SUSTAINABILITY OF PUBLIC FINANCE: EASTERN EUROPEAN COUNTRIES CASE

Daniel JURAVLE
Faculty of Economics and Business Administration
University Alexandru Ioan Cuza of Iasi, Romania
daniel.juravle@yahoo.com

Abstract: *The sustainability of fiscal deficits is of increasing importance for both the governors and theorists. This article analyzes the how the financial stability influences the economic growth in 4 East European countries for the period 1995-2018, using 6 macroeconomic variables: GDP growth, deficit, financial development, gross financial capital formation, inflation, population, trade. The methodology used is threshold autoregressive (TAR) models and through it is established for each country 2 thresholds for fiscal deficits. According to the analysis, the threshold values for the fiscal deficits that influence the economic growth are different for the linear part (between 2.12 for Bulgaria and 3.37 for Hungary) and the non-linear one (4.11 Romania and 4.33 Czech Republic). Any value of the deficit above this threshold produces a negative effect on the economy, and the lower values have a positive effect; the education for the political factors would be that the respective states must keep the deficit within the calculated limits.*
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1. INTRODUCTION

Before the imbalances become major and have irreversible and important consequences, it is necessary for policy makers to determine whether financial stability is paramount over time and whether this is a permanent requirement for them. But the problem of measuring the fiscal deficit and mainly its permanence over time is a very controversial issue both among the governors and especially the theorists. The financial crisis of 2008-2009 has led to policies to stimulate and help the financial and economic sector and implicitly to the rising of public debts for most European countries, some of them (Greece, Italy, Spain) having serious problems with public finances (Chibi, 2019; Uryszek, 2015).

A wide debate has always existed among theorists about the possible reciprocal effects of financial sustainability and economic growth and concerns two major issues: firstly, the transmission of effects from one variable to another (Ehigiamusoe, 2019), and secondly the meaning of the effects between variables (unilaterally or bilateral), both aspects having strong backers and strong theoretical explanations (Ueshina, 2018).

For liberal economists, the fiscal balance was paramount, as there could be no budget deficit, which negatively affected the economy. In contrast, with the emergence of Keynesian theory, the exact opposite of the old theory, namely the positive influence of budget deficit, especially regarding the period of economic crisis, when larger deficits are encouraged to stimulate the economy (Lau and Tien-Ming, 2018). In the 1990s, the endogenous theory developed by Barro holds the reference in economic theory by incorporating public spending into the economic growth model, establishing an optimum for their level: if it is greater than optimal, the effect is negative; if it is smaller than optimal the effect is positive (Sharma et al., 2019).

The Maastricht treaty foresees as a convergence criterion for EU countries the existence of a budget deficit of maximum 3% of GDP, (without having at that time a serious theoretical and practical justification), which was seriously violated in the European debt crisis 2010, a fact with strong implications for policy makers (Uryszek, 2015). From the point of view of the theoreticians, the subject begins to gain importance starting with the 90s, initially through Barro (1990) which considers a series of linear effects, so that a series of nonlinear effects can be established between variable (Minea, 2008).

The structure of the following paper is further highlighted: section two presents the specialized literature in the field; section 3 presents the nonlinear analysis methodology; part 4 treats the results obtained, for the last part, the conclusions to complete the work.

2. LITERATURE REVIEW

The specialized literature paid great attention to analysis of how financial stability and economic growth are interconnected, the results being largely inconsistent and contradictory, the different determinants being generated by the analyzed time periods, the political ideology of the government, the econometric methods used. In the literature there are 3 thinking currents regarding the effects of fiscal deficit in the long term and economic growth: the positive impact is sustained by the Keynesian vision (Alagidede et al., 2018), neutral by the followers of the Ricardian Equivalence Hypothesis (REH) theory and negative by the neoclassical theory. Supporters of Keynesian theory believe that the call for large budget deficits to increase public spending leads to economic growth; the negative effects of the increase of the fiscal deficit are outweighed by the positive effects of the impact of public investments, especially those in the infrastructure, thus generating a multiplication effect in the economy. The followers of the neo-classical theory consider that the increase of the fiscal deficits leads to the increase of the public expenditures and implicitly to the drainage of the financial resources from the private agents to the public sector, affecting in the long term the economic growth reducing it.

