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Macroeconomic Prospects for Public Finance Management Sustainability: An Econometric Approach for Debt in Central and Eastern European Countries

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Abstract

This paper presents the evolution of the level of public debt in Central and Eastern European countries outside the Monetary Union and explores the sustainability of public debt through the analysis of socioeconomic and institutional factors. We analyze the relationship between economic factors (budget deficit, economic growth rate, interest rate), social factors (unemployment rate, life expectancy), institutional factors (efficiency of public administration, degree of democratization, level of corruption) and public debt. Research on this geographical area has been relatively scarce. Using an OLS regression design, the results indicate and quantify the importance of the dynamics between public debt, budget deficit, interest rate, and economic growth. We find that, for CEE countries, sustainability of the public debt/GDP level depends to a high extent on life expectancy: 1 percentage point increase in life expectancy leads to an increase in public debt of approximately 6.5%. The results have significant policy implications as high levels of debt can strain government finances, leading to potential fiscal crises.

Keywords: fiscal policies, Keynesian approach, public debt, sustainability, public finance management

JEL classification: H30, H6, C1, C5, E60, E12, E24

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1. Introduction

The operationalization of elements included in public debt management is a cross-cutting subject of sustainable development, as the sustainability of economic development encompasses all determinants of public debt, and the sustainability of public debt depends entirely on the level of development. Globally, not just nationally, increasing levels of public debt threaten efforts to achieve the Sustainable Development Goals established by the United Nations 2030 Agenda for Sustainable Development (UN Resolution A/RES/70/1 of September 25, 2015). Specifically, the rising level of public debt could jeopardize efforts aimed at eradicating extreme poverty, among other objectives.

In the specialized literature, various approaches to sustainable development are observed. From an economic perspective, the concept is inevitably influenced by two approaches that propose different objectives, as well as tools and mechanisms, for achieving a high level of development. This paper addresses these two perspectives: the liberal and the Keynesian approaches, from the perspective of the economic and social factors influencing

public debt. The implications of these factors for economic and social policies remain at the discretion of policymakers.

In a simplified version, the definition of sustainable development refers to economic development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission Report, 1987). Development is a cumulative and circular process, based on specific elements (territory, natural resources, human resources, etc.) and a set of comparative and/or competitive advantages that determine differentiated spatial evolutions and impose certain categories of interventions, in line with national needs. In particular, these categories of interventions are partially conditioned by the evolution of the determinants of public debt studied in this work.

It is also worth mentioning that Romania is the only CEE country that found itself in the excessive deficit procedure in April 2020 (according to the EU Stability and Growth Pact). The budget deficit reached almost 9.8% of GDP in 2020. It remains to be seen whether Romania will continue its public sector reform by reducing expenses to finance the budget deficit, even though this measure could further restrict the already limited progress of reforms undertaken so far (Vasile, 2013). Although in the short-term policymakers' attention is focused on generating primary surpluses in the budget balance, it is necessary to evaluate the sustainability level and the effects of measures aimed at reducing expenses.

The analysis of factors influencing the level of public debt in CEE countries is relatively limited, even though there are numerous empirical studies dealing with the relationships between these factors in advanced and even emerging economies. This work is motivated by the existence of this gap in empirical literature. The objectives of this research endeavour are two-folded. First, we present the evolution of public debts in Central and Eastern European (CEE) countries outside the Monetary Union (UM), compared to UM member states. Second, we partially evaluate the sustainability level of public debt in CEE through the analysis of economic, social, and institutional factors influencing the level of public debt/GDP.

The structure of this article is as follows. Section 2 is divided into two main parts and presents the literature on the topic. The first sub-part presents the theoretical debates surrounding the topic and the second sub-part analyzes the empirical literature about the main determinants of public debt levels. Part 3 presents the results of the descriptive exploratory analysis as well as the entire estimation methodology. Within section 4, the OLS regression results are shown, while part 5 contains the conclusions.

2. Literature review. Debating the issue of public debt

2.1. Theoretical approaches

Specialized literature regarding the determinants of public debt in relation to its sustainability can be divided into two main categories: studies focusing on a single country (Thomas & Wu, 2009; Dumitrescu, 2014; Lankester-Campos *et al.*, 2020) and empirical studies aiming to estimate data through regression for a group of states (Jacobs *et al.*, 2019; Reinhart & Rogoff, 2010; Panizza & Presbitero, 2013). In the European literature, analyses regarding a single country often have a pragmatic rather than academic character, being conducted with the purpose of formulating public policies to improve economic and financial indicators related to public debt. Moreover, most of the empirical academic studies refer to the states in the Monetary Union (Jacobs *et al.*, 2019; Gruber & Kamin, 2012; Panizza & Presbitero, 2013; Brady & Magazzino, 2018) rather than the states in Central and Eastern Europe that have not adopted the Euro. Furthermore, many analyses applied to a group of countries do not provide precise estimates (Gruber & Kamin, 2012), even though they are useful tools that encourage localized research focused on fewer determinants of public debt. Without referring to the history of economic theories and without presenting their arguments in full, the paper delineates two main perspectives on the issue of public debt: the liberal approach and the new Keynesian approach.

