THE DEBT-GROWTH RELATIONSHIP IN THE WESTERN BALKANS, DEVELOPING EUROPE, AND THE EUROZONE ECONOMIES: TESTING FOR THE EXISTENCE OF A TIPPING POINT

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Abstract

This paper examines the impact of public debt on economic growth in European regions, focusing on two objectives: first, to determine whether a threshold exists in the debt-growth relationship beyond which debt impedes growth, and second, to assess whether this threshold varies across regions. Using a threshold regression model, the analysis confirms such thresholds and identifies distinct levels: 22.2 percent for the Western Balkans, 37.4 percent for selected emerging European economies, and 82.6 percent for the Eurozone. These findings show that the debt-growth threshold depends on factors like economic structure and debt management capacity, suggesting a uniform debt management approach is ineffective. Instead, tailored strategies are needed to address regions' unique economic contexts. By identifying specific thresholds, this research provides valuable insights for policymakers, guiding fiscal strategies that balance stability and growth while considering regional dynamics. The paper contributes to the discourse on debt sustainability and supports informed decision-making for resilience.

Keywords: *public debt, economic growth, threshold, Western Balkans, Europe*

JEL Classification codes: *H63, H68, F34, O47*

1. Introduction

The relationship between public debt and economic growth has long drawn substantial academic and policy attention, yet empirical findings remain inconclusive. Despite this uncertainty, governments continue to rely heavily on debt to finance public spending, and debt-to-GDP (Gross Domestic Product) ratios have risen steadily across many economies, particularly in recent years. In this context, the need for a deeper understanding of the debt-growth nexus is not only of academic interest but also a pressing priority for policymakers seeking to balance fiscal sustainability with growth imperatives in an increasingly volatile global environment

A fundamental principle in debt management is the emphasis on borrowing for productive investments (Zanna et al. 2019). Essentially, if a country can

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generate growth through debt-financed investments, it can reduce the likelihood of a debt crisis. It is, therefore, crucial to examine the impact of debt-financed government spending on economic growth. The European sovereign debt crisis highlighted the importance of this issue, demonstrating how excessive borrowing combined with structural vulnerabilities can amplify economic and political pressures.

This paper examines the debt-growth nexus using a threshold regression model to capture potential non-linearities in the impact of public debt on economic performance. The analysis focuses primarily on the Western Balkans, a region with limited fiscal space, structural constraints, and scarce empirical evidence regarding debt thresholds. By constructing a dataset tailored to the specific conditions of these economies, the paper provides new insights into a region often overlooked in the literature. To assess the robustness of the findings, the sample is expanded to include European Union (EU) member states classified as Emerging and Developing Europe (EDE). These countries share similar development characteristics with the Western Balkans but operate within the institutional framework of the EU, allowing for a comparative perspective. A third group—Eurozone members that adopted the euro before 2007—is included as a benchmark to illustrate how debt-growth relationships may differ in more institutionally advanced environments.

Overall, the contribution of this paper lies in its regional comparative approach and its application of threshold techniques to previously underexamined economies. The remainder of the paper proceeds as follows: Section 2 reviews debt dynamics over time; Section 3 surveys the literature on debt and growth; Section 4 presents the data and discusses the methodology; Section 5 reports the results; and Section 6 concludes.

2. Debt dynamics

Despite a noticeable decline in government debt over the past two years, looking further back, the situation reveals an upward trend in government liabilities (Table 1). This upward trend is largely the result of two factors: first, in response to more frequent crises, governments have increased spending, aiming to alleviate the impact of these events, and second, the persistently low-interest rate during 2009-2018, has made debt financing more attractive (Hofmann et al. 2021) and a more feasible option compared to increasing taxes or reducing spending.

Table 1. Government debt in percent of GDP in Advanced Economies and EMDEs

Year	Advanced Economies	Emerging Market and Developing Economies
2006	73.38	36.97
2008	77.74	33.40
2010	97.38	37.40
2012	105.62	36.72
2014	103.70	39.86
2016	105.78	49.11
2018	102.95	52.57
2020	122.95	64.64
2022	112.28	64.17

Source: IMF World Economic Outlook, October 2023

Overall, the stock of government debt as percent to GDP rose from 73.38 percent in 2006 to a staggering 122.95 percent in 2020 and then dropped to 112.28 percent in 2022. The trajectory in Emerging Market and Developing Economies (EMDE), however, presents a slightly different picture. While they also exhibit pronounced increases during crises, with debt to GDP ratio increasing from 37 percent in 2006 to 64 percent in 2022, unlike advanced economies, EMDEs have consistently accumulated debt even in non-crisis periods, aiming to boost growth through increased spending (Kose, Ohnsorge, and Sugawara 2020).

The debt trends in our three focus regions, as presented in Table 2 below, offer an insightful perspective on how these regions compare with broader global trends. While experiencing an uptick in debt levels, each of these regions exhibit unique patterns regarding the magnitude of the debt increase.

Overall, Table 2 underscores the varied fiscal strategies and economic resilience exhibited by different regions in response to global economic challenges.

Table 2. Government debt in percent of GDP in selected regions

Year	Western Balkans	Selected EDE	Eurozone
2006	35.26	41.68	69.09
2008	31.89	40.60	70.62
2010	38.98	49.92	86.88
2012	47.81	51.85	93.96
2014	56.18	52.07	96.47
2016	56.57	53.22	93.50
2018	48.84	47.49	89.12
2020	54.82	56.43	100.30
2022	49.29	51.02	94.14

Source: IMF World Economic Outlook, October 2023

3. Literature review

The theoretical perspectives on the relationship between public debt and economic growth have evolved considerably. The Keynesian framework viewed debt as a short-run stabilizing tool that supports demand and employment, whereas Neoclassical models emphasized long-term costs, arguing that persistent borrowing raises interest rates, crowds out investment, and constrains potential output (Modigliani 1961; Diamond 1965; Barro 1979; Feldstein 1982). Building on this, the Ricardian equivalence hypothesis proposed that government borrowing may be neutral for aggregate demand because rational agents anticipate future tax liabilities and adjust their savings, accordingly, leaving consumption and investment unchanged (Barro 1974). Later, endogenous growth theories reconciled these views by recognizing that while fiscal expansion can stimulate short-term activity, excessive debt may hinder capital formation and productivity unless directed toward growth-enhancing investment (Romer 1986; Barro 1990).

