CHAPTER 2

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EFFECTIVENESS OF ENVIRONMENTALLY RELATED TAXES IN THE REPUBLIC OF SERBIA

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The environmentally related taxes should be the main economic policy instrument for environment protection. In accordance with available theoretical and empirical literature the authors try to find out whether the environmentally related taxes (the energy taxes, transport taxes, pollution taxes, and resource taxes) in the Republic of Serbia are effective. Taking into account the obtained results the authors can draw a conclusion that the environmentally related taxes in the Republic of Serbia are relatively effective. The results of estimated panel FE model in the period from 2008 to 2020 show that the environmentally related taxes increase reduce an emission of carbon oxides by 0.37% and ammonia by 0.78%. It is a worrying fact that the emission of particulates <2.5 μm grows along with the environmental related tax increase. The authors also show that there is no correlation between the environmentally related taxes and greenhouse gases emission.

Keywords: *Environmentally Related Taxes, Air Pollution, Greenhouse Gases Emission, Panel FE model, Correlation*

INTRODUCTION

Environmental pollution is a process that has been going on for millennia. For a long time, issues of the environment pollution had not been relevant in human consciousness. However, the industrial revolutions and the processes that accompanied them lead to a significant increase in pollution. Lukinović et al. (2021) state that a high level of the anthropogenic and technogenic activities caused by industrialization and population growth has a significant devastating effect on the environment that becomes more important than ever. Carbon emission as an undesired

product of industrialization and economic development is one of the biggest environmental polluters. The Western Balkans countries have been in the process of economic development for over two decades. OECD (2022) report for Serbia states cleaner air and the introduction of sustainable energy sources as recommendations for improvement the quality of life and further economic development. The potential of the Republic of Serbia for the using of the renewable energy sources is significant (Jovanović et al., 2018). It is widely known that government plays a key role in achieving the sustainable development, especially in transition countries. However, there is a lack of studies that analyze a rule of government in sustainable development in mentioned economies. Correspondingly, this paper attempts to explore some part of the governments' role in the sustainable development promotion and transformation of Serbia`s economy from transitional to sustainable one. Specifically, sustainable economic development should be accompanied by adequate measures, which will mitigate the consumption of natural resources and enable sustainable production with minimal environment pollution (Radosavljević et al., 2022). Andrei et al. (2016) consider that in the post-transition countries the environmentally related taxes should play a key role in achieving sustainable development. The environmentally related taxes were introduced to encourage industry to use the modern clean technology, renewable energy and produce environmentally acceptable products. In other words, the environmentally related taxes contribute to sustainable development by replacing old polluting practices with cleaner ones. However, the introduction of the environmentally related taxes is only one part of the comprehensive measures that need to be implemented leading to sustainable development.

There is no generally obtained definition of the environmentally related taxes. The OECD`s and the IEA`s (International Energy Agency) definition state that: "*Environmentally related tax is a tax whose tax base is a physical unit (or proxy of it) that has a proven, specific negative impact on the environment*". The environmentally related taxes in the Republic of Serbia are defined on the basis of the Law of environmental protection. In Serbia they include the taxes for the use of flora and fauna, taxes for the use of natural resources, and taxes for environmental pollution. This group of taxes also includes the taxes for the protection and improvement of the environment. Each of these taxes has very clear criteria by which it is calculated (see Drašković and Tornjanski, 2015). The economic and financial aspects of the environmental protection in the Republic of Serbia are presented in the National Strategy in the field of environment. The environmentally related taxes should be main economic policy instrument

for environemnt protection. In accordance with available economic literature and practice, the following hypotheses of this study are defined:

Hypothesis One: The environmentally related taxes in the Republic of Serbia are effective.

Hypothesis Two: An increase of the environmentally related taxes has an impact on air pollution emission.

Hypothesis Three: There is a high correlation between environmentally related taxes and greenhouse gases emission.

The authors consider the environmentally related taxes to be effective if they have an effect on reducing pollution in Serbia.

After introduction, in the second part of this paper the authors analyze the economic aspects of environmental protection. The environmentally related taxes in the EU and in the Republic of Serbia are analyzed in detail in the third, fourth a fifth part of this study. In the sixth and seventh parts of this paper are examined the effectiveness of the environmentally related taxes (the energy taxes, transport taxes, pollution taxes, and resource taxes). In the sixth part of this paper the authors estimate an effect of the environmentally related taxes on air pollution emission, while in the seventh part of this study the authors examine correlation between the environmentally related taxes and greenhouse gases emission. The further research directions are presented in the eighth part of this paper, while the main results, conclusion, as well as limits of this study are presented in the final part of this paper.

ECONOMIC ASPECTS OF ENVIRONMENTAL PROTECTION

The relationship between the economic development and the environmentally related taxes has been analyzed by many authors. It is very important, especially for developing countries, to reveal the long-run relationship between two variables taking into account their aim to achieve sustainable development. Using Granger causality method Abdullah and Morley (2014) confirm that economic growth positively affects the environmentally related taxes in the OECD countries and vice versa covering the period from 1995 to 2006. Employing the same methodology, Andrei et al. (2016) show negative relationship between the environmentally related taxes and economic growth in Romania in the period from 2000 to 2011. The same relationship reveals Tchapchet-Tchouto et al. (2022) on the example of 31 European countries during the period from 2009 to 2019. Furthermore, using OLS and quantile regression, the mentioned authors show that low-income economies were rather negatively influences than medium and upper-income economies across

the Europe. On the other side, Hassan et al. (2020) show that relationship between economic growth and environmentally related taxes depends on whether in the observed OECD country there is a mechanism to redistribute the environmental revenues or not. The author employ Correlation Random Effect (CRE) model on the example of 31 OECD countries during the period from 1994 to 2013. The ecological crisis of the 1960s led the OECD to introduce the polluter pays principle in 1972, which defined the theoretical basis for the introduction of the environmentally related taxes in the most of developed countries all around the world. The polluter pays principle is one of the basic principles recognized in national, as well as in international regulations and public policies in the field of environment. It is included into the basic legal acts of the European Union. Essentially, the principle implies that the costs of environmental protection should be paid by the one who created them. The prerequisite of this principle is the existence of the government intervention in the field of environmental protection. However, in the practical implementation of the polluter pays principle, there are numerous challenges. Following Cordato (2001) three main challenges are:

- how to define pollution – who are polluters,
- how much should polluters pay based on emitted pollution, and
- who should be paid (the governments or those who bear the consequences of pollution).

In the most countries, pollution is clearly defined by legal acts in cooperation with experts from different fields, the polluters are categorized into several groups (see for example the Table 3), while the government collects taxes and implements different measures in order to reduce pollution. The tax payers are all whose business activities pollute the environment. The approach of shifting costs to the polluters is called internalization of the environmental costs and should result in reducing pollution to a level that is socially acceptable. In order to internalize the environmental externalities, the environmentally related taxes have been applied in developed countries for several decades. Practice has shown that the environmentally related taxes are more effective compared to other economic instruments aimed at internalization of the environmental externalities.

