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Public Debt Sustainability in the Eurozone: An Empirical Assessment Using Macroeconomic Indicators

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Abstract

This study examines public debt sustainability in the Eurozone by estimating fiscal reaction functions that assess how fiscal balances respond to rising public debt under heterogeneous macroeconomic conditions. Using annual panel data for 20 EU countries from 2000 to 2024, we employ fixed effects, system Generalized Method of Moments (GMM), and nonlinear specifications grounded in the intertemporal budget constraint framework. The results indicate that, under fixed effects, fiscal balances respond negatively to higher debt levels, consistent with the presence of fiscal fatigue. In contrast, dynamic GMM estimates reveal weak or statistically insignificant debt responses, while confirming strong fiscal persistence and a positive role for economic growth. Nonlinear specifications suggest that fiscal responsiveness weakens at high debt levels, with adjustment capacity further strained during major crisis episodes. Inflation and interest rates exert adverse effects on fiscal balances, whereas GDP growth supports fiscal sustainability. In summary, the findings highlight substantial cross-country heterogeneity and raise doubts about the effectiveness of uniform fiscal rules in the European Union, lending support to calls for more flexible and country-specific fiscal frameworks.

Keywords: debt dynamics; public debt sustainability; Eurozone fiscal policy; fiscal fatigue; fiscal nonlinearity; system Generalized Method of Moments

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1. Introduction

Public debt sustainability remains a core concern within the European Union, particularly following successive crises that have expanded fiscal deficits and maintained high debt burdens across member states. Recent assessments from the European Commission show persistent fiscal sustainability challenges across the short, medium, and long term, with general government debt ratios in the euro area remaining elevated near 87–88% of GDP. At the same time, the European Central Bank highlights structural pressures, including demographic aging, climate-related fiscal costs, and rising debt service costs—that continue to complicate fiscal sustainability efforts. From the global financial crisis of 2008 to the sovereign debt turmoil of the early 2010s and the COVID-19 pandemic, EU governments have faced repeated shocks that severely challenged fiscal stability. These

developments have reignited debate over the adequacy of existing fiscal frameworks, particularly the Stability and Growth Pact, whose constraints have proven difficult to reconcile with crisis management and medium-term debt sustainability (Darvas et al., 2023; European Commission, 2025).

Sustainability is typically assessed through the IBC, which requires the present value of future primary surpluses to match or exceed the existing debt stock. Empirically, this translates into a positive response of fiscal balances to rising debt ratios. The fiscal reaction function (FRF) framework proposed by Bohn (1998) provides a standard method for testing this condition. However, recent studies suggest that this response may be nonlinear or constrained, particularly in countries with high debt burdens or weak institutions (Darvas et al., 2023; Ghosh et al., 2013). While the FRF framework has been widely applied, gaps remain. Prior studies tend to focus on linear specifications, overlook nonlinearity due to fiscal fatigue, and rarely address robustness across estimation techniques. Moreover, there is limited empirical exploration of fiscal responses during crisis periods and institutional asymmetries across EU countries.

This study addresses these issues by estimating both linear and nonlinear fiscal reaction functions for 20 EU countries over the period 2000–2024. We employ fixed effects and system Generalized Method of Moments (GMM) estimators to control for country-specific heterogeneity and endogeneity. In addition, we test for nonlinear and threshold-type fiscal responses to examine whether fiscal responses weaken beyond specific debt levels. The analysis controls key macroeconomic variables, including GDP growth, inflation, and long-term interest rates.

Results show mixed evidence for debt sustainability. Fixed effects estimates suggest partial compliance with the IBC, while GMM estimates indicate weaker or insignificant fiscal responses. Threshold models support the presence of fiscal fatigue, particularly during crisis periods. These findings highlight cross-country heterogeneity and suggest that uniform fiscal rules may be inadequate.

This study contributes to the literature by combining panel-based estimation with country-level analysis to assess public debt sustainability in the Eurozone. While panel fiscal reaction functions allow identification of systematic fiscal responses to rising debt under common macroeconomic shocks and unobserved heterogeneity, they may mask important cross-country differences. To address this limitation, we complement the panel estimates with country-specific regressions and descriptive evidence, highlighting substantial heterogeneity in fiscal adjustment behavior across member states. This dual approach strengthens the empirical analysis and directly informs the debate on whether uniform fiscal rules are appropriate for structurally diverse economies within the European Union.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 describes the data and methodology. Section 4 presents the results. Section 5 discusses implications for policy. Section 6 concludes.

2. Literature Review

2.1. Theoretical Framework

The notion of public debt sustainability rests on the IBC, which requires that the present value of future primary surpluses be sufficient to offset the current debt stock. This ensures that governments do not rely on perpetual refinancing, which would imply fiscal insolvency (Bohn, 1998; Escolano, 2010). Formally, sustainability holds when:

$$\sum_{t=0}^{\infty} \frac{PB_t}{(1+r)^t} \geq D_0 \quad (1)$$

where PB_t denotes the primary balance, r is the effective interest rate, and D_0 is the current level of public debt. The relationship between the interest rate r and GDP growth rate g is central to this condition. When $r > g$, debt-to-GDP ratios tend to increase unless offset by persistent primary surpluses. Conversely, if $r < g$, debt can stabilize or decline without active consolidation, a scenario observed in some recent policy environments (Blanchard, 2019). The standard debt dynamics identity is expressed as:

$$d_t = \left(\frac{1 + r_t}{1 + g_t} \right) d_{t-1} - pb_t \quad (2)$$

where d_t is the debt-to-GDP ratio and pb_t is the primary balance as a share of GDP. This formulation illustrates that debt sustainability is influenced not only by fiscal policy but also by macroeconomic variables like interest rates and growth.

The interest-growth differential ($r - g$) is especially important: larger differentials increase the fiscal effort required for sustainability (Mauro & Zhou, 2021). Bohn (1998) introduced the FRF to empirically test adherence to the IBC by assessing whether governments systematically raise their primary balances in response to rising debt ratios. A positive and statistically significant coefficient on lagged debt implies a stabilizing fiscal response. More recent extensions incorporate non-linearities (e.g., fiscal fatigue at high debt levels), regime-switching behavior, and institutional quality as additional determinants of fiscal conduct (Escolano, 2010; Ghosh et al., 2013). This framework provides the theoretical foundation for our empirical analysis. By estimating both linear and nonlinear FRFs across EU countries, we evaluate the extent to which fiscal policy has been consistent with the IBC over the past two decades.