Although the coexistence of two theoretical perspectives is observed, there is a consensus regarding the dependence of the level of public debt on the previous and current level of public deficit (Gargouri & Ksantini, 2016; Greiner & Fincke, 2015; Salsman, 2017). The liberal approach starts from the assumption that deficits and

public debt mainly affect private investments: the deficit motivates governments to increase demand for loans, thus raising interest rates. Consequently, private investments become increasingly expensive, reducing the motivation for private investments. This crowding-out effect is widely debated in the specialized literature, with Keynesian counterarguments being predominant. For example, it is considered that the crowding-out effect is rarely so strong as to nullify the entire expansionary effect of public spending, maintaining a net economic stimulus that motivates private investments (Baumol & Blinder, 2009; Mankiw, 2008). Additionally, other studies diminish the effects of deficits on the interest rate as there are various other factors affecting the interest rate (Mankiw, 2008).

The new Keynesian approach starts from the assumption that technological progress and population growth will eventually lead to economic growth and increase the state's capacity to pay interest on government debt (Mankiw, 2008). In this sense, it is considered that only a level of public debt that grows at a rapid pace, faster than nominal GDP (Mankiw, 2008), will lead to a permanent fiscal burden that calls into question governments' credibility with creditors regarding their ability to continue paying interest. Only in this scenario, with a high level of public debt relative to GDP, could creditors impose high interest rates to compensate for increased risk (Reinhart & Rogoff, 2010). Only in this scenario, without the ability to borrow at a reasonable level of interest rates, the budget must be immediately balanced through tax increases and reduction of public spending.

2.2. Determinants of public debt

There is a consensus regarding the relationship between deficit and public debt (Bohn, 2007; Escolano, 2010; D'Erasmo *et al.*, 2016). The dynamic relationship between public deficit (p_t) and public debt (d_t) takes the form:

$$d_t = (1 + y)d_{t-1} - p_t, \text{ where } y_t = \frac{r_t - g_t}{1 + g_t},$$

with r_t representing the real interest rate and g_t, the GDP growth rate.

This relationship is also used to measure the sustainability of public debt. Models of this type use only the deficit, the level of public debt, and a few control variables, identifying linear or nonlinear responses of the deficit to changes in public debt. However, the use of this type of quantification is redundant since the intertemporal budget constraint remains under very weak assumptions generally satisfied by data (D'Erasmo *et al.*, 2016). Instead, although not used in this work, the model describes the relationship between deficit and public debt, creating a suitable framework for hypotheses formulation. It is expected that there is a negative relationship between public debt and deficit.

Regarding the relationship between public debt and economic growth, the theoretical debate contains different arguments. From a liberal perspective, public debt has a negative effect, transmitted through the interest rate, on economic growth. Thus, economic growth is hindered by the crowding-out effect, and to compensate, governments are forced to adopt austerity measures.

Regarding the relationship between public debt and life expectancy, studies conclude the existence of a positive relationship. In particular, studies emphasize that population aging leads to an increase in the public debt/GDP ratio, and tax rates that maximize economic growth and utility increase with life expectancy (Kamiguchi & Tamai, 2019). Empirical studies conclude that if fiscal deficit policy is sustainable, deficit reductions financed by bonds increase workers' capital stock and reduce the long-term unemployment rate, although the policy will increase the short-term unemployment rate.

Numerous works have attempted to explain the heterogeneous relationship between public debt and economic growth from an institutional perspective. For example, Ahlborn and Schweickert (2018) explain the high degree of heterogeneity that can be observed at the level of country groups with distinct economic systems: liberal (Anglo-Saxon), continental (core EU members), and Nordic (Scandinavian). Panizza and Presbitero (2013) demonstrate that public debt has no effect on economic growth in countries with a high degree of institutional quality. However, considering the previous hypotheses, we expect a high degree of impact of institutional factors

on the interest rate, not on economic growth overall. Institutional quality could be one of the factors determining the increase or decrease in the interest rate in some countries. In line of the different studies, we formulate our research hypotheses:

- ✓ *H1: The relationship between the budget balance and public debt is positive.*
- ✓ *H2: Economic growth positively/negatively influences the level of public debt through the interest rate.*
- ✓ *H3: The relationship between the unemployment rate and public debt is positive.*
- ✓ *H4: The relationship between life expectancy and public debt is positive.*
- ✓ *H5: A high level of institutional quality leads to a lower level of public debt.*

3. The evolution and dynamics of determinants of public debt in Central and Eastern European non-Eurozone member states

3.1. Exploratory data analysis

■ ***Evolution of public debt***

After the economic recession during the 2007-2010 period, the public debt of European countries within the EMU sharply deviated from its trajectory compared to countries outside the EMU. Table 1 (Geometric mean/Standard deviation) demonstrates significant variations in public debt territorially. As a general trend, public debt increased in the context of the sovereign debt crisis for all European Union member states.

In comparison to EMU countries with higher levels of public debt relative to GDP, CEE states register lower values: while some member states (Greece, Italy, Portugal) have a high level of indebtedness as the public debt-to-GDP ratio exceeded 100% for at least two periods of time, and other states (Austria, France, Spain) were slightly above the reference value of 60% established by the Maastricht Treaty, the majority of CEE states (with the exception of Croatia and Hungary) managed to achieve a public debt level lower than 60% of GDP, adhering to the Maastricht Treaty criteria for the analysed periods. However, it is anticipated that the COVID-19 pandemic will lead to a notable deterioration of the budgetary position and a significant increase in public debt in 2020-2021 for all EU member states (European Central Bank, 2020).