Supporters of Ricardian Equivalence Hypothesis (REH) consider a neutral effect of fiscal deficit: because in the long term the economy is in balance, a short-term increase in the public deficit will be later compensated by raising taxes and lowering expenses so that the effect overall the economy is zero (Alagidede et al., 2018).

The econometrical studies regarding the analysis of fiscal policy and economic growth involve two approaches: in a first phase starting with the 1960s the linear approach, so that after the 1990s the nonlinear approach will be promoted (Salma and Said, 2016). The promoters of the linear approach start from the Keynesian view that in the event of a crisis, there is a need for a fiscal deficit to finance higher public spending (Slimani, 2016).

Subsequently, Aschauer (1989) analyzes the US economy and find out a positive effect from financial stability to economic growth; Barro (1996) analyzes 100 countries and shows that economic growth is negatively and significantly influenced by the public deficit. The followers of nonlinear theory start from the threshold regression model of Hansen (1999). Adam and Bevan (2005) analyze 45 countries and use the panel methodology to establish the existence of an optimal level of 1.5% of GDP (above this level of deficit the effects on the economy are negative). Minea and Villieu (2008) analyze the OECD countries taking into account the level of public debt in GDP: for the weakly indebted countries the increase of the public deficit is done by cutting the public spending, whereas for the heavily indebted countries this is no longer possible; the optimal level of public debt that negatively influences economic growth is estimated at 90%.

For Eastern European countries, studies are few and do not analyze the nonlinear effect of the fiscal deficit on the economy. However, the following studies that deal with the problem can be mentioned. Brasoveanu and Brasoveanu (2009) analyze Romania for the period 1990-2007, using time series modeling and find out a negative influence of fiscal deficit on economic growth. Próchniak (2011) analyzes 10 CEE countries for the period 1993-2005 and shows that the economic growth is positively influenced by the fiscal equilibrium. Mişa and Kagitci (2019) analyze the 28 EU countries for the period 2007-2017 using the panel methodology and establish the negative effect of the fiscal deficit on the economic growth for the studied countries.

3. METHODOLOGY

The classic methodology applied to study the sustainability of fiscal fiscal policies is to discover the maximum point and to observe whether or not in the current situation, the fiscal deficit exceeds this point. The classic models for this analysis are Smooth transition autoregressive (STAR) models that detect the nonlinear effects of fiscal policies.

The model used in the present study involves discovering the threshold value and determining whether for the countries analyzed, the current level is higher / lower than the present one.

The model developed in the present study is the following:

$$\textit{Economic growth} = \textit{constant} + \alpha \times \textit{deficit fiscal} + \beta \times Xi \textit{ (financial development, gross fixed capital formation, inflation, population, trade)}$$

the variables that will be used in the analysis model:
- Economic growth - it is calculated as the GDP variation and the series are quarterly
- Fiscal deficit - calculated as the difference between revenue and expenditure, as a percentage of GDP, the series are quarterly
- Gross fixed capital formation - calculated as a percentage of GDP, the series are quarterly
- inflation - calculated as CPI change, quarterly series
-trade - calculated as the sum of imports and exports related to GDP, quarterly series

In the present study to identify the optimal level of the fiscal deficit that influences the economic growth, the Threshold Autoregressive (TAR) model will be used, which establishes 1-2 optimal points depending on the dependent variables. for the analyzed situation, the TAR model will be:

$$Economic\ growth_i = constant + \alpha_1\ x\ Economic\ growth_{i-1} + \alpha_2\ x\ deficit\ fiscal_i\ [deficit\ fiscal_i < optim] + \alpha_3\ x\ deficit\ fiscal_i\ [deficit\ fiscal_i > optim] + \alpha_4\ x\ financial\ development + \alpha_5\ x\ gross\ fixed\ capital\ formation + \alpha_6\ x\ inflation + \alpha_7\ x\ population + \alpha_8\ x\ trade + \varepsilon_i$$

where the fiscal deficit takes values either greater than the optimum (> optimal) or lower (<optimal), and the coefficients α2 and α3 are those which indicate lower values.

