

ECONOMETRIC MODELING OF THE CORRELATION BETWEEN THE TAXATION EFFICIENCY INDEX AND THE SHARE OF TAX REVENUES IN THE GROSS DOMESTIC PRODUCT, IN SOME STATES OF THE EUROPEAN UNION, BY TAX REVENUE CATEGORIES

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Abstract

The paper seeks to highlight the importance of tax revenues within the economy of a country and to analyze the efficiency of tax revenue collection in Romania, in the period 2010-2019, focusing on identifying the factors that determined the low collection of tax revenues. Next, we set out to identify to what extent the collection problems could be explained by the efficiency of taxation.

In this sense, we used the regression method between the taxation efficiency index on the four types of tax revenues analyzed in the report (VAT, CAS, profit tax, revenues tax) as an independent variable and the share of tax revenues in GDP on all four categories (VAT, CAS, profit tax, revenues tax) as dependent variable. The analysis was done for each of the countries in the European Union New Member States group for the period 2010-2019.

Keywords: efficiency, effectiveness, collection, tax system.

Classification JEL: H20, M40, M41

1. Introduction

Compared to European countries, Romania is not doing very well from many points of view and this was highlighted with the emergence of the COVID-19 crisis. However, if Romania were prepared to collect at the average level of the region, it would have enough resources to bring the financing of critical public services to levels that seem unattainable today.

It is true that progress has been made recently, but it must be sustainable.

In 2018, the efficiency index of the collection of taxes paid by companies increased slightly, from 0.24 in 2017 to 0.27, an increase attributed by the Fiscal Council to the 17.6 percent advance of taxes paid by commercial companies, compared to the previous year (Fiscal Council 2019), but in 2019 it again recorded a reduction to 0.26. The developments could be encouraging only in the conditions where Romania would benefit from an institutional and legislative architecture that would transform these advances into something sustainable that would significantly influence the ratio between GDP and revenues collected by the state. If we take the neighboring country, Bulgaria, as a basis for comparison, the transformation can take at least 5 years. And 30% of GDP in the form of taxes, fees and social contributions is not a very ambitious target if we want to reach at least the level of performance in revenue collection recorded in the Central and Eastern European region.

Scandinavian countries or France are examples of robust fiscal governance. At the other extreme are the states that repeatedly find themselves in the situation of requesting international financial assistance (so-called bailouts) and whose levels of financing of public goods are consistently well below those recorded in countries with a similar degree of development; these countries reflect clear cases of failed fiscal governance. For example, since 1975, Nigeria, Ecuador, Uruguay, and Argentina have experienced, on average, four sovereign defaults, while Pakistan and Romania, in most years since 1990 onwards, they were engaged in one form or another of IMF assistance (Ban and Rusu, 2019).

The role of the fiscal authorities is to collect sufficient revenue to cover expenses and to ensure that all taxpayers contribute to the establishment of government funds, in accordance with the provisions of the Fiscal Code (Ban and Rusu, 2019). Romania still has many disadvantages in this chapter and a comparison with European states that record performance in revenue collection gives us a clearer picture of the situation and helps us in the process of developing some directions of action in order to increase performance tax revenue collection and more.

Since I have observed the existence of a link between the degree of collection efficiency and the cyclical position of the economy using the regression method I will check if this link exists and if it is significant. Following the analysis of the efficiency of tax revenue collection in Romania compared to the new EU member states and the identification of some models of good practices that could be followed by our country in order to increase the efficiency and effectiveness of collection, we proceeded to the econometric modeling of the correlation between the efficiency index of taxation and the share of tax revenues in GDP, in the EU NSM, by categories of tax revenues.

2.Literature review

Taxation is one of the main tools available to governments to encourage entrepreneurship and innovation. Fiscal policies can contribute to reducing entrepreneurial risk and the costs of running an entrepreneurial activity. Taxation helps correct market failures; examples of this include inadequate investment in research and development, venture financing and environmental externalities such as pollution. Thus, a well-designed tax system could raise living standards by providing incentives for smart and green investments. (European Commission, 2016).

Fiscal policy in Romania is defining for the functionality of the economic system as a whole, the taxes of both economic agents and natural persons, being recognized as having the largest weight in the revenues collected in Romania, unlike other European states where the budget revenues come from mostly from indirect taxes or taxes on the consumption of economic goods. This implied a considerable tax burden on labor, putting pressure on real incomes or purchasing power to meet demand. (Bălăceanu, Apostol and Dogaru, 2015).

The issue of the efficiency of fiscal systems has been analyzed in specialized literature, with specialists formulating various points of view regarding the importance of ensuring the efficient functioning of fiscal systems and the characteristics that should be found in an efficient fiscal system. Mainly, the opinions of the specialists converge towards the idea that an efficient fiscal system should generate the increase in tax revenues without discouraging economic activities (Tanzi and Zee, 2000).

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The current actions, to make fiscal policy more flexible, are part of a wider reform process, with the aim of bringing to the surface the revenues from the gray and black area of the economy for the benefit and renewal of the Romanian economic system. The changes that appear in the fiscal policy are intended to stimulate economic activity as a provider of well-being and prosperity, access to these objectives for each citizen being possible through an improvement in the collection of revenues to the state budget. (Bălăceanu, Apostol and Dogaru, 2015).