An implementation of the polluter pays principle also implies socially responsible governments' behavior in preserving natural resources and concern for the future generations. Furthermore, its application in the Republic of Serbia has been very important in the process of harmonizing environmental protection regulations with the European Union regulations through the negotiation Chapter 27. The economic growth in Serbia is

highly connected with sustainable development and Green Agenda. The EU aims to build a smart, sustainable and inclusive economy that is low-carbon and resource-efficient. Compliance of the Republic of Serbia with the EU in the field of environmental protection is still in progress. Namely, cluster 4 – Green Agenda and sustainable connectivity was opened at the end of 2021 and according to European Commission Report (2022) narrow development has been realized. The environmentally related taxes have been implemented in all EU member states. Famulska et al. (2022) find that in 27 EU countries, the share of the environmentally related taxes in GDP is decreasing during the period from 2009 to 2020. According to Misztal (2022) it is necessary to pay greater attention to the environmentally related taxes in Poland, the Czech Republic, Estonia and Poland, due to the fact that the environmentally related taxes in these countries have not reducing carbon emissions.Ţibulcã (2021) consider that although the EU has set the goal of being climate neutral by 2050, it will probably happen later.

ENVIRONMENTALLY RELATED TAXES IN THE EU

In the Table 1 are presented an amount of the environmentally related taxes in the EU by type as well as the share of total environmentally related taxes of GDP and TSC (total government revenue from taxes and social contributions) during the period from 2002 to 2020. As can be seen, although the absolute amounts of all observed taxes are increasing, the share of the total environmentally related taxes in GDP is decreasing. The same conclusion may be drawn when observing the share of the total environmentally related taxes in TSC. Namely the environmentally related taxes` share in GDP was 6.62 in 2002, while almost two decades later it was 5.57. Similarly, the environmentally related taxes` share in TSC was 2.55 in 2002, and nearly twenty years later it was 2.24. According to the Eurostat database in 2020 the energy taxes constituted 77% of the total environmentally related taxes, 2.24% of GDP and 5.42% of TSC. The transport taxes` share in the total environmentally related taxes was 19.3%, their share in GDP was 0.43% and their share in TSC was 1.04. The pollution taxes constituted 3.7% of the total environmentally related taxes, 0.08% of GDP and 0.2% of TSC. In the same year 47.6% of the total environmentally related taxes were paid by corporations, 48.6% by households and 3.8% by non-residents. Considering the environmentally related taxes by type, the percentages vary depending on the type of taxes. Specifically, 52% of the energy taxes were paid by corporations, 43.3% by households and 4.6% by non-residents. Contrary to that, 31% of the transport taxes were paid by corporations, 68.2% by households and 0.8%

by non-residents, while 42% of the taxes on pollution and resources were paid by corporations, 56.8% by households and 1.2% by non-residents.

Table 1: Environmentally related taxes in the EU by type and total taxes % of TSC and GDP (€ million)

Year	Energy taxes	Transport taxes	Pollution & resource taxes	Total taxes	Share of TSC	Share of GDP
2002	167269	42468	7901	217638	6.62	2.55
2003	175551	43335	7783	226668	6.71	2.59
2004	179056	48532	7866	235454	6.71	2.57
2005	182496	52048	7980	242524	6.58	2.54
2006	186392	54879	8518	249789	6.35	2.47
2007	187347	57788	8906	254040	6.07	2.37
2008	189353	56287	9360	255001	5.98	2.30
2009	189759	50925	8806	249489	6.20	2.36
2010	198633	52036	8934	259604	6.23	2.36
2011	209372	53644	9338	272354	6.27	2.41
2012	215326	53412	9722	278460	6.22	2.44
2013	220822	53615	9705	284142	6.20	2.47
2014	226251	54662	10074	290986	6.20	2.47
2015	231682	56731	10562	298975	6.16	2.45
2016	241247	58419	10533	310199	6.20	2.47
2017	246003	59924	10661	316588	6.06	2.42
2018	252153	61942	10610	324705	5.99	2.40
2019	256618	62531	10666	329815	5.89	2.35
2020	232411	56838	10636	299885	5.42	2.24

Source: Eurostat database

The environmentally related taxes by country in 2020 are presented in detail in the Table 2. Considering the environmentally related taxes by countries, in 2020 the highest absolute level of the taxes had been paid in Germany (47,642,290,000€), in France (41,272,000,000€), in Italy (40,281,000,000€), in the Netherlands (14,318,000,000€), and in Spain (16,020,000,000€) as can be seen in the Table 2. In all observed countries was recorded a lower level of the environmentally related taxes in 2020 compared to the previous year. The average decline across the EU was 9.4%. In some countries was recorded an almost drastic decline in the level of the tax revenues; Estonia -26.4%, Luxemburg -19.9%, Malta -18.8%, Austria -17.2% and Slovenia -16.6%.

Following the data presented in the Table 2, the highest share of the environmentally related taxes in GDP was recorded in Slovenia (4.67%), Greece (3.77%), and Croatia (3.29%), while the lowest share of the environmentally related taxes in GDP was recorded in Ireland (1.21%), Luxemburg (1.39%), and Slovakia (1.42%).

Table 2: Environmentally related taxes in the EU by country in 2020

	Total taxes (€ million)	Share of TSC				Share of GDP
		Energy taxes	Transport taxes	Pollution/ Resource taxes	Total taxes	
EU	231552.11	4.19	1.04	0.20	5.42	2.24
Slovenia	1114.46	11.05	1.13	0.15	12.32	4.67
Latvia	791.67	8.48	1.26	0.37	10.12	3.23
Bulgaria	1642.08	8.71	1.01	0.16	9.88	3.03
Greece	4826.00	7.06	2.04	0.01	9.11	3.77
Croatia	1262.72	6.76	1.96	0.10	8.81	3.29
Netherlands	14318.00	4.45	2.30	1.12	7.87	3.16
Malta	143.33	3.61	3.08	0.78	7.47	2.27
Cyprus	410.40	5.54	1.52	0.13	7.20	2.49
Estonia	601.64	6.53	0.12	0.48	7.13	2.45
Italy	40281.00	5.67	1.31	0.08	7.06	3.04
Romania	3878.69	6.39	0.51	0.02	6.92	1.88
Poland	11711.97	6.02	0.48	0.33	6.84	2.50
Denmark	5165.80	3.54	2.83	0.35	6.72	3.20
Finland	4605.14	4.54	1.91	0.05	6.50	2.75
Portugal	3598.51	4.78	1.50	0.05	6.33	2.38
Lithuania	859.37	5.57	0.33	0.26	6.16	1.92
Hungary	2279.36	4.47	0.80	0.57	5.84	2.12
Ireland	2767.86	3.58	2.23	0.01	5.82	1.21
Czech Republic	3880.70	5.19	0.32	0.04	5.55	2.00
Belgium	7961.10	3.77	1.45	0.28	5.50	2.54
Austria	4599.40	2.85	2.05	0.05	4.94	2.10
Spain	16020.00	3.84	0.62	0.22	4.69	1.76
France	41272.00	3.77	0.54	0.29	4.61	2.19
Sweden	7142.91	3.42	1.02	0.14	4.58	1.99
Germany	47642.29	3.41	0.71	0.00	4.12	1.71
Slovakia	1965.13	3.27	0.59	0.18	4.04	1.42
Luxemburg	810.58	3.20	0.27	0.02	3.49	1.39

Source: Eurostat database

The biggest share of the energy taxes in TSC was reported in Slovenia (11.05%), Bulgaria (8.71%), and Latvia (8.48%). Contrary to that, the lowest share of the energy taxes in TSC was reported in Luxemburg (3.20%), Slovakia (3.27%), and Germany (3.41%). The greatest share of the transport taxes in TSC was reported in Denmark (2.83%), Netherlands (2.30%), and Ireland (2.23%), while the lowest share of the transport taxes in TSC was reported in Estonia (0.12%), Luxemburg (0.27%), and Czechia (0.32%).