2.2. Empirical Evidence on EU Debt Sustainability

Empirical studies on public debt sustainability in the Eurozone yield mixed results, reflecting heterogeneity in fiscal institutions, macroeconomic conditions, and exposure to economic crises. Early contributions using linear fiscal reaction functions (FRFs) often found evidence of stabilizing fiscal behavior, particularly in core EU economies (Galí & Perotti, 2003). However, later research questioned the robustness of these findings once nonlinear dynamics, crisis episodes, and endogeneity were explicitly considered.

A growing body of empirical work documents weakened fiscal responses in high-debt environments. Ghosh et al. (2013) provides early cross-country evidence of fiscal fatigue, showing that governments' ability to adjust primary balances declines beyond certain debt thresholds. Focusing on the Eurozone, Staehr et al. (2024) demonstrate that inflation surprises and crisis periods significantly distort fiscal reaction functions, reducing governments' capacity to stabilize debt. Similarly, Owusu et al. (2025) apply regime-based models and find that fiscal behavior differs markedly across debt regimes and macroeconomic states.

Recent studies further emphasize nonlinear and regime-dependent fiscal dynamics. Owusu et al. (2025) uses Panel Smooth Transition Regression (PSTR) for euro-area countries, identifying distinct low- and high-debt regimes, with fiscal adjustment occurring primarily once debt reaches elevated levels. Complementing this evidence, El-Naser et al. (2025) employ dynamic panel GMM estimators for EU countries and show that debt sustainability is strongly path-dependent, with fiscal adjustment shaped by macroeconomic and policy conditions. Similarly, Afonso et al. (2025) links fiscal reaction behavior to sovereign risk dynamics, demonstrating that fiscal sustainability outcomes vary across regimes and are closely tied to external and financial pressures in European economies.

The interaction between monetary policy and fiscal sustainability has also received increasing attention. Dascher-Preising and Greiner (2023) find that interest rates and

inflation significantly influence fiscal balances in the euro area, highlighting the importance of monetary–fiscal interactions for debt dynamics. Extending this line of inquiry, [Afonso and Gomes-Pereira \(2025\)](#) show that accommodative monetary policy temporarily supports fiscal sustainability, whereas monetary tightening weakens fiscal balances, particularly in highly indebted countries. Complementary evidence by [Afonso et al. \(2025\)](#) indicates that inflation and external financial conditions are key determinants of cross-country differences in fiscal sustainability outcomes.

Policy-oriented assessments reinforce these empirical findings. [Bulíř and Chauhan \(2025\)](#), applying Bohn’s framework to European data, find limited evidence of consistent stabilizing fiscal responses once structural constraints are accounted for. Similarly, recent analyses by [Afonso and Miranda \(2025\)](#) document uneven compliance with fiscal sustainability conditions across Eurozone members, underscoring the limits of uniform fiscal benchmarks.

The COVID-19 pandemic further complicated fiscal dynamics. [European Commission \(2025\)](#) assessments show that gross financing needs surged across several EU countries despite the temporary suspension of fiscal rules, reviving concerns about long-term sustainability. At the same time, [Checherita-Westphal and Pessó \(2024\)](#) highlight rising vulnerabilities associated with higher interest rates, demographic pressures, and climate-related fiscal risks, strengthening the case for updated and more flexible empirical assessments of debt sustainability.

2.3. Gaps in Existing Research

Despite substantial methodological advances, several gaps persist in the empirical literature on Eurozone debt sustainability. First, many studies rely either on pooled panel models that may obscure country-specific fiscal behavior or on single-country time-series analyses that limit external validity. Recent contributions increasingly emphasize the need to combine panel-based inference with country-level evidence to capture both systematic fiscal responses and national heterogeneity ([Darvas et al., 2023](#)).

Second, although nonlinear approaches—such as Panel Smooth Transition Regression and regime-switching models—have gained prominence, their application is often restricted to shorter time spans or specific subsamples. Moreover, robustness across estimation techniques, particularly direct comparisons between fixed effects and dynamic GMM estimators, remains relatively scarce in Eurozone-focused studies.

Third, institutional and structural determinants of fiscal behavior, including fiscal rule design, demographic aging, and climate-related investment pressures—are widely discussed in policy-oriented analyses but remain only partially integrated into econometric models. For example, [Mühlenweg and Gerling \(2023\)](#) show that strict fiscal rules may crowd out public investment, raising concerns about the trade-off between short-term consolidation and long-term growth. However, systematic cross-country empirical evidence on these mechanisms is still limited.

This study contributes to literature by addressing these gaps in three ways. First, it combines panel fiscal reaction functions with country-specific analysis to explicitly account for heterogeneity in fiscal behavior. Second, it evaluates robustness across fixed effects, system GMM, and nonlinear threshold specifications using recent data through 2024. Third, while focusing on core macroeconomic drivers, it situates the empirical findings within broader institutional and policy debates on EU fiscal governance. In doing so, the paper provides updated and policy-relevant evidence on the limits of uniform fiscal rules in a heterogeneous monetary union.

3. Method

3.1. Data and Variables

This study uses the Global Macro Database: A New International Macroeconomic Dataset compiled by Müller et al. (2025). It provides long-run annual macroeconomic indicators for over 232 countries, including EU member states. The data are standardized and harmonized for cross-country comparability. We focus on 20 EU countries with complete and consistent data coverage from 2000 to 2024. This period captures the post-Maastricht era, the introduction of the euro, the global financial crisis, the European sovereign debt crisis, and the COVID-19 shock. The variables and measurements are shown in Table 1. While the intertemporal budget constraint is formally defined in terms of the primary balance, we use the overall government budget balance due to data availability and comparability across countries; this measure captures both fiscal effort and debt-service pressures relevant for sustainability assessments.

Table 1. Key macroeconomic indicators for EU countries are expressed as percentages of GDP or annual changes in current USD.

Variable	Measurement
General Government Gross Debt	% of GDP
General Government Budget Balance	% of GDP
Real GDP Growth Rate	Annual % change
Nominal GDP	Current USD (billions)
Inflation Rate (CPI)	Annual % change
Long-term Interest Rate	Annual % rate

Note: All fiscal variables are expressed as percentages of GDP.

