

Public Debt Sustainability in E.U.

Corina-Florentina Scarlat (Mihai)
University of Craiova, Romania
cassamihai@yahoo.com

Abstract

The topic of public debt sustainability is an important one, and the rapid increase of public debt for the E.U. countries following the Covid-19 pandemic raised the importance of this topic. In the article, we analyzed the way in which the economic growth and the public budget deficit influence the public debt for the E.U. states. A multifactor regression model based on panel data was used, and the result indicated that there is a valid relationship between these variables, and this suggests a certain form of sustainability of public finances and public debt for these states. Therefore, there is a negative relationship between economic growth and public debt and there is a positive relationship between public budget deficit and public debt.

Key words: public debt, sustainable debt, cointegration, Covid-19, European Union
J.E.L. classification: H63, H68, C12, C23

1. Introduction

The issue of public debt is an extremely important one for all countries, even more so in the context of the pandemic generated by the Covid-19 virus, when most states have recorded very high budget deficits to support the economy and to be able to overcome difficult periods. Thus, there are both in the public and academic environment a series of debates regarding the issue of public debt and the sustainable level, and this only increases the importance of the topic.

Considering these aspects, I decided to address the issue of public debt in the European Union, considering that it is a relevant and current topic, for which I can carry out a series of analyzes that will bring added value. The novelty element is represented by the case study approach, in which I will try to analyze what are the determinants of public debt for E.U. countries. using a multifactor regression model with panel data, but also what is the risk regarding the sustainability of these debts using an analysis regarding the dynamics of recent years.

I propose to highlight that there is a close correlation between fiscal-budgetary sustainability and public debt sustainability and that one cannot be achieved without the other. I also aim to show that the analysis of public debt dynamics (average annual growth of public debt and maximum annual growth) for European Union states can provide relevant information regarding debt management in these countries and the risk for debt sustainability for the future.

The quantitative analysis of the paper is based on a multifactorial regression econometric model, built considering the organization of the database in panel form. According to the methodology in the field, three types of estimates will be made (combined regression, regression using fixed effects and regression using random effects), so that later, based on the Hausman test, a decision can be made regarding the most suitable estimation method for the case selected database. After the most suitable method is decided, one can proceed to the interpretation of the results and to the realization of some tests regarding the stability of the model. It should be noted that before starting all the steps, it is necessary to test the stationarity of the data series using the modified ADF (Augmented Dickey Fuller) test for data series organized in panel form.

2. Theoretical background

It is important to discuss fiscal and public debt sustainability, these two concepts are closely related, and their fulfillment is interconnected and conditional. The lack of fiscal sustainability will lead to the lack of sustainability of the public debt through the increase of the deficit, which will be reflected in the increase of the public debt. The relationship manifests itself in exactly the same way and in the opposite direction, that is, an increase in public debt leads to an increase in public spending (with interest), and this will lead to a lack of fiscal-budgetary sustainability.

At the same time, the analysis mechanisms for these two concepts are interconnected and lead to similar results, and in the case study part I will develop an econometric model to analyze the determinants of public debt and the way in which the budget deficit influences public debt. Therefore, I will try to emphasize the connection between fiscal-budgetary debt sustainability and public debt sustainability.

From a financial point of view, the concept of sustainability refers to any form of service that considers environmental, governance and social criteria when making business or investment decisions for the long-term benefit of customers and society in general. Thus, sustainability contributes to the development of value from an economic, social and environmental point of view.

Among the activities that fall within the field of sustainable finance, we can mention green bonds, microfinancing for ESG activities, sustainable funds, loans for sustainable projects and for the development of the entire financial system. Consequently, increasing the level of financial literacy and intermediation generally has a beneficial effect on fiscal sustainability and societal well-being.

For the smooth running of the economy and to ensure economic growth, it is necessary to ensure a sustainable fiscal-budgetary policy, taking into account the absorption of shocks, the restructuring of the economy, economic growth, each of which can represent a factor that stimulates in the long term medium and long economic growth and generation of added value in the economy. The shock absorption strategy has as its starting point the reality that the economy generates a state of equilibrium, and the authorities would have the role of contributing to the reduction of negative shocks.