In essence, a sustainable system of budget revenue collection involves the permanent improvement of voluntary compliance and increasing the efficiency and effectiveness of tax administrations' actions in combating tax evasion.

Tax revenues are of particular importance within the economy of a country, they have not only a financial role but also an economic one, when they are used as levers in the event that it is desired to either stimulate or limit an activity or a social one that manifests itself as a result of attributions of the state to protect certain social categories (Coman Lința and Mogoiu, 2018).

3. Research methodology

Next, we set out to identify to what extent the collection problems could be explained by the efficiency of taxation.

In this sense, we used the regression method between the taxation efficiency index on the four types of tax revenues analyzed in the report (VAT, CAS, profit tax, income tax) as an independent variable and the share of tax revenues in GDP on all four categories (VAT, CAS, profit tax, income tax) as dependent variable.

The analysis was done for each of the countries in the NMS group for the period 2010-2019.

The data series used in the study were annual and were collected from the Eurostat website and from the Fiscal Council's annual reports for the period 2010-2019.

The classic linear regression model represents one of the most versatile and frequently used statistical techniques in economic analysis, and not only that.

The demo version of the EViews 11.0 Enterprise Edition for Windows software was used as a technical aid in the econometric modeling process. The programming limitations of this software are inherent to the results presented in this paper.

The general matrix form of the regression model used is described by the relation

$$Y = \alpha + \beta X + \varepsilon \quad (1)$$

where:

Y – is the dependent/endogenous variable (Share of budget revenues in GDP) of size $1 \times t$;

X – is the matrix of independent/exogenous variables of size $k \times t$;

α, β – is the vector of coefficients, of size $k \times 1$, the parameters of the model;

ε - is the error variable.

The regression models from the different scenarios are defined and the functions implemented in the Eviews 11.0 program are used. for performing the validation tests: F statistic for model validation, Durbin Watson statistic for testing the autocorrelation of errors and Jarque Bera for testing the normality of the series of residuals.

When using the regression model, Eviews provided us with the following information for each of the types of tax revenues analyzed, of which we will interpret the most relevant indicators.

In this sense, we proceeded to Test the influence of taxation efficiency on collection issues:

1. Value added tax

First of all, we checked the distribution of the variables, starting with the variable Share of VAT in GDP (figure no. 1.1)

Hypothesis formulation:

Ho – the distribution is normal;

H1 – the distribution is not normal.

The probability of the Jarque – Bera test > 0.05 means that we accept the data come from a normal distribution.

The Kurtosis flattening coefficient is:

$K > 3 \Rightarrow$ we have a leptokurtic;

$K = 3 \Rightarrow$ we have a normal distribution;

$K < 3 \Rightarrow$ we have a platykurtic distribution.

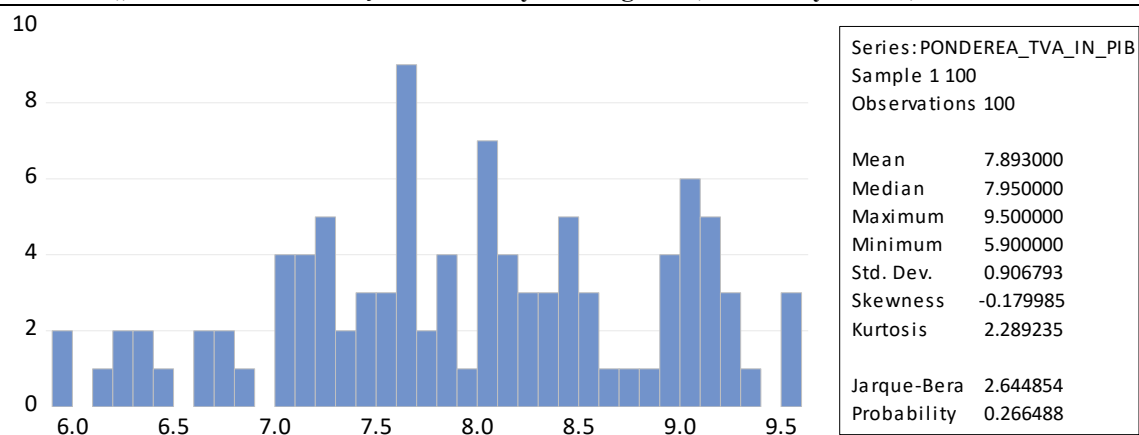


Figure no. 1.1 Distribution of the share of VAT in GDP

In our case we have $K=2.644854 \Rightarrow$ we have a Platy-Kurtic distribution of the variable close to the normal distribution.

We continued with the same procedure for the Taxation Efficiency Index Variable in the case of VAT. (figure no. 1.2)

Hypothesis formulation:

H_0 – the distribution is normal;

H_1 – the distribution is not normal.

The probability of the Jacque – Bera test > 0.05 means that we accept the data come from a normal distribution.

The Kurtosis flattening coefficient is:

$K > 3 \Rightarrow$ we have a leptokurtic;

$K = 3 \Rightarrow$ we have a normal distribution;

$K < 3 \Rightarrow$ we have a platykurtic distribution. In our case we have $K=4.612934 \Rightarrow$ we have a Lepto Kurtic distribution of the variable close to the normal distribution.