Table 3: Energy taxes by economic activity in the EU in 2020

	Industry, utilities and construction		Services		Households		Non-residents	
	Amount	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**
EU	53774.4	23.2	60026.6	25.9	100325.2	43.3	10248.1	4.4
Slovenia	321.9	28.9	120.5	10.8	670.1	60.1	0.0	0.0
Latvia	153.5	19.4	258.5	32.7	294.6	37.2	32.2	4.1
Bulgaria	619.9	37.8	454.9	27.7	491.3	29.9	20.1	1.2
Greece	1299.2	26.9	1363.2	28.2	1874.6	38.8	33.7	0.7
Croatia	106.0	8.4	587.6	46.5	419.3	33.2	65.2	5.2
Netherlands	2219.0	15.5	4378.0	30.6	7160.0	49.6	57.0	0.4
Malta	25.0	17.4	41.3	28.8	25.6	17.9	49.9	34.8
Cyprus	96.9	23.6	91.6	22.3	215.6	52.5	4.4	1.1
Estonia	225.1	37.4	184.1	30.6	142.0	23.6	16.2	2.7
Italy	8484.4	21.1	10238.7	25.4	19784.0	49.1	739.7	1.8
Romania	2834.9	73.1	485.0	12.5	508.4	13.1	4.9	0.1
Poland	3104.8	26.5	3728.0	31.8	3765.0	32.1	805.0	6.9
Denmark	731.6	14.2	1092.4	21.1	3136.2	60.7	0.0	0.0
Finland	899.6	19.5	1685.9	36.6	1814.4	39.4	50.0	1.1
Portugal	638.1	17.7	1109.2	30.8	1670.1	46.4	111.8	3.1
Lithuania	117.8	13.7	292.7	34.1	408.5	47.5	0.0	0.0
Hungary	612.7	26.9	641.9	28.2	883.9	38.8	0.0	0.0
Ireland	357.7	12.9	1005.0	36.3	1332.2	48.1	22.7	0.8
Czech Republic	1552.3	40.0	1448.2	37.3	682.7	17.6	35.7	0.9
Belgium	1923.2	24.2	2394.0	30.1	3315.5	41.6	167.3	2.1
Austria	787.6	17.1	838.5	18.2	1662.4	36.1	1218.4	26.5
Spain	3759.0	23.5	4930.9	30.8	7107.1	44.4	0.0	0.0
France	11098.6	26.9	9808.3	23.8	17629.1	42.7	1045.1	2.5
Sweden	1369.3	19.2	1966.3	27.5	3516.8	49.2	6.4	0.1
Germany	10059.8	21.1	9844.4	20.7	21040.1	44.2	5296.7	11.1
Slovakia	311.8	15.9	809.3	41.2	744.6	37.9	33.3	1.7
Luxemburg	65.0	8.0	228.4	28.2	84.8	10.5	432.2	53.3

Notes: Amount is shown in million €. Services = Services (including trade, transportation and storage). The rest of the energy taxes (that are not included in the table) are classified into category Other NACE and not-allocated energy taxes.
Source: Eurostat database

The highest share of the pollution and resource taxes in TSC was reported in the Netherlands (1.12%), Hungary (0.57%), and Malta (0.78%), while the lowest share of the pollution and resource taxes in TSC was reported in Germany (0.00%), Ireland (0.01%), and Greece (0.01%). The energy taxes consist about 80% of all environmentally related taxes in the

EU. Consequently, in the Table 3 is presented the energy taxes by economic activity and by country.

According to Eurostat database, in the EU the highest share of the energy taxes was paid by households (43.3%). In Denmark the mentioned share was 60.7%, in Slovenia 60.1%, while in Luxemburg was 10.5% and in Romania 13.1% in 2020. 25.9% of the energy taxes in the EU were paid by services sector (including trade, transportation and storage). The service sector paid the highest percentage of the energy taxes in Slovenia (41.2%), Croatia (46.5%) and the Czech Republic (37.3%), while the service sector paid the lowest percentage of the energy taxes in Slovenia (10.8%) and Romania (12.5%). 23.2% of the energy taxes in the EU was paid by industry, utilities and construction sector. Industry, utilities and construction sector paid the highest percentage of the energy taxes in Bulgaria (73.1%), the Czech Republic (40.0%), Bulgaria (37.8%), and Estonia (37.4%), while the industry, utilities and construction sector paid the lowest percentage of the energy taxes in Luxemburg (8.0%) and Croatia (8.4%). 4.4% of the energy taxes in the EU was paid by non-residents. Non-residents paid the highest percentage of the energy taxes in Luxemburg (53.3%), Malta (34.8%), and Austria (26.5%), while non-residents paid the lowest percentage of the energy taxes in Spain (0.0%), Slovenia (0.0%), Lithuania (0.0%) and Hungary (0.0%). The households are the biggest polluters in Slovenia, Latvia, Greece, the Netherlands, Cyprus, Italy, Poland, Denmark, Finland, Portugal, Lithuania, Hungary, Ireland, Belgium, Austria, Spain, France, Sweden, and Germany. The industry, utilities and construction sector is the biggest polluter in Bulgaria, Estonia, Romania, and the Czech Republic. The service sector (including trade, transportation and storage) is the greatest polluter in Croatia and Slovenia, while non-residents are the biggest polluters in Malta and Luxemburg.

ENVIRONMENTALLY RELATED TAXES IN SERBIA

As can be clearly seen in the Table 4, similarly as in the EU countries, all environmentally related taxes in Serbia have an increasing trend. According to the Statistical office of the Republic of Serbia database, the energy taxes have the highest share (from 79.5% to 87.0%) in the total environmental tax revenue, which is in accordance with the average of EU countries (on average about 77%). The resource taxes have the lowest share (from 1.3% to 2.8%) in the total environmental tax revenue, while the pollution taxes make from 4.2% to 8.3% of the total environmental tax revenue during the observed period. The common share of resource and pollution taxes in the total environmental taxes in Serbia is significantly

higher than in the EU countries (on average about 3,6%). The share of the transport taxes in the total environmental tax revenue in Serbia was from 6.7% to 10.4% in observed period, which is twice less than in the EU countries (on average about 19,5%).