4. EMPIRICAL RESULTS

The countries analyzed in this article are 4 Eastern European states: Bulgaria, Czechia, Hungary and Romania, the analysis period being 1995-2019. The source of the analysis data is Eurostat, IMF and World Bank Database, the frequency of the series being quarterly. Descriptive statistics are presented in the following table. as can be seen the biggest economic growth in the analyzed period had Romania (3.19) and the smallest Romania (1.02); three countries had a deficit (Czechia, 2.64), of which 2 (Hungary, -4.47 and Romania, -3.37), even quite large, above the 3% threshold; the only country with a budget surplus was Bulgaria (0.60); the degree of financial development is quite low for all Eastern European countries, being below 50% (the highest is in Czechia, 47.28, and the smallest in Romania, 23.44); Inflation during this period was very high (Bulgaria, 188.10%; Romania, 21.14%); trade openness knows important values (over 100% for Bulgaria, Czechia and Hungary, and lower for Romania, 67.25).

Tabel 1 Descriptive statistics for the main variables

	GDP_growth	Deficit	Financial development	Gfcf	Inflation	Population	Trade
Bulgaria	1.02	0.60	46.40	19.50	188.10	7.77	101.20

Czech Republic	2.64	-2.33	47.28	28.29	4.30	10.37	116.30
Hungary	2.14	-4.47	38.28	22.67	8.96	10.09	129.77
Romania	3.19	-3.37	23.44	24.25	21.14	20.98	67.25

Source: own calculations

Table no.2 presents the results of the linearity test. As can be seen, for all hypotheses H01-H04, the test results indicate the rejection of the linear model, which means choosing a Smooth Transition Autoregressive (STAR) model. These results indicate that economic growth can be modeled by a smooth transition regression model that presents two regimes (a growth regime, a deceleration regime and a shift represented by the fiscal deficit) and a non-linear process governed by 4 lakes. Next we present the results of the Breusch-Godfrey Serial Correlation LM Test which shows that for all tests the hypothesis of the existence of serial autocorrelation between residuals generated by the regression model is rejected; thus, between the analyzed series there is no serial correlation.

Table 2 Smooth Threshold Linearity Tests

	H01: b1=0	H02: b1=b2=0	H03: b1=b2=b3=0	H04: b1=b2=b3=b4=0	Breusch-Godfrey Serial Correlation LM Test
Bulgaria	1.08	4.08	5.64	5.98	3.34
	0.40	0.01	0.02	0.08	0.01
Czech Republic	1.22	1.10	0.83	0.82	4.78
	0.35	0.44	0.65	0.65	0.00
Hungary	0.38	0.35	0.07	0.07	0.50
	0.88	0.94	0.99	1.00	0.26
Romania	0.89	2.14	84.78	84.78	3.19
	0.53	0.36	0.08	0.08	0.00

Source: own calculations

Table 3 presents the Smooth Threshold Regression results, for the two components, linear and nonlinear, for each country. The deficit results for all countries for both components, linear and non-linear, show that this negatively influences economic growth (Bulgaria -2.11; Czechia -2.76; Hungary -0.75; Romania -0.75), which is in line with the specialized literature. The other variables of the analysis present values corresponding to the previous results from the literature. By using the threshold regression model, for all countries, it is estimated for the linear one-threshold model (Bulgaria, 1.51; Czechia, 0.20; Hungary, 0.26; Romania, 0.19), estimating a linear regression, but the general models are non-linear (each has a nonlinear component and a threshold value).