Table 1. Evolution of public debt/GDP ratio from 2000 to 2019

Country	Geometric mean				Standard deviation			
	2000-2004	2005-2009	2010-2014	2015-2019	2000-2004	2005-2009	2010-2014	2015-2019
Austria	66.12	69.73	82.47	77.97	0.65	5.76	1.04	5.98
Belgium	104.31	93.37	104.20	101.98	5.06	4.75	2.55	3.16
Cyprus	60.33	54.98	80.55	99.26	3.94	6.70	23.04	5.88
Denmark	47.97	33.66	44.36	35.99	3.11	5.02	1.27	2.58
Estonia	5.24	4.84	8.42	9.10	0.37	1.31	2.11	0.82
Finland	41.78	37.05	52.75	61.37	1.17	3.85	5.41	2.00
France	61.49	69.36	90.33	97.60	3.41	7.69	3.95	1.14
Germany	60.94	67.24	79.45	65.46	3.00	3.42	2.56	5.22
Greece	103.97	109.73	168.19	180.73	2.13	9.69	13.83	3.41
Ireland	31.66	32.98	107.41	67.24	3.35	16.47	14.05	7.94
Italy	106.96	107.90	126.47	134.66	1.87	4.95	7.31	0.43
Latvia	13.51	14.73	43.01	38.08	0.99	11.65	3.00	1.54
Lithuania	21.46	18.16	38.42	38.07	1.98	5.35	1.78	3.45
Luxembourg	7.58	10.63	21.45	21.46	0.20	4.16	1.91	0.93
Malta	65.65	64.78	65.53	49.12	4.25	3.39	2.73	5.74
Netherlands	50.13	49.64	64.47	56.63	1.23	5.92	3.86	6.57
Portugal	60.35	76.21	120.92	125.38	5.12	6.49	14.05	6.20
Slovakia	46.21	32.17	48.56	50.85	4.24	3.19	6.26	1.66
Slovenia	26.60	25.98	55.68	73.99	0.60	5.00	17.20	6.68
Spain	51.05	41.65	81.15	97.98	4.95	6.70	17.07	1.57

Country	Geometric mean				Standard deviation			
	2000-2004	2005-2009	2010-2014	2015-2019	2000-2004	2005-2009	2010-2014	2015-2019
Sweden	49.94	41.70	39.50	40.03	1.29	4.44	3.24	3.35
United Kingdom	35.71	46.08	81.42	86.20	1.84	9.93	4.61	0.60
Bulgaria	**51.45**	**17.44**	**17.83**	**24.41**	**14.50**	**5.66**	**4.99**	**3.50**
Croatia	**37.56**	**40.93**	**70.91**	**77.83**	**1.76**	**4.47**	**11.36**	**4.72**
Czech Republic	**24.00**	**28.73**	**41.35**	**34.40**	**4.74**	**2.56**	**3.10**	**3.73**
Hungary	**56.07**	**67.90**	**78.59**	**71.38**	**2.61**	**6.91**	**1.67**	**4.29**
Poland	**41.20**	**46.96**	**54.03**	**50.04**	**4.55**	**1.90**	**2.00**	**3.14**
Romania	**22.72**	**14.47**	**35.33**	**36.04**	**2.69**	**4.18**	**3.79**	**1.43**

Source: Authors' calculations based on data from European Central Bank.

Overall, during the period of 2000-2020, all CEE states, except Bulgaria, experienced an increase in the level of public debt, with Romania showing a stabilization trend. Compared to the previous period (2010-2014), the analysis of the evolution of public debt during the period of 2015-2020 demonstrates a high degree of variation: Hungary, Poland, and the Czech Republic registered declines in this indicator, while Croatia and Bulgaria recorded significant increases.

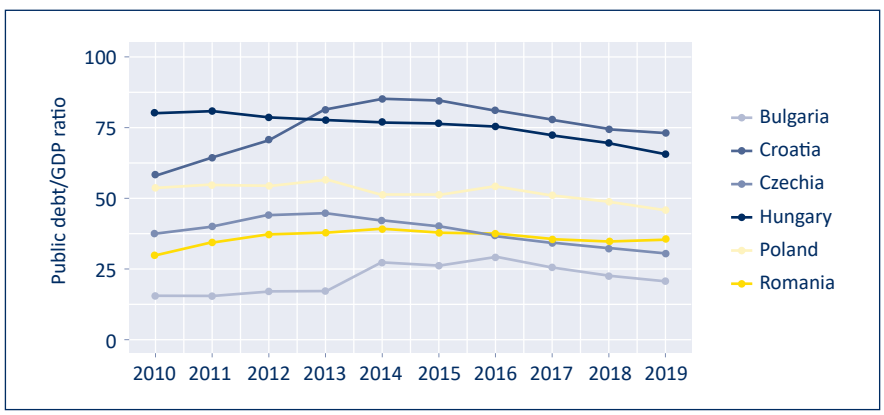

Figure 1. Evaluation of public debt/GDP ratio in CEE states from 2010 to 2019

Source: Authors' calculations based on data from European Central Bank.

Compared to other countries such as Portugal, Italy, and Greece, the level of public debt in CEE states is not alarming. However, in the context of the COVID-19 pandemic with new financing operations, loans from the European Central Bank, and the purchase of corporate debt, it is expected that the public debt of all countries will increase, questioning the type of economic and social policies needed to ensure sustainable development. In particular, for CEE states, projections from the International Monetary Fund indicate a significant increase in public debt.