Table 4: Environmental tax revenue by tax type in the Republic of Serbia (million RSD)

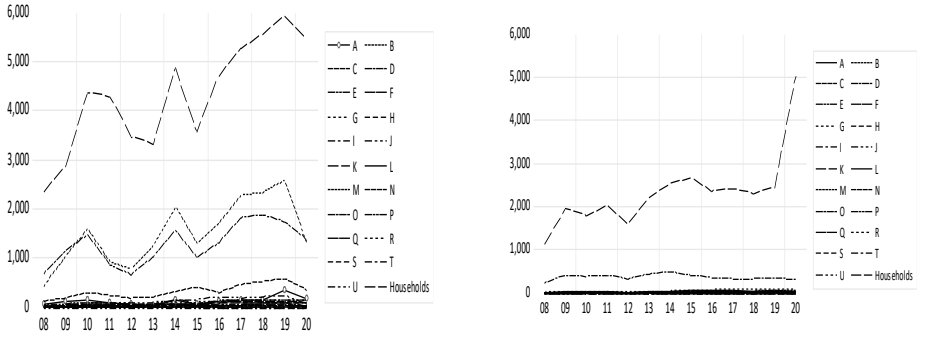
Year	Energy taxes		Transport taxes		Pollution taxes		Resource taxes	
	Amount	**%**	**Amount**	**%**	**Amount**	**%**	**Amount**	**%**
2008	59122.3	80.4	8869.2	12.0	4017.4	5.5	1513.6	2.1
2009	75788.9	80.8	9667.0	10.3	5742.6	6.1	2588.5	2.8
2010	81109.2	79.5	10157.7	9.9	8520.0	8.3	2370.7	2.3
2011	90418.4	81.5	10851.8	9.8	7110.2	6.4	2639.0	2.3
2012	91719.7	82.5	11504.0	10.4	5727.4	5.1	2195.1	2.0
2013	109690.8	84.5	10619.9	8.2	6459.0	5.0	3003.2	2.3
2014	128563.0	84.1	11045.7	7.3	9844.6	6.4	3413.7	2.2
2015	144900.1	86.7	11782.7	7.0	6992.6	4.2	3522.9	2.1
2016	161796.2	86.7	12600.1	6.7	9136.2	4.9	3120.9	1.7
2017	167779.2	85.6	13817.4	7.0	11071.6	5.7	3238.0	1.7
2018	182389.8	86.1	14769.6	7.0	11612.4	5.5	3053.7	1.4
2019	192180.2	85.9	15788.9	7.0	12457.3	5.6	3289.7	1.5
2020	189557.9	87.0	16275.1	7.5	9069.1	4.2	2988.5	1.3

Source: Author`s calculation based on Statistical Office of the Republic of Serbia database

The growth rates of the environmental tax revenue **(**measured by the ratio of the environmental tax revenue amount in the current year compared to the environmental tax revenue amount in the last year**)** were as follows; 27% in 2009, 9% in 2010, 8.7% in 2011, 0.01% in 2012, 16.8% in 2013, 17,8% in 2014, 9.4% in 2015, 10.4% in 2016, 5% in 2017, 8.1% in 2018, and 5.6% in 2019, while in 2020 was recorded a decline of 2.6%. The share of environmental tax revenue in GDP in the Republic of Serbia has been increasing; from 2.7% in 2008 to 4.2% in 2020. As a comparison, the authors have listed below the share of the environmental tax revenue in GDP of the neighboring countries in 2020; Croatia 3.91%, Slovenia 3.61%, Bulgaria 3.03%, Montenegro 2.96%, Hungary 2.46%, Romania 1.59%, Albania 0.41%, while the average share of the OECD countries was 1.35%. The authors may conclude that the growth rates of the environmental tax revenue are bigger than these have recorded in the neighboring countries during the observed period. In the Republic of Serbia the environmental tax revenue as a share of total tax revenue in 2008 was 6.9% while in 2020 it was even 11.6%. The environmental compensation system in the Republic

of Serbia is good, but it is also characterized by numerous shortcomings (for detailed information see Stojanović, 2017).

- *Figure 1. Pollution and resource taxes in the Republic of Serbia by activity*



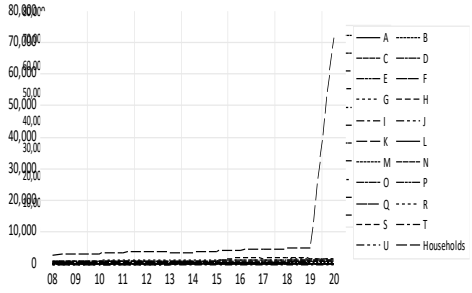
Note: A – Agriculture, forestry and fishing; B – Mining and quarrying; C – Manufacturing; D – Electricity, gas, steam and air conditioning supply; E – Water supply, sewerage, waste management and remediation activities; F – Construction; G – Wholesale and retail trade, repair of motor vehicles and motorcycles; H – Transportation and storage; I – Accommodation and food service activities; J – Information and communication; K – Financial service activities and insurance; L – Real estate activities; M – Professional, scientific and technical activities; N – Administrative and auxiliary service activities; O – Public administration and defense; compulsory social security; P – Education; Q – Health and social protection; R – Art, entertainment and recreation; S – Other service activities; T – Activities of households as employers; undifferentiated goods – and services – producing activities of households for own use; U – Activities of extraterritorial organizations and bodies

Source: Author`s calculation based on Statistical Office of the Republic of Serbia database; EViews 12 econometric program

According to Eurostat database, the neighboring countries recorded the slightly lower environmental tax revenue share in total environmental tax revenue in 2020; Croatia 10.53%, Slovenia 9.8%, Bulgaria 9.88%, Hungary 6.92%, Romania 5.89%, Albania 1.75%, while the average share of the environmental tax revenue in total tax revenue in the OECD countries was 4.56%. The environmentally related tax revenue per capita in Serbia was 521.01 USD in 2020. By way of comparison the environmentally related tax revenue per capita in Croatia was 991.04 USD, Slovenia 1254 USD, Bulgaria 623.29 USD, Montenegro 401.09 USD, Hungary 899.63 USD, Romania 416.66 USD, Albania 33.42 USD, while the average share of OECD countries was 551.89 USD in 2020. The highest level of the environmentally related tax revenue per capita had been paid in Netherland 1832.72 USD, Denmark 1639.95 USD and Luxemburg 1511.6 USD in 2020 (OECD statistics). As a unit measure it is used USD converted at 2010 PPP.

The most of economic activities usually have negative consequences on environment. Economic activities aim at profit maximization are not in accordance with the increased costs of the environment protection, bearing in mind that the higher costs for environmental protection have negative impact on profitability. However, as can be seen from the Figure 1 and the Figure 2, all environmentally related taxes in the Republic of Serbia have been rising.