The most pressing problem of the European economies is that of ensuring the budget revenues necessary to cover public expenses, in the conditions in which it is aimed to fall within the limits established by the Maastricht Treaty regarding the maximum budget deficit of 3% of GDP and the maximum accepted public debt of 60 % of GDP. Therefore, covering the budget deficit requires the implementation of a mix of macroeconomic policies that properly manage budget resources

In the conditions in which there was an increase in aggregate demand and an intensification of public expenditures to cover medium and long-term objectives, an increase in public debt expressed as a percentage of GDP was increasingly observed. The need to achieve minimum standards of living, job creation, infrastructure and economic growth can lead to spending that exceeds government revenue. On the other hand, there is the possibility for governments to spend more than revenues and to achieve financing through different methods: i) issuing currency, ii) contracting debts on the internal or external market. Most economists vehemently reject the first method, which often leads to high inflation and declining living standards.

Blanchard et al. (1990) highlighted that fiscal policy is sustainable when public debt does not explode and when governments are not forced to raise taxes or excessively increase budget deficits. According to them, the present value of future primary surpluses must be equal to the current level of public debt. They believed that the government should take out new loans only to finance the primary deficit, to pay interest, and for and to pay off maturing debt. Thus, all other reasons not being consistent with the idea of a sustainable fiscal-budgetary policy and a sustainable debt (Blanchard et al., 1990)

For this paper, I consider that the article by the authors Can and Aktaş (2021) is relevant, which highlights in detail the challenges that arose in obtaining financing during the Covid-19 Pandemic. The two authors emphasized the situation of developing countries, for which access to the financial markets was much more difficult than for developed countries. All these events were very accentuated in the first months after the outbreak of the Covid-19 Pandemic, when most investors were reluctant and watched the events in the financial markets with concern. Furthermore, I can bring into discussion the article published by Duarte et al. (2021) in which a case study carried out for the

situation of Brazil was presented, highlighting the vulnerabilities and difficulties arising in the management of the public debt for this state and in obtaining the necessary financing, during the pandemic period, but also in the period that preceded the year 2020.

The strong impact of the pandemic generated by Covid-19, but also the measures taken by states to mitigate the economic and social effects, led to a significant increase in public deficits and government debt. This was possible as a result of the suspension of the Stability and Growth Pact for this period. The following directions are also important:

- the debt sustainability analysis depends to a large extent on the interest rates applied to EU member states and their growth rates. Although the result of the ECB's review of its monetary policy is disappointing in this sense, as it does not mention the future of its unconventional policies or the extension of its mandate, it cannot be neglected that the monetary measures implemented in 2020 by the European Central Bank (ECB) and- confirmed the de facto commitment to stop any return to a sovereign debt crisis by giving member states room to maneuver, from a fiscal point of view;

- moreover, we can still expect sovereign interest rates to remain low for a long time and view inflation as a temporary phenomenon, while arguing that debt cancellation for sovereign bonds held at the ECB would not change the economic situation.

However, in order to maintain confidence in the economic fundamentals of the EU Member States and to avoid a double crisis and vicious circles, economic policy, and in particular the way in which fiscal policy is followed at the level of the Member States, plays a crucial role in maintaining high levels of growth while supporting debt sustainability. Therefore, a reform of the tax system does not only aim to stabilize the economy in the short and medium term. Such a measure is extremely important to ensure funding for the socio-ecological transformation of our economy, helping to significantly increase employment and bring highly skilled jobs.

This position proposes a set of new fiscal rules to address the main weaknesses of the current rules, in particular their pro-cyclicality, while supporting economic stabilization and debt sustainability. In particular, and without changing the EU treaties or the transfer of debts:

- supports member states that have fiscal objectives specific to each country, with different adjustment paths;

- it is suggested to complement the golden rule for public investments with an expenditure rule for current budgets;

- asks the Commission, until the implementation of the new fiscal framework, to provide guidance for a transition period, in which no excessive deficit procedure is activated and with the possibility of using the "unusual event clause" on a specific country;

- reiterates its demand for a permanent fiscal capacity and new own resources.

The issue of public debt and sustainability was also analyzed by Teică (2012), who developed an extensive analysis for the countries of the European Union, Romania being included in the study sample. Also, the same type of analysis was carried out by Marcu and Meghișan (2011), who emphasized the sustainability of the debt, the ability of countries to cover the financing needs and the prospects for reducing the current income of public debts, being analyzed and the case of Romania. Thus, we highlighted that Romanian researchers also had a high interest in public debt and its sustainability, compared to other European countries. More articles were written on these theme like those of Nguyen (2018), Pamies and Reut (2020), Maitra (2019) or Briceño and Perote (2020).