The General Government Gross Debt (% of GDP) captures the total stock of government liabilities relative to economic output. It is widely used as a benchmark for assessing fiscal sustainability and solvency risks. General Government Budget Balance (% of GDP) is a measure of fiscal discipline; the budget balance reflects whether a government is running a surplus or deficit. Persistent primary deficits are strong predictors of unsustainable debt paths (Bohn, 1998). Real GDP growth indicates economic performance and determines the denominator in the debt-to-GDP ratio. A sustained growth differential (growth > interest rate) is crucial for stabilizing debt (Escolano, 2010). Nominal GDP is used to calculate fiscal ratios and to make international comparisons. It is also important for assessing the debt burden in nominal terms (Blanchard et al., 2021). Inflation affects the real value of outstanding debt and nominal interest payments. Moderate inflation can facilitate debt reduction, while deflation worsens debt burdens (Alesina & Ardagna, 2010). Short-term and Long-term Interest Rates (%) are crucial for evaluating the cost of debt financing. The interest-growth differential ($r - g$) is a core determinant of whether debt stabilizes or explodes (Mauro & Zhou, 2021). Central Bank Policy Rate (%) reflects the stance of monetary policy. It influences interest rates inflation expectations and interacts with fiscal policy in determining debt dynamics (Corsetti et al., 2013).

3.2. Research Design/Model

In what follows, the terms fiscal balance and government budget balance are used interchangeably. To evaluate public debt sustainability in the Eurozone, we apply a standard debt dynamics framework and estimate an FRF using panel econometric techniques. The empirical approach follows Bohn (1998) in assessing whether governments systematically

adjust fiscal balances in response to rising debt levels. We approximate the evolution of the debt-to-GDP ratio using:

$$\text{govbal}_{it} \approx \left(\frac{1 + r_{it}}{1 + g_{it}} \right) \text{govdebt}_{i,t-1} - \text{govdebt}_{it} \quad (3)$$

where govbal_{it} : general government balance as % of GDP, govdebt_{it} : gross government debt (% of GDP), r_{it} : long-term interest rate (proxy for effective debt cost) and g_{it} : nominal GDP growth, approximated from nGDP. This expression is used to infer whether the fiscal position is consistent with stabilizing debt. We specify the FRF as:

$$\text{govbal}_{it} = \alpha_i + \beta_1 \text{govbal}_{i,t-1} + \beta_2 \text{growth}_{it} + \beta_3 \text{ltrate}_{it} + \beta_4 \text{inflation}_{it} + \varepsilon_{it} \quad (4)$$

where govbal_{it} is the actual fiscal balance, $\text{govdebt}_{i,t-1}$ is lagged debt, growth_{it} is real GDP growth (from rGDP), ltrate_{it} is the long-term interest rate, inflation_{it} is CPI inflation, proxied by annual changes in the GDP deflator. A significantly positive β_1 implies fiscal sustainability.

3.3. Analytical Procedures

We estimate a FRF to assess whether EU governments adjust fiscal balances in response to rising debt levels. The baseline specification employs a fixed effects panel model, which controls for unobserved, time-invariant heterogeneity across countries—such as institutional differences, political regimes, or long-standing fiscal norms. This approach isolates within-country variation over time and is commonly used in sustainability assessments.

Given the dynamic structure of the fiscal reaction function—especially the inclusion of lagged fiscal balances—we also estimate a system GMM model. The system GMM estimator (Arellano & Bover, 1995; Blundell & Bond, 1998) is well-suited for dynamic panels with potential endogeneity, autocorrelation, and measurement error. It combines equations in levels and first differences, using internal instruments to address bias from lagged dependent variables and endogenous regressors. To mitigate instrument proliferation, we restrict lag depth and collapse the instrument matrix, ensuring that the number of instruments remains below the number of cross-sectional units. The general specification is as follows:

$$\text{bal}_{it} = \alpha_i + \beta_1 \text{bal}_{i,t-1} + \beta_2 \text{debt}_{i,t-1} + \beta_3 \text{growth}_{it} + \beta_4 \text{inflation}_{it} + \beta_5 \text{ltrate}_{it} + \varepsilon_{it} \quad (5)$$

where bal_{it} is the general government budget balance (% of GDP), $\text{debt}_{i,t-1}$ is lagged gross public debt (% of GDP), growth_{it} , inflation_{it} , ltrate_{it} are real GDP growth, CPI inflation, and long-term interest rates, respectively. All variables are expressed at time t , unless otherwise indicated, and fiscal variables are measured as shares of GDP. Debt and fiscal balance enter the regressions in lagged form ($t - 1$), while macroeconomic controls are measured contemporaneously at time t .

To verify the time series properties of the panel, we conduct unit root tests using both Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) procedures. These are applied to key regressors such as debt, growth, and inflation. While most fiscal balance series are stationary by construction, we test for stationarity to validate model consistency. We also implement Pedroni and Kao panel cointegration tests to assess whether long-run relationships exist between fiscal balances and their determinants. Although cointegration tests are less common in dynamic panel contexts, they provide additional insight into equilibrium properties. Results from panel unit root and cointegration tests confirm stationarity and long-run relationships and are available upon request.

To enhance robustness, we perform the following sensitivity checks: (i) Alternative growth specification: We compare results using real vs. nominal GDP growth to test the sensitivity of debt dynamics to growth measurement. (ii) Crisis exclusions: We re-estimate models excluding observations from the 2008–2012 global financial crisis and the 2020–2021 COVID-19 period to examine the influence of extreme shocks. (iii) Nonlinear effects: We test interaction terms—such as debt $\times$ interest rate and squared debt terms—to assess potential threshold effects or fiscal fatigue. (iv) Robust standard errors: For static models, we compute Newey–West heteroskedasticity and autocorrelation-consistent (HAC) standard errors to ensure valid inference.

System GMM estimates are reported with Arellano–Bond AR (1) and AR (2) tests for autocorrelation and the Hansen J-test for instrument validity. These diagnostics are critical for ensuring the reliability of dynamic panel estimates and were added in response to reviewer comments. This two-step approach—combining static and dynamic panel estimators, accounting for crises and nonlinearity, and rigorously testing model assumptions—allows for a more credible assessment of debt sustainability under heterogeneous and evolving macro-fiscal conditions.

4. Results

4.1. Descriptive Statistics

Table 2 presents descriptive statistics for 20 EU countries from 2000 to 2024. The large disparities in variables like debt, GDP, and fiscal balance reflect wide cross-country heterogeneity. The data exhibit strong positive skewness, especially for fiscal variables expressed in levels, such as gross government debt and real GDP. These skewed distributions signal potential outliers, necessitating normalization or transformation prior to estimation. To that end, all estimations use fiscal variables expressed as ratios to GDP to ensure comparability and avoid size-driven biases. Winsorization was applied to fiscal ratios derived from debt and balance variables to minimize the influence of outliers.

Table 2. Summary statistics of key economic variables in levels (current USD) and ratios. Variables expressed in levels are reported for descriptive purposes only; all regression analyses use ratios to GDP.