As data became more widely available, research began to shed greater light on the debt–growth relationship. A growing body of evidence suggests that the impact of debt on growth is not one-directional. Early contributions by Barro (1991) and Fischer (1993) highlighted how fiscal imbalances and inflation—often associated with high public debt—tend to slow long-term growth. Subsequent cross-country analyses deepened this understanding. Pattillo, Poirson, and Ricci (2002, 2004) identified an inverted-U relationship between external debt and growth, suggesting that debt may initially stimulate economic performance but becomes detrimental beyond certain thresholds. Similar nonlinear or threshold effects were later reported by Reinhart and Rogoff (2010), Baum, Checcherita-Westphal, and Rother (2012), and Caner, Grennes, and Koehler-Geib (2010), each finding that excessive public debt levels are associated with diminishing or negative returns to growth. Collectively, these studies underscore that the relationship between debt and economic performance is conditional and nonlinear, varying across countries, debt composition, and institutional settings.

A pivotal contribution to this discourse is the work of Reinhart and Rogoff (2010), which stands as a cornerstone in understanding the public debt-growth dynamics. Their comprehensive analysis of historical data, spanning 200 years and encompassing 44 countries, finds that once gross government debt surpasses roughly 90 percent of GDP, it generally exerts a significant negative effect on economic growth. However, Herndon, Ash, and Pollin (2013) later revealed data and coding errors, showing that this rule lacked robustness and that the relationship is context dependent. This prompted more sophisticated empirical strategies. Building on Hansen's framework, Kumar and Woo (2010) modeled the nonlinear relationship between public debt and growth, showing that moderate debt can foster investment while excessive debt hinders growth through crowding-out and fiscal stress. Baum, Checcherita-Westphal, and Rother (2012) similarly found an inverted U-shaped debt–growth relationship in euro area economies. Extending this work, Mencinger, Aristovnik, and Verbič (2014) and Égert (2015) highlighted that debt thresholds vary across countries depending on institutional quality, fiscal credibility, and external conditions.

Recent research has advanced the empirical and methodological frontier by introducing greater flexibility and realism into models of debt–growth dynamics. Karadam (2018) identified asymmetry in this relationship, showing that low to moderate debt supports growth while excessive debt is detrimental, with thresholds varying by country and model specification. Building on this, Kitutila (2024) employed a Panel Smooth Transition Regression (PSTR) approach for Sub-Saharan Africa, revealing gradual rather than abrupt regime shifts, while Chen, Stengos, and Zhang (2024) used panel kink regressions to capture nonlinearities and cross-country heterogeneity.

Beyond the direct debt–growth relationship, empirical studies consistently emphasize the importance of controlling for other macroeconomic factors that condition growth outcomes. Variables such as trade openness, inflation, and initial income levels are frequently included to isolate the specific impact of public debt. Baum, Checcherita-Westphal, and Rother (2012) and Mendonça and Brito (2021) control for openness and capital formation to account for the role of external integration and investment, while Eberhardt and Presbitero (2015) highlight initial GDP per capita as a key determinant of cross-country heterogeneity in debt effects. These practices reflect the broader consensus that debt's influence on growth operates alongside structural and macroeconomic variables, reinforcing the need for a well-specified empirical framework.

In summary, the evolving literature demonstrates that the growth effects of debt are nonlinear, context-dependent, and mediated by institutional and macroeconomic conditions. These insights provide the theoretical and empirical foundation for employing a threshold framework in this paper, allowing the relationship between public debt and growth to vary across regimes and over time. By integrating structural (openness and inflation) and initial-condition

(income level) controls, the model aims to capture both the direct and conditional effects of debt on growth dynamics in diverse European and Western Balkan economies

4. Data and methodology

Building on the theoretical foundations and insights from the existing literature, this section outlines the empirical strategy employed to investigate the research questions. It provides a detailed account of the data sources, key variables, and the construction of the dataset, followed by an explanation of the model specification and its theoretical grounding.

The empirical analysis draws on several datasets. First, the dataset for the six Western Balkan countries is used, covering the period 2006-2022. As discussed in Section 2, these six countries make a specific grouping as per their similarities in terms of economic structure and level. Second, the analysis is expanded by adding data for the current four emerging economies that are members of the EU. Finally, the analysis is further expanded to include Eurozone economies that have joined the monetary union prior to 2007. A complete list of countries used in this analysis is attached to Annex 1.

On the data, per capita GDP and trade indicators are sourced from the World Bank's World Development Indicators (WDI), while all remaining variables are drawn from the IMF's *World Economic Outlook* (October 2023 edition). Table 2 provides a summary of the variables employed in the analysis, including their definitions and respective data sources. More detailed descriptions and broader definitions are presented in Annex 2.

Regarding the model specification and its theoretical grounding, it builds on two principal theoretical channels through which public debt is expected to influence economic growth. In the neoclassical tradition, Diamond (1965) and Barro (1979) show that moderate borrowing can stimulate aggregate demand and investment, but beyond a certain level it crowds out private capital, reduces savings, and requires distortionary taxation that depresses long-run growth. Endogenous growth theory (Romer 1986; Barro 1990) complements this view by emphasizing that debt-financed expenditure can enhance human and physical capital formation, but excessive borrowing increases macroeconomic risk, raises risk premia, and generates policy uncertainty that reduces incentives for private investment. These theoretical mechanisms all imply *nonlinear* effects of debt on growth: positive or neutral at low levels, and negative beyond a certain indebtedness threshold.