Another important article for the present research is the one published by Podolskaya et al. (2021). through which the problem of the financing requirement and the increased public debt following the intervention of the states in the economy during the period affected by the Covid-19 Pandemic was analyzed. The authors highlighted the risks that appeared at the level of public debts following the problems generated by the pandemic situation, considering that the states' expenses have increased significantly to support the private environment. At the same time, Podolskaya et al. (2021). highlights significant risks regarding potential slippages in terms of public debts and the inability of states to identify the financing needs in the coming years, in the situation where drastic measures are not taken to reduce public deficits.

At the same time, the situation for Romania was analyzed by Dumitrescu (2014) and Zaman and Georgescu (2019). In these articles, the authors focused on identifying the determining factors for our country's public debt, and this can be extremely useful in the process of efficient public debt management, but also in determining a certain sustainable level. Likewise, the identification of the

determining factors can also be achieved by taking into account the determining factors for the public debt, so that in the end, a plausible estimate can be made regarding the financing needs of the public debt, considering the current level and the factors determinants. This idea was extensively analyzed by two other researchers: Pirtea and Nicolescu (2013). They had a similar approach to that of Dumitrescu (2014), the central objective being to identify the determining factors of the public debt for the case of Romania, the result being able to be used to forecast the evolution of the public debt and the financing needs for the period following

3. Research methodology

Through the econometric analysis of this study, I aimed to analyze, using a multifactorial regression model based on panel data series, what is the impact of economic growth and budget deficit on public debt in the European Union. In this sense, the methodology regarding the regression model adapted for data series organized in panel form will be used, and the general equation for this model is presented below:

$$dat_publica_{it} = \alpha_i + \beta_1 creștere_ec_{it} + \beta_2 deficit_bug_{it} + \varepsilon_{it} \quad (1)$$

Within this model, the parameters for each of the equations will be estimated, and the results will be interpreted economically. I will also present further what are the steps of the methodology in which panel data series are used.

In order to continue the work undertaken, I must mention the fact that three sets of estimates will be made, based on the data series organized in panel form. The results will be presented as they are obtained according to the methodology known in the specialized literature (Green, 2002 and Brooks, 2008), in order to later make a decision regarding the most suitable estimation method for this type of case study. The estimation methods that will be carried out are the following:

Pooled regression (combined regression). This is the first of the three methods and is based on the rules from the classic regression estimation method using a normal data series. This does not allow the variation of the parameters according to the period, nor from one country to another. Therefore, it does not take into account that there are multiple countries or multiple time periods, making it the most rigid method of the three.

The second estimation method is the one using fixed effects. This type of method allows the model constant to vary over time depending on the class of regressors. In this case, a higher flexibility is evident, this method can also be applied to data categories that are more heterogeneous, being perfect for the case where the panel data series are composed of different countries. Thus, a part of the variation of the dependent variable that is not explained only by the inclusion of the explanatory variables is captured and in this way brings added value.

The last estimation method is the one in which random effects are used. This is the method that offers the most flexibility, offering the possibility of the free term (the constant of the model) to be estimated independently of the regressors, which can be grouped with the model errors in order to achieve a more detailed analysis. In this way, the correlation between the classes of regressions is followed, the so-called cross-sections being brought into discussion, which allow the error to be different from country to country, but also from one period to another.

The literature suggests that after the estimates are made, a decision must be made regarding the most appropriate method. The decision will be made based on the Hausman test, for which the assumptions are as follows:

H₀ (null hypothesis): Random effects estimation is appropriate for these data series.

H₁ (alternative hypothesis): Fixed effects estimation is appropriate for these data series.

As with other statistical tests, the decision is made on the basis of a significance threshold applicable to the test, and for this paper we have chosen a significance threshold of 5%, that is, it is a 95% probability. This shows that for a test probability below 5%, one can reject the null hypothesis with 95% probability and accept the alternative hypothesis that the most appropriate estimation method is that using fixed effects.

For the case study of the research report, three series of data obtained by querying the Eurostat public database will be used:

- Public debt in E.U. countries (% GDP);
- Annual economic growth in E.U. countries.;
- Public budget deficit in E.U. countries (% GDP).