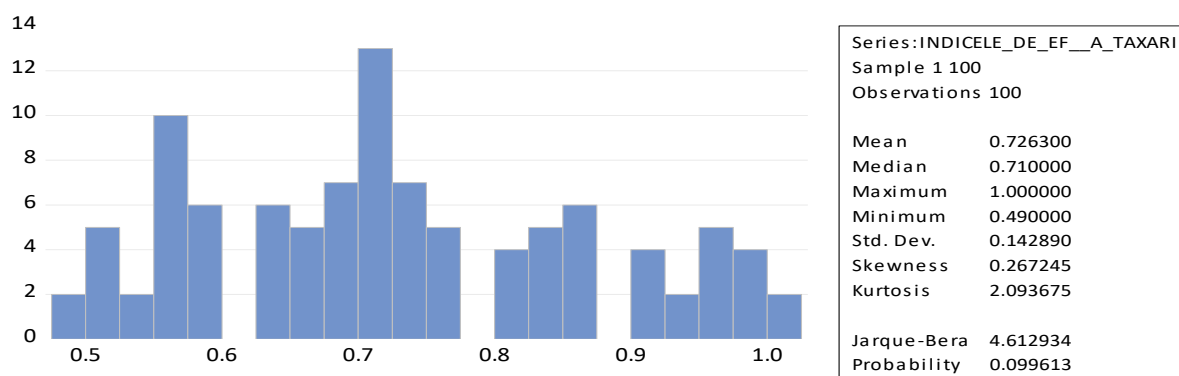


Figure no 1.2 Distribution of the taxation efficiency index in the case of VAT

In the case of VAT, the regression result shows that there is a significant relationship between the VAT charging efficiency index and the share of VAT revenues in GDP.

In table no. 1.1. the result of the model validation test is presented:

Table no 1.1. The results of running the regression between the VAT charging efficiency index and the share of VAT revenues in GDP

Dependent Variable: PONDEREA_TVA_IN_PIB

Method: Least Squares

Date: 04/18/21 Time: 22:03

Sample: 1 100

Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.315467	0.393315	13.51452	0.0000
INDICELE_DE_EF_A_TAXARII_TVA	3.548855	0.531446	6.677729	0.0000
R-squared	0.312725	Mean dependent var		7.893000
Adjusted R-squared	0.305712	S.D. dependent var		0.906793
S.E. of regression	0.755576	Akaike info criterion		2.297124
Sum squared resid	55.94771	Schwarz criterion		2.349228
Log likelihood	-112.8562	Hannan-Quinn criter.		2.318212
F-statistic	44.59207	Durbin-Watson stat		2.244007
Prob(F-statistic)	0.000000			

The P-value is less than 0.05 which indicates that the regression coefficients are statistically significant.

R-squared has a value of 0.312725, which means that the dependent variable - the VAT collection efficiency index, explains 31.27% of the dependent variable, namely the share of VAT revenues in GDP. Thus, we can appreciate that there is a moderate connection between the endogenous variable and the exogenous variable.

Prob (F-statistic) $0.000000 < 0.05$ indicates that the statistical relationship between the independent and dependent variable is significant.

Residue analysis

We used the Jarque-Bera test which takes into account both the skewness coefficient and the flattening coefficient and checks to what extent the empirical distribution can be approximated by a normal distribution. The null hypothesis of this test assumes that the data sample comes from a normal distribution. The JB statistic has an asymptotic χ^2 distribution.

According to the χ^2 distribution, the critical value of the Jarque - Bera test for a degree of statistical significance of 5% is 5.99. In other words, if the JB statistic calculated for a series of returns is greater than 5.99 we reject the null hypothesis.

This test first calculates the coefficient of asymmetry (Skewness) and the coefficient of vaulting (Kurtosis) for the residuals obtained by MCMMP. The hypotheses to be tested are:

H0: The residuals have a normal distribution ($S=0$ and $K=3$);

H1: The residuals do not have a normal distribution.

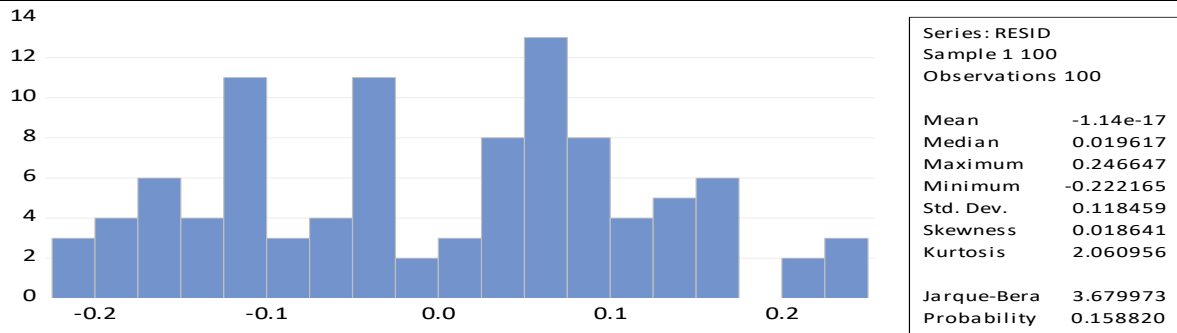


Figure no. 1.3 Distribution of residuals when testing the influence of VAT charging efficiency on collection problems

Jarque-Bera = 3.679973 Probability = 0.158820. Since the Probability associated with the JB statistic is > 0.05 we accept $H_0 \Rightarrow$ The residuals are normally distributed.