Figure 2: Energy taxes and transport taxes in the Republic of Serbia by activity



Note: A – Agriculture, forestry and fishing; B – Mining and quarrying; C – Manufacturing; D – Electricity, gas, steam and air conditioning supply; E – Water supply, sewerage, waste management and remediation activities; F – Construction; G – Wholesale and retail trade, repair of motor vehicles and motorcycles; H – Transportation and storage; I – Accommodation and food service activities; J – Information and communication; K – Financial service activities and insurance; L – Real estate activities; M – Professional, scientific and technical activities; N – Administrative and auxiliary service activities; O – Public administration and defense; compulsory social security; P – Education; Q – Health and social protection; R – Art, entertainment and recreation; S – Other service activities; T – Activities of households as employers; undifferentiated goods – and services – producing activities of households for own use; U – Activities of extraterritorial organizations and bodies

Source: Author`s calculation based on Statistical Office of the Republic of Serbia database; Eviews 12 econometric program

The highest amount of the pollution taxes in the Republic of Serbia (the left part of the Figure 1) has been paid by households; mining and quarrying (sector B); electricity, gas, steam and air conditioning supply (sector D); and manufacturing industry (sector C). Correspondingly, the highest level of the resource taxes (the right part of the Figure 1) has been paid by households; and electricity, gas, steam and air conditioning supply (sector D). The greatest amount of the energy taxes in the Republic of Serbia (the left part of the Figure 2) has been paid by households; transportation and storage (sector H); manufacturing (sector C); and electricity, gas, steam and air conditioning supply (sector D). A similar situation was recorded in the EU countries. The highest level of the transport taxes (the right part of the Figure 2) has been paid by households. Taking into account the presented data, the authors can draw a clear conclusion that the biggest polluters are households, sector D, sector C,

sector B and sector H, which has a negative influence on the profitability of companies from the mentioned sectors to a large extent (for more information about the profitability of this sector, see Stoiljković et. al, in press). In the observed period, the contribution of sector B to the total GDP had been from 1.8% to 2.7%, the contribution of sector C to the total GDP had been from 13.3% to 17.2 %, the contribution of sector D to the total GDP had been from 3.2% to 4% and the contribution of sector H to the total GDP had been from 3.2% to 3.9%. According to Rybak et al. (2022) CH_4 emissions are mainly related to agricultural sector in Sweden. However, the agricultural sector (the part of sector A), which has been often cited as the development force of the Serbian economy due to growing exports and a good basis for development (see Balaban et. al 2022, Živkov et. al 2022) is not a major polluter considering air pollution.

Table 5: Correlation between transport taxes, resource taxes, energy taxes and pollution taxes by activity in the Republic of Serbia

	Transport taxes	**Resource taxes**	**Energy taxes**	**Pollution taxes**
Transport taxes	1.000000			
Resource taxes	0.681235	1.000000		
Energy taxes	0.414268	0.654408	1.000000	
Pollution taxes	0.439022	0.883257	0.623807	1.000000

Source: Author`s calculation based on Statistical Office of the Republic of Serbia database; Eviews 12 econometric program

Based on the obtained results presented in the Table 5, it can be seen that all individual taxes implemented for the purpose of environmental protection in the Republic of Serbia are correlated. As can be seen, there is a weak correlation between the transport taxes on one side and the energy taxes (0.414268) and the pollution taxes (0.439022) on the other side. Obtained results show moderate correlation between the transport taxes and the resource taxes (0.681235), the resource taxes and the energy taxes (0.654408), and the energy taxes and the pollution taxes (0.623807). The correlation matrix reveals strong correlation between the resources taxes and the pollution taxes (0.883257). In the interpretation of the degree of correlation, the authors followed Hinkle et al. (2003).Following the obtained results, the authors conclude that the companies or households that has been paid a high amount of the transport taxes also has been paid a high amount of the resource taxes in obtained period (from 2008 to 2020). Additionally, it is evident from the Table 5 that the companies or households that has been paid a high amount of the resource taxes has been paid a high amount of the pollution taxes, transport taxes and energy taxes.

The obtained findings furthermore show that the companies or households that has been paid a high amount of the energy taxes also has been paid a high amount of the resource taxes and pollution taxes, while the companies that has been paid a high level of the pollution taxes has been paid a higher level of the resource taxes and energy taxes. Karmarker et al. (2021) show that the introduction of the environmentally related taxes promotes technological modernization. These results could have significant consequences especially for transition countries. Hashmi and Alam (2019) confirm this claim and show that 1% growth in the environmentally friendly technology decrease carbon emissions by 0.017%. Liu et al. (2022) argue that the environmentally related taxes increase business investments for environmental protection. Conducting slightly different research, Doğan et al. (2022), as well as Zhao et al. (2022) argue that the strict environmental related laws encourage the environmentally friendly methods of production with minimal emissions. Conducting the research on panel data from the OECD countries Hassan et al. (2020) conclude that the environmentally related taxes introduced at a higher level of GDP have a greater impact on the economic growth rate.

IMPACT OF ENVIRONMENTALLY RELATED TAXES ON AIR POLLUTION

Although the environmentally related taxes were introduced as a main instrument of economic policy in order to reduce pollution, there is a lack of studies that examine their effectiveness. Furthermore, there is no unique assertion about the real impact of the environmentally related taxes on air pollution. In order to answer the question whether the environmentally related taxes are effective or not, Miller and Vela (2013) analyze the relationship between the environmental achievement and the level of the environmentally related taxes in fifty countries all around the world covering the period from 1995 to 2010. Employing the dynamic panel model, the authors conclude that the higher level of the environmentally related taxes is connected with the reduction of CO_2 and PM_{10} emissions. At the same time the higher level of the environmentally relied taxes has been reducing energy use and production from fossil sources. Employing different panel models Hashmi and Alam (2019) estimate an impact of the environmental regulation and innovation on the carbon emission in the OECD countries covering the period from 1999 to 2014. The authors show that 1% growth of the environmentally related taxes per capita reduces carbon emissions by 0.03% in the the OECD countries. Using quantile autoregressive distributed lag (QARDL) method Chien et al. (2021)

examine the role of the environmental innovation, environmentally related taxes, and green energy in the USA during the period from 1970 to 2015. In accordance with the obtained results the authors confirm that the environmentally related taxes decrease haze pollution such as particulates < 2.5μm in the USA. Contrary to that, using the system generalized method of moment (SYS-GMM) model, Bashir et al. (2020) show that the environmentally related taxes have negative impact on carbon emissions in the OECD countries during the period form 1995 to 2015.