Table 2. Projections of public debt/GDP ratio

	2020	2021	2022	2023	2024	2025
Bulgaria	24.1	23.7	22.2	21.0	19.9	18.9
Croatia	87.7	85.5	82.7	80.3	78.0	76.0
Czech Republic	39.1	41.4	42.5	42.8	42.4	41.9
Hungary	77.4	75.9	73.2	69.8	66.4	63.5
Poland	60.0	60.2	59.2	59.3	59.9	60.9
Romania	44.8	49.6	54.4	58.5	62.2	65.4

Source: International Monetary Fund.

To partially measure the degree of sustainability of public debt, these findings lead to the analysis of the determinant factors of public debt.

■ ***Evolution of macroeconomic indicators***

Regarding the budget deficit, most CEE countries have recorded deficits ranging up to 5%, Romania being the only one to exhibit an extreme value of approximately 7% in 2009. It is notable that there is no strictly positive relationship between the level of public debt and the budget balance. Negative relationships are observed for Croatia, Poland, and Romania, while Bulgaria and Czechia show a positive relationship. The case of Hungary is unclear.

This variation, along with the inability to draw conclusions regarding the relationship between the budget balance and public debt, is concerning, and the analysis of short-term consequences of high budget deficits must be applied at the level of each state. Tailored analyses could provide insights into the degree of economic growth influencing the budget balance and debt levels, including risks to government credibility. Additionally, tailored analyses should consider both COVID-19-related financing and the types of decisions leading to budget deficits/surpluses: whether governments have engaged in profitable projects to stimulate the economy (infrastructure, subsidies for businesses) or if budget revenues have decreased due to tax cuts. Moreover, to determine the degree of sustainability of public debt, tailored analyses should focus exclusively on budget deficit values and find specific methodologies for measuring the impact of various factors on the budget deficit.

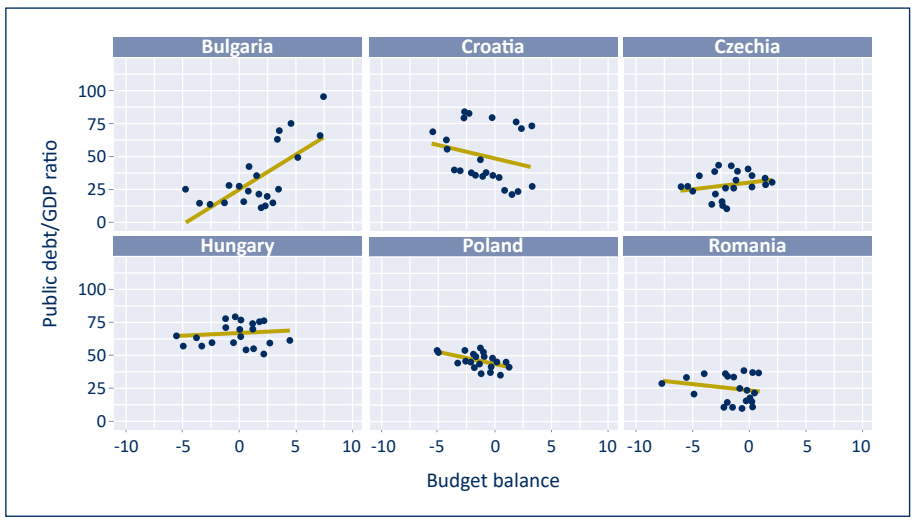

Figure 2. Budget balance and public debt

Source: Authors' calculations based on data from European Central Bank.

Regarding economic growth, the case of Poland is not clear, while for Croatia, Czechia, Hungary, and Romania, the relationship between public debt and economic growth is negative, with a high degree of economic growth reducing the level of public debt. Only in the case of Bulgaria, the relationship between economic growth and the level of public debt is positive: the degree of economic growth increases the ratio of public debt/GDP, which could question the sustainability of public debt. However, in the case of Bulgaria, tailored analyses should focus on the evolution of the interest rate. It is important to investigate why the long-term interest rate in one country remains relatively low, despite high public debt, while it suddenly rises in another country under the same circumstances.

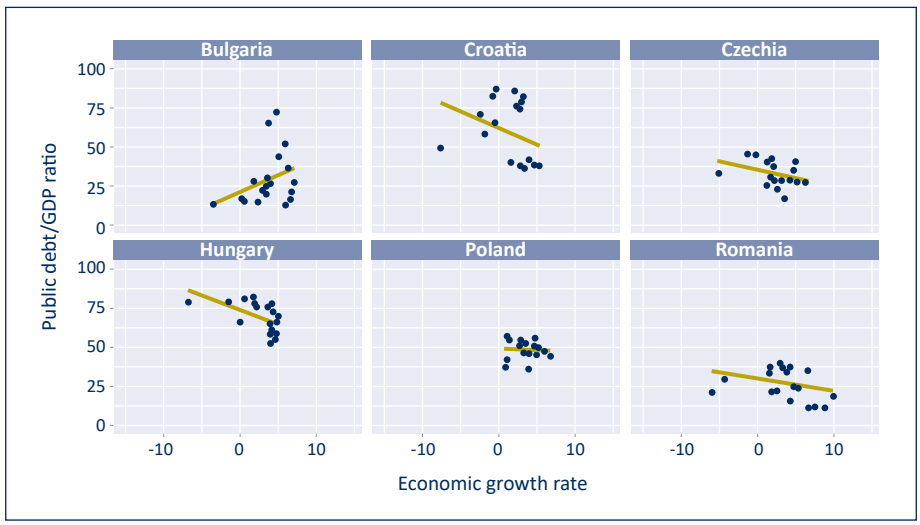

Figure 3. Economic growth and public debt

Source: Authors' calculations based on data from European Central Bank.

