Econometric Modeling of the Correlation Between the Type of Income Taxation of Natural Persons and the Standard of Living in the E.U.

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Abstract

The purpose of the paper is to pursue the economic and mathematical correlation between the type of income taxation of natural persons and the indicators that reflect the economic well-being of a country. The starting point of this paper is given by the researches carried out on the topic of proportional tax rate (we shall name it flat tax rate)versus progressive tax rate, at the level of the E.U.existing 8 countries that applythe flat income tax and 20 countries that have preferred the progressive tax rate. The analysis of the correlation between the income tax, calculated by applying the flat income tax and the one determined with the help of the progressive tax rate, and the macroeconomic indicators: GDP/inhabitant, the unemployment rate, the national minimum wage, the risk of poverty, confirmed the existence of an economic and mathematical relation between them, a relation that we established with the help of the SPSS program.

The period analysed from an econometric point of view is 2009 - 2018, the main data source being Eurostat.

Key words: flat tax rate, progressive tax rate, economic well-being, correlation, regression
J.E.L. classification: C58, K34, O11

1. Introduction

Financiers and tax specialists have always been concerned about how the income of natural persons should be taxed: by applying a flat income tax or by applying a progressive tax rate? These concerns result from the desire to respect one of the basic principles of public finances, namely the fiscal equity.

Unfortunately, although numerous studies and researches in this field have been conducted, an ideal in taxation has not been reached because no type of tax applied to natural persons is perfect and leads to shortcomings both at the level of taxpayers as well as at the level of the state.

The previous researches, having as central elements the tax rates and the indicators that reflect the economic well-being, have demonstrated the existence of a direct, significant correlation between them. In other words, the type of taxation significantly influences the economic well-being within the respective country. Thus, starting from these certainties, we intended in this research paper to highlight the economic and mathematical relation between these indicators. We have demonstrated this fact by using Eurostat data on economic well-being indicators, such as: GDP/inhabitant, the unemployment rate, the risk of poverty and the national minimum wage, but also the income tax as a significant part of the incomes that constitute the GDP structure.

The case study of the paper is divided into countries applying the flat income tax, these being 8 in number (Romania, Bulgaria, Ungaria, Cehia, Estonia, Letonia, Lituania and Slovacia), and countries applying the progressive tax rate, 20 in number.

2. Literature review

Research into the type of taxation and its effects on the economy has brought us a number of opinions from specialists in the field.

Supporting the limited progressive system, we also meet the economist and politician Joseph Garnier, who demonstrates that this system of taxation is the most equitable, the tax increasing proportionally with the revenues, but with a moderate limit.

Adam Smith is of the opinion that progressive taxation is the right one, which is fairly settled in the case of wealthy people, while also considering that it is normal for wealthy people to contribute to the state budget not only commensurate with their incomes but also over their incomes. (Adam Smith, France, 2018, p. 525).

The tax rate is defined in the current legislation as the tax determined on the unit of measure of the matter, the taxable asset. At world level there are either tax quotas expressed in percentages as is the case with income taxes, income taxes, etc., or in monetary units in relation to the unit of taxable amount as in the case of excise duties.

Analyses on the correlations between the macroeconomic indicators and the income tax are also found at the authors Marcu N, Cârstina S and Siminică M, these demonstrating in the case study of the paper, among others, the existence of a direct and significant correlation between the level of GDP and taxes (MarcuN ,Cârstina S, Siminică M, Bucharest, 2015, p. 285). These authors started from the relation between GDP and the value added realized within a country, reporting at the same time to the GDP and the structure of value added, the level of taxes being an element in the structure.

Another analysis of the correlation between the level of taxes and the indicators of economic growth is found also at the authors Padovano F and Galli E, they also demonstrate a direct and significant correlation between the specific indicators of the macroeconomic environment such as: the GDP, the gross national income, the national minimum wage and the income tax, and a significant and inverse correlation between the income tax and the unemployment rate and the risk of poverty (Padovano F, Galli E, Germany, 2007, p. 164).

Therefore, the correlation between the indicators that reflect the economic well-being and the income tax stimulated us to go further with the research, thus establishing as an objective the determination of the relation, of the economic and mathematical equation between them.

3. Research methodology

The execution of the present paper has as starting point the analysis of the correlation between the corporate tax and the indicators of economic well-being: GDP/inhabitant, the minimum wage, the risk of poverty and the unemployment rate. From the execution of these analyses, starting from the specialized papers previously presented but also from our own research we have established the existence of direct and significant correlations between the corporate tax and the well-being indicators.

Considering that from the point of view of how to determine the income tax for natural persons there are two ways at level of the E.U.: by applying the flat income tax or by applying the progressive tax rate, the 28 countries are divided according to the approach in taxable material, as follows: 8 countries where the flat income tax is applied, such as Romania, and 20 countries where we have a progressive tax rate.

The correlation analysis was carried out on the two categories of countries and also on this principle we carried out the economic and mathematical modeling. Thus, the analysis took into account 80 variables in the countries with flat income tax and 200 variables in the countries with progressive tax rates. The analysed period is 2009 - 2018, the data being taken from the Eurostat website.