This theoretical duality motivates an empirical framework that allows the debt–growth relationship to vary across regimes defined by a data-driven threshold. Threshold models are particularly appropriate in this context because they operationalize the idea—present in both neoclassical and endogenous growth frameworks (Diamond 1965; Barro 1979; Romer 1986)—that the marginal effect of debt changes qualitatively once borrowing exceeds a fiscally sustainable or growth-compatible range. In this sense, the threshold model is not merely a statistical device but a direct empirical representation of well-established theoretical mechanisms, and one that has been widely applied in recent empirical work on nonlinear debt–growth dynamics (Caner and Hansen 2004; Baum, Checherita-Westphal, and Rother 2012).

Guided by this theoretical foundation, the baseline empirical analysis adopts a pooled least squares version of the static panel threshold regression framework, developed by Hansen (1996, 2000). The model is constructed with Y_{it} capturing real GDP growth and D_{it} measuring the contemporaneous public debt-to-GDP ratio for each country and year. To isolate the effect of public debt, the model includes the standard growth-theory control variables C_{it}: initial GDP per capita (to capture convergence), trade openness (to capture the benefits of international integration), and inflation (to proxy macroeconomic stability).

The model is expressed separately for regimes below and above the debt threshold δ:

Table 3. Data Definitions and Sources

Variable	Definition (as per source)	Source
GDP growth	Annual % change in constant-price GDP (expenditure-based).	
Debt	Gross general government debt; includes all liabilities requiring future repayment (GFSM 2001).	IMF, WEO database, Oct 2023
Inflation	Year-on-year % change in average consumer prices.	
Trade openness	Sum of exports and imports of goods and services (% of GDP).	World Bank, World Development Indicators
GDP per capita	GDP (constant 2015 USD) divided by midyear population.	

Low-debt regime ($D_{it} \leq \delta$)

$$Y_{it} = \beta_{0,1} + \beta_{1,1}D_{it} + \beta_{2,1}C_{it} + \varepsilon_{it} \qquad (1)$$

High-debt regime ($D_{it} > \delta$)

$$Y_{it} = \beta_{0,2} + \beta_{1,2}D_{it} + \beta_{2,2}C_{it} + \varepsilon_{it} \qquad (2)$$

Combined threshold specification

$$Y_{it} = \beta_{0,1}1\{D_{it} \leq \delta\} + \beta_{0,2}1\{D_{it} > \delta\} +$$
$$\beta_{1,1}D_{it}1\{D_{it} \leq \delta\} + \beta_{1,2}D_{it}1\{D_{it} > \delta\} +$$
$$\beta_{2,1}C_{it}1\{D_{it} \leq \delta\} + \beta_{2,2}C_{it}1\{D_{it} > \delta\} + \varepsilon_{it}. \qquad (3)$$

Here, $\beta_{1,1}$ and $\beta_{1,2}$ measure the marginal effect of debt in the low- and high-debt regimes, respectively. The coefficients $\beta_{2,1}$ and $\beta_{2,2}$ allow the impact of control variables to differ across regimes, thereby reflecting the possibility that openness, stabilization, or convergence channels operate differently at different debt levels.

The selection of control variables follows established empirical growth frameworks. Initial GDP per capita reflects conditional convergence (Barro 1991) and is measured using its 2005 value to mitigate endogeneity (Mencinger, Aristovnik, and Verbič 2014; Caner, Grennes, and Koehler-Geib 2010). Trade openness is widely recognized to enhance growth through technology diffusion, scale expansion, and export diversification (Pattillo, Poirson, and Ricci 2002; Hurić-Bjelan and Hadžiahmetović 2020). Inflation proxies macroeconomic instability, with theoretical and empirical evidence showing that high inflation distorts investment decisions, increases interest rate volatility, and amplifies debt-servicing burdens (Fischer 1993; Égert 2015). Together, these controls ground the empirical model firmly in mainstream growth theory.

Econometrically, the specification corresponds to the static panel threshold regression model developed by Hansen (1996, 2000). This approach enables the marginal effect of public debt on economic growth to vary endogenously across regimes separated by a data-driven threshold value δ of the debt-to-GDP ratio. In contrast to ad hoc piecewise regressions or spline approaches, Hansen's methodology allows the threshold, the regime-specific coefficients, and their statistical significance to be estimated jointly and consistently. This regime-dependent structure captures the nonlinearities emphasized in both neoclassical and endogenous growth theory, where the effects of debt on growth differ qualitatively at low versus high levels of indebtedness. Moreover, the model accommodates potential structural shifts in fiscal capacity, institutional quality, and macroeconomic constraints that arise as countries accumulate debt, thereby providing a theoretically coherent and empirically rigorous way

of modeling nonlinear fiscal–growth interactions.

Subsequent empirical applications in the debt–growth literature—such as Caner and Hansen (2004), Baum, Checherita-Westphal, and Rother (2012), and Mencinger, Aristovnik, and Verbič (2014)—have demonstrated the usefulness of the threshold approach for identifying nonlinearities and regime-dependent fiscal dynamics. These studies consistently report that debt tends to have small or statistically insignificant effects on growth below a country-specific threshold, whereas growth becomes significantly weaker once the threshold is exceeded. Related empirical contributions employing variants of Hansen's technique (Égert 2015; Karadam 2018; Chudik et al. 2015) likewise document threshold-type nonlinearities, often finding that the marginal effect of debt becomes increasingly negative as debt ratios rise. This accumulated evidence lends strong empirical support to the adoption of a threshold model in the present analysis and provides benchmark findings to which the current results can be compared.