Regarding the interest rate, Croatia, Poland, and Hungary have similar interest rates, ranging between 2.5% and 7.5%, while Bulgaria and Czechia have relatively lower values. Romania records the highest interest rates among CEE states. A strictly negative relationship can be observed in the case of Croatia, Romania, and Czechia. For all other CEE states, the relationship between the interest rate and the ratio of public debt/GDP is unclear. This observation supports the hypothesis that there is no causality between public debt and the interest rate. Tailored research should focus on the relationship between the deficit, the rate of economic growth, and the interest rate.

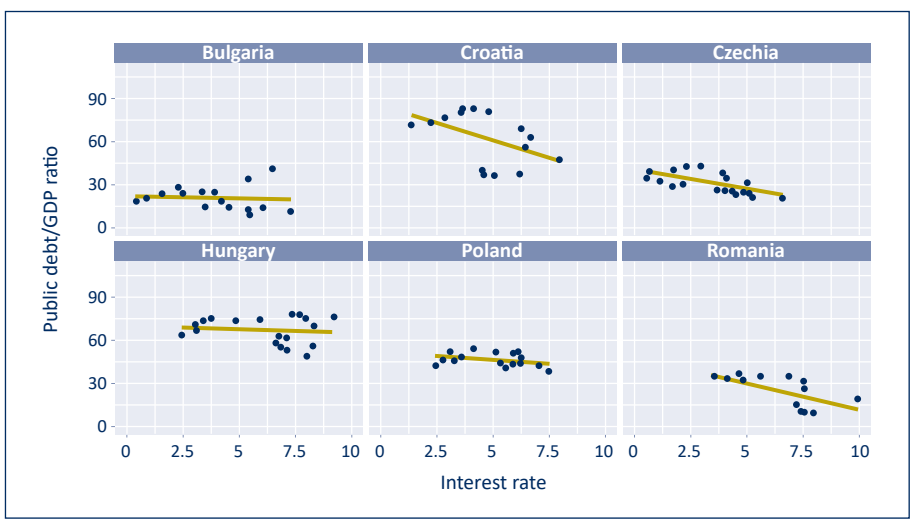

Figure 4. Interest rate and public debt

Source: Authors' calculations based on data from European Central Bank.

Regarding the current account balance, as expected, a positive relationship with the ratio of public debt/GDP is observed, with a surplus in the current account increasing public debt. The case of Poland is unclear.

Compared to other states, Romania and Poland have exhibited extreme deficits of up to 35%, which could affect subsequent econometric results. Excessive domestic private expenditures on foreign goods and services can generate a deficit in the current account, which in turn can be financed through a public deficit or through a surplus of domestic savings. However, financing the current account deficit from domestic savings can be difficult, and in this case, public debt would increase.

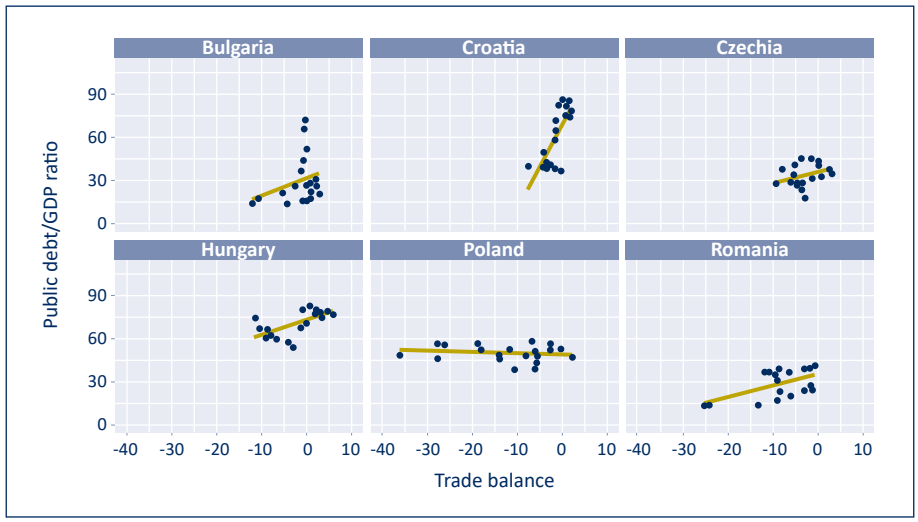

Figure 5. Current account of the balance of payments and public debt

Source: Authors' calculations based on data from European Central Bank.

■ ***Evolution of socioeconomic indicators***

Studies indicate that the determinants of public deficits/debts in Europe are not only economic but also social. The aging populations will mean that some European countries will face increasing costs for pensions and healthcare, amidst relatively weak fiscal positions and risky dependency ratios (Hansen & Gordon, 2014). To determine the impact of demographic changes on public debt, the ratio of public debt to life expectancy at birth can be evaluated. Life expectancy data indicate the number of years a newborn would live if prevailing mortality patterns at the time of birth remained the same throughout life. All countries in the European Union have recorded an upward trend in life expectancy, with Germany or France reaching a life expectancy of over 80 years. CEE states have also experienced an increase in life expectancy, with life expectancy reaching over 75 years in the last decade. Consequently, governments are expected to spend more on social policies, pensions, and healthcare to improve living conditions.