Therefore, the distribution of the series of residuals (figure 1.3): the value of the Jarque-Berra statistic suggests a normal distribution from the point of view of asymmetry and flattening.

Correlating this information, we appreciate that there is a statistically significant relationship between the VAT collection efficiency index and the share of VAT revenues in GDP, so that in the case of VAT, collection problems can be explained by the efficiency of taxation.

After testing the influence of the value added tax, we continued using the same regression model, described in detail in the case of VAT, for the other types of tax revenues analyzed.

Next, I will present only the graphs, tables and results obtained.

2. Profit tax

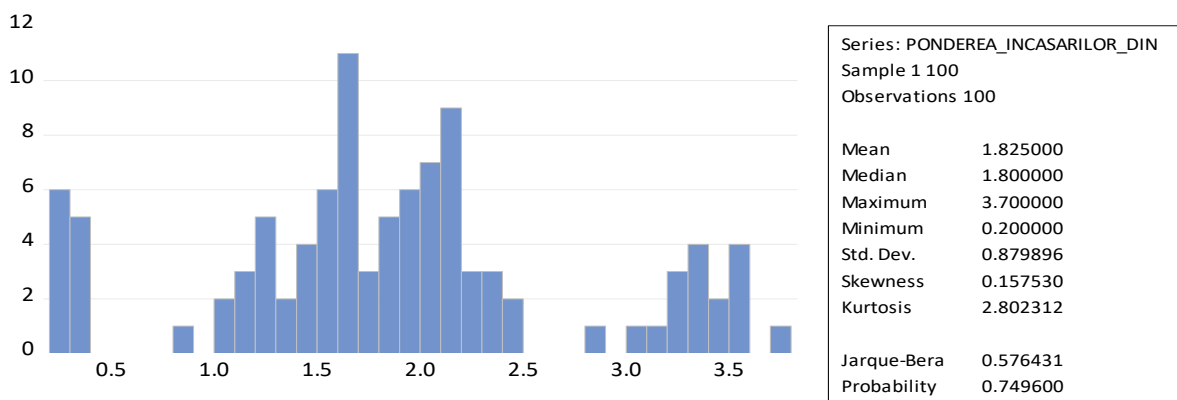


Figure no. 2.4 Distribution of the share of profit tax in GDP

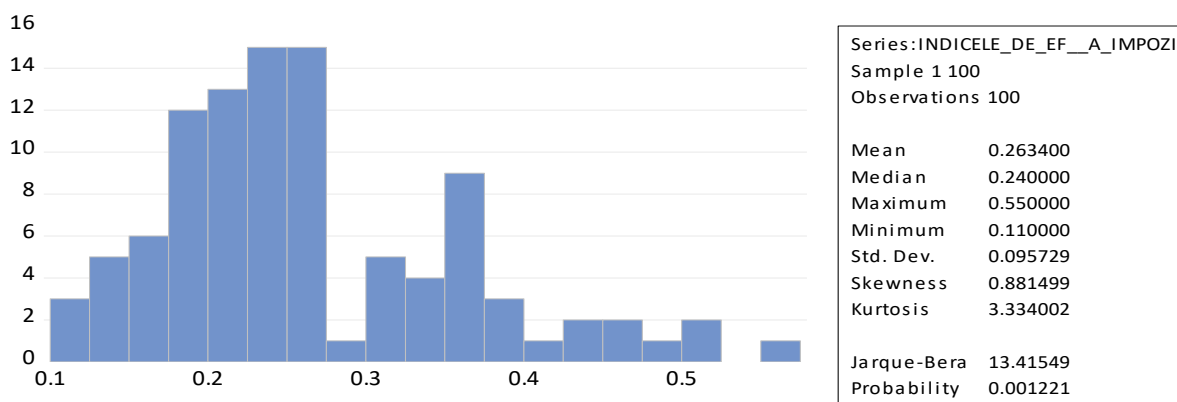


Figure no. 2.5 Distribution of the efficiency index of corporate tax taxation

In table no. 3.2. the result of the model validation test is presented.

We can see that in the case of corporate tax, the regression result shows that there is a significant relationship between the corporate tax efficiency index and the share of corporate tax revenue in GDP.

Table no. 2.2. Results of running the regression between the corporate tax efficiency index and the share of corporate tax receipts in GDP

Dependent Variable: PONDEREA INCASARIILOR DIN IMPOZITUL PE P
ROFIT IN PIB
Method: Least Squares
Date: 04/21/21 Time: 22:03
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.543920	0.220670	2.464850	0.0154
INDICELE_DE_EF_A_IMPOZITARII_PR...	4.863631	0.787848	6.173314	0.0000
R-squared	0.279993	Mean dependent var	1.825000	
Adjusted R-squared	0.272646	S.D. dependent var	0.879896	
S.E. of regression	0.750420	Akaike info criterion	2.283429	
Sum squared resid	55.18673	Schwarz criterion	2.335533	
Log likelihood	-112.1715	Hannan-Quinn criter.	2.304517	
F-statistic	38.10981	Durbin-Watson stat	2.901597	
Prob(F-statistic)	0.000000			