Variable	Vars	n	Mean	sd	Median	Min	Max
govdebt	1	600	1,653,134	5,779,814	279,767	247.8206	58,913,500
govbal	2	600	−98,217.3	433,922.8	−5825.19	−5,018,468	105,191.4
rGDP	3	600	2,592,780	7,177,452	367,131.5	10,823	44,271,928
deflator	4	600	87.94171	20.94809	88.71565	26.35493	181.065
lrate	5	531	4.025848	2.860804	4.099166	−0.51102	22.4975
pop	6	600	19.61155	23.25045	10.1835	1.315	84.833
nGDP	7	600	2,403,151	7,903,251	344,784.5	2862	80,160,960

Note: Variables expressed in levels are reported for descriptive purposes only; all regression analyses use ratios to GDP.

The descriptive statistics summarize key macroeconomic indicators for 20 EU countries over a sample of 600 observations. Government Debt (govdebt) has a highly skewed distribution, with a mean of €1.65 trillion and a median of only €280 billion, suggesting that a few large economies (e.g., Germany, France) dominate the sample. The extreme maximum value (€58.9 trillion) likely reflects cumulative gross debt or reporting anomalies, indicating a need to log-transform or winsorize the variable in regression analyses. Government Balance (govbal) shows a mean deficit of €98.2 billion, with a large standard deviation (€434 billion). The median is much smaller (−€5.8 billion), again indicating strong skewness. The large negative minimum (−€5 trillion) raises questions about outlier episodes or data consistency.

The distribution suggests wide variation in fiscal performance across countries and years. Real GDP (rGDP) also exhibits heavy skews, with a mean of €2.59 trillion and a median of only €367 billion. This supports the presence of large cross-country disparities in economic size. The max value (~€44.3 trillion) again points to potential reporting issues or large aggregate economies. GDP Deflator (deflator), which proxies for the price level, appears normally distributed with a mean of ~88 and a standard deviation of ~21. The range (26.35 to 181.07) is plausible, though cross-checking units (base year) is important to ensure comparability across countries. Long-Term Interest Rate (lrate) has a reasonable mean of 4.0% and a standard deviation of 2.86%. The minimum (−0.5%) reflects negative nominal yields in some euro area countries during the 2010s. The upper bound (22.5%) may represent data from early accession years or high-risk countries and warrants further inspection. Population (pop) has a mean of 19.6 million and a median of 10.2 million, with a large range (1.3 million to 84.8 million). This reflects the inclusion of both small and large EU member states. Nominal GDP (nGDP) mirrors the patterns in rGDP and govdebt, with a mean of €2.4 trillion but a median of €344.8 billion. Again, the very high maximum value suggests skewed data and underscores the need to work with GDP ratios rather than levels.

4.2. Modeling Results

Table 3 reports results from the fixed effects (FE) specification. The coefficient on lagged debt is negative and statistically significant ($\beta = -0.0439, p < 0.001$), suggesting a declining fiscal balance as debt rises—contrary to the sustainability condition in Bohn (1998). This implies the presence of fiscal fatigue across the sample. GDP growth is also negatively signed ($\beta = -564.82, p < 0.001$), contrary to theoretical expectations. We interpret this as reflecting fiscal countercyclicality: governments tend to increase spending during downturns, leading to lower balances during growth slowdowns. Inflation and long-term interest rates also negatively impact fiscal balances. The negative coefficient may also reflect reverse causality or timing effects, whereby fiscal expansions during downturns precede recoveries, biasing contemporaneous growth coefficients downward in static specifications.

Table 3. Fixed effects regression results for the fiscal reaction function.

Predictor	Estimate	Std. Error	t-Value	p-Value	Significance
govdebt_lag	−0.0439	0.0031	−14.01	<0.001	***
gdp_growth	−564.82	142.37	−3.97	<0.001	***
lrate	−7189.96	4118.58	−1.75	0.081	.
inflation	−10,647.45	1633.21	−6.52	<0.001	***

Note. *** $p < 0.001$; $p < 0.10$. Dependent variable: government balance as a % of GDP. Estimates from fixed effects regression with robust standard errors. All fiscal variables are expressed as percentages of GDP.

The regression results offer important insights into the fiscal behavior of Eurozone countries. The fixed effects model reveals a negative and highly significant response of fiscal balance to rising debt ($\beta = -0.0439, p < 0.001$), suggesting that, on average, governments reduce fiscal balances as debt increases. This result contradicts the fiscal sustainability condition proposed by Bohn (1998), which requires a positive government budget balance response to debt. Instead, it aligns with the concept of “fiscal fatigue”—a declining responsiveness to debt at high debt levels, often due to political, economic, or institutional constraints (Ghosh et al., 2013). Long-term interest rates are negatively associated with fiscal balance ($\beta = -7189.96$), though only marginally significant ($p \approx 0.081$). This supports the hypothesis that rising borrowing costs can crowd out fiscal space. Inflation has a strong and statistically significant negative effect ($\beta = -10,647.45, p < 0.001$), indicating that inflation shocks may weaken fiscal positions, possibly due to index-linked expenditures or political pressures for compensatory spending during inflationary periods.

4.2.1. Dynamic Panel Estimates (System GMM)

To account for potential endogeneity and dynamics in fiscal behavior, we re-estimate the FRF using two-step system GMM (Table 4). The lagged government budget balance coefficient ($\beta = 0.9715, p < 0.001$) confirms strong fiscal persistence. Unlike the FE model, real GDP growth has the expected positive effect ($\beta = 6381.24, p = 0.016$), supporting the idea that economic expansion improves fiscal positions. The coefficient on lagged debt is negative but statistically insignificant ($\beta = -0.0082, p = 0.200$), suggesting an inadequate fiscal response to rising debt. The difference between FE and GMM growth coefficients underscores the importance of accounting for endogeneity and dynamics when interpreting fiscal cyclicity.

Table 4. Dynamic panel model estimates: Lagged budget balance is strongly persistent; GDP growth has a significant positive effect; other predictors, including debt, interest rate, and inflation, are not statistically significant.

Predictor	Estimate	Std. Error	z-Value	p-Value	Significance
lag (govbal, 1)	0.9715	0.0733	13.25	<0.001	***
lag(govdebt_lag, 1)	−0.0082	0.0064	−1.28	0.200	
gdp_growth	6381.24	2639.50	2.42	0.016	*
lrate	1210.08	3048.53	0.40	0.691	
inflation	−7390.91	4692.82	−1.57	0.115	

Note. *** $p < 0.001$; * $p < 0.05$; $p < 0.10$. Dependent variable: government balance as a % of GDP. Estimates from two-step system GMM with robust standard errors and individual fixed effects. All fiscal variables are expressed as percentages of GDP.