The relationship between public debt/GDP and life expectancy is positive for all CEE states, except Bulgaria. Romania and Bulgaria have the lowest life expectancy values, which do not favour an increase in the level of public debt since, in the event of a crisis, governments would not be required to adopt costly measures.

Another socioeconomic variable that requires addressing for assessing the evolution of the public debt ratio is the unemployment rate, as individuals without employment receive unemployment benefits or other social benefits. Theoretically, an increase in the unemployment rate leads to an increase in public debt due to the cost of providing unemployment insurance. For Bulgaria, Hungary, and Croatia, this hypothesis is confirmed. However, in the case of Romania and Czechia, the relationship between the unemployment rate and public debt is less clear, which could signal a stronger influence of other factors on public debt, especially since these states have a low unemployment rate.

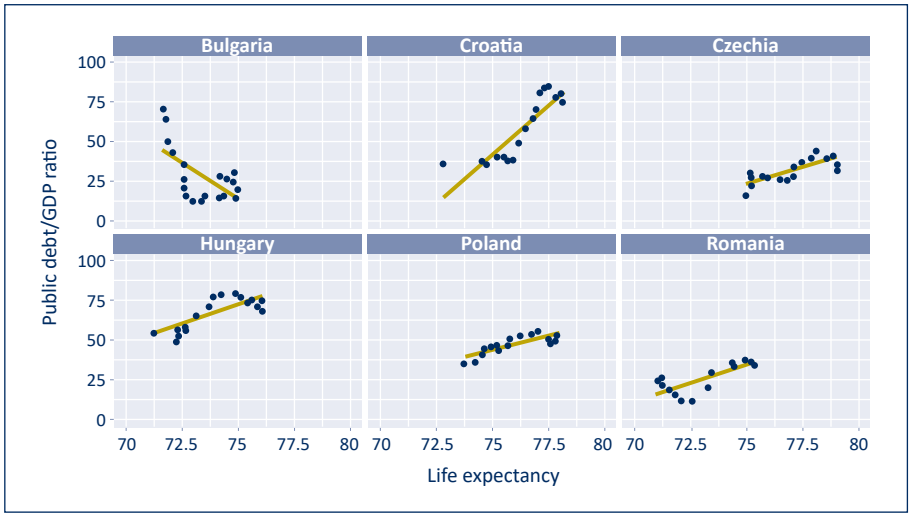

Figure 6. Life expectancy and public debt

Source: Authors' calculations based on data from European Central Bank.

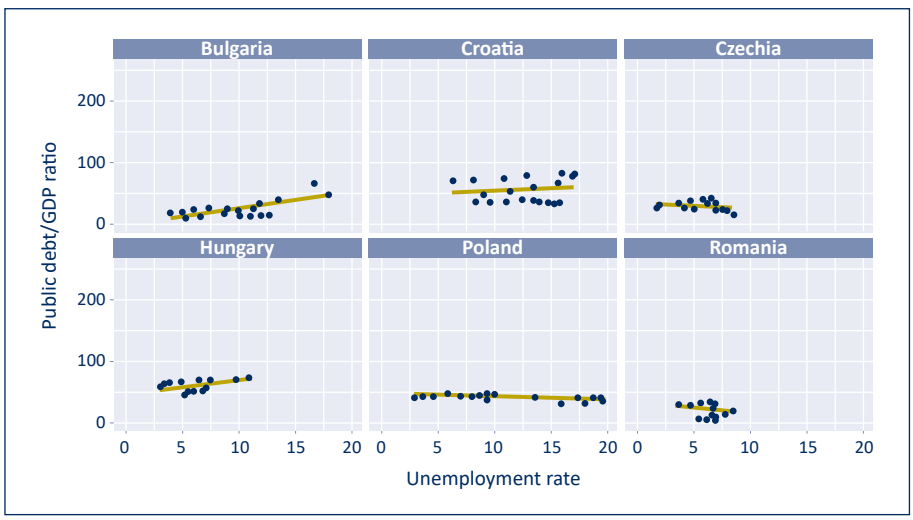

Figure 7. Unemployment rate and public debt

Source: Authors' calculations based on data from European Central Bank.

To determine the degree of sustainability, it is necessary to evaluate how institutional elements can affect the governance of public debt and its evolution, especially in the absence of a fiscal union. Specialized literature concludes that institutional elements have been essential factors in the unfolding of the sovereign debt crisis as governments have been unable to reach a consensus on implementing structural reforms of the market (Ahlborn & Schweickert, 2018). In the case of institutional factors, there are gaps in the specialized literature, especially in the context of new theories of economic growth. Many studies conclude that a higher level of institutional quality, or lower levels of corruption, lead to a decrease in the level of public debt (Ahlborn & Schweickert, 2018; Panizza & Presbitero, 2013). However, achieving a high level of institutional quality requires additional measures that require funding.

This paper considers the following institutional factors: voice & accountability, government effectiveness, control of corruption, and the Corruption Perception Index.

Overall, the evolution of these indicators demonstrates similarity. Periods of increases or decreases at the level of all states and all indicators are similar. For example, in the case of Romania, the period 2013-2015 saw an increase in each indicator. Similarly, the case of Czechia reflects the same trend. Because of this trend, subsequent econometric analysis was limited to using a single indicator as a proxy variable for all others.

However, it is noteworthy that in the period 2017-2019, Poland and Hungary experienced significant decreases in each index, demonstrating a contrary trend to the democratization process.