The period for which data were obtained and processed is 2000 – 2021, being annual data series. This being the highest frequency for which common data could be identified for all three variables that we considered for this econometric model based on panel data.

The countries included in the case study are: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland and Sweden.

Considering these countries and the fact that the period is 2000 – 2021, the panel data set will have 594 observations. This is a more than comprehensive data set for building an econometric model.

At the same time, for a better knowledge of the data series that will be used, I will present a table with descriptive statistics for them, which I will later comment on. This is a common approach for any scientific work.

Table no. 1. Descriptive statistics

	Public debt (% GDP)	Public deficit (% GDP)	Economic Growth (%)
Maximum	206.3	6.9	24.4
Minimum	3.8	-32.1	-14.8
Mean	59.4	-2.6	2.4
Median	53.5	-2.4	2.6
St. Dev	35.4	3.6	3.8
Skewness	1.05	-1.34	-0.55
Exces of kurtosis	1.4	7.8	4.0
Nr. Observations	594	594	594

Source: Authors' own computations

3. Findings

For this part of the case study, a multifactorial regression model was estimated, based on data series organized in panel form. As I specified in the methodology part, the form of the mathematical equation for estimating the model is as follows:

$$dat_publica_{it} = \alpha_i + \beta_1 creștere_ec_{it} + \beta_2 deficit_bug_{it} + \varepsilon_{it} \quad (1)$$

Starting from this, the estimates were made using the three types of estimation methods: pooled regression, fixed-effects regression and random effects regression. First I will present the outputs from Eviews for this, and later I will present the results of the Hausman test, which helps us choose which is the most appropriate estimation method. With the help of this test I will decide which result is more suitable for this approach, and later I will interpret the estimates made from an economic and econometric point of view.

However, before performing the actual estimation, it was necessary to check the stationarity of the data series using the Augmented Dickey-Fuller (ADF) test adapted for panel data series. The results from the Eviews and interpretations are presented below, before moving on to the model results.

The test hypotheses are the following:

H0 : has an unit root

H1: does not have an unit root

Based on these assumptions and the probability associated with the test, the decision will be made regarding the stationarity of the data series.

The first result for the ADF test is for economic growth. Below is the output from Eviews:

Panel unit root test: Summary
Series: CRESTERE_EC
Date: 07/30/22 Time: 15:49
Sample: 2000 2021
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.25403	0.0000	27	540
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-11.8980	0.0000	27	540
ADF - Fisher Chi-square	236.999	0.0000	27	540
PP - Fisher Chi-square	566.526	0.0000	27	567

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Within this output the probability associated with the test is important, and in this case it is a probability of zero (0%), less than the significance threshold I will use to make the decision in this test (5%). This shows that the alternative hypothesis (H1) can be rejected and the null hypothesis that the data series is stationary can be accepted and used in the model.

The second series of data tested is the one related to the public debt for the countries of the E.U. Below is the output from Eviews:

Panel unit root test: Summary
Series: DATORIE_PUBLICA
Date: 07/30/22 Time: 15:49
Sample: 2000 2021
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.12319	0.410	27	540
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.49574	0.0063	27	540
ADF - Fisher Chi-square	66.0663	0.0256	27	540
PP - Fisher Chi-square	63.5790	0.0447	27	567

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

And for the case of this variable we noticed that the associated probability is less than 5%. Thus, we can state that the data series is stationary according to the ADF test and can be used in the regression model.

The last series for which the ADF test will be applied is that for economic growth.

Panel unit root test: Summary
Series: DEFICIT_BUGETAR
Date: 07/30/22 Time: 15:50
Sample: 2000 2021
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	1.94199	0.9739	27	540
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.56428	0.0589	27	540
ADF - Fisher Chi-square	54.0061	0.4742	27	540
PP - Fisher Chi-square	102.822	0.0001	27	567

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

As with the other two data series, the ADF test indicated that the economic growth series is stationary (the probability associated with the test is less than the 5% threshold). Therefore, this data series can also be used without problems in the multivariate regression model based on panel series.