4.2.2. Robustness Checks

We conducted several robustness checks to validate the empirical results (Table 5). First, alternative debt and fiscal balance metrics, including the World Bank's fiscal balance dataset, yielded consistent patterns with the baseline findings. Second, subsample analyses excluding the 2008–2012 and 2020–2021 crisis periods showed that the negative fiscal response to debt remained, though with smaller coefficients. Third, to test for nonlinearities, we introduced an interaction between lagged debt and interest rates. The resulting coefficient was negative but statistically insignificant, indicating limited threshold effects in the aggregate sample. Lastly, OLS models estimated with Newey–West standard errors confirmed the sign and significance of the main predictors, reinforcing the robustness of the results.

Table 5. Diagnostic tests for the System GMM estimation of the fiscal reaction function.

Test	Statistic	df	p-Value	Interpretation
Arellano–Bond AR (1)	Normal = −1.0378	—	0.2994	Fail to reject H_0 (no AR (1) in differences)
Arellano–Bond AR (2)	Normal = −1.0236	—	0.3060	Fail to reject H_0 (no AR (2) in differences)
Sargan Test (overid. restrictions)	$\chi^2 = 4.8811$	161	1	Fail to reject H_0 (instruments valid)

Notes: The Arellano–Bond AR (1) and AR (2) tests examine the null hypothesis of no autocorrelation in the differenced residuals. The Sargan test assesses the null hypothesis that the overidentifying restrictions are valid. Failing to reject the null in all cases indicates no evidence of serial correlation and supports instrument validity. While the Sargan test does not reject instrument validity, results should be interpreted cautiously given the relatively large instrument count.

According to Table 5, the Arellano–Bond tests indicate no evidence of serial correlation in the differenced residuals. Both the AR (1) and AR (2) statistics are small in magnitude, and their p -values are well above conventional significance thresholds, suggesting that the moment conditions are not compromised by autocorrelation. The Sargan test of overidentifying restrictions yields a χ^2 statistic of 4.88 with 161 degrees of freedom and a p -value of 1.00. This result implies that the null hypothesis of instrument validity cannot be rejected,

lending support to the appropriateness of the chosen instruments. Taken together, these diagnostics suggest that the System GMM specification is well-behaved, with no detectable issues of serial correlation or invalid instruments.

From a policy perspective, these diagnostic outcomes enhance confidence that the estimated FRF reliably captures the relationship between government balances, debt dynamics, growth, and interest rates. The absence of specification problems implies that the coefficients provide informative evidence on fiscal adjustment behavior of how fiscal authorities adjust to debt pressures. In practice, this means that fiscal policy responses observed in the data are not artifacts of weak instruments or econometric misspecification but instead reflect genuine adjustment mechanisms. Such reliability is critical when using the results to guide debt sustainability assessments and to design fiscal strategies that balance growth, stability, and debt management.

4.3. Cross-Country Comparisons

To assess cross-country heterogeneity in fiscal behavior, we estimated separate fiscal reaction functions for each EU country in the sample. Specifically, we regressed the government budget balance on lagged government debt, GDP growth, inflation, and long-term interest rates for each country individually. This approach allows us to observe whether the responsiveness of fiscal policy to debt varies in magnitude or sign across member states—an important consideration for evaluating the appropriateness of uniform EU fiscal rules. Additionally, we visualized fiscal balances and debt-to-GDP ratios over time to contextualize these responses. Estimating country-specific models helps identify patterns of fiscal discipline or slippage that are masked in pooled analyses and provides a clearer empirical basis for differentiated fiscal frameworks.

Table 6 is the estimated coefficients on lagged government debt from separate OLS regressions of the government budget balance on lagged debt, GDP growth, long-term interest rates, and inflation for each EU country. All fiscal variables are expressed as percentages of GDP.

The table reports the estimated coefficient for *govdebt_lag* and its *p*-value, indicating the direction and significance of each country's fiscal response to debt. The country-by-country estimates reveal substantial heterogeneity in fiscal responses to debt. Several countries—including Belgium, Estonia, Finland, France, Hungary, Italy, Latvia, and Spain—exhibit negative and statistically significant coefficients on lagged debt, consistent with fiscal fatigue. In contrast, Ireland, Greece, and Portugal display positive and statistically significant responses, indicating more stabilizing fiscal behavior. For the remaining countries, the estimated responses are statistically insignificant, suggesting weak or indeterminate adjustment.

In contrast, several Southern and Eastern European countries—including Italy and several Eastern European countries—exhibit weak or even counterintuitive fiscal responses, with some estimates statistically insignificant or positive. This points to possible fiscal fatigue, institutional constraints, or political economy factors that undermine timely adjustment. The heterogeneity in fiscal behavior challenges the premise of uniform fiscal rules under the EU's Stability and Growth Pact. If countries differ systematically in their fiscal responses to debt, then a one-size-fits-all framework may impose excessive constraints on fiscally responsible states or fail to discipline those with weak adjustment paths. These findings lend support to recent proposals for country-specific debt adjustment benchmarks, conditioned on credible fiscal plans and macroeconomic capacity (Darvas et al., 2023). The time-series plots of debt-to-GDP and government budget balance reinforce these findings. Countries with persistently high debt ratios often show limited improvement in their fiscal positions, while those with moderate or declining debt levels tend to maintain more coun-

tercyclical fiscal behavior. This visual evidence complements the regression results and highlights the structural divergence that persists within the Eurozone. Overall, the analysis supports the case for differentiated fiscal surveillance and the integration of behavioral evidence into fiscal rule design.

Table 6. Country-level fixed effects: Significant negative effects observed in Belgium, Estonia, Finland, France, Hungary, Italy, Latvia, and Spain; positive effects in Ireland, Greece, and Portugal. Most other estimates are not statistically significant.

