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Inhalt / Content

KAPITEL 14 / *CHAPTER 14*
EMPIRICAL RESEARCH ON THE ENVIRONMENTAL TAX PERFORMANCE IN THE EUROPEAN COUNTRIES

ЕМПІРИЧНІ ДОСЛІДЖЕННЯ ЕФЕКТИВНОСТІ ЕКОЛОГІЧНИХ ПОДАТКІВ У ЄВРОПЕЙСЬКИХ КРАЇНАХ

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Introduction

State tax policy in the field of environmental tax administration is a variable component in the system of macroeconomic regulation. This is primarily due to the implementation of eco-reforms on a permanent basis, which is in line with today's global environmental challenges. The European countries have made special progress in reforming the environmental tax system. European experience in environmental tax management can be borrowed by transformational economies, Ukraine in particular, as an excellent practice of adapting to global environmental standards. The assessment of factors influencing the effectiveness of environmental tax reforms implemented by the European countries is of crucial concern. Along with such factors as tax competition and tax harmonization, the country's environmental tax system also depends on many other macroeconomic parameters, the study of which is an urgent scientific and practical task for building a system of environmental taxes on an effective basis.

14.1. Identification of economic impact factors related to the environmental tax performance

The statistical portal of the European Union contains information on four main groups of environmental taxes, namely [1]:

- energy taxes,
- pollution taxes,
- resource taxes,
- transport taxes.

The absolute value of the share of environmental taxes in the GDP of the European countries and its dynamics are presented in Figure 1.

The calculated share of environmental taxes as a percentage of GDP in the European Union is quite significant, which indicates a satisfactory state of macroecological policy in the study region.

Since the object of the empirical analysis is a macroeconomic policy of the European countries, we propose to distinguish the macroeconomic factors in the following way [2]:

1. Internal macroeconomic factors: nominal GDP, real GDP, inflation, business cycle stage, budget deficit, energy consumption.

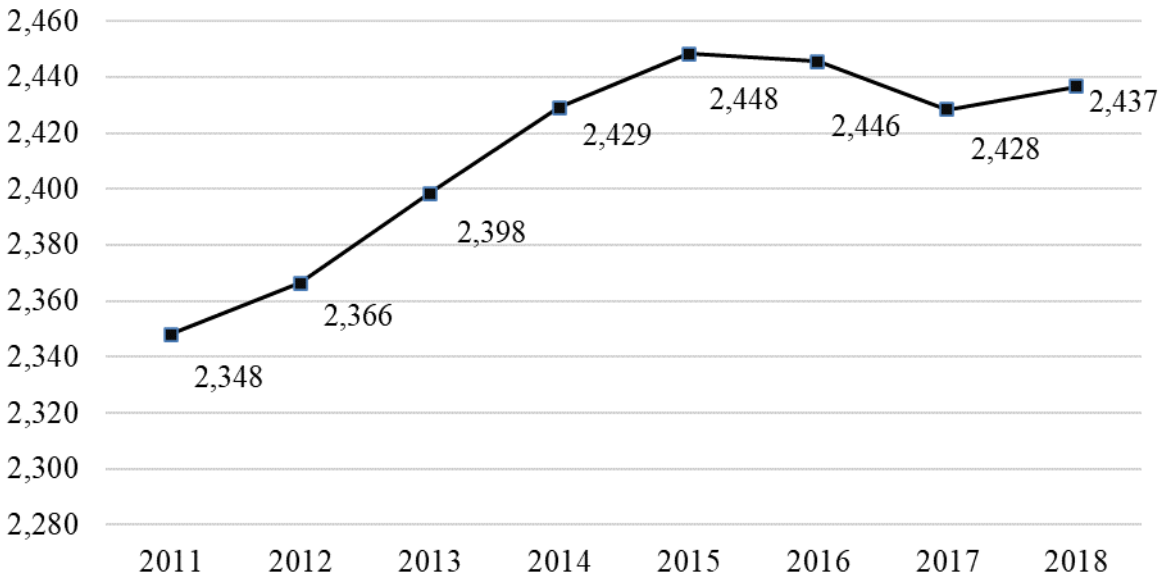

Figure 1 – Share of environmental taxes in the GDP of the EU countries

2. External macroeconomic factors: public debt, exports, foreign direct investments.

3. Institutional macroparameters: ecological culture (productivity of resources), shadowing of the economy, trust in government.

