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Fiscal rules management in the EU: differences between fiscally sustainable and unsustainable countries

1. Introduction

In recent years, the examination of fiscal sustainability has gained considerable importance in public finance, particularly in the context of the European Union (EU) (see e.g. Afonso & Coelho, 2024; Afonso et al., 2024; Darvas et al., 2024; Carnazza et al., 2023; Truger, 2022; Barbier-Gauchard et al., 2021; Blanchard et al., 2021; Căpraru et al., 2021; Larch et al., 2021; Polat and Polat, 2021). The term ‘fiscal sustainability’ is used to describe the capacity of a government to maintain its current fiscal policies without risking insolvency or excessive debt accumulation, which could otherwise have an adverse effect on economic stability (Dornean & Oanea, 2015). A government is considered to be in a state of fiscal sustainability when it is able to finance its fiscal or budgetary deficits without generating explosive increases in public debt over the long term (Lau & Lee, 2021; Bui, 2020; Ngo & Nguyen, 2020). The global financial crisis of 2008, the subsequent European debt crisis, and more recently, the fiscal pressures

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brought about by the Coronavirus Disease 2019 (Covid-19) pandemic and the war in Ukraine have intensified concerns about the long-term sustainability of public finances in the EU (Andrián et al., 2024; Zahariev et al., 2021). In light of the interconnectivity of EU economies, the sustainability of public finance at the union level and within individual member states is of paramount importance for the maintenance of macroeconomic stability and the smooth functioning of the European Monetary Union (EMU). A deeper understanding of the sustainability of public finances in individual EU countries, as well as at the EU level as a whole, is necessary for designing effective economic governance and informed policymaking that address the fiscal heterogeneity within the EU.

The examination of fiscal sustainability at the EU level and across individual EU countries is essential due to several key reasons. Firstly, the EU operates under a shared fiscal and monetary framework, with member states bound by common fiscal rules (Larch et al., 2021). However, despite this framework, there are significant fiscal disparities across member states, with varying levels of debt, budget deficits, and economic resilience, pointing out an important heterogeneity among EU countries (Barbier-Gauchard et al., 2021). These disparities can pose risks to the overall stability of the EMU, as financial distress in one member state can easily spill over to others via a contagion effect. Therefore, the purpose of this study is to assess the long-term relationship between government revenues and expenditures as an indicator of fiscal sustainability and explore the differences in fiscal sustainability among EU member states. This study addresses the scientific problem of growing fiscal sustainability disparities within the EU, where some member states demonstrate long-term equilibrium between revenues and expenditures, while others do not. This variation raises critical question about the underlying factors driving these differences and the implications for fiscal stability in the union. In this context, this study employs cointegration analysis to test for the long-term equilibrium relationship between government revenues and expenditures, as a key indicator of fiscal sustainability (in accordance with Afonso & Coelho, 2024) across EU countries.

While understanding fiscal sustainability is crucial, it is equally important to explore the mechanisms that influence it, such as fiscal rules.

The EU has established a set of fiscal rules (Council Directive 2011/85/EU, 2011) designed to ensure fiscal discipline and prevent excessive deficits and debt accumulation among its member states. These rules, such as those embedded in the Stability and Growth Pact (SGP), set limits on budget deficits

and public debt as a percentage of GDP (Căpraru et al., 2021; Larch et al., 2021; Zahariev et al., 2021; Ko, 2020). Despite these regulations, compliance with fiscal rules has varied, and some countries have struggled to adhere to the prescribed limits, leading to important fiscal imbalances and tensions within the union. As a result, understanding the role of fiscal rules in influencing the budgetary outcomes of EU member states is critical for evaluating their effectiveness and for considering potential reforms to the fiscal governance framework.

In summary, this study emphasizes the importance of assessing fiscal sustainability in the context of the EU's shared fiscal framework and highlights the significant role fiscal rules play in shaping budgetary outcomes. Our research is inspired by Afonso and Coelho (2024). We fill a gap in recent empirical research on fiscal discipline by applying a combination of cointegration analysis and panel data analysis, which offers a comprehensive approach to understanding the intricate dynamics of public finance in the EU. To our best knowledge, there are no papers focusing directly on how the effectiveness of fiscal rules varies across different EU member states based on their sustainability of public finance and our results aim to contribute to the broader debate on the future of fiscal governance in Europe.