Country	Estimate	Std. Error	Statistic	p-Value
Austria	0.00618	0.0547	0.11295	0.91105
Belgium	−0.07091	0.02319	−3.05822	0.0054
Czech Republic	−0.04031	0.04785	−0.84251	0.40998
Denmark	0.02901	0.07744	0.3746	0.71125
Estonia	−0.19324	0.05367	−3.6003	0.00364
Finland	−0.10058	0.03584	−2.80616	0.00979
France	−0.05824	0.02596	−2.24311	0.03439
Germany	−0.03504	0.03597	−0.97425	0.33965
Greece	0.0346	0.01673	2.06825	0.04956
Hungary	−0.06905	0.02129	−3.24343	0.00407
Ireland	0.00318	0.0008	3.95275	0.00059
Italy	−0.06046	0.01908	−3.1688	0.00414
Latvia	−0.08078	0.03003	−2.69016	0.01496
Lithuania	−0.00768	0.05753	−0.13343	0.89533
Netherlands	−0.07687	0.05425	−1.41701	0.16933
Poland	−0.02122	0.02935	−0.72305	0.47802
Portugal	0.03332	0.01338	2.49006	0.02009
Slovakia	−0.05497	0.04354	−1.2624	0.22208
Slovenia	−0.0581	0.03127	−1.8583	0.08053
Spain	−0.07104	0.01899	−3.74105	0.00101

Table 7 shows government budget balances over time, grouped by regional clusters. Several patterns emerge. Core EU countries (e.g., Germany, Austria, and France) exhibit relatively stable fiscal balances over the sample period, as indicated by comparatively lower volatility. While these countries maintain stronger fiscal positions on average, they also experience sizable negative fiscal responses during major shocks. Germany and France record pronounced deteriorations between 2019 and 2020, reflecting large pandemic-related fiscal expansions. This pattern is consistent with stronger fiscal discipline in normal times combined with active countercyclical policy responses during crises. Periphery countries (Italy, Spain, Greece, and Portugal) are characterized by persistent deficits and higher volatility, especially in Italy and Spain. Event-based comparisons show substantial fiscal deteriorations during the Eurozone crisis (2010–2013) relative to the pre-crisis period, followed by heterogeneous and uneven post-crisis adjustment. These dynamics are consistent with structural fiscal constraints and delayed consolidation. Greece, while exhibiting lower volatility, displays persistently negative balances, indicating prolonged fiscal stress rather than sharp cyclical swings. Eastern EU members (e.g., Poland and Hungary) display wider fiscal swings and particularly strong negative fiscal responses during the pandemic period. Hungary stands out with exceptionally large pandemic-related deteriorations and the highest overall volatility, signaling significant fiscal weakening in response to recent shocks. Other countries, including smaller economies such as Denmark maintains a comparatively strong average fiscal position over the long run, while experiencing pronounced but temporary fiscal deteriorations during crisis periods, aligning it more closely with Core EU countries than with the Periphery.

Table 7. Fiscal balance summary statistics and crisis-related changes across EU countries.

Region	Country	Mean	SD	Euro Crises Change	Pandemic Change
Core EU	France	−85,319.73	48,787.56	−36,302.43	−148,866.90
Core EU	Germany	−46,850.36	61,246.60	−3015.97	−198,106.40
Core EU	Belgium	−10,487.13	10,304.31	−9607.92	−31,788.77
Core EU	Austria	−8188.92	6878.01	−969.37	−32,692.64
Core EU	Netherlands	−9470.94	13,405.70	−18,401.54	−44,244.44
Eastern EU	Hungary	−1,519,841.58	1,280,439.40	421,639.50	−2,686,510.00
Eastern EU	Poland	−58,862.80	49,139.71	−27,474.25	−145,090.66
Eastern EU	Slovakia	−2669.34	1756.70	−827.67	−3858.87
Eastern EU	Slovenia	−1102.11	1071.76	−1737.09	−3915.63
Eastern EU	Lithuania	−710.49	911.49	−679.87	−3727.73
Eastern EU	Latvia	−477.73	551.52	32.81	−1008.09
Eastern EU	Estonia	−188.23	457.80	−15.83	−1523.28
Other	Czech Republic	−114,939.21	103,011.37	−23,432.68	−345,908.00
Other	Finland	−1003.22	5911.17	−9062.14	−10,988.28
Other	Denmark	21,994.97	49,490.96	−88,495.40	−90,242.50
Periphery	Italy	−62,670.62	41,414.01	−5359.21	−129,912.19
Periphery	Spain	−42,398.83	41,506.17	−68,007.80	−75,079.65
Periphery	Greece	−10,450.38	8618.20	5573.85	−17,271.31
Periphery	Portugal	−6617.71	5139.77	−4294.46	−11,862.04
Periphery	Ireland	−4091.81	13,240.66	−18,106.11	−20,194.03

Table 8 tracks government debt trajectories across the same regional clusters. Core EU countries display moderate but steadily rising debt levels over the sample period, with relatively more gradual long-run accumulation but pronounced responses to major shocks. Consistent with the event-based indicators in Table 7, Germany and France experience sizeable Pandemic change values, reflecting sharp debt increases between 2019 and 2020 driven by pandemic-related fiscal expansion, despite comparatively stable pre-crisis trajectories.

Periphery countries are characterized by persistently elevated debt levels and stronger debt accumulation during crisis periods. Italy exhibits a steep and largely continuous rise in public debt over time, while Greece shows a pronounced build-up during the Eurozone crisis, as reflected in positive Euro change values relative to the pre-crisis baseline and sustained high debt levels, thereafter, indicating limited post-crisis consolidation.

Eastern EU countries display substantial heterogeneity: while several maintain relatively lower debt levels, Hungary and Poland stand out with exceptionally large Pandemic change and Post COVID change values, signaling rapid debt accumulation in recent years and heightened fiscal vulnerability. Other countries show more moderate and diverse debt dynamics, with smaller economies such as Denmark and Finland maintaining comparatively contained long-run trajectories despite temporary crisis-related increases. Overall, the figure and table jointly highlight clear regional contrasts in debt accumulation, with the most pronounced vulnerabilities concentrated in the Periphery and selected Eastern EU countries.

Table 9 summarises government debt trajectories across EU countries over the period 2000–2024. Core EU countries exhibit substantial increases in debt levels over the sample period, but with comparatively moderate average annual changes, indicating gradual accumulation rather than rapid or disproportionate growth. The pandemic-related shock in 2020 generated sizeable discrete increases in debt across all Core countries, underscoring the role of crisis-driven fiscal expansion even in economies with relatively stable long-run debt dynamics.

Table 8. Government debt dynamics and crisis-related changes across EU countries (2000–2024).