4. Fiscal macroparameters: tax culture, fiscal freedom.

Research findings based on a correlation analysis are represented in the Tables 1–4.

Table 1 – Assessment of the internal macroeconomic impact factors

Indicators	Nominal GDP	Real GDP	Inflation	Business cycle stage	Budget deficit	Energy consumption
Energy taxes	0,9916	0,7306	-0,6915	-0,1028	0,6987	-0,8192
Pollution taxes	0,9544	0,8016	-0,4951	-0,0836	0,8602	-0,6792
Resource taxes	0,8776	0,8174	-0,6856	0,2607	0,6826	-0,6017
Transport taxes	0,9968	0,9308	-0,4837	-0,0149	0,9086	-0,5820
Total env. taxes	0,9932	0,7737	-0,6657	-0,0856	0,7442	-0,7910
Averaged	0,9372	0,8108	-0,6043	-0,0052	0,7789	-0,6946
Direction	Straight	Straight	Inverse	Inverse	Straight	Inverse
Density	Very strong	Strong	Moderate	Absent	Moderate	Moderate

Table 2 – Assessment of the external macroeconomic impact factors

Indicators	Public debt	Exports	FDI
Energy taxes	0,7534	0,9022	0,9962
Pollution taxes	0,5732	0,9441	0,9469

Indicators	Public debt	Exports	FDI
Resource taxes	0,8478	0,6138	0,9296
Transport taxes	0,4259	0,8839	0,9963
Total env. taxes	0,7086	0,9120	0,9972
Averaged	0,6618	0,8512	0,9732
Direction	Straight	Straight	Straight
Density	Moderate	Strong	Very strong

Table 3 – Assessment of the institutional macroeconomic impact factors

Indicators	Ecological culture	Shadow economy	Trust in government
Energy taxes	0,9784	-0,8381	0,1342
Pollution taxes	0,9662	-0,9552	0,1609
Resource taxes	0,7717	-0,0494	0,6035
Transport taxes	0,9614	-0,9336	0,3732
Total env. taxes	0,9763	-0,8973	0,1754
Averaged	0,9308	-0,7347	0,2895
Direction	Straight	Inverse	Straight
Density	Very strong	Moderate	Absent

Table 4 – Assessment of the fiscal macroeconomic impact factors

Indicators	Tax culture	Fiscal freedom
Energy taxes	0,8748	0,6939
Pollution taxes	0,9390	0,7130
Resource taxes	0,5575	0,1330
Transport taxes	0,8504	0,5150
Total env. taxes	0,8837	0,6744
Averaged	0,8210	0,5459
Direction	Straight	Straight
Density	Strong	Moderate

14.2. Economic interpretation of the obtained correlates

The economic interpretation of the earlier obtained results is represented in the Table 5–8 [3].

Table 5 – Economic interpretation of the statistically driven results on the internal factors analysis

№	Correlates	Correlation ratio	Economic interpretation
1	Nominal GDP - environmental taxes	0,9372	With the growth of GDP, there is an increase in environmental tax revenues to the budget. Revenues from environmental taxes are 94 % due to the impact of nominal GDP. The growth of nominal GDP causes the material well-being of taxpayers, who accumulate certain funds to ensure the quality of the environment.
2	Real GDP per capita – environmental taxes	0,8108	The growth of real GDP per capita has a positive effect on the dynamics of environmental tax revenues.

№	Correlates	Correlation ratio	Economic interpretation
			Revenues from environmental taxes are 81 % due to the impact of real GDP per capita. Real GDP (compared to nominal) is less correlated with environmental taxes due to the prudent tax policies, which prevents inflation.
3	Inflation – environmental taxes	-0,6043	The impact of inflation on environmental taxes is negative. Revenues from environmental taxes by 60% are due to lower inflation in the EU. Fighting inflation has a positive impact on the dynamics of environmental tax revenues.
4	Business cycle stage – environmental taxes	-0,0052	At the stage of economic recovery, revenues from environmental taxes are reduced, which may indicate the absence of antagonistic relations between economic growth and environmental quality. In general, the correlation between the factors is almost absent.
5	Budget deficit – environmental taxes	0,7789	With the reduction of the budget deficit, there is an increase in tax revenues. Revenues from environmental taxes are 78 % due to the impact of the budget deficit. As tax revenues increase, the budget deficit narrows. This dependence indicates the high quality of the fiscal function of environmental taxes.
6	Energy consumption – environmental taxes	-0,6946	Energy consumption is declining due to increased environmental taxes. Revenues from environmental taxes are 69% due to energy consumption.