Recent global analyses and meta-studies further reinforce the appropriateness of this specification. The World Bank's *Global Waves of Debt* report (Kose et al. 2020) presents comprehensive evidence that high and rising debt levels in emerging and developing economies are associated with weaker subsequent growth, heightened vulnerability to shocks, and greater macroeconomic instability—precisely the types of regime shifts captured by threshold models. Similarly, the IMF–World Bank Debt Sustainability Framework (DSF) operationalizes country-specific debt thresholds that vary with institutional strength, policy credibility, and macroeconomic fundamentals, closely mirroring the logic of Hansen-type threshold regressions. Complementary meta-analytic evidence and recent empirical work (Heimberger 2021; Augustine and Rafi 2023) confirm that the debt–growth relationship is inherently nonlinear and context-dependent, with no universal threshold applying across countries. Together, these contributions substantiate the theoretical and empirical justification for estimating a Hansen-style threshold model with standard growth controls, allowing for the heterogeneity and nonlinearities emphasized throughout the fiscal sustainability and development economics literature.

While the baseline threshold specification is static, both theory and empirical research highlight that the growth effects of public debt may materialize with a temporal lag. In neoclassical models, debt-financed stimulus raises demand immediately, but the negative effects—crowding out, higher taxation, and reduced capital accumulation—emerge gradually (Barro 1979; Diamond 1965). Endogenous growth models similarly

predict lagged effects via human capital accumulation and investment dynamics (Romer 1986). Empirical studies report analogous patterns: Pattillo, Poirson, and Ricci (2002), Baum, Checherita-Westphal, and Rother (2012), and Chudik et al. (2015) find that debt burdens affect growth with delay, particularly through debt servicing and risk premia channels.

To account for such dynamics, the baseline two-regime threshold model is augmented by including a one-period lag of the debt-to-GDP ratio, D_{it-1}, as follows:

$$Y_{it} = \beta_{0,1} 1\{D_{it} \leq \delta\} + \beta_{0,2} 1\{D_{it} > \delta\} +$$
$$\beta_{1,1} D_{it} 1\{D_{it} \leq \delta\} + \beta_{1,2} D_{it} 1\{D_{it} > \delta\} +$$
$$\theta_1 D_{it-1} 1\{D_{it} \leq \delta\} + \theta_2 D_{it-1} 1\{D_{it} > \delta\} +$$
$$\beta_{2,1} C_{it} 1\{D_{it} \leq \delta\} + \beta_{2,2} C_{it} 1\{D_{it} > \delta\} + \varepsilon_{it}. \qquad (4)$$

The parameters θ_1 and θ_2 capture the delayed effects of debt in the low- and high-debt regimes, respectively. To evaluate whether these lagged effects differ significantly between regimes, a Wald test of the null hypothesis $H_0 : \theta_1 = \theta_2 = 0$ is conducted following Baum, Checherita-Westphal, and Rother (2012).

This specification enables the model to capture both nonlinear (threshold-based) and dynamic (time-dependent) channels through which public debt affects growth, thereby reflecting the short-run stimulus and longer-run debt-overhang mechanisms emphasized in the theoretical and empirical literature.

5. Empirical results

This section outlines the empirical implementation of the threshold regression framework. It begins by describing the composition and characteristics of the regional samples used in the analysis, followed by the formal testing procedure for the existence of a debt threshold. Once the presence of a threshold is established, the section presents the estimated threshold values and regime-specific coefficients for each regional group. The final subsection introduces a dynamic robustness check that incorporates lagged debt to examine whether the growth effects of debt materialize with delay.

Regarding the composition and characteristics of the regional samples used in the analysis, the Western Balkan countries form the core sample, reflecting their relatively limited fiscal space, shallow financial markets, and heightened vulnerability to external shocks. These features imply a lower debt-carrying capacity and make it plausible that even moderate increases in public debt may trigger growth-reducing effects in the region.

To assess whether these patterns are specific to the Western Balkans or also present in economies with similar developmental legacies but stronger institutional anchors, the sample is expanded to include four EU member states that were classified as emerging and developing economies at the time this dataset was initially compiled. These countries—Bulgaria, Hungary, Poland, and Romania—share structural and historical similarities with the Western Balkans but differ in one key respect: they have benefited from many years of EU membership, which provides enhanced policy credibility, access to EU structural funds, and more advanced fiscal and regulatory frameworks. Their inclusion allows us to examine whether EU-related institutional improvements meaningfully shift the debt–growth threshold, while maintaining comparability with the Western Balkan sample.

The third group comprises Eurozone economies that joined the monetary union prior to 2007. Restricting the Eurozone sample to countries that were already members before the beginning of the estimation window (2006–2022) ensures that all economies in this group operated under a stable common monetary and institutional environment throughout the full sample period. These advanced economies typically possess deeper financial markets, broader fiscal capacity, and stronger institutional quality, which collectively enable them to sustain substantially higher public debt ratios without immediate adverse effects on growth.

Taken together, the three samples represent a deliberate gradient of institutional and economic development—from transition economies with constrained fiscal space, to emerging EU members with strengthened policy frameworks, and finally to advanced Eurozone economies. This structure enhances the interpretability of the empirical findings, allowing the analysis to identify not only whether debt thresholds exist, but also how institutional capacity and economic structure shape the point at which public debt becomes growth-reducing.

Having described the sample composition and its relevance for the empirical analysis, the next step is to establish whether a statistically significant debt threshold exists. To empirically validate the applicability of the threshold regression model outlined in Equation (3), an initial test is conducted to ascertain the presence of a threshold in the debt-to-growth relationship. This test determines whether the slope coefficients and intercepts are identical across the two regimes, as presumed by the null hypothesis:

$$H_0: \beta_{0,1} = \beta_{0,2}; \ \beta_{1,1} = \beta_{1,2}; \quad \beta_{2,1} = \beta_{2,2}.$$

This null hypothesis implies that if the public debt-to-GDP ratio does not exert a differential impact on economic growth at varying levels, then the coefficients in both the low-debt and high-debt regimes should be statistically indistinguishable.