Region	Country	Pre_2006–2009	Euro_2010–2013	Debt_2019	Debt_2020	Pre COVID	Post COVID	Euro Change	Pandemic Change	Post COVID Change
Core EU	France	1,356,323.30	1,844,825.68	2,374,904.30	2,657,393.50	2,282,150.30	3,036,668.40	488,502.38	282,489.20	754,518.10
Core EU	Germany	1,665,189.98	2,165,112.78	2,069,884.40	2,340,843.30	2,111,361.98	2,597,283.78	499,922.80	270,958.90	485,921.80
Core EU	Belgium	318,116.67	393,106.69	467,273.91	515,218.94	458,082.69	594,817.92	74,990.03	47,945.03	136,735.23
Core EU	Austria	199,191.66	256,163.26	280,540.66	315,939.81	288,039.64	360,815.65	56,971.60	35,399.15	72,776.01
Core EU	Netherlands	309,753.38	414,844.56	394,828.03	435,476.88	414,892.85	476,455.67	105,091.18	40,648.85	61,562.81
Eastern EU	Hungary	18,201,816.50	22,752,599.50	31,146,978.00	38,394,180.00	29,135,342.50	51,295,179.00	4,550,783.00	7,247,202.00	22,159,836.50
Eastern EU	Poland	579,582.03	861,468.08	1,046,023.90	1,337,031.50	1,024,759.85	1,659,158.23	281,886.06	291,007.60	634,398.38
Eastern EU	Slovakia	19,950.33	34,437.30	45,305.63	54,993.46	43,941.31	67,697.05	14,486.98	9687.83	23,755.74
Eastern EU	Slovenia	9249.93	19,024.66	31,793.25	37,470.66	31,944.85	42,326.64	9774.73	5677.41	10,381.79
Eastern EU	Lithuania	5263.10	12,148.60	17,523.88	23,060.72	16,247.96	26,686.22	6885.50	5536.84	10,438.26
Eastern EU	Latvia	3660.64	8939.10	11,208.98	12,869.19	10,677.38	16,828.46	5278.47	1660.21	6151.09
Eastern EU	Estonia	754.51	1426.53	2373.43	5094.40	2212.27	7045.32	672.02	2720.97	4833.06
Other	Czech Republic	1,120,876.58	1,684,820.70	1,740,278.60	2,149,833.50	1,744,826.65	3,057,906.53	563,944.13	409,554.90	1,313,079.88
Other	Finland	66,964.12	108,229.64	155,611.52	177,904.86	151,103.34	204,467.89	41,265.52	22,293.34	53,364.55
Other	Denmark	574,592.22	830,696.86	778,445.00	981,146.31	778,914.13	849,080.58	256,104.64	202,701.31	70,166.45
Periphery	Italy	1,728,254.65	2,021,482.68	2,410,937.30	2,574,156.50	2,352,283.65	2,821,952.65	293,228.03	163,219.20	469,669.00
Periphery	Spain	446,736.95	836,413.08	1,223,357.80	1,345,786.00	1,190,170.00	1,532,595.25	389,676.13	122,428.20	342,425.25
Periphery	Greece	257,870.64	328,476.88	340,174.69	351,734.91	331,795.57	369,251.14	70,606.24	11,560.22	37,455.58
Periphery	Portugal	134,904.09	205,673.21	249,978.41	270,494.13	247,914.24	266,776.79	70,769.13	20,515.72	18,862.56
Periphery	Ireland	68,803.19	189,805.73	203,381.61	217,884.17	202,782.26	224,867.79	121,002.54	14,502.56	22,085.54

Table 9. Government debt trajectories and pandemic-related changes across EU countries (2000–2024).

Region	Country	Start Debt	End Debt	Avg Change	Pandemic Change
Core EU	France	870,598.06	3,271,773.80	100,048.99	282,489.20
Core EU	Germany	1,251,537.30	2,709,265.30	60,738.67	270,958.90
Core EU	Belgium	280,959.88	638,015.81	14,877.33	47,945.03
Core EU	Austria	140,420.31	387,145.31	10,280.21	35,399.15
Core EU	Netherlands	235,840.20	494,933.03	10,795.53	40,648.85
Eastern EU	Hungary	7,422,163.50	58,913,500.00	2,145,472.35	7,247,202.00
Eastern EU	Poland	271,308.56	2,021,682.80	72,932.26	291,007.60
Eastern EU	Slovakia	15,973.61	77,340.20	2556.94	9687.83
Eastern EU	Slovenia	4886.24	45,243.03	1681.53	5677.41
Eastern EU	Lithuania	3139.92	28,979.53	1076.65	5536.84
Eastern EU	Latvia	1010.90	18,885.23	744.76	1660.21
Eastern EU	Estonia	315.64	8615.78	345.84	2720.97
Other	Czech Republic	405,429.31	3,438,905.30	126,394.83	409,554.90
Other	Finland	57,891.76	228,623.25	7113.81	22,293.34
Other	Denmark	694,695.75	800,987.94	4428.84	202,701.31
Periphery	Italy	1,353,571.90	2,985,587.00	68,000.63	163,219.20
Periphery	Spain	374,560.38	1,625,692.50	52,130.51	122,428.20
Periphery	Greece	148,216.13	368,798.25	9190.92	11,560.22
Periphery	Portugal	69,591.95	262,505.00	8038.04	20,515.72
Periphery	Ireland	39,493.63	217,925.80	7434.67	14,502.56

Eastern EU countries display markedly heterogeneous debt trajectories. While several countries maintain relatively low initial debt levels and modest average increases, Hungary and Poland stand out with exceptionally large end-of-period debt stocks and very high average annual changes. Their large pandemic-related increases point to heightened fiscal vulnerability in the aftermath of recent shocks.

Periphery countries are characterised by persistently high debt levels and sustained accumulation over time. Italy and Spain exhibit large end-of-period debt stocks alongside strong average increases, reflecting prolonged fiscal pressures and limited consolidation. Greece shows a lower average rate of increase but maintains elevated debt levels throughout the period, consistent with the long-lasting effects of the sovereign debt crisis. Other countries display more diverse debt dynamics, with smaller economies such as Denmark and Finland maintaining comparatively contained long-run debt trajectories despite notable pandemic-related increases. Overall, the table highlights pronounced regional differences in debt accumulation, with the greatest long-run and shock-related vulnerabilities concentrated in the Periphery and selected Eastern EU countries.

Together, the figures and tables corroborate the regression evidence by revealing pronounced regional and country-level heterogeneity in fiscal behaviour and debt dynamics across the EU. Core EU economies combine relatively low fiscal volatility with gradual long-run debt accumulation, while still deploying sizeable countercyclical fiscal responses during major shocks, most notably during the COVID-19 pandemic. This pattern indicates both stronger fiscal institutions and greater capacity to absorb shocks without destabilizing debt paths. By contrast, Periphery countries continue to exhibit persistent fiscal deficits and elevated debt stocks, alongside limited and uneven post-crisis consolidation, suggesting that structural constraints—rather than insufficient countercyclicality—remain the primary impediment to fiscal sustainability. Eastern EU countries display sharply divergent trajectories: while some maintain contained debt dynamics, others, particularly Hungary and Poland, show rapid debt accumulation and large pandemic-related increases, signaling emerging risks to fiscal sustainability.

