the most greenhouse gas emissions, and replacing them with the use of renewable sources, which we also perceive as the biggest and best opportunity to reverse the trend towards a sustainable future. The next part of our analysis included the transport sector (in the form of environmental taxes), which also negatively contributes to environmental degradation. In the case of Slovakia, the regression model indicates a decreasing trend in the share of environmental taxes in total GDP. Denmark's policy in this field may be an example for Slovakia, but also for other EU countries; Denmark has achieved the highest revenues from environmental taxes on transport compared to the rest of the EU, which means that, despite higher tariffs and tax burdens, it is stimulating its citizens to reorient their behaviour in favour of the environment, in the form of a switch to electric vehicles or sustainable transport mobility.

Each of the EU countries is trying to keep its own specificities and characteristics, which represent its economic, social and cultural core. This heterogeneity of countries is the precious essence of the EU. According Shobande et al. (2024), Chovancová & Vavrek (2020), Shevchenko et al. (2021) endorsing training programs and educational initiatives aimed at cultivating the requisite skills for the energy transition and the adoption of green or circular economy practices is imperative for ensuring the realization of a successful low-carbon economy. However, achieving sustainability goals towards green economic models is one of the topics where, even though countries choose individual approaches, a collective homogeneous approach is necessary.

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