Residue analysis

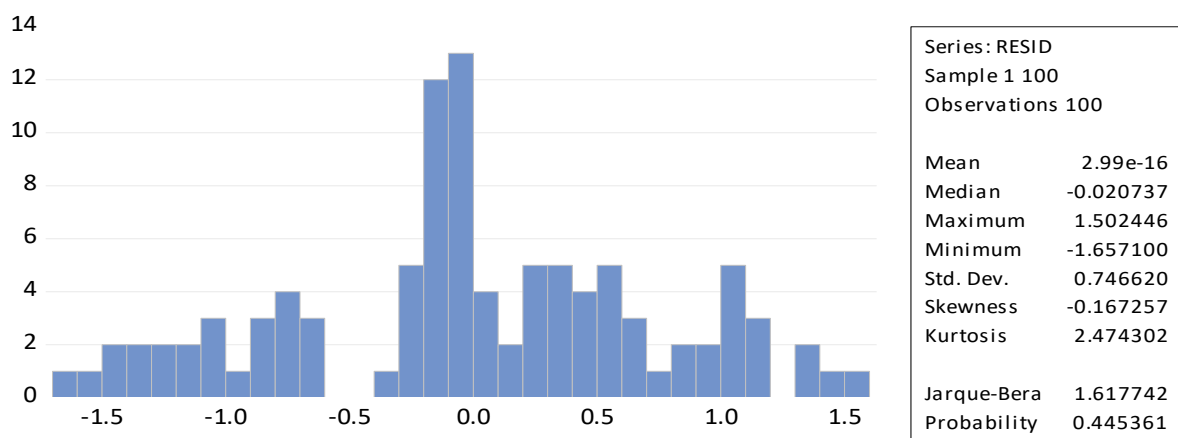


Figure no. 2.6 Distribution of residuals when testing the influence of corporate tax efficiency on collection problems

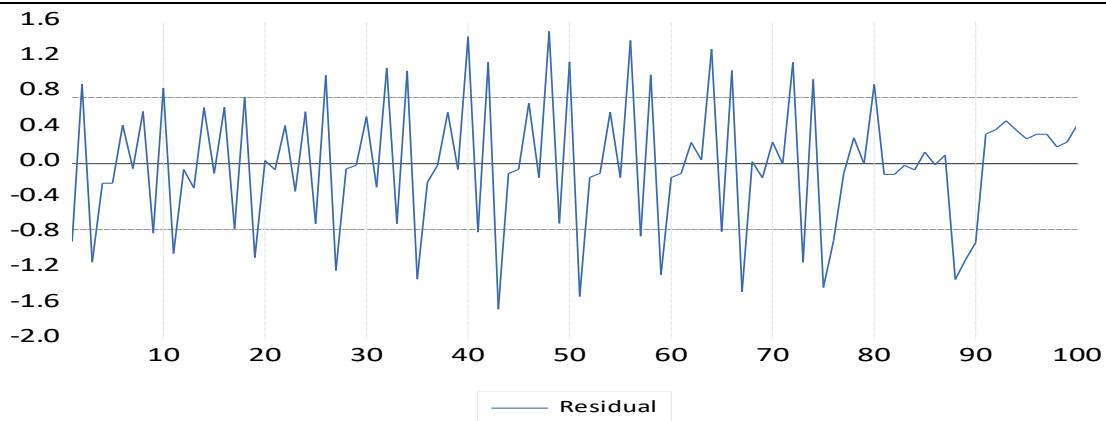


Figure no. 2.7 Plot of residuals when testing the influence of corporate tax efficiency on collection problems

By correlating this information, we can conclude that there is a statistically significant relationship between the efficiency index of corporate taxation and the share of corporate tax revenues in GDP, so in the case of corporate tax, collection problems can be explained by the efficiency of taxation.