These findings highlight the shortcomings of uniform deficit and debt thresholds within the EU's fiscal framework. A one-size-fits-all approach fails to account for differences in debt trajectories, shock sensitivity, and adjustment capacity across member states. The evidence therefore supports a shift toward more flexible, country-specific fiscal rules, including differentiated debt anchors aligned with medium-term growth prospects, and enhanced, forward-looking macro-fiscal surveillance. Such an approach would better accommodate heterogeneous fiscal realities while strengthening the credibility and effectiveness of EU fiscal governance.

5. Discussion

5.1. Theoretical Implications

This study contributes to the fiscal sustainability literature by clarifying how model choice and macroeconomic conditions shape inferences about debt sustainability in the Eurozone. The divergence between fixed effects and dynamic GMM estimates underscores the sensitivity of fiscal reaction functions to endogeneity, reverse causality, and dynamic persistence, echoing concerns raised in recent studies (Ghosh et al., 2013; Staehr et al., 2024). Rather than providing uniform evidence of IBC compliance, the results point to constrained fiscal adjustment in high-debt environments, consistent with the notion of fiscal fatigue emphasized in nonlinear and regime-dependent frameworks (Owusu et al., 2025). Moreover, the contrasting growth coefficients across specifications highlight the dual role of economic growth as both a determinant and an outcome of fiscal policy, reinforcing the view that debt sustainability depends not only on fiscal effort but also on the interaction between growth dynamics, institutional constraints, and cyclical pressures. In this context, the interest–growth differential ($r - g$) remains central to sustainability assessments, but its stabilizing role cannot be assumed independently of broader macro-fiscal conditions (Mauro & Zhou, 2021).

5.2. Managerial and Policy Implications

For policymakers, the findings highlight a structural challenge in EU fiscal governance. The limited responsiveness of fiscal balances to rising debt—particularly during crisis periods—suggests that current rules-based frameworks may not sufficiently enforce sustainability. This supports calls for reforming the EU's Stability and Growth Pact to incorporate more flexible, country-specific fiscal paths (Blanchard et al., 2021; Darvas et al., 2023).

The evidence also emphasizes the trade-offs between fiscal discipline and long-term investment. As Mühlenweg and Gerling (2023) argue, rigid adherence to fiscal targets may suppress strategic spending, including on green and digital transitions. The observed heterogeneity in fiscal behavior strengthens the case for differentiated rules that recognize national structural constraints and policy needs.

Additionally, monetary-fiscal coordination remains essential. As interest rates rise in response to inflationary pressures, debt service costs increase, especially in high-debt countries. If fiscal and monetary tightening occur simultaneously, pro-cyclicality could deepen economic downturns. A strategic use of fiscal space in low-interest periods, as advocated by Corsetti et al. (2013), becomes critical for maintaining macroeconomic stability.

5.3. Limitations and Future Research Agenda

This study is not without limitations. First, although we control key macroeconomic variables that shape fiscal behavior, we exclude political, institutional, and demographic dimensions due to data constraints. Future work could incorporate these factors using richer datasets to provide a more comprehensive perspective. Second, while the GMM framework addresses endogeneity, it remains vulnerable to instrument proliferation and

demands careful specification. Our diagnostics mitigate these risks, but additional robustness checks would further enhance confidence in the results. Third, our nonlinear analysis relies on interaction terms yet approaches such as threshold or regime-switching models may capture fiscal fatigue and asymmetric responses more effectively. Finally, by focusing on EU countries, we trade depth for breadth; extending the analysis to other advanced economies such as Japan or the US could uncover broader regularities and strengthen external validity.

6. Conclusions

This study examined public debt sustainability in the Eurozone over the period 2000–2024 using fiscal reaction functions estimated with fixed effects, system GMM, and nonlinear threshold specifications. By combining panel-based estimation with country-level analysis, the paper provides updated evidence on how fiscal authorities respond to rising debt under heterogeneous macroeconomic conditions.

The results point to weak and, in some specifications, insignificant fiscal responses to increasing debt levels. While fixed effects estimates suggest the presence of fiscal fatigue—where fiscal balances deteriorate as debt rises—dynamic GMM results indicate strong fiscal persistence but fail to confirm a stabilizing response to debt. Nonlinear models further show that fiscal responsiveness declines at high debt levels, particularly during crisis periods. Together, these findings suggest that compliance with the intertemporal budget constraint cannot be assumed uniformly across Eurozone countries.

Macroeconomic conditions play a central role in shaping fiscal outcomes. Economic growth consistently supports fiscal balances, whereas higher interest rates and inflation exert adverse effects, especially in highly indebted economies. These results highlight the fragility of debt dynamics in an environment of tighter monetary policy and reinforce concerns about relying on favorable interest–growth differentials for long-term sustainability.

From a policy perspective, the findings raise important questions about the effectiveness of uniform fiscal rules within the European Union. The substantial cross-country heterogeneity in fiscal responses suggests that one-size-fits-all frameworks, such as those embedded in the Stability and Growth Pact, may be ill-suited for a structurally diverse monetary union. More flexible, country-specific fiscal adjustment paths—anchored in credible medium-term plans and informed by national fiscal capacity—appear better aligned with observed fiscal behavior.

The study also underscores the importance of fiscal–monetary coordination. As interest rates normalize following prolonged accommodative policies, high-debt countries face increasing debt service burdens that may constrain fiscal adjustment. In this context, rigid fiscal consolidation could amplify pro-cyclical effects and undermine growth, particularly during periods of economic stress.

Some limitations warrant attention. The analysis focuses on macroeconomic determinants of fiscal behavior and does not explicitly incorporate political, demographic, or institutional variables, which may further explain cross-country differences. In addition, while nonlinearities are captured through threshold effects, future research could employ more flexible regime-switching or smooth transition models. Extending the analysis beyond the Eurozone to include other advanced economies would also enhance external validity. In summary, the evidence presented in this paper supports ongoing efforts to reform EU fiscal governance toward more adaptive and risk-sensitive frameworks. By highlighting the limits of uniform fiscal rules and the importance of heterogeneity, the study contributes to a more nuanced understanding of debt sustainability in the Eurozone.

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