The paper is structured as follows. We begin with a comprehensive review of the relevant literature. In the second section, we offer detailed explanation of the data sources and used methods. Next, we present and discuss the obtained results. Finally, the paper concludes by summarizing key insights and brings ideas for future research in the field.

2. Literature review

The concept of fiscal sustainability, which plays a pivotal role in the field of public finance, is subjected to extensive analysis within the academic literature (Ciaffi et al., 2024; Baksay & Kiss, 2023; Marín-Rodríguez et al., 2023; Yeyati & Sturzenegger, 2023; Hasdemir & Omay, 2019; Brady & Magazzino, 2018). A variety of methods are used to evaluate the sustainability of fiscal policies. In the view of Blanchard (1990), a fiscal policy is considered sustainable if, following a period of greater variance in the debt-to-GDP ratio, its value is observed to return gradually to its initial value. This approach therefore suggests that fiscal policy sustainability does not necessitate a constant debt-to-GDP ratio. Another approach, known as Model-Based Sustainability (MBS), was introduced by Bohn (1998) and it aims to determine whether an increase in the public debt-output

ratio is accompanied by a corresponding positive change in the primary balance-output ratio. If all other factors influencing fiscal policy remain stable, a positive relationship between debt and the primary surplus is enough to ensure that the debt ratio will return to a finite, steady-state level. Since its introduction by Bohn (1998), the MBS approach has been extended and modified due to some of its limitations (as it fails to assess the non-linear relationship between the primary balance and public debt, and it ignores uncertainty) by various authors. First, to compensate for these limitations, Ghosh et al. (2013) introduce nonlinearities into the model to account for the increasing fragility of fiscal sustainability at higher debt levels, while Mendoza and Ostry (2008) apply the MBS approach to emerging markets, highlighting how fiscal responses to debt can differ across economies. Second, Celasun et al. (2006) incorporate stochastic elements into the model to address fiscal sustainability under uncertainty, particularly in economies prone to external shocks.

Additionally, a certain group of research studies employs time series techniques to analyse debt dynamics and sustainability of public finance, e.g. Kopits and Barnhill (2003), who use the Value-at-Risk (VaR) methodology to examine the sustainability of public finance. This approach involves the simulation of a distribution of potential future financial conditions for the government, with an assessment of the probability of financial failure for given distribution.

In light of the ongoing discourse on fiscal sustainability, a significant number of papers have focused on the examination of the assumption of cointegration between government revenues and expenditure. This is exemplified by the work of Bravo and Silvestre (2002), Llorca and Redzepagic (2008), Westerlund and Prohl (2010), Brady and Magazzino (2018), and Afonso and Coelho (2024). First, Brady and Magazzino (2018) examine the sustainability of public accounts for 28 EU member states and uncover evidence indicating a panel cointegration relationship between government revenue and expenditure, as well as between the primary government balance and the public debt-to-GDP ratio. This suggests that European countries are fiscally sustainable, even though the results identify that Portugal, Ireland, Italy, Greece, and Spain do not have a sustainable fiscal position. Second, the cointegration of government revenues and expenditures (using Johansen (1992) methodology for cointegration testing) for eleven EU countries between 1960 and 2000 is tested by Bravo and Silvestre (2002). The findings indicate that, in the circumstances of Austria, France, Germany, the Netherlands, and the United Kingdom, public budgets are sustainable. Thirdly, Afonso and Coelho (2024) investigate the sustainability

of public finance in 19 EU countries. Their findings indicate the existence of panel cointegration between government revenues and expenditure; between the primary government balance and the lagged public debt-to-GDP ratio; and between the public debt-to-GDP ratio and the lagged primary government balance.

Fiscal sustainability and the enforcement of sound public finances are increasingly linked to the application of fiscal rules. These rules serve as institutional mechanisms designed to ensure that governments maintain a sustainable fiscal trajectory. While sustainability focuses on the relationship between debt, revenues, and expenditures, fiscal rules provide the formal structures—such as budget balance, debt, and expenditure rules—that aim to control budgetary imbalances (Badinger & Reuter, 2017). As highlighted in recent literature, fiscal rules contribute not only to fiscal discipline but also help stabilize government spending and debt, which are critical for long-term fiscal sustainability (Debrun et al., 2008; Bergman et al., 2016). This connection between fiscal sustainability and fiscal rules forms the basis for further exploration into how fiscal rules interact with traditional fiscal performance indicators and contribute to improved fiscal outcomes.