3. Revenues tax

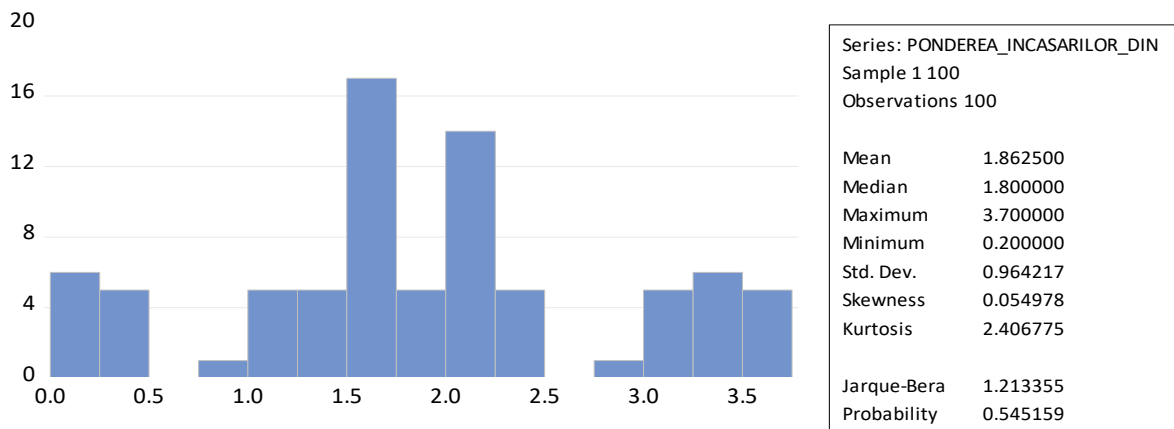


Figure no. 3.8 Distribution of the share of revenues tax in GDP

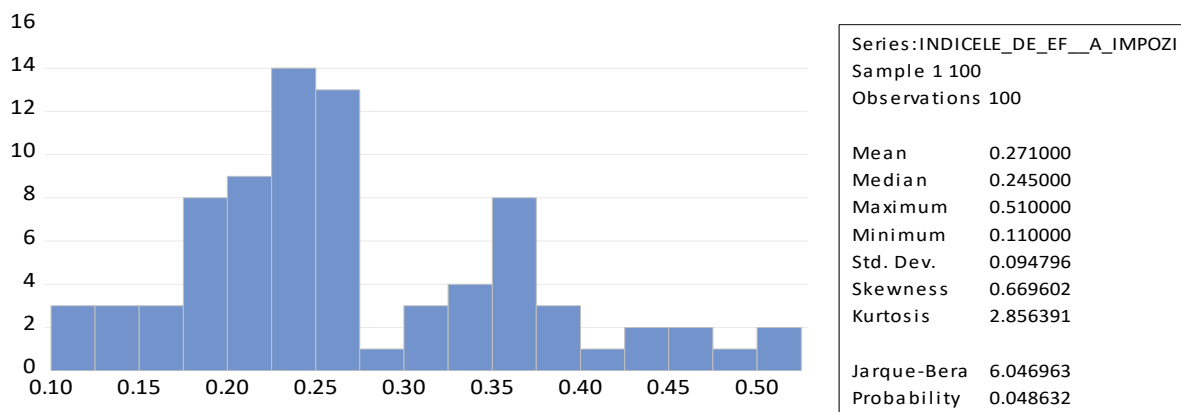


Figure no. 3.9 Distribution of the revenue taxation efficiency index

In table no. 3.3. the result of the model validation test is presented.

We can observe from this that in the case of revenue tax, the regression result shows that there is a significant relationship between the revenues tax efficiency index and the share of income tax revenue in GDP.

Table no 3.3. Results of running the regression between the revenues tax efficiency index and the share of revenues tax receipts in GDP.

Dependent Variable: PONDEREA_INCASARILOR_DIN_IMPOZITUL_PE_VENIT

IN_PIB

Method: Least Squares

Date: 04/18/21 Time: 21:32

Sample: 1 80

Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.288996	0.271301	1.065223	0.2901
INDICELE_DE_EF__A_IMPOZITARII_PR...	5.806288	0.945610	6.140259	0.0000
R-squared	0.325859	Mean dependent var	1.862500	
Adjusted R-squared	0.317216	S.D. dependent var	0.964217	
S.E. of regression	0.796740	Akaike info criterion	2.408106	
Sum squared resid	49.51398	Schwarz criterion	2.467656	
Log likelihood	-94.32422	Hannan-Quinn criter.	2.431981	
F-statistic	37.70278	Durbin-Watson stat	3.146880	
Prob(F-statistic)	0.000000			

Residue analysis

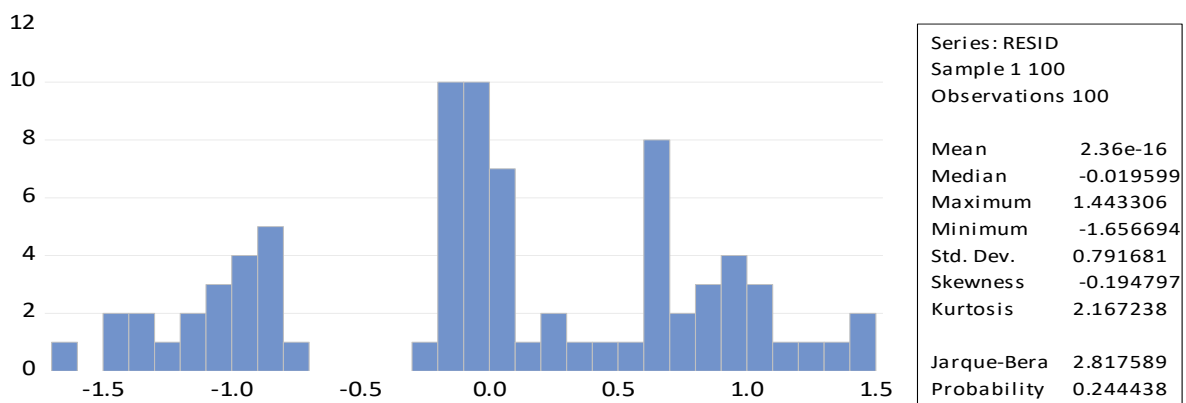


Figure no. 3.10 Distribution of residuals when testing the influence of revenues tax efficiency on collection problems