Table 6: Brief review of previous studies – environmentally related taxes and air pollution

Author(s)	**Sample**	**Period**	**Methodology**	**Effectives of taxes**
Miller and Vela (2013)	50 countries all around the world	1995-2010	Dynamic panel model	Effective
Hashmi and Alam (2019)	OECD countries	1999-2014	Different panel models	Effective
Chien et al. (2021)	The USA	1970-2015	QARDL	Effective
Bashir et al. (2020)	OECD	1994-2016	SYS-GMM	Not effective
Rafique et al. (2022)	29 OECD countries	1994-2016	PMG; FMOLS; DOLS; FE; D-H causality	Effective
Xin and Xie (2022)	China	2000-2020	Non parametric methods	Effective

Note: The authors consider the environmentally related taxes to be effective if they have an effect on reducing air pollution
Source: The authors' review on the base of available literature

Employing advanced econometric techniques Rafique et al. (2022) conclude that the environmentally related taxes applied in 29 OECD countries during the period from 1994 to 2016 are effective. The authors claim that their study should be some kind of guidelines for the introduction of the environmentally related taxes in other countries all around the world. A brief review of the current studies that examine the influence of the environmentally related taxes on air pollution is presented in the Table 6. The results of research conducted in Serbia about the effectiveness of the environmentally related taxes are scarce. Radovanović and Đukić (2015) states that the conventional policies implemented to ensure economic growth are not in accordance with sustainable development policies that take into account limited resources. In addition of that, Mitić et al. (2017)

confirms that 1% increase in GDP leads to a 0.35% growth in CO_2 emissions, which further requires the higher level of investments in the environmental protection as well as an increase of the environmentally related taxes. Mitić et al. (2017) employ the dynamic ordinary least squares (DOLS) and the fully modified ordinary least squares (FMOLS) models on the example of 17 transition countries covering the period from 1997 to 2014. Knežević and Pavlović (2020) reveal a strong correlation between the environmentally related taxes and expenses for environmental protection in the Republic of Serbia during the period from 2009 to 2017, while the same conclusion is not confirmed for the EU countries. In order to fill the gap related to the lack of studies that examine the effectiveness of environmentally related taxes in the Republic of Serbia, following the ideas of mentioned authors (see Table 6) the authors estimate the following panel Fixed-Effect model:

$$ERT_{it} = \alpha_i + \beta_1 X_{it-nitrogen\ oxides} + \beta_2 X_{it-non-methane\ volatile\ organic\ compounds} + \beta_3 X_{it-sulphur\ oxides} + \beta_4 X_{it-particulates<2.5} + \beta_5 X_{it-particulates<10} + \beta_6 X_{it-carbon\ oxides} + \beta_7 X_{it-ammonia} + \epsilon_{it} \quad (1)$$

$$\text{for } t = 1, \dots, T \text{ and } i = 1, \dots, N$$

where:

ERT_{it} – dependent variable (the environmental related taxes) observed for individual *i* and *t*,

α_i – intercept, varies among individual units of observation, but is constant over time. It consists of constant part (μ) and an error term for individual observation units (γ_i),

β – is the $k \times 1$ matrix of parameters,

X_{it} – is the $1 \times k$ (the number of independent variables) regressor vector,

ϵ_{it} – error term.

As the dependent variable the authors employ the total sum of the different environmentally related taxes: the transport taxes, the resource taxes, the energy taxes and the pollution taxes by sectors. In the panel Fixed-Effect (FE) model the authors include the following independent variables by sectors:

- the nitrogen oxides, t (Mg);
- non-methane volatile organic compounds, t (Mg);
- sulphur oxides, t (Mg);
- particulates < 2.5μm, t (Mg);

- particulates < 10μm, t (Mg);
- carbon monoxide, t (Mg) and
- ammonia, t (Mg).

Table 7: Levin, Lin & Chu and Im, Pesaran & Shin unit root tests

Tests/ Variables	Common root – Levin, Lin & Chu			Individual root – Im, Pesaran & Shin	
	None	Individual intercept	Individual intercept and trend	Individual intercept	Individual intercept and trend
Environmentally related taxes	-4.59901 (0.0000)	-65.6044 (0.0000)	-4.10072 (0.0000)	-4.84821 (0.0097)	-2.03401 (0.0006)
Nitrogen oxides	-3.99110 (0.0000)	-65.6044 (0.0000)	-10643.4 (0.0000)	-15.5036 (0.0000)	-1118.57 (0.0000)
Non-methane volatile organic compounds	-3.4805 (0.0003)	-65.7379 (0.0000)	-80.9681 (0.0000)	-18.7989 (0.0000)	-8.85339 (0.0000)
Sulphur oxides	-3.02400 (0.0012)	-2.49047 (0.0064)	-4.08096 (0.0000)	-5.4e+14 (0.0000)	-1.9e+14 (0.0000)
Particulates < 2.5μm	-1.41406 (0.0787)	-1.56902 (0.0583)	-2.97595 (0.0015)	-5.4e+14 (0.0000)	-2.0e+14 (0.0000)
Particulates < 10μm	-0.96045 (0.1684)	-30.3669 (0.0000)	-22.6048 (0.0000)	-5.85115 (0.0000)	-2.45238 (0.0000)
Carbon oxides	-5.0242 (0.0000)	-21.8668 (0.0000)	-33.2943 (0.0000)	-6.82439 (0.0000)	-3.72099 (0.0001)
Ammonia	-3.57191 (0.0002)	-2.28029 (0.0043)	-3.23226 (0.0006)	-5.48180 (0.0000)	-2.54781 (0.0000)

Note: Levin, Lin and Chu unit root test Null Hypothesis state that there is a unit root (common unit root test); Im, Peasarn & Shin Null Hypothesis state that there is a unit root (individual unit root test).

Source: Author`s calculation based on Statistical Office of the Republic of Serbia database; Eviews 12 econometric program

In order to have an appropriate number of variables, the environmentally related taxes by sector are compared with air pollution emissions by sector. In other words, twenty cross-sections (see note bellow the Figure 1 and the Figure 2) and thirteen periods (from 2008 to 2020) are included in the estimated panel Fixed-Effect model. Hausman test shows that panel FE model is appropriate. As we can see in the Table 7, all observed variables are stationary. The results of the estimated panel FE model are presented in the Table 8. The obtained findings show that the environmentally related taxes increase leads to reduction of air pollution. The p-value show that the 1% growth of the environmentally related taxes reduces emission of carbon oxides by 0.37% (the coefficient is negative and significant at 5% significance level). Furthermore, the 1% increase in

the environmentally related taxes reduces emission of ammonia by 0.78% (the coefficient is negative and significant at 5% significance level). Contrary to that, the emission of particulates <2.5μm grows along with the environmental related tax increase (coefficient is significant at 10% significance level), which is worrying. According to Chien et al. (2021), green growth, eco-innovation, environmentally related taxes, and use of renewable energy are key factors for reducing particulates <2.5μm.as can be seen from the Table 8, the environmentally related taxes have no effect on the other observed variables (nitrogen oxides, non-methane volatile organic compounds, sulphur oxides, particulates <10μm) included in the estimated FE model.