The economic and mathematical modeling begins with the descriptive statistics in which we have pursued the level of the average and of the standard deviation. In order for the analysis to be relevant the average must be above the standard deviation in terms of value.

The test of the relevance of the resulting econometric models was performed using ANOVA (Analysis of variance) and the Summary model, in which we analysed the level of the variable F and of the significance threshold R.

The statistical program used to model the correlation between the income tax of natural persons and the economic well-being indicators is SPSS, version 15.1. The method selected in order to obtain the regression model is the enter method, the sig threshold set being of 0.05. The resulting econometric model is a simple linear regression, the coefficients specific to each variable being

taken from the coefficients table.

4. Case study

The economic and mathematical modeling of the correlation between the income tax and the economic well-being indicators has been performed starting with the countries that apply the flat income tax.

The first thing carried out in order to validate the regression model is the descriptive statistics, which is presented in the following table:

Table no. 1 – Descriptive statistics

Indicators	Mean	Std. Deviation	N
Income tax in GDP	728,30	288,386	80
GDP	10868,75	3325,338	80
Unemployment rate	9,28	3,783	80
Minimum wage	265,48	72,657	56

Source: Table taken from SPSS

The data in the table present us an average value well above the standard deviation, which suggests that the analysis performed is correctly approached. At the same time we notice the N level, more precisely the number of variables taken into account in the analysis performed.

The next step in obtaining the regression model is to reflect the correlation level. The lack of a correlation leads to the cancellation of the regression model. The correlation coefficient is reflected in the following table:

Table no. 2 – Level of correlation

Indicators		Income tax in GDP	GDP	Unemployment rate	Minimum wage
Pearson Correlation	Income tax in GDP	1,000	,941	-,303	,868
	GDP	,941	1,000	-,249	,872
	Unemployment rate	-,303	-,249	1,000	,029
	Minimum wage	,868	,872	,029	1,000
Sig. (1-tailed)	Income tax in GDP	.	,000	,003	,000
	GDP	,000	.	,013	,000
	Unemployment rate	,003	,013	.	,415
	Minimum wage	,000	,000	,415	.
N	Income tax in GDP	80	80	80	56
	GDP	80	80	80	56
	Unemployment rate	80	80	80	56
	Minimum wage	56	56	56	56

Source: Table taken from SPSS

We observe a correlation index close to 1 which suggests the presence of a strong and direct link between the variables income tax, GDP and the minimum wage. Between the income tax and the unemployment rate the correlation is lower and inverse.

The tests for validation of the regression model for countries applying a flat income tax start with the summary model. The variables of the model are presented in the following table:

Table no.3 –Test summ(b)

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Cha. Stat					D-W
	R Sq. Chan.	F Chan.	df1	df2	Sig. F Chan.	R Sq. Chan.	F Chan.	df1	df2	Sig. F Chan.
1	,957(a)	,915	,911	86,218	,915	187,780	3	52	,000	1,843

Source: Table taken from SPSS

The data in the table indicate a level of R of 0.957 almost perfect, the maximum value being 1, which means a very big significance of the regression equation that is to be realized. Also the variable F resulting from the Durbin-Watson test indicates that the regression model will have significance from an economic point of view.

After testing with the summary model we went further to a second test, this being the ANOVA test, the resulting variables being reflected in the following table:

Table no. 4 - ANOVA(b)

Model		Sum of Sq.	df	Mean Sq.	F	Sig.
1	Regress.	4187615,827	3	1395871,942	187,780	,000(a)
	Residual	386545,265	52	7433,563		
	Total	4574161,092	55			

Source: Table taken from SPSS

From the table above the variable that draws our attention is the variable F which is the equivalent of the significance threshold in the summary model. This variable also validates the regression model.

After all these tests we determined the coefficients of the regression model, which are reflected in the following table:

Table no. 5 - Coefficients(a)

Model	Unstand. Coeff.		Stand. Coeff.	t	Sig.	95% Conf. Interval for B		Correl.		
	B	Std. Error	β	Low. Bound	Upp. Bound	Zero-order	Part.	Part	B	Std. Error
1 (Constant)	-84,250	55,842		-1,509	,137	-196,305	27,806			
GDP	,050	,009	,573	5,739	,000	,032	,067	,941	,623	,231
Unemployment rate	-13,045	3,720	-,171	-3,507	,001	-20,510	-5,580	,303	-,437	-,141
Minimum wage	1,483	,384	,374	3,864	,000	,713	2,253	,868	,472	,156

Source: Table taken from SPSS

The resulting coefficients led us to obtain the following regression equation:

$Y = 0{,}573*GDP – 0{,}171*Rs + 0{,}374*Sm + ε$

Where: Rs–the unemployment rate

Sm –the national minimum wage

ε - thestandard error.