Using the heteroskedasticity-consistent Lagrange Multiplier test to detect the existence of the threshold in the data, the null hypothesis is rejected, thus confirming the presence of a threshold effect. Such findings open the way for a threshold regression model as per Equation (3), including the estimation of the unknown threshold value δ. Given the complexities involved in estimating threshold models, including the potential biases arising from small samples and the likelihood that the ratio test statistic may not adhere to the standard asymptotic distribution, bootstrap p-values for testing the null hypothesis are utilized. Bootstrap methods, as demonstrated by Hansen (1996), are effective in replicating the asymptotic distribution of the test statistic, thus providing more reliable inference in the context of threshold models.

The null hypothesis for all three groups of countries is rejected, indicating the presence of a threshold in the relationship between public debt and GDP growth. However, notable differences exist between the groups. In the Western Balkan countries, a critical threshold of 22.20 percent for the debt-to-GDP ratio is identified, above which increasing public debt negatively impacts GDP growth. The thresholds for the selected EDE countries and Eurozone economies are found to be much higher, at 37.4 and 82.8 percent respectively. These differences underscore the diverse economic structures, policies, and the quality of government spending and the overall institutional

efficiency, highlighting the need for tailored contextual approaches to debt management and growth.

The coefficient for the debt-to-GDP ratio is statistically significant across all groups presented in the following three tables, indicating its importance in influencing GDP growth. Except for the lower debt regime in the Western Balkans, inflation is positively associated with growth. Trade openness demonstrates a positive relationship with GDP growth across all groups, suggesting the importance of international trade in driving economic expansion. The initial per capita GDP coefficient is consistently negative and significant, highlighting the role of starting economic conditions in shaping growth trajectories. These findings emphasize the multifaceted nature of the debt-growth relationship and underscore the importance of considering various economic factors when formulating policy interventions. The following subsections offer more details.

a) Western Balkan

Findings for Western Balkan countries in Table 4 indicate a nonlinear relationship between public debt and GDP growth, marked by a critical juncture at a 22.20 percent debt-to-GDP ratio. When the public debt is below or equal to this threshold, an increase in the public debt-to-GDP ratio positively impacts on GDP growth, and negatively if debt levels exceed this threshold. Regarding control variables, the results show that higher inflation rates adversely affect GDP growth under the low debt regime, while under the higher debt regime its impact on growth turns positive. Although a slightly higher average inflation

Table 4. Regression results for the Western Balkan countries

Lower debt regime with debt-to-GDP ≤ 22.20 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	0.1076	0.00771	13.96	0.000	0.0925	0.1227
Inflation	-0.1466	0.01115	-13.14	0.000	-0.1684	-0.1247
Trade openness	0.0350	0.00417	8.40	0.000	0.0268	0.0432
Initial GDP per capita	-0.0001	0.00001	-0.59	0.557	0.0002	0.0001

Higher debt regime with debt-to-GDP > 22.20 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	-0.0110	0.00173	-6.34	0.000	-0.0144	-0.0076
Inflation	0.1735	0.00817	21.24	0.000	0.1575	0.1895
Trade openness	0.0306	0.00157	19.50	0.000	0.0276	0.0337
Initial GDP per capita	-0.0004	0.00004	-10.35	0.000	0.0005	0.0003

under the lower debt regime might partially explain its negative contribution to growth in the Western Balkans, further investigations in this relationship is needed. A more comprehensive analysis is essential to fully elucidate the dynamics of this transition in the inflation-growth relationship. Trade openness exhibits a significant positive impact on growth under both regimes, while the initial GDP per capita has a rather low coefficient in both regimes, albeit with different signs and not significant under the low debt regime.

The identified threshold of 22.20 percent for the Western Balkan countries is notably lower compared to other similar studies and datasets assessed in this paper. This could be attributed to a multitude of factors distinctive to the Western Balkan region, such as profound and delayed economic transformations and a legacy of inherited debt, among others. These findings underscore the unique economic dynamics at play within the Western Balkans, offering valuable insights for both policymakers and economists when considering the implications of public debt on growth.

b) Selected Emerging and Developing European countries

The analysis of the selected EDE countries reveals nuanced insights into the debt-growth nexus (Table 5). Unlike in the case of the Western Balkans only, where a 22.4 percent threshold was identified, the expanded dataset suggests a higher threshold of 37.4 percent, which is statistically significant as evidenced by bootstrap p-values. All control variables seem to have positive impact on GDP growth in both scenarios.

These findings suggest that initial economic conditions, represented by per capita GDP, impact the relationship between public debt and growth. Also, the debt thresholds differences between the datasets could reflect broader economic conditions, the scale of economic activities, and the fact that the additional emerging and developing countries included in the analysis are part of the European Union.

c) Eurozone

In line with the above findings for the Western Balkans and the EDE countries, the analysis of Eurozone economies confirms the nonlinear dynamic relationship between public debt and economic growth (Table 6). Though, the threshold of 82.6 percent is notably higher, beyond which the relationship becomes negative, aligning with the hypothesized detrimental impact of high debt levels on economic performance. In the higher debt regime, inflation has a surprisingly high positive coefficient, while trade openness retains its positive influence on GDP growth. In both the lower and higher public debt regimes, we observe a negative coefficient for Initial GDP per capita. This may suggest that economies with higher initial levels of GDP per capita experience slower rates of economic growth, which aligns with the economic principle known as 'convergence theory'.

These findings highlight the unique economic dynamics within the Eurozone and underscore the importance of understanding the underlying factors for specific thresholds and debt-growth dynamics in different regions when formulating effective debt management and growth strategies.