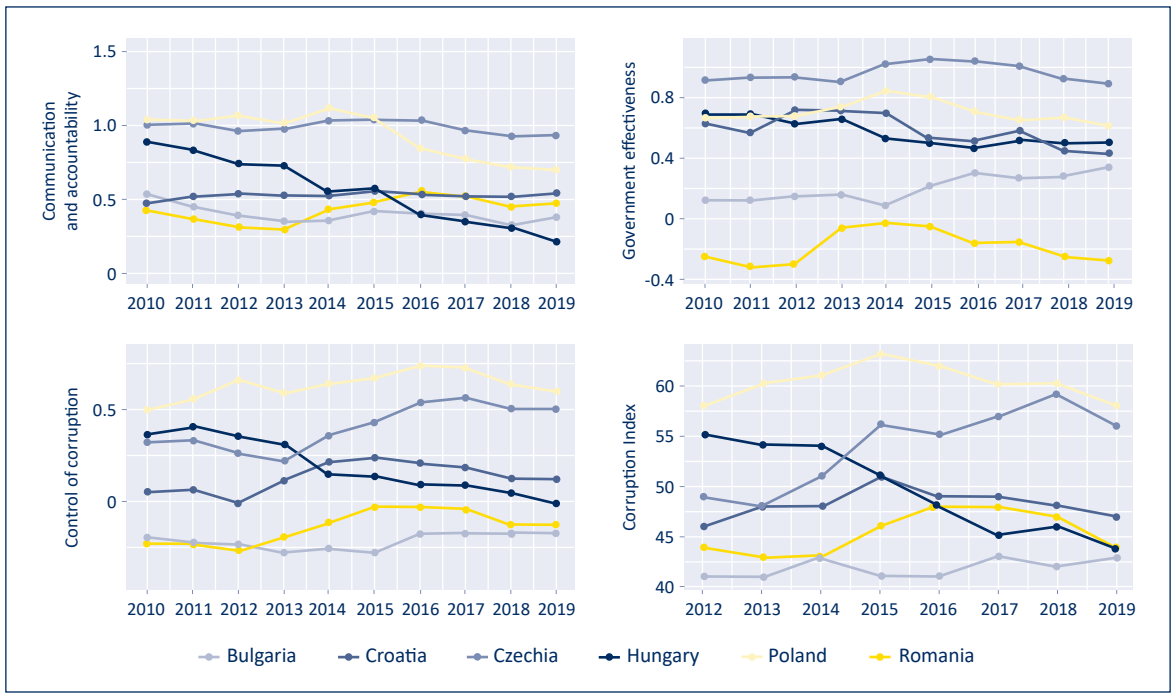

Figure 8. Evolution of institutional indicators by country

Source: Authors' calculations based on data from European Central Bank.

3.2. Empirical analysis

■ *Estimation methodology*

To measure the impact of factors on the level of public debt in CEE countries, we conducted a multiple linear regression with the dependent variable being the public debt/GDP ratio for the period 2000-2020, as follows:

$$Public\ debt/GDP\ ratio_t = \beta_0 + \beta_1 \times Economic\ growth\ rate_t + \beta_2 \times Interest\ rate_t + \beta_3 \times Budget\ balance_t + \beta_4 \times Life\ expectancy_t + \beta_5 \times Unemployment\ rate_t + \beta_6 \times Democracy\ index_t + \varepsilon$$

The estimation was conducted using panel data and includes 95 observations for all CEE countries. The use of panel data has several advantages compared to cross-sectional or time series data as the combination of interindividual differences and intra-individual dynamics allows for: constructing and testing more complex behavioural hypotheses, controlling for the impact of omitted variables, investigating dynamic relationships, and providing micro-level foundations for aggregate data analysis. The model adheres to most of the fundamental assumptions of the classical regression model, which have been verified through various tests: variables are measured on a continuous scale, linearity of the dependent variables with the independent variable, homoscedasticity (errors have constant variance), absence of multicollinearity.

4. Research results

The research results validate or invalidate the research hypotheses of this study. However, they do not provide an assessment of the sustainability of public debt. The adjusted R-squared value of 0.311 indicates a positive linear association of the data but is relatively low in significance. The model provides some valuable insights but is not very robust.

Table 3 synthesizes the results of the empirical analysis. The main findings possess a high degree of generality, but within the context of different theoretical frameworks, they provide several points for debate:

✓ As expected, a positive relationship between public debt and budget balance is identified. H1 is validated. However, future research should consider limited time periods characterized by either budget surplus or deficit. These preliminary results demonstrate that 1 percentage point increase in the public balance/GDP ratio leads to an approximately 2.9% increase in the public debt/GDP ratio. H1 formulated as a result of the literature study is validated.

✓ The relationship between economic growth rate and public debt is negative: 1 percentage point increase in the economic growth rate leads to a decrease in public debt of 0.5%. H2 is completely validated for CEE countries. However, this result is not statistically significant. H2 is not validated as the impact of the interest rate is not quantified by the estimation methodology, only in relation to economic growth. The interest rate positively influences the level of public debt: 1 percentage point increase results in approximately 1 percentage point increase in public debt. In this case, the results are inconclusive, and further analysis is needed. Additionally, it is noted that the inflation rate was not considered an explanatory variable, even though it may lead to an increase in the nominal interest rate.

✓ The relationship between the unemployment rate and public debt is also positive validating H3: 1 percentage point increase in the unemployment rate leads to approximately 1% increase in the public debt level. Additionally, surprising and contrary to previous studies, is the positive relationship between the Democracy Index and public debt.