Building on the role of fiscal rules in promoting fiscal sustainability, several authors examine their relationship with traditional fiscal performance indicators. Studies by e.g. Debrun et al. (2008), Nerlich and Reuter (2013), Fall et al. (2015), Cordes et al. (2015), Badinger and Reuter (2017), Asatryan et al. (2018), Caselli and Reynaud (2020), Bergman et al. (2016), Albu (2024) explore how fiscal rules influence budgetary outcomes, government spending, and overall fiscal discipline. To point out first comprehensive study, Debrun et al. (2008) uncover that budget balance rule and debt rule contribute to limiting the budget deficit. Their empirical studies have demonstrated that countries with fiscal rules tend to exhibit superior fiscal outcomes, including the reduction of fiscal deficits. They posit that the evidence indicates a causal relationship between fiscal rules and fiscal behaviour. Caselli and Reynaud (2020) reveal that well-designed fiscal rules exert a considerable influence on the fiscal balance. Afonso and Jalles (2017) assert that fiscal rules play a pivotal role in determining fiscal sustainability. Indeed, expenditure-based fiscal rules are of great significance in elucidating the fiscal reaction function coefficients. EU countries that implement fiscal rules demonstrate a marked enhancement in their fiscal discipline in comparison to EU countries that lack such rules (Barbier-Gauchard et al., 2021). Moreover, research in the EU context shows how fiscal rules lead to less procyclical fiscal policies (Debrun

et al., 2008; Reuter, 2015). As posited by Nerlich and Reuter (2013), fiscal rules are associated with reduced public expenditure and revenue. However, the impact on revenue is comparatively minor, resulting in an improvement in the primary balance. Furthermore, fiscal rules exert a constraining influence on social benefit spending, remuneration of public employees, public services and defence expenditure. Nevertheless, some of the studies have challenged the notion that there is a causal relationship between the implementation of rules and the resulting outcomes. Heinemann et al. (2018) observe that, while fiscal rules overall contribute to greater fiscal discipline by reducing deficits. This may not be the case for countries within the Euro area, where there is evidence that fiscal rules are associated with increased deficits. In addition, Caselli and Reynaud (2019) conclude that fiscal rules exert a negligible influence on fiscal performance unless they are meticulously crafted. Furthermore, Golinelli and Momigliano (2006) identify a statistically significant impact of EU fiscal rules for countries subjected to an excessive deficit procedure. As far as the Organisation for Economic Co-operation and Development (OECD) countries are concerned, Fall et al. (2015) have identified a correlation between the implementation of fiscal rules and an improvement in fiscal performance. Furthermore, the findings suggest that independent fiscal institutions appear to limit spending when they interact with a balanced budget rule. In their study, Afonso and Jalles (2011) found that the fiscal authorities of OECD countries adhere to a Ricardian regime, demonstrating an improvement in budget balances in response to increases in debt-to-GDP ratios. Cordes et al. (2015) also reported that expenditure rules are associated with spending control, counter-cyclical fiscal policy and improved fiscal discipline. Furthermore, expenditure rules have been linked to lower expenditure volatility and higher investment efficiency. Some economists posit that fiscal rules are a primary factor contributing to the constrained levels of public investment observed in Europe (Wijsman and Crombez, 2021). Badinger and Reuter (2017) uncover that countries with more rigorous fiscal rules exhibit superior budgetary balance, reduced interest rate spreads for bonds, and lower GDP volatility. They assert that countries with more stringent fiscal rules are negatively correlated with output volatility, and that this occurs indirectly, with fiscal rules dampening the volatility of fiscal policy. Moreover, Asatryan et al. (2018) demonstrate that constitutional budget-balance rules result in a diminished probability of sovereign debt crises and a reduction in the debt-to-GDP ratio. Furthermore, the majority of these consolidations can be attributed to a decline in public expenditures. Caselli and Reynaud (2020) identify a correlation between the

implementation of fiscal rules and a reduction in budget deficits. However, this relationship disappears when endogeneity is considered. Additionally, Bergman et al. (2016) find that fiscal rules are effective in reducing structural primary deficits at all levels of government, provided that the government in question is efficient.