Table 5. Regression results for selected Emerging and Developing European countries

Lower debt regime with debt-to-GDP ≤ 37.4 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	0.0160	0.00474	3.380	0.001	0.007	0.025
Inflation	0.2951	0.00939	31.410	0.000	0.277	0.313
Trade openness	0.0221	0.00158	14.020	0.000	0.019	0.025
Initial GDP per capita	0.0001	0.00005	2.070	0.039	0.000	0.000

Higher debt regime with debt-to-GDP > 37.40 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	-0.04544	0.00185	-24.580	0.000	-0.049	-0.042
Inflation	0.07915	0.00703	11.250	0.000	0.065	0.093
Trade openness	0.00133	0.00107	1.250	0.212	-0.001	0.003
Initial GDP per capita	0.00003	0.00001	3.310	0.001	0.000	0.000

Table 6. Summary of regression results for the Eurozone countries

Lower debt regime with debt-to-GDP ≤ 82.6 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	0.0068	0.000862	7.92	0.0004	0.0051	0.0085
Inflation	0.1789	0.005480	32.64	0.0000	0.1681	0.1896
Trade openness	0.0442	0.000298	148.45	0.0000	0.0436	0.0448
Initial GDP per capita	-0.0001	0.000001	-103.80	0.0000	-0.0001	-0.0001

Higher debt regime with debt-to-GDP > 82.6 percent

GDP Growth	Coef.	St. err.	t-value	p-value	[95% Conf. Interval]	
Debt (percent to GDP)	-0.01862	0.0005	-41.1	0.0000	-0.01951	-0.01774
Inflation	0.44003	0.0054	81.78	0.0000	0.42974	0.45085
Trade openness	0.02149	0.0003	64.59	0.0000	0.02084	0.02214
Initial GDP per capita	-0.00005	1.9000	-23.80	0.0000	-0.00005	-0.00041

d) Lagged effects of debt

To examine whether the effect of public debt on growth unfolds with delay, the baseline threshold model was augmented with a one-period lag of the debt-to-GDP ratio for the Western Balkan region. This dynamic extension captures the possibility that debt-financed spending may influence growth gradually, while excessive debt may exert immediate contractionary effects.

In the low-debt regime, the contemporary debt coefficient is negative but statistically weak, whereas the lagged debt term is positive. This pattern suggests that moderate borrowing does not stimulate growth immediately but yields delayed gains—consistent with the gradual payoff of public investment.

In the high-debt regime, current debt exerts a strong and highly significant negative effect, confirming short-run debt-overhang pressures. The lagged debt coefficient, however, is again positive and significant, indicating that past borrowing may partially offset the immediate drag, possibly reflecting consolidation efforts or the eventual productivity of earlier investment.

The combined model, which incorporates both regimes and a regime interaction term, reinforces these dynamics: current debt remains strongly negative, lagged debt remains strongly positive, and the regime interaction is mildly negative, suggesting that delayed benefits weaken as debt surpasses the threshold.

The Wald test for equality of lagged effects across regimes ($\theta_1 = \theta_2$) fails to reject the null hypothesis, indicating that the delayed adjustment mechanism operates similarly regardless of regime. Overall, the dynamic model supports the baseline findings: debt has immediate contractionary effects at higher levels, while lagged debt contributes positively, aligning with theoretical expectations of short-run overhang and medium-run adjustment (Baum, Checcherita-Westphal, and Rother 2012; Chudik et al. 2015).

Table 7. Dynamic threshold regressions with lagged debt effects (Fixed Effects, cluster-robust SEs)

Variable	Low-debt regime	High-debt regime	Combined model
Debt (current)	−0.229	−0.450	−0.472
Debt (lagged)	0.383	+0.396	+0.397
Regime. interaction (D_regime)	—	—	−0.170 (0.10)
Inflation	−0.247	−0.035	−0.082
Trade openness	0.029	+0.034	+0.039
R² (within)	0.23	0.58	0.57
N	17	79	96
Wald test ($\theta_1=\theta_2$)	—	—	F(1,5)=0.05, p=0.83

As seen in the previous sections, the analysis reveals marked variation in debt thresholds across the three groups. For the Western Balkans, the results suggest a notably low debt threshold, indicating that even relatively modest debt levels may begin to constrain growth. This likely reflects the region's still-developing institutional frameworks, limited revenue mobilization capacity, shallow financial markets, and a legacy of delayed transitions. These structural weaknesses can magnify the adverse effects of public debt, as governments face elevated borrowing costs, reduced fiscal space, and heightened investor caution.

In this context, policymakers in the Western Balkans should prioritize strengthening the foundations of fiscal and economic governance—including public debt management institutions, budgetary credibility, and macroeconomic coordination. These reforms are essential for enhancing the region's debt-carrying capacity over time and enabling more effective countercyclical fiscal policy as institutional maturity improves.

That said, these findings should be interpreted with appropriate caution. This analysis offers a single empirical contribution to a complex and evolving issue. The estimated thresholds are influenced by limitations inherent in the dataset, including sample size constraints, data quality issues, and a relatively short time horizon. Accordingly, the results should not be treated as definitive policy benchmarks, but rather as indicative reference points that warrant further examination. Continued research—especially country-specific studies employing alternative methodologies and longer time frames—is essential to advance the understanding of debt-growth dynamics and to inform more nuanced, context-specific guidance for prudent public debt accumulation in the region.

The higher threshold observed among EU EDE countries likely reflects the institutional and credibility benefits associated with EU membership, including access to structural funds, stronger policy frameworks, and enhanced investor confidence. Meanwhile, the much higher threshold found in the Eurozone is consistent with the characteristics of advanced economies, such as broader fiscal space, deeper financial markets, and access to the European Central Bank's monetary instruments. These factors collectively enable them to sustain higher public debt levels without immediate growth repercussions.

6. Conclusion

This paper offers a detailed examination of the impact of public debt on economic growth across diverse European economies, with a focus on the Western Balkans, a region often underrepresented in economic literature. Findings not only confirm the non-linear relationship between public debt and economic growth but also identify region-specific debt thresholds that diverge notably from previous studies. In the Western Balkan countries, the critical debt-to-GDP threshold stands at 22.4 percent, a relatively low threshold which may reflect the regions' economic vulnerabilities and structural inefficiencies.

For selected emerging European economies, the threshold is established at a higher level, 37.40 percent. While for the Eurozone countries it is established at a much higher level of 82.6 percent, suggesting that these economies are characterized by stronger economic foundations and robust debt management frameworks, which can sustain higher debt levels without adverse growth impacts.