✓ The relationship between life expectancy and public debt is positive validating H4: 1 percentage point increase in life expectancy leads to an increase in public debt of approximately 6.5%. The results validate H4 but require a nuanced approach taking into account budget deficits, public debt, and life expectancy. The results are concerning, demonstrating a high degree of unsustainability of the public debt level.

✓ There is no need to discuss H5 as the results are not statistically significant.

Table 3. Results of the empirical analysis

Dependent variable	Public debt/GDP ratio
Economic growth rate	-0.524
	(0.453)
Interest rate	5.604***
	(0.0004)
Budget surplus/deficit	2.945***
	(0.0013)
Life expectancy	6.505***
	(0.0039)
Unemployment rate	1.072**
	(0.0303)

Dependent variable	Public debt/GDP ratio
Democracy Index	7.167
	(0.3220)
Observations	95
R^2	0.355
Adjusted R^2	0.311

Notes: * p < 0.1, ** p < 0.05, and *** p < 0.01.

As mentioned, the research results do not provide an evaluation of the sustainability of public debt due to several considerations. Firstly, the lack of a methodology directly targeting sustainability assessment, rather than determining factors of public debt, was a hindrance that did not facilitate achieving this objective. It is recommended that the evaluation of public debt sustainability follows one of the three methodological approaches developed in the literature: the unstructured empirical framework developed by Bohn (2007), the structural empirical framework based on a dynamic general equilibrium calibrated with a fully specified fiscal sector (Trabandt & Uhlig, 2011), or the implicit internal approach motivated by Reinhart and Rogoff (2011).

Secondly, exploratory data analysis at the level of the CEE country group reveals a high degree of variation, making it difficult to formulate conclusions and recommendations for the economic policies of the states. The use of aggregated data for this type of objective is not recommended, as customized analyses at the level of each state are necessary. Additionally, for exploring the specific economic conditions of the group of states, aggregated data would be highly useful if applying methodologies that restrict the determinants of public debt.

Lastly, to verify the validity of conclusions presented in specialized studies in the context of CEE countries (e.g., the impact of public debt on economic growth or the impact of economic growth on public debt), other research methods such as the VAR (vector autoregression) model used by Jacobs *et al.* (2019) are necessary. Furthermore, to obtain conclusions regarding this geographical area, a GMM (generalized method of moments) model can be applied, which would allow the inclusion of all variables in the model. The estimation methodology used in this work is improvable as it includes explanatory variables that are not strictly exogenous. In this regard, a GMM method would allow their inclusion, and the dependent variable (public debt/GDP) would be considered dynamic, depending on its past values. A GMM model would also automatically control for specific individual effects of each state and include instrumental variables, such as public health expenditures. However, a GMM model cannot be applied for a long period as it is constructed for smaller time-series data with a large number of subjects.

5. Conclusions

The specialized literature on public debt determinants can be categorized into country-specific studies and empirical analyses of multiple states. Country-specific studies typically aim at policy formulation, while empirical research often focuses on states within the Monetary Union, overlooking Central and Eastern Europe. Two main theoretical perspectives emerge: the liberal approach, emphasizing the negative impact of deficits on private investments, and the new Keynesian approach, highlighting the role of economic growth in managing debt. Key findings suggest that deficit and debt are directly related, economic growth influences debt through interest rates, life expectancy correlates positively with debt, and high institutional quality can reduce debt levels. Research hypotheses reflect these dynamics, underscoring the complexity and multifaceted nature of public debt determinants.

The novelty of the study lies in its applicability in Central and Eastern Europe. The relationship between public debt and its level of sustainability has different approaches in the empirical literature. Existing studies are rich in investigations that explore the determinants of public debt, either at the level of a single country or a group of states. However, there is a gap in research focusing on the countries in Central and Eastern Europe, especially those that have not adopted the euro. As the economic dynamics and fiscal policies in these regions can vary significantly from those in the Monetary Union states, it is essential to conduct more precise and focused studies in these areas. Such investigations could provide a deeper understanding of the unique influences shaping public debt in these countries and could offer more appropriate guidance for future public policies and financial management.

In terms of limitations, the research does not assess the sustainability of public debt overall but describes the different relationship across macroeconomic indicators. The chosen methodology is not designed for sustainability evaluation, which is crucial for comprehensive analysis. Recommended methodologies for sustainability assessment, such as those proposed by Bohn (2007), Trabandt and Uhlig (2011), and Reinhart and Rogoff (2011), were not employed. Moreover, the model is described as not very robust, implying that it may not fully capture the complexities of the relationships being studied.

Future research should focus on addressing the limitations identified in this study to provide more comprehensive insights into public debt dynamics. Specifically, incorporating methodologies designed to assess the sustainability of public debt, such as those proposed by Bohn (2007), Trabandt and Uhlig (2011), and Reinhart and Rogoff (2011), would be crucial. Additionally, employing more robust statistical models like VAR and GMM could enhance the analysis by capturing dynamic relationships and addressing endogeneity issues. Including the inflation rate and other relevant variables in the analysis, as well as conducting customized analyses for individual countries rather than relying on aggregated data, would further refine the findings. Exploring these avenues would provide a deeper understanding of the factors influencing public debt and offer more actionable recommendations for economic policy.

Therefore, there is an increased need for research addressing these aspects to complement and enhance our understanding of public debt and its sustainability in Europe. Increased attention to these states could contribute to the development of more effective strategies for managing public debt and could support efforts to promote financial and economic stability in the region.

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