Table 8: Estimated Fixed-Effect model and diagnostic tests

Variable	**Coefficient**	**Prob.**
c	3257.497	0.3147
Nitrogen oxides	0.269693	0.2004
Non-methane volatile organic compounds	-0.303898	0.6145
Sulphur oxides	-0.017806	0.4673
Particulates < 2.5μm	3.955141	0.0560
Particulates < 10μm	2.016260	0.1843
Carbon oxides	-0.372990	0.0204
Ammonia	-0.777079	0.0286
Effect specification		
R-squared	0.942452	
Adjusted R-squared	0.936030	
F-statistics	146.7613	
Prob. (F-statistics)	0.000000	

Source: Authors' calculation based on Statistical Office of the Republic of Serbia database, EViews12 program

The applied diagnostic tests show that the panel FE model is well specified. Furthermore, the adjusted R-squared shows that even 93.6% variation of the dependent variable (the environmentally related taxes by sector) is explained by the independent variables included in the panel FE regression model. Furthermore, the F statistic is less than 0.05, indicating that the sample data provide sufficient evidence that the applied panel FE model fits well. Leal Filho et al. (2015) conduct a comparative analysis on the sustainable governance in different types of European economies (Denmark, Finland, Germany, Latvia, Lithuania and Poland). As the fundamental causes of a weak governance implementation in some of analyzed economies the authors state the lack of understanding of sustainable development among public decision makers, and the non-existence of the inter-sectored collaboration. The policy makers in the

Republic of Serbia should take into account these findigs, bearing in mind that, Leal Filho et al. (2015) believe that examples of good practice can be applied to any type of economy.

ENVIRONMENTALLY RELATED TAXES AND GREENHOUSE GASES EMISSION

Employing novel econometric techniquesYunzhao (2022) concludes that environmentally related taxes are effective in seven emerging countries during the period from 1995 to 2018. Yue et al. (2022) draw a same conclusion on the example of five island economies covering the period from 2001 to 2020. Zhu and Lin (2022) argue that the environmentally related taxes reduce the mining industry's CO_2 emissions in China as the major energy consumer during the period from 2004 to 2019. Emphasizing sustainable development as the main factor of the EU progress Rybak et al. (2022) analyze an impact of the environmentally related taxes on CO_2 and CH_4 emissions in Sweden and Poland using the Autoregressive Moving Average with exogenous terms (ARMAX) models during the period from 2011 to 2019. The authors show that the environmentally related taxes reduce CO_2 emissions. Employing the ordinary least squares (OLS) model Dehdar et al. (2022) conclude that the environmentally related taxes are effective in the OECD countries covering the period from 1994 to 2015. Using the fully modified ordinary least squares (FMOLS) and the dynamic ordinary least squares (DOLS) models Doğan et al. (2022) show that the environmentally related taxes increase leads to reduction in carbon emissions in the G7 countries during the period from 1994 to 2014, while Wolde-Rufael and Mulat-Weldemeskel (2021) confirm this finding employing the augmented mean group (AMG) and the fully modified ordinary least squares (FMOLS) models in seven emerging countries covering the period from 1994 to 2015.

Table 9: Brief review of previous studies – environmentally related taxes and greenhouse emission

Author(s)	Sample	Period	Methodology	Effectives of taxes
Doğan et al. (2022)	G7 countries	1994-2014	Regression	Effective
Ţibulcã (2021)	27 EU countries	2000-2018	Regression	Effective
Hao et al. (2021)	G7 countries	1991-2017	CS-ARDL	Effective
Karmarker et al. (2021)	42 high and middle-income countries	1995-2018	CCEMG AMG	Effective

Chien et al. (2021)	The USA	1970-2015	QARDL	Not effective
Wolde-Rufael and Mulat-Weldemeskel (2021)	7 emerging economies	1994-2015	AMG FMOLS	Effective
Akkay and Hepsag (2021)	Turkey	1958-2018	Non-linear cointegration, ECM	Not effective
Khan et al. (2021)	19 EU countries	1990-2018	MMQR	Effective
Dehdar et al. (2022)	OECD countries	1994-2015	OLS	Effective
Misztal et al. (2022)	Bulgaria, Czechia, Estonia, Poland	2008-2022	Correlation; OLS; VAR Simultaneous equation	Effective
Telatar and Birinci (2022)	Turkey	1994-2019	Non-linear cointegration	Not effective
Doğan et al. (2022)	G7	1994-2014	FMOLS DOLS	Effective
Rybak et al. (2022)	Sweden and Poland	2011-2019	ARMAX	Effective
Zhu and Lin (2022)	China	2004-2019	SUR	Effective
Yunzhao (2022)	E7	1995-2018	CUP-FM CUP-BC D-H causality	Effective
Yue et al. (2022)	5 island economies	2001-2020	Quantile regression	Effective

Note: The authors consider the environmentally related taxes to be effective if they have at least a small effect on reducing greenhouse emission
Source: The authors' summarization on the base of available literature

As opposite to the mentioned studies Chien et al. (2021) find a negative relationship between the environmentally related taxes and CO_2 emissions in the USA during the period from 1970 to 2015 employing quantile autoregressive distributed lag (QARDL) method, while Telatar and Birinci (2022) and Akkay and Hepsag (2021) show that environmentally related taxes has no effect on CO_2 emissions in Turkey. Telatar and Birinci (2022) employ nonlinear cointegration test on the available data during the period from 1994 to 2019. Akkay and Hepsag (2021) use asymmetric nonlinear cointegration test and novel error correction model covering the wide period from 1985 to 2018. Employing the method of moments' quantile regression (MMQR) Khan et al. (2021) show that the renewable energy,

pure technology and environmentally related taxes reduce the carbon emissions in 19 countries of the EU.

On the sample of 28 OECD countries Sen and Vollebergh (2018) find that the energy taxes reduce carbon emissions from fossil fuel consumption in the long run. It can be concluded that the environmentally related taxes, economic growth, sustainable development, foreign direct investment, use of renewable energy, urbanization and industrialization have a significant long-term impact on the ecological footprint in all countries around the world. There are a lot of studies that analyze the ecological footprint in developed countries, but there is a lack of studies that examine this issue in the underdeveloped or developing countries. A brief review of the current studies that examine the impact of the environmentally related taxes on greenhouse emissions is presented in the Table 9.

The authors tried to answer the question of whether the environmentally related taxes reduce greenhouse gas emissions in the Republic of Serbia. Due to low availability of data (from 2010 to 2014), it was not possible to estimate the regression model. Hence, for this purpose, a correlation matrix is applied. The following greenhouse gases emissions by sector are included in the estimation:

- carbon dioxide, kt (Gg);
- carbon dioxide from biomass used in a fuel, kt (Gg);
- hydro fluorocarbons, t (Mg);
- methane t (Mg) and
- nitrous oxides, t (Mg).