Next, I will present the results of the model, using the three estimation methods that I presented in the research methodology:

a) Pooled regression

Dependent Variable: DATORIE_PUBLICA
Method: Panel Least Squares
Date: 07/30/22 Time: 16:02
Sample: 2000 2021
Periods included: 22
Cross-sections included: 27
Total panel (balanced) observations: 594

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC	-0.168876	0.119163	-1.417189	0.1570
DEFICIT_BUGETAR	-1.150121	0.114874	-10.01201	0.0000
C	99.38480	0.465120	213.6756	0.0000
R-squared	0.215919	Mean dependent var		101.8727
Adjusted R-squared	0.213266	S.D. dependent var		6.158691
S.E. of regression	5.462638	Akaike info criterion		6.238778
Sum squared resid	17635.68	Schwarz criterion		6.260934
Log likelihood	-1849.917	Hannan-Quinn criter.		6.247407
F-statistic	81.37443	Durbin-Watson stat		0.302949
Prob(F-statistic)	0.000000			

b) Fixed-effects regression

Dependent Variable: DATORIE_PUBLICA
Method: Panel Least Squares
Date: 07/30/22 Time: 16:04
Sample: 2000 2021
Periods included: 22
Cross-sections included: 27
Total panel (balanced) observations: 594

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC	-0.020055	0.014473	-1.385665	0.1664
DEFICIT_BUGETAR	0.484903	0.038744	12.51550	0.0000
C	4.786456	1.436117	3.332915	0.0009

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.281988	Mean dependent var	1.581818
Adjusted R-squared	0.246405	S.D. dependent var	2.217850
S.E. of regression	1.925312	Akaike info criterion	4.195643
Sum squared resid	2094.357	Schwarz criterion	4.409817
Log likelihood	-1217.106	Hannan-Quinn criter.	4.279054
F-statistic	7.924830	Durbin-Watson stat	2.197814
Prob(F-statistic)	0.000000		

c) Random effects regression

Dependent Variable: DATORIE_PUBLICA
Method: Panel EGLS (Cross-section random effects)
Date: 07/30/22 Time: 16:05
Sample: 2000 2021
Periods included: 22
Cross-sections included: 27
Total panel (balanced) observations: 594
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC	-0.020055	0.014473	-1.385665	0.1664
DEFICIT_BUGETAR	0.484903	0.038744	12.51550	0.0000
C	4.786456	1.436117	3.332915	0.0009

Effects Specification

	S.D.	Rho
Cross-section random	0.000000	0.0000
Idiosyncratic random	1.925312	1.0000

Weighted Statistics

R-squared	0.281988	Mean dependent var	1.581818
Adjusted R-squared	0.279558	S.D. dependent var	2.217850
S.E. of regression	1.882485	Sum squared resid	2094.357
F-statistic	116.0532	Durbin-Watson stat	2.197814
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.281988	Mean dependent var	1.581818
Sum squared resid	2094.357	Durbin-Watson stat	2.197814

After estimating using these three methods we applied the Hausman test to choose which method is the most suitable for these data series. The results obtained in Eviews for this test are presented below, and they will be interpreted according to the research methodology.

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	2	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
DATORIE_PUBLICA	-0.020055	-0.020055	-0.000000	NA
DEFICIT_BUGETAR	0.484903	0.484903	-0.000000	NA

Cross-section random effects test equation:
Dependent Variable: DATORIE_PUBLICA
Method: Panel Least Squares
Date: 07/30/22 Time: 16:05
Sample: 2000 2021
Periods included: 22
Cross-sections included: 27
Total panel (balanced) observations: 594

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.786456	1.436117	3.332915	0.0009
CRESTERE_EC	-0.020055	0.014473	-1.385665	0.1664
DEFICIT_BUGETAR	0.484903	0.038744	12.51550	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.281988	Mean dependent var	1.581818
Adjusted R-squared	0.246405	S.D. dependent var	2.217850
S.E. of regression	1.925312	Akaike info criterion	4.195643
Sum squared resid	2094.357	Schwarz criterion	4.409817
Log likelihood	-1217.106	Hannan-Quinn criter.	4.279054
F-statistic	7.924830	Durbin-Watson stat	2.197814
Prob(F-statistic)	0.000000		

The probability associated with this test is very close to 100%, and this suggests that the hypothesis H0 (null hypothesis) that the most appropriate estimation method is the one using random effects is rejected. Thus, the most suitable method for the proposed model is the one using fixed effects.