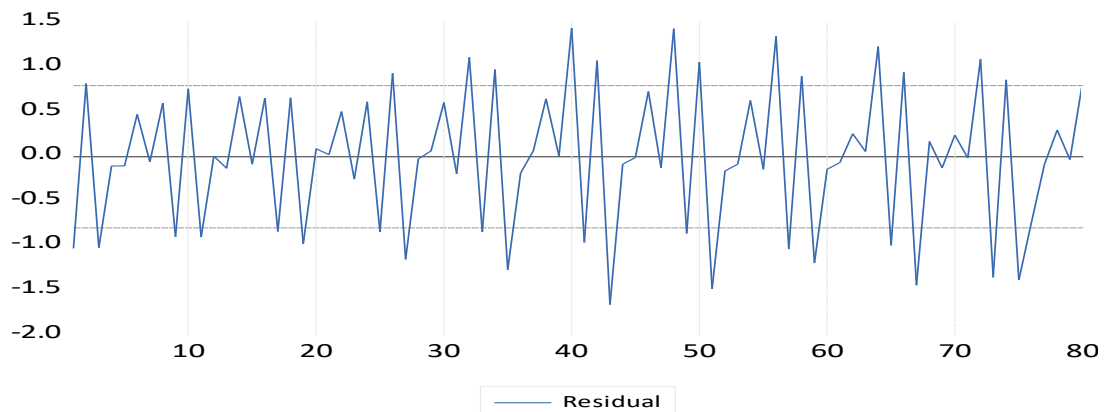


Figure no. 3.11 Plot of residuals when testing the influence of revenues tax efficiency on collection problems

Correlating this information, we can conclude that there is a statistically significant relationship between revenues tax efficiency indices and the share of income tax revenues in GDP, so in the case of revenues tax, collection problems can be explained by tax efficiency.

4. Social security contributions

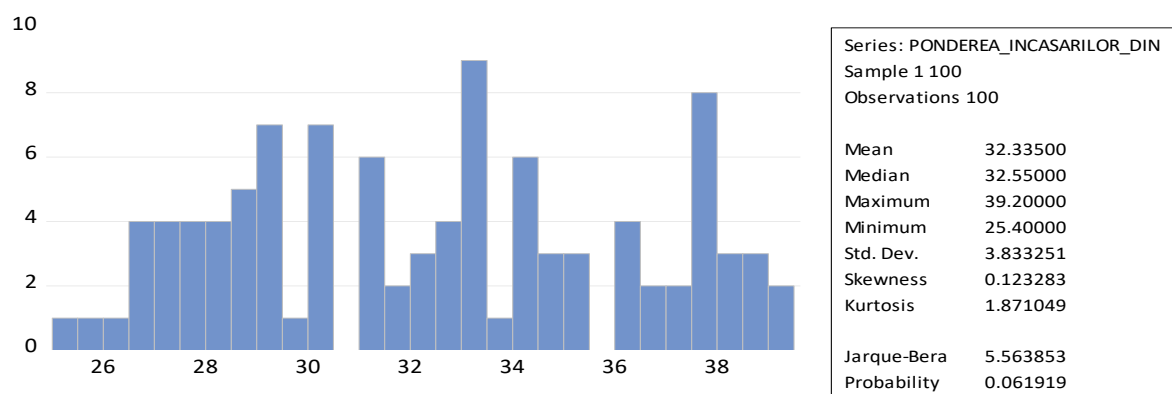


Figure no 4.12 Distribution of the share of CAS receipts in GDP

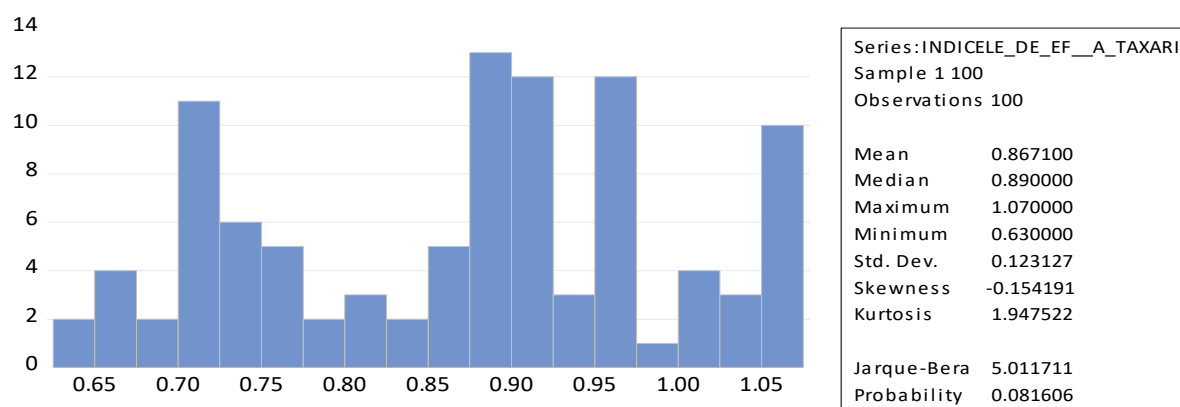


Figure no. 4.13 Distribution of the charging efficiency index in the case of CAS

The result of the model validation test is presented below.

Thus, in the case of CAS, the regression result shows that there is a significant relationship between the CAS taxation efficiency index and the share of CAS revenues in GDP.

Table no. 4.4. Results of running the regression between the CAS taxation efficiency index and the share of CAS receipts in GDP.