Table 6 – Economic interpretation of the statistically driven results on the external factors analysis

№	Correlates	Correlation ratio	Economic interpretation
1	Public debt – environmental taxes	0,6618	Public debt has a positive effect on the payment of environmental taxes by entrepreneurs. Environmental taxes are a source of debt repayment. Revenues from environmental taxes are 66% due to the impact of public debt.
2	Exports – environmental taxes	0,8512	The development of export potential has a positive effect on the dynamics of environmental tax revenues. Such dynamics is 85% due to the influence of foreign economic activity. By developing export-oriented business, entrepreneurs contribute to the replenishment of the budget with environmental taxes.
3	FDI – environmental taxes	0,9732	Foreign investors comply with environmental legislation in the EU countries. Revenues from environmental taxes are 97% due to the impact of foreign direct investment. In general, the openness of the economy helps to revive the business climate and tax activity of businesses.

Table 7 – Economic interpretation of the statistically driven results on the institutional factors analysis

№	Correlates	Correlation ratio	Economic interpretation
1	Ecological culture – environmental taxes	0,9308	The efficiency of the use of physical resources provides a direct impact on the dynamics of environmental taxes. Paying taxes, entrepreneurs act as carriers of ecological culture. The incomings of environmental taxes to the budget by 93% are

№	Correlates	Correlation ratio	Economic interpretation
			determined by the influence of environmental culture. Ecological culture implies the highest level of resource conservation, which can be achieved partly and through an unavoidable payments of environmental taxes.
2	Shadow economy – environmental taxes	-0,7347	The shadowing of the economy has a negative impact on tax policy. The downward trend in the shadow economy in the EU is conducive to increased payment of environmental taxes. The dynamics of environmental tax revenues by 73% is due to the influence of the shadow economy factor. Bringing the economy out of the shadows contributes to the incomings of environmental taxes to the budget.
3	Trust in government – environmental taxes	0,2895	In general, trust in government has a positive effect on the economic activity of entrepreneurs. However, given the weak correlation between the studied factors, it follows that there is a high level of environmental responsibility of businessmen, which is manifested through the awareness of the need to pay environmental taxes, regardless of the degree of trust in political power.

Table 8 – Economic interpretation of the statistically driven results on the fiscal factors analysis

№	Correlates	Correlation ratio	Economic interpretation
1	Tax culture – environmental taxes	0,8210	Payment of environmental taxes by entrepreneurs is a component of the general tax culture in the EU. Revenues of environmental taxes to the budget by 82 % depend on the factor of fiscal efficiency of tax management. Based on this, it can be argued that the administration of environmental taxes is effective and provides a high tax culture in the EU.
2	Fiscal freedom – environmental taxes	0,5459	The positive correlation between the studied factors indicates the ease of environmental taxes. Revenues from environmental taxes by 55% are due to the influence of fiscal freedom.

The conducted analysis allows us to identify at the macro-level the stimulators (catalysts) and destimulators (inhibitors) of environmental tax policy in the European Union [4].

Table 9 – Catalysts and inhibitors of environmental tax policy in the European countries

Factors	Correlation ration	Catalysts	Inhibitors	Neutral factors
Nominal GDP	+0,9932	+		
Real GDP per capita	+0,7737	+		
Inflation	-0,6657		+	
Business cycle stage				+
Government debt	+0,7086			

Factors	Correlation ration	Catalysts	Inhibitors	Neutral factors
Budget deficit	+0,7442	+		
Exports	+0,9120	+		
Foreign direct investments	+0,9972	+		
Ecological culture	+0,9763	+		
Tax culture	+0,8837	+		
Shadow economy	-0,8973		+	
Trust in government	+0,1754			+
Energy consumption	-0,7910		+	
Fiscal freedom	+0,6744	+		

The formation of environmental tax policy performance indicators should imply taking into account the assessment of fiscal and reproductive (multiplicative) functions of environmental taxes. For this purpose, we propose in our paper to calculate a multiplicator and accelerator of environmental taxes.