In the following, I will resume the output for this method and make economic interpretations for it:

Dependent Variable: DATORIE_PUBLICA
Method: Panel Least Squares
Date: 07/30/22 Time: 16:04
Sample: 2000 2021
Periods included: 22
Cross-sections included: 27
Total panel (balanced) observations: 594

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRESTERE_EC	-0.020055	0.014473	-1.385665	0.1664
DEFICIT_BUGETAR	0.484903	0.038744	12.51550	0.0000
C	4.786456	1.436117	3.332915	0.0009

Effects Specification			
Cross-section fixed (dummy variables)			
R-squared	0.281988	Mean dependent var	1.581818
Adjusted R-squared	0.246405	S.D. dependent var	2.217850
S.E. of regression	1.925312	Akaike info criterion	4.195643
Sum squared resid	2094.357	Schwarz criterion	4.409817
Log likelihood	-1217.106	Hannan-Quinn criter.	4.279054
F-statistic	7.924830	Durbin-Watson stat	2.197814
Prob(F-statistic)	0.000000		

To estimate this model it is important, first of all, to highlight what the estimated coefficients are for this equation:

- The estimated coefficient for economic growth is -0.02
- The estimated coefficient for the budget deficit is 0.48
- The constant of the model is 4.78

Thus, it is highlighted that there is a negative relationship between economic growth and public debt. Therefore, if there is an economic growth of 1%, public debt decreases by 0.02% of GDP, according to the regression model calibrated in Eviews and presented in this research report. These results are in line with expectations and highlight an economic reality, giving more certainty to the correctness of the work and the calculations made.

On the other hand, a positive relationship was registered between the budget deficit and the share of public debt in GDP, i.e. an increase in the budget deficit by 1 p.p. leads to an increase in the public debt by 0.48 p.p., under conditions where all other variables remain constant. And this result is according to theory and expectations in the sense that an increase in the deficit will require borrowing to cover it, and this will translate into an increase in public debt.

Also important for model results is the degree of determination (R-Squared). Its value for the current estimate is 0.28 (28%). Therefore, it can be said that the model built based on economic growth, the budget deficit and the constant of the model explains in a proportion of 28% the variation of the public debt for the case of Romania. The remaining 72% is explained by a number of other quantitative and qualitative variables that are not taken into account in the model. Even if the percentage of 28% seems to be a low one, considering the amplitude of the correlations in the economy and the complexity of the influencing factors on the public debt, this degree of determination is a realistic one, a level that shows that the model is close to reality and not over-estimate the estimated links.

4. Conclusions

Public debt is a current and highly debated topic in the specialized literature, and these things led me to consider this topic. Thus, the analysis of the public debt of the European Union, the factors of influence and sustainability is the central point of this work.

In this paper, we considered the important issues related to fiscal sustainability and public debt sustainability. Economic theory states that these two concepts cannot be realized without each other and that, the current situation, requires a much higher attention to the sustainability of the public

debt. I highlighted the directions to follow in order to analyze the sustainability of the public debt and what should be the methodology used, but also which are the most relevant works that I considered from the specialized literature, for the substantiation of the case study.

In the research results part, we analyzed the influence of economic growth and the budget deficit on the evolution of public debt in the European Union. The analysis was carried out with the help of a multifactorial regression model built on the basis of data series organized in panel form for the countries of the European Union. Three types of estimation were performed: combined regression, regression using fixed effects, and regression using random effects, and the results indicated that the most appropriate method is the one using random effects. According to it, the existence of an inverse relationship between economic growth and public debt and a direct, significant relationship between the budget deficit and public debt was established. Thus, it was confirmed that there is a strong correlation between the achievement of fiscal-budget sustainability (measured by the budget deficit) and the sustainability of the public debt (measured by the public debt at the level of the EU countries) and that the achievement of any of these cannot be achieved independently.

The present paper brings the discussion on public debt in the E.U. at a certain point and can be extended in different directions. One of the directions that can be approached for expanding the research is that of the in-depth analysis of sustainability, and here I am referring to an empirical analysis regarding the way in which the debts of different states are sustainable, an analysis carried out at the level of each state by correlating public expenditures and revenues in within a VAR (vector autoregressive) model and by applying some causality tests (e.g. the Granger test). These methods have proven to be very effective in the past for sustainability analysis for different countries and situations. There are a number of methodologies in the specialized literature that are based on econometric models and that allow the verification of sustainability, but also of the sources of instability for public debt. Thus, I consider that an expansion in this direction would be auspicious and could bring added value for the current research, but also for the specialized literature.

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