Nonetheless, the implications of these findings are clear: there is no one-size-fits-all debt threshold for economic growth. Consequently, each region must tailor its fiscal policies to align with its economic conditions, institutional frameworks, and growth aspirations. For the lower-income nations of Europe, the Eurozone's adept handling of higher debt levels provides a benchmark and a set of strategic lessons for balancing debt accumulation with economic sustainability and growth.

This research, while shedding light on the critical relationship between public debt and economic growth across various European regions, is not without limitations. Economic growth is affected by multiple factors, one of which may be public debt. While the estimation model incorporates a number of control variables that impact growth, there are other factors that are not part of this analysis. Additionally, the paper's focus on GDP growth as the sole indicator of economic performance may overlook other important factors, such as employment rates, income inequality, and social welfare. Thus, future studies could expand upon this research by incorporating additional macroeconomic variables that reflect the diverse economic conditions and structural idiosyncrasies of each region. Further research might also consider the qualitative aspects of public debt, such as the composition of

creditors, debt maturity profiles, and currency denomination, which can significantly influence the debt's impact on economic growth.

In conclusion, this paper enhances our understanding of the intricate balance between debt and growth. It confirms that while public debt can fuel economic expansion within certain bounds, surpassing these bounds may hinder economic vitality. The challenge for policymakers is to discern these region-specific thresholds and to craft fiscal strategies that straddle the delicate line between beneficial and detrimental debt levels. As such, this analysis not only informs current fiscal policy debates, but also adds a nuanced perspective to the broader discourse on economic growth and debt sustainability in different European regions. The higher thresholds observed in the more developed regions of Europe suggest that strengthening economic foundations and debt management strategies enable countries sustain higher debt levels without adverse effects on growth.

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Annex 1: List of countries and their grouping used in the analyses

Western Balkan	Emerging and Developing Europe (selected countries)	Eurozone (countries that joined Eurozone before 2007)
Albania	Albania	Austria
Bosnia and Herzegovina	Bosnia and Herzegovina	Belgium
Kosova	Bulgaria	Finland
Montenegro	Hungary	France
North Macedonia	Montenegro	Germany
Serbia	North Macedonia	Greece
	Poland	Ireland
	Romania	Italy
	Serbia	Luxembourg
		Netherlands
		Portugal
		Spain

Annex 2: Data source and definition

Variables	As defined by the source	Source
GDP growth	Annual percentages of constant price GDP are year-on-year changes; the base year is country-specific. Expenditure-based GDP is total final expenditures at purchasers' prices (including the f.o.b. value of exports of goods and services), less the f.o.b. value of imports of goods and services. [SNA 1993]	International Monetary Fund, World Economic Outlook Database, October 2023
Debt	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable. Thus, all liabilities in the GFSM 2001 system are debt, except for equity and investment fund shares and financial derivatives and employee stock options. Debt can be valued at current market, nominal, or face values (GFSM 2001, paragraph 7.110).	
Inflation	Annual percentages of average consumer prices are year-on-year changes.	
Exports of goods and services	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	World Bank World Development Indicators
Imports of goods and services	Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.	
GDP per capita	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2015 U.S. dollars.	

Annex 3: Descriptive statistics

**Table 3.1. Summary of data for Western Balkan countries**

Variable	Obs.	Mean	Std. Dev.	Min	Max
Countries	102	3.5	1.716	1	6
Years	102	2014	4.923	2006	2022
GDP Growth	102	3.104	3.644	-15.31	13.04
Debt (percent to GDP)	102	43.796	20.956	5.57	107.35
Inflation	102	3.149	3.594	-2.42	14.21
Trade openness	102	94.756	19.858	59.83	170.82
Initial GDP per capita	102	3532.967	948.819	2284.59	5013.2

Figure 3.1. Debt (percent to GDP) over years for Western Balkan countries
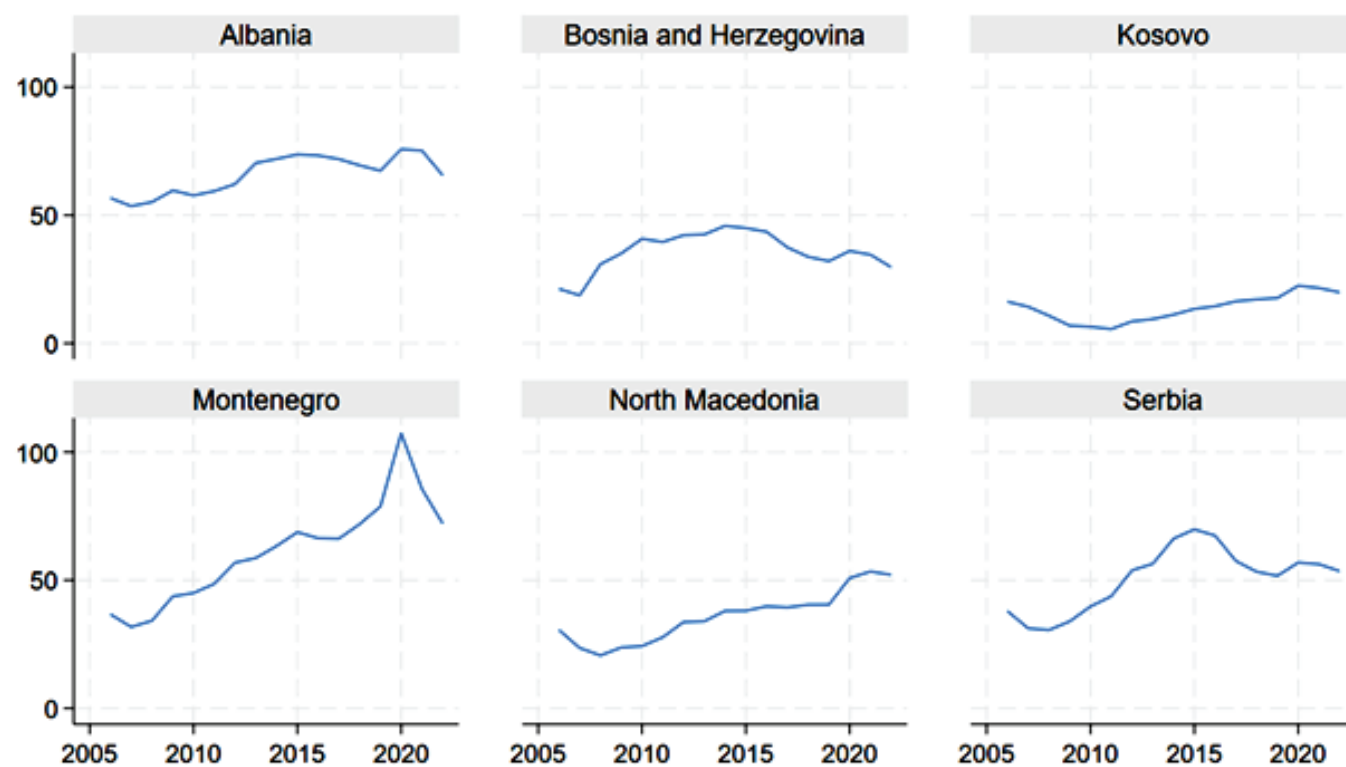
Table 3.2. Summary of data for the selected Emerging and Developing Europe