Table 3 Smooth Threshold Regression

		Deficit	ln(financial_development)	ln(GFCF)	ln(inflation)	ln(population)	ln(trade)
Bulgaria	(linear part)	1.51 (0.03)	4.52 (0.15)	-14.29 (0.02)	3.51 (0.25)	-0.02 (0.75)	0.41 (0.17)
	(nonlinear part)	-2.11 (0.02)	6.02 (0.98)	-16.91 (0.06)	1.09 (0.00)	22.33 (0.08)	1.00 (0.86)
Czech Republic	(linear part)	0.20 (0.75)	1.30 (0.33)	23.09 (0.38)	-0.12 (0.76)	-4.94 (0.55)	1.48 (0.90)
	(nonlinear part)	-2.76 (0.30)	1.31 (0.33)	-15.81 (0.74)	-0.45 (0.63)	-5.19 (0.68)	27.10 (0.21)
Hungary	(linear part)	0.26 (0.59)	-2.67 (0.60)	16.48 (0.47)	-0.15 (0.83)	-2.16 (0.86)	-0.38 (0.98)
	(nonlinear part)	-0.75 (0.32)	-6.93 (0.29)	1.64 (0.97)	-0.09 (0.90)	-0.23 (0.98)	4.21 (0.89)
Romania	(linear part)	0.19 (0.94)	-5.32 (0.62)	21.45 (0.48)	-0.07 (0.83)	-10.29 (0.77)	-3.61 (0.78)
	(nonlinear part)	-0.70 (0.82)	-30.74 (0.24)	14.74 (0.68)	-0.70 (0.40)	-27.52 (0.53)	33.25 (0.18)

Source: own calculations

For **Bulgaria**, the models obtained are the following:

*Regime 1 (liniar): Economic growth = 1.51*deficit + [4.52*Findev+-14.29*GFCF+3.51*Inf +-0.02*Pop+1.48*Trade]*

*Regime 2 (non-liniar): Economic growth = -2.11*deficit + [1.30*Findev+23.09*GFCF+-0.12*Inf+22.33*Pop+1.00*Trade]*

For **Czechia**, the models obtained are the following:

*Regime 1 (liniar): Economic growth = 0.20*deficit + [1.30*Findev+23.09*GFCF+-0.12*Inf +-4.94*Pop+1.48*Trade]*

*Regime 2 (non-liniar): Economic growth = -2.76*deficit + [1.31*Findev+-15.81*GFCF+- 0.45*Inf+-5.19*Pop+27.10*Trade]*

For **Hungary**, the models obtained are the following:

*Regime 1 (liniar): Economic growth = 0.26*deficit + [-2.67*Findev+16.48*GFCF+-0.15*Inf +-2.16*Pop+-0.38*Trade]*

*Regime 2 (non-liniar): Economic growth = -0.75*deficit + [-6.93*Findev+1.64*GFCF+- 0.09*Inf+-0.23*Pop+4.21*Trade]*

For **Romania**, the models obtained are the following:

*Regime 1 (liniar): Economic growth = 0.19*deficit + [-5.32*Findev+21.45*GFCF+-0.07*Inf +-10.29*Pop+-3.61*Trade]*

*Regime 2 (non-liniar): Economic growth = -0.75*deficit + [-30.74*Findev+14.74*GFCF+- 0.70*Inf+-27.52*Pop+33.25*Trade]*

In the table 4 we present Confidence Intervals for the studied models, and for the main component analyzed, the fiscal deficit, in detail: for Bulgaria it is between 0.13 and 2.89 (linear) and -3.91 and -0.31 (non-linear); for Czechia (between -1.20 and 1.61 for the linear model and between -8.42 and 2.90 for the non-linear model); for Hungary (between -0.81 and 1.33 for linear and between -2.36 and 0.85 for non-linear); for Romania (between -6.20 and 6.60 for linear and -8.79 and 7.28 for non-linear).