Table 10: Correlation between environmentally related tax and greenhouse gases emission

	Environmentally related taxes	**Carbon dioxide**	**Carbon dioxide from biomass**	**Hydro fluoro-carbons**	**Methane**	**Nitrous oxides**
Environmentally related taxes	1.000000					
Carbon dioxide	0.221298	1.000000				
Carbon dioxide from biomass used as a fuel	0.744939	0.173266	1.000000			
Hydro fluorocarbons	0.300370	0.177757	0.222741	1.000000		
Methane	0.052442	0.028672	0.113192	0.060918	1.000000	
Nitrous oxides	0.374215	0.337597	0.373828	0.761226	0.505312	1.000000

Source: Authors' calculation based on Statistical Office of the Republic of Serbia database, EViews12

The obtained results from the Table 10 clearly show that there is no correlation between the environmentally related taxes by sectors and greenhouse gases emission in Serbia during the period from 2010 to 2014. In fact, the correlation is very weak or weak between the observed variables. The only exception is the high positive correlation between the environmentally related taxes and carbon dioxide from biomass used as a fuel (correlation coefficient is 0.744939). In the interpretation of the degree of correlation, as in the previous chapter, the authors followed Hinkle et al. (2003).

CONCLUSION

This paper attempts to explore some part of the governments' role in the sustainable development promotion and transformation of Serbia`s economy from transitional to sustainable one. The ecological crisis of the 1960s led the OECD to introduce the polluter pays principle in 1972, which defined the theoretical basis for the introduction of the environmentally related taxes in the most of developed countries all around the world. The polluter pays principle is one of the basic principles recognized in national, as well as in international regulations. An implementation of the polluter pays principle also implies socially responsible government's behavior in preserving natural resources and concern for the future generations. Although the environmentally related taxes were introduced as a main instrument of economic policy in order to reduce pollution in the countries all-around the world, there is a lack of studies that examine their effectiveness. There are almost no studies with a similar subject investigating data for the Republic of Serbia, which is a contribution to the literature. Although the main goal of introducing the polluter pays principle is to reduce pollution, its application in the Republic of Serbia has been very important in the process of harmonizing environmental protection regulations with the European Union regulations through the negotiation Chapter 27. When analyzing the level of taxes in the Republic of Serbia and the EU, the authors concluded that the movement of taxes is growing, in both cases. The only thing that is different is that the share of transportation taxes in the total environmentally related taxes is significantly lower in Serbia. Namely, the share of the transport taxes in the total environmental tax revenue in Serbia was from 6.7% to 10.4% in observed period, which is twice less than in the EU countries (on average about 19,5%).

In accordance with available economic literature and practice, we defined three hypotheses. According to obtained results we may draw a conclusion that the environmentally related taxes in the Republic of Serbia are relatively effective during the period from 2008 to 2020. The authors consider the environmentally related taxes to be effective if they have an effect on reducing pollution in Serbia. According to obtained results, the authors may draw a conclusion that an increase of the environmentally related taxes has an impact on air pollution emission. The results of estimated panel FE model show that the environmentally related taxes increase leads to reduction of emission of carbon oxides by 0.37% and ammonia by 0.78%. It is a worrying fact that the particulates<2.5μm grow along with the environmental related tax increase. The particulates<2.5μm pose the greatest health risk. According to Chien et al. (2021), green growth, eco-innovation, environmentally related taxes, and use of renewable energy are key factors for reducing the particulates<2.5μm. Following the obtained results, the environmentally related taxes does not lead to a reduction of the particulates<2.5μm, hence an attention of policy makers in the Republic of Serbia should be focused on other three factors. The environmentally related taxes have no effect on the other air polluters, such as the nitrogen oxides, non-methane volatile organic compounds, sulphur oxides, and particulates<10μm. The adjusted R-squared shows that even 93.6% variation of the environmental related taxes is explained by the independent variables included in the panel FE regression model.

As can be clearly seen in the Table 4, similarly as in the EU countries, all environmentally related taxes in Serbia have an increasing trend. According to the Statistical office of the Republic of Serbia database, the energy taxes have the highest share (from 79.5% to 87.0%) in the total environmental tax revenue, which is in accordance with the average of EU countries (on average about 77%). The resource taxes have the lowest share (from 1.3% to 2.8%) in the total environmental tax revenue, while the pollution taxes make from 4.2% to 8.3% of the total environmental tax revenue during the observed period. The common share of resource and pollution taxes in the total environmental taxes in Serbia is significantly higher than in the EU countries (on average about 3,6%). The share of the transport taxes in the total environmental tax revenue in Serbia was from 6.7% to 10.4% in observed period, which is twice less than in the EU countries (on average about 19,5%). It can be argued that the authors partially confirmed the Hypothesis One and Hypothesis Two, while the Hypothesis Three was not confirmed. Namely, there is no correlation between the environmentally related taxes and greenhouse gases emission covering the period from 2010 to 2014. The authors also find the high

positive correlation between the environmentally related taxes and carbon dioxide from biomass used as a fuel (correlation coefficient is 0.744939), which should be explored in more detail in the future studies. The share of environmental tax revenue in GDP in the Republic of Serbia has been also increasing during the period from 2008 to 2020. In 2020 it was 4.2%, which is significantly higher than the average of the EU countries (2,24%). Taking those results into account, it can be said that in Serbia, an adequate part of GDP is allocated for the purpose of reducing pollution.

Based on the obtained results as well as available theoretical and empirical literature, the authors propose that the environmentally related taxes should be a main economic policy instrument for environment protection. As a consequence of an introduction and an increase of the environmentally related taxes all around the world there are reduction of air pollution emissions and greenhouse gas emission. Furthermore, the environmentally related taxes encourage technological modernization, use of renewable energy and production with minimal emission which will contribute to the transformation of Serbia`s economy from transitional to sustainable one.

Although each of observed environmentally related taxes has very clear criteria by which it is calculated, it is worth to mention as a limit of this study that following Drašković and Tornjanski (2015) in the Republic of Serbia there is no adequate methodology for calculating and monitoring revenues and expenses related to environmental protection. Furthermore, according the same authors, the available data may not be sufficiently reliable and transparent. As a limitation of the study, the authors also state the low availability of data on greenhouse gases emission (from 2010 to 2014) which is the main reason why the authors apply correlation in order to find out more about an impact of the environmentally related taxes on greenhouse gases emission. The authors agree that applying regression model would be a much better solution, but applying an adequate regression model to such a small set of data is not possible.

FUTURE RESEARCH DIRECTIONS

The authors suggest examination of the validation of the environmental Kuznets curve hypothesis for the Republic of Serbia. The environmental Kuznets curve hypothesis defines the connection between environmental quality and per capita income that is closely related to the topic of this study. The authors consider that the results of estimation of the environmental Kuznets curve hypothesis validity would complete the results that the authors obtained in this study.

The authors also suggest exploring a potential problem that arises from an existence of so-called pollution havens countries. Many authors have been written about this controversial hypothesis, which emphasizes the fact that large polluters remove their production from the developed countries to those countries (usually developing or underdeveloped countries) where the costs of pollution are significantly lower. In this way, practically, the global pollution is not reduced, and the environmental revenues are not sufficient to reduce the resulting pollution. Therefore, the authors consider that it would be useful to compare the implementation and the level of the environmentally related taxes and pollution in the countries in different stages of development around the world.

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