Dependent Variable: PONDEREA_INCASARILOR_DIN_CAS_IN_PIB

Method: Least Squares

Date: 04/18/21 Time: 21:59

Sample: 1 100

Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.56002	2.426094	8.062349	0.0000
INDICELE_DE_EF_A_TAXARII_CAS	14.73300	2.770426	5.317954	0.0000
R-squared	0.223951	Mean dependent var	32.33500	
Adjusted R-squared	0.216032	S.D. dependent var	3.833251	
S.E. of regression	3.394036	Akaike info criterion	5.301714	
Sum squared resid	1128.909	Schwarz criterion	5.353817	
Log likelihood	-263.0857	Hannan-Quinn criter.	5.322801	
F-statistic	28.28063	Durbin-Watson stat	2.788864	
Prob(F-statistic)	0.000001			

Residue analysis

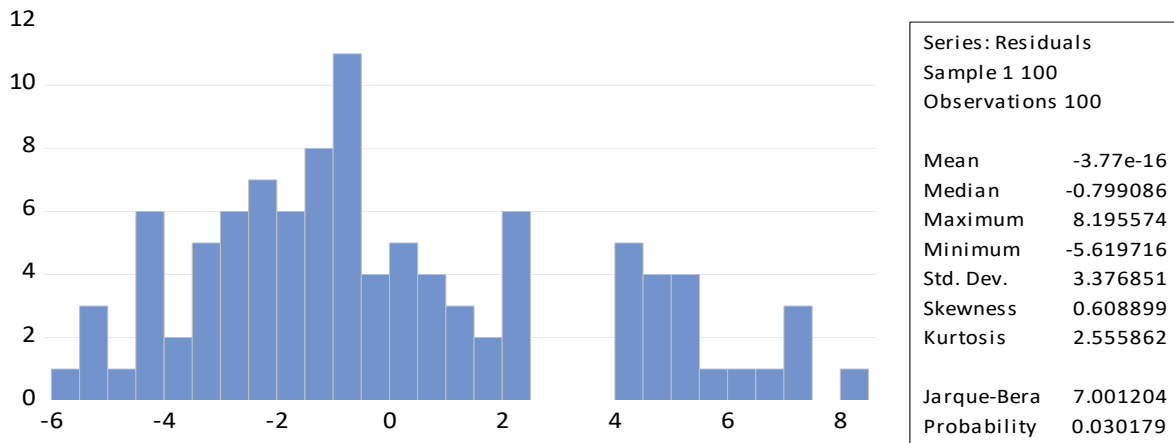


Figura 4.14 Distribuția reziduurilor în cazul testării influenței eficienței taxării în cazul CAS asupra problemelor de colectare

The plot of residuals shows neither it nor a major deviation from normality nor a violation of the assumption that the errors have the same constant dispersion (figure no. 3.15)

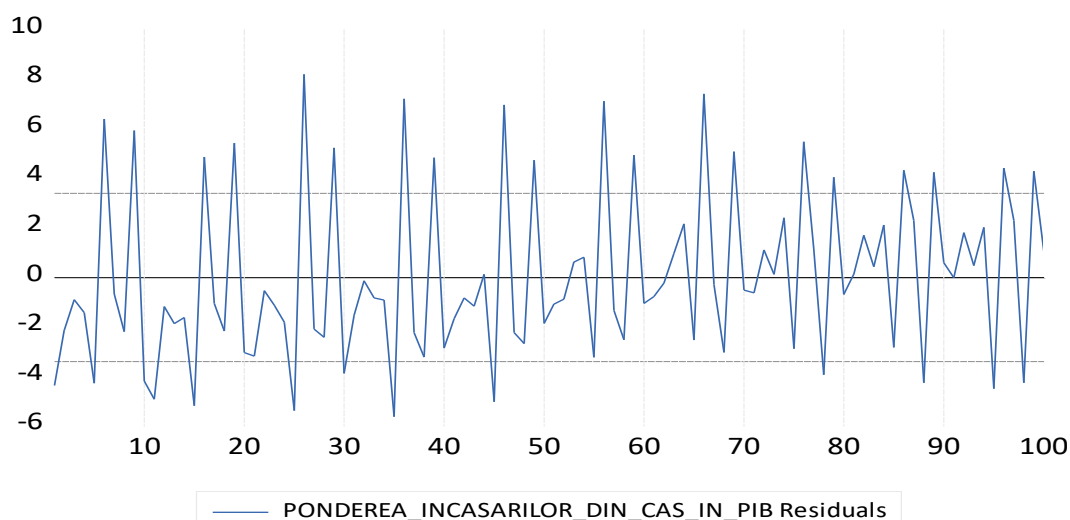


Figure no. 4.15 Plot of residuals when testing the influence of CAS charging efficiency on collection problems

Correlating this information, we can conclude that there is a statistically significant relationship between CAS collection efficiency indices and the share of CAS revenues in GDP, so that even in the case of CAS, collection problems can be explained by taxation efficiency.

4. Conclusions

Overall, the regressions indicate the existence of a significant link between the taxation efficiency index on the four revenues categories and the share of tax revenues (on the four analyzed categories) in GDP. Thus, we can conclude that in the analyzed states the collection problems can be explained by the efficiency of the collection process.

From my point of view, the biggest problem related to the efficiency of tax revenue collection concerns the VAT field. According to EC reports, in recent years, Romania recorded the largest VAT collection gap in the EU.

My research shows the close connection between the level of the fiscal gap and the tax efficiency index in the VAT field. In this situation, I recommend the authorities to borrow good practices of other member states in the field of tax administration, such as real-time transaction analysis, mandatory electronic invoicing, the introduction of the international standard for data exchange between companies and tax authorities electronically (SAF-T), which can lead to an increase in the VAT collection rate.

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