Table 4 Coefficient Confidence Intervals 95% CI

		Deficit		ln(financial_development)		ln(GFCF)		ln(inflation)		ln(population)		ln(trade)	
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Bulgaria	(linear part)	0.13	2.89	5.41	12.44	-1.99	11.04	-0.01	0.01	-26.96	-1.62	-2.88	9.92
	(nonlinear part)	-3.91	-0.31	-16.00	18.01	-34.92	1.08	0.312	1.87	-3.67	48.34	-11.19	13.20
Czech Republic	(linear part)	-1.20	1.61	-29.90	20.01	-32.30	78.49	-1.05	0.79	-22.75	12.85	-23.92	26.89
	(nonlinear part)	-8.42	2.90	-34.13	37.10	-118.57	86.95	-2.49	1.58	-32.04	21.64	-18.00	72.21
Hungary	(linear part)	-0.81	1.33	-13.82	8.47	-32.99	65.95	-1.84	1.53	-29.20	24.87	-64.16	63.38
	(nonlinear part)	-2.36	0.85	-21.05	7.18	-104.66	107.95	-1.77	1.58	-39.91	39.44	-67.76	76.18
Romania	(linear part)	-6.20	6.60	-30.41	19.77	-48.92	91.84	-0.92	0.77	-96.21	75.62	-34.75	27.52
	(nonlinear part)	-8.79	7.28	-88.74	27.26	-69.22	98.72	-2.62	1.222	-129.22	74.18	-20.82	87.32

Source: own calculations

In the table 5 the results for the general, non-linear analysis model are presented. For all countries there is a Threshold value, a low mass value in Bulgaria (2.12) and higher in the other countries, Hungary (3.37), Romania (4.11) and Czechia (4.33). The speed of adjustment of the model is also varied for the respective countries, being lower for Czechia (1.30) and Romania (1.65) and higher in Hungary (5.54) and Bulgaria (6.02). R-squared for all models is significant, showing that they are well specified.

Table 5 The results for the non-linear model

	Slope	Threshold	R-squared
Bulgaria	6.02	2.12	0.71

	(0.98)	(0.85)	
Czech Republic	1.30 (0.33)	4.33 (0.00)	0.64
Hungary	5.54 (0.99)	3.37 (0.98)	0.63
Romania	1.65 (0.54)	4.11 (0.01)	0.89

Source: own calculations

The results obtained in the present study are in agreement with those obtained in the specialized literature: the fiscal deficit negatively affects the economic growth. For the 4 Eastern European countries, there is a linear approach from economic growth to fiscal deficit, but by studying the nonlinear approach it is shown that it performs better, given that this relationship cannot remain economically linear throughout the period time. For the 4 countries, a threshold level is identified (Bulgaria, 2.12; Hungary, 3.37; Romania, 4.11; Czechia, 4.33), the linear model being generally positive and the nonlinear one negative. The fiscal deficit has the greatest influence on economic growth in Bulgaria and Czechia (negative, over 2%), and lower in Hungary and Romania (negative, over 0.70%).

CONCLUSION

This article contributes to the specialized literature by studying the relation of fiscal deficit to economic growth for 4 Eastern European countries: Bulgaria, Czechia, Hungary and Romania, between 1995-2019, taking into account the following macroeconomic variables: financial development, gross fixed capital formation, inflation, population and trade. For the respective countries, both linear and nonlinear models were analyzed, the latter proving better for explaining the phenomenon, each of the respective models having a threshold point.

The coefficients obtained for each model show that the fiscal deficit has a negative effect for all countries, being more pronounced in Bulgaria and Czechia, and weaker in Hungary and Romania. The modeling results show that for each country there is a threshold level (Bulgaria, 2.12; Hungary, 3.37; Romania, 4.11; Czechia, 4.33), a level above which the fiscal deficit negatively affects the economy. Based on these findings, it is assumed that the respective Eastern European states should properly adjust their deficits, either by reducing public spending or by increasing fiscal revenues, in order not to reach the situation of exceeding these critical thresholds.

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