In order to obtain the regression model for the countries applying the progressive tax rate, we observed the research methodology, thus, the first thing achieved was the analysis based on the descriptive statistics. The indicators of descriptive statistics are reflected in the following table:

Table no. 6 - Descriptive Statistics

Indicators	Mean	Std. Deviation	N
Income tax in GDP	4342,262	3273,1313	200
GDP	30659,50	15364,084	200
Unemployment rate	9,48	5,044	200

Source: Table taken from SPSS

In this case, it is also noticed an average value above the standard deviation value, which suggests that the analysis performed, is statistically correct.

The next step is to analyse the correlation between the variables analysed and considered, the level of correlation being reflected in the following table:

Table no. 7 - Correlations

Indicators		Income tax in GDP	GDP	Unemployment rate
Pearson Correlation	Income tax in GDP	1,000	,857	-,394
	GDP	,857	1,000	-,406
	Unemployment rate	-,394	-,406	1,000
Sig. (1-tailed)	Income tax in GDP	.	,000	,000
	GDP	,000	.	,000
	Unemployment rate	,000	,000	.
N	Income tax in GDP	200	200	200
	GDP	200	200	200
	Unemployment rate	200	200	200

Source: Table taken from SPSS

There is a direct, strong correlation between the income tax and the GDP and an inverse correlation between the income tax and the unemployment rate. We can declare that the levels and significances of the correlations are maintained as for the countries that apply a progressive tax rate.

After the certainty that there is a correlation between the variables, we went furtherto the test of the significance of the regression model. The first test performed is the one using the summary model, the level of the resulting variables being reflected in the following table:

Table no. 8 - Test Summ(b)

Model	R	R^2	Adj. R^2	Std. Error of the Estimate	Cha. Stat					D-W
	R Sq. Chan.	F Chan.	df1	df2	Sig. F Chan.	R Sq. Chan.	F Chan.	df1	df2	Sig. F Chan.
1	,858(a)	,737	,734	1688,6241	,737	275,338	2	197	,000	1,994

Source: Table taken from SPSS

The variable R with the level of 0.858, as well as the variable F from Durbin-Watson with the level of 1.994 indicate a high level of significance of the regression equation to be performed. Considering the successful passing of the first test, we approached another form of testing, the one by means of ANOVA. The level of the resulting variables is reflected in the following table:

Table no. 9 - ANOVA(b)

Model		Sum of Sq.	df	Mean Sq.	F	Sig.
1	Regression	1570228387,417	2	785114193,708	275,338	,000(a)
	Residual	561735943,303	197	2851451,489		
	Total	2131964330,720	199			

Source: Table taken from SPSS

The ANOVA test indicates a high level of significance of the variable F regression equation being in this case also at a sufficiently satisfactory level for validating the regression equation.

We can also notice the significance threshold - sig which although has a maximum limit of 0.05, in our case not being observed by ANOVA because of the extremely small value, reason why we have one more argument that the regression equation will have economic significance.

The last step to achieve the regression equation for the countries applying a progressive tax rate is to determine the regression coefficients. The level of these coefficients is reflected in the following table:

Table no. 10 - Coefficients(a)

Model		Unstand. Coeff.		Stand. Coeff.	t	Sig.	95% Conf. Interval for B		
	B	Std. Error	β	Low. Bound	Upp. Bound	Zero-order	B	B	Std. Error
1 (Constant)	-771,690	442,168			-1,745	,083			
GDP	,178	,009		,835	20,852	,000	,857	,830	,763
Unemployment rate	-35,519	25,969		-,055	-1,368	,173	-,394	-,097	-,050

Source: Table taken from SPSS

The data reflected in the previous table lead us to obtain the following regression equation:

X = 0,835*GDP -0,055*Rs + ε

Considering the two regression equations, validated by the Summary model and ANOVA tests, we can remark that the objective of the paper has been reached, by means of a case study performed being obtained a regression equation for each of the two categories: countries applying a flat income tax and countries applying a progressive tax rate.

5. Conclusions

The execution of the paper entitled *Econometric Modeling of the Correlation between the Type of Income Taxation of Natural Persons and the Standard of Living in the E.U.*, allows us to underline some conclusions relevant to the field of taxation but also to the macroeconomic field, being followed the correlation between the two, respectively the way in which they influence each other.

Thus, from the results obtained, we can say that:

- there is a strong, significant correlation between the type of taxation and the GDP, both at the level of the countries applying the flat income taxas well as at the level of those applying the progressive tax rate;

- there is also noticed a significant correlation between the income tax and the national minimum wage;

- it has been established a weaker correlation in terms of significance and an inverse one between the unemployment rate and the income tax in both situations;

- at the level of the countries with flat income tax we have been able to establish the regression equation taking into account the risk of poverty as well, whereas for the countries with flat income tax it has not been recognized as a variable;

- the error regarding the realization of a regression model was smaller for the countries with flat income tax, sig. 55,842 while for those with progressive tax rate it was set at 442.168, but overall both models are validated by summary and ANOVA.

The margin of error was higher for the countries with progressive tax rate as the number of variables taken into account is bigger, simultaneously underlining the heterogeneity at the macroeconomic level of the countries in the sample. In other words, although these countries were linked by the type of taxation applied to the incomes of natural persons, the standard of living, respectively their economic power is different.

6. References

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