Variable	Obs.	Mean	Std. Dev.	Min	Max
Countries	153	5.778	2.907	1	10
Years	153	2014	4.915	2006	2022
GDP Growth	153	2.909	3.571	-15.31	13.04
Debt (percent to GDP)	153	47.589	19.43	12.43	107.35
Inflation	153	3.442	3.614	-1.6	14.55
Trade openness	153	104.563	28.338	58.47	186.72
Initial GDP per capita	153	5589.759	2625.351	2675.51	11278.62

Figure 3.2. Debt (percent to GDP) over years for the selected Emerging and Developing Europe
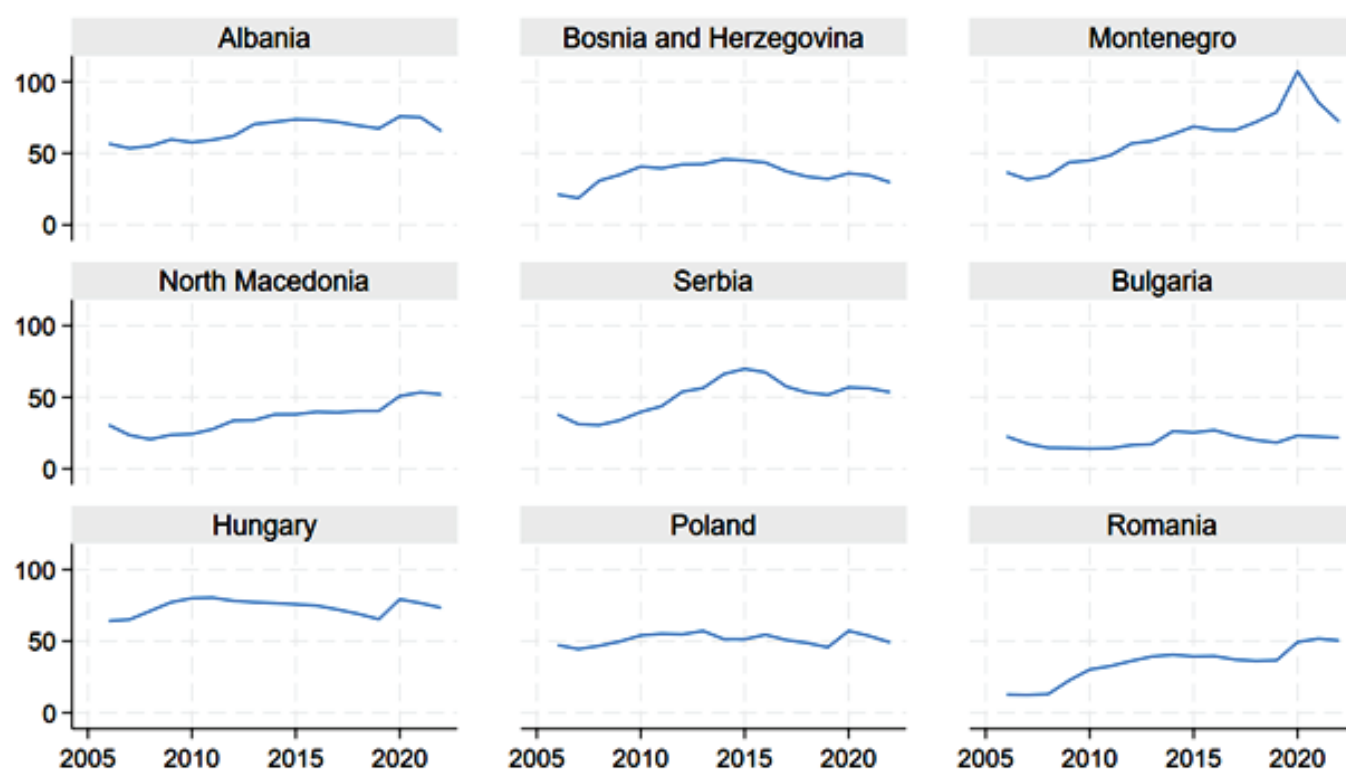
Table 3.3. Summary of data for the Eurozone

Variable	Obs.	Mean	Std. Dev.	Min	Max
Countries	204	16.5	3.461	11	22
Years	204	2014	4.911	2006	2022
GDP Growth	204	1.422	3.991	-11.17	24.48
Debt (percent to GDP)	204	86.415	40.647	8.1	212.43
Inflation	204	1.931	2.103	-1.68	11.63
Trade openness	204	119.456	80.333	45.42	393.14
Initial GDP per capita	204	40561.682	20228.12	19224.029	101222.05

Figure 3.3. Debt (percent to GDP) over years for the Eurozone