The environmental tax multiplicator is an extra income received by the country as a result of the implementation of environmental tax reforms. This indicator shows how much GDP will change when the environmental tax changes by 1 euro. If the multiplicator takes a positive value, it tells about a high reproducibility of environmental taxes. If the studied indicator varies within zero or takes a negative value, then this dependence can be interpreted as a manifestation of a purely fiscal function of environmental taxes.

In addition to the multiplicator, it is proposed to calculate in the paper the inverse indicator – the accelerator of environmental taxes. The accelerator of environmental taxes in its economic essence is an indicator of fiscal environmental intensity of GDP.

In addition, we recommend to calculate the elasticity of GDP by environmental taxes, which shows how a change in environmental taxes by 1% causes a corresponding change in GDP. If the coefficient of elasticity is positive and exceeds 1, the environmental tax policy is considered to be effective.

Studies conducted across the European Union, which were based on an analysis of 27 countries, show that the region is relatively effective in performing of environmental tax policy.

Table 10 – Analysis of the effectiveness of environmental tax policy in the European Union

Indicators	Total	Energy	Pollution	Resources	Transport
Multiplicator	28,77	40,46	3272,38	4517,03	279,06
Accelerator	0,03	0,02	0,0005	0,00015	0,0041
Elasticity, %	0,79	0,74	2,34	0,56	1,36

Progress in improving of the environment quality on a tax basis can be seen

mainly in the transport sector. It is transport taxes that demonstrate the highest efficiency in terms of achieving the macroeconomic effect – the reproduction of the public product, and at the same time the quality of the environment. Other types of environmental taxes perform mainly a fiscal (budget-filling) function.

14.3. Factorial analysis results: evidence from selected countries

The next step of the research study is to analyze the impact of catalysts and inhibitors on the environmental tax multiplicator. We will conduct such an analysis on the example of Germany (Table 11-12), which demonstrates high rates of sustainable development.

Table 11 – Factorial analysis results: Germany profile

№	Variables	Factor 1	Factor 2
1	Nominal GDP	-0,955937	0,008451
2	Real GDP per capita	-0,944154	0,256266
3	Inflation	0,200506	-0,911429
4	Government debt	-0,258706	-0,617632
5	Exports	-0,834816	0,537843
6	Ecological culture	-0,894180	-0,206397
7	Shadow economy	0,703290	-0,009931
8	Tax culture	-0,727508	-0,649237
9	Fiscal freedom	-0,864892	-0,083361
	Total variance	5,180772	2,038348
	Total share	0,575641	0,226483

Thus, for further study of environmental tax policy in Germany, we choose significant factors № 1,2,5,6,7,8,9.

Table 12 – Determinants of economic efficiency of environmental taxes: evidence from Germany

Factor	Regression equation	Economic interpretation
Nominal GDP	y=0,0004x-1061,4	An increase in nominal GDP by 1 euro causes an increase in the environmental tax multiplicator by 0,0004 units
Real GDP	y=0,0518x-1759,9	The growth of real GDP by 1 euro causes an increase in the multiplicator of environmental taxes by 0,0518 units
Exports	y=23,158x-1059,7	Export growth of 1 euro causes an increase in the environmental tax multiplicator by 23,158 units

Factor	Regression equation	Economic interpretation
Ecological culture	y=204,38-486,13	Increasing the productivity of natural resources by 1 unit causes an increase in the multiplicator of environmental taxes by 204,38 units
Shadow economy	y=85,215x-1331,2	An increase in the size of shadow economy by 1 euro leads to an increase in the multiplicator of environmental taxes by 85,215 units
Tax culture	y=91,67x-3641,3	Improving the tax culture by 1 unit contributes to the growth of the multiplicator of environmental taxes by 91,67 units
Fiscal freedom	y=54,95x-3350,6	The growth of fiscal freedom by 1 unit stimulates an increase in the multiplicator of environmental taxes by 54,95 units

Thus, the factors that significantly stimulate the effectiveness of environmental tax policy in Germany are the following: exports (+23 units), ecological culture (+204 units), shadow economy (+85 units), tax culture (+92 units), fiscal freedom (+55 units).

A wide range of environmental tax instruments and skillful implementation of tax policy leads to a rapid sustainable development in the European Union.

Conclusions

European experience in forming an effective environmental tax system can be actively used by countries with economies in transition. Based on our research, it was found that environmental quality can be achieved not only on a probabilistic basis through additional funds released due to the growth of material well-being of entrepreneurs, but also through targeted planning of environmental costs.

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Chapter 14.

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