Further, Afonso and Guimarães (2015) evaluate the correlation between enhanced budgetary balances, the progression of revenue margins and the implementation of fiscal regulations. The study reveals a correlation between the implementation of fiscal rules and the achievement of a primary balance. The implementation of superior fiscal regulations has been demonstrated to yield more favourable primary balances, which in turn lead to better debt ratios. The objective of Bergman et al. (2016) was to ascertain the impact of fiscal rules on individual countries within the EU. Their findings indicated that more robust national regulations are associated with more sustainable fiscal policies, with this effect extending to a broad range of government effectiveness, government transparency and political commitment. This outcome leads to the conclusion that the implementation of multiple fiscal rules provides an additional enhancement in the primary balance.

The potential of fiscal rules to promote fiscal consolidation by imposing constraints on government spending and deficits has been the subject of much recent academic study (e.g. by Chrysanthakopoulos & Tagkalakis, 2023; Aaskoven & Wiese, 2022; Gootjes & de Haan, 2022). Firstly, Chrysanthakopoulos & Tagkalakis (2023) investigate the impact of fiscal rule design on fiscal adjustment. The results indicate that the implementation of well-designed fiscal rules, comprising both strict and flexible elements, enhances the probability of initiating and successfully concluding fiscal adjustment. Secondly, Aaskoven and Wiese (2022) conclude that the implementation of both national and supranational fiscal regulations is more effective in achieving sustained debt reduction during periods of fiscal consolidation when they are embedded in a robust national fiscal framework. This framework should include a greater range of fiscal rules, formal enforcement procedures and stronger fiscal councils. Thirdly, Gootjes and de Haan (2022) investigating whether fiscal rules increase the probability of a successful fiscal adjustment, defined as a reduction in public debt. Their findings indicate that the implementation of fiscal rules increases the likelihood of successful fiscal adjustments, provided that the level of fiscal transparency is sufficiently high.

Finally, some authors use cyclically adjusted primary balances or adjusted expenditures as dependent variables in their research (e.g. Bergman et al., 2016;

Afonso & Guimarães, 2015; Albuquerque, 2011; Caselli and Reynaud, 2020; Pfeil and Feld, 2024). As far as the explanatory variables are concerned, they have been varied. For example, the strength of the national fiscal rule, government efficiency, public debt and GDP are used (Bergman et al., 2016; Albuquerque, 2011).

To conclude, existing empirical literature on fiscal sustainability and fiscal rules is rich, using different approaches, incorporating different variables (i.e. indicators) and obtaining different results. Inspired by the most recent study by Afonso and Coelho (2024), we enrich the empirical research by testing long-term cointegration relationships between government revenues and expenditures across European countries, through which we evaluate a key indicator of fiscal sustainability. Further, inspired by Afonso and Coelho (2024) and Pfeil and Feld (2024), we test impact of fiscal rules on budget balance and bring new insights by searching for different impacts in fiscally sustainable and unsustainable countries.

3. Data and methods

The primary aim of this paper is to investigate whether fiscal rules promote fiscal sustainability across the EU-27 countries. Given the ongoing debates on the role of fiscal rules in ensuring such sustainability, this study takes a comprehensive approach by first assessing fiscal sustainability both at the panel level for all EU-27 countries and at the individual country level.

We test the fiscal sustainability of 27 European Union (EU-27) countries using annual data on government expenditure and government revenue. All data for general government expenditure and revenue (expressed in billions of national currency) are taken from the European Commission Annual Macro-Economic Data (AMECO) database (AMECO Database - European Commission, 2024). The data cover the time period from 1995 to 2021. This timeframe is marked by significant fiscal policy events within the EU, including the implementation of the Stability and Growth Pact and its subsequent reforms, the global financial crisis, the European debt crisis, all of which are critical for understanding fiscal sustainability trends in the EU. This timeframe ensures comprehensive coverage of fiscal developments and allows for meaningful comparisons across member states. The endpoint of 2021 was determined by the availability of consistent and reliable data, ensuring the robustness of the analysis. On the basis of these variables, we assess the long-run relationship between government revenue and expenditure,

a critical factor for determining fiscal sustainability (in accordance with e.g. Afonso and Coelho, 2024) in each individual country. All statistical analyses are conducted using Stata software.

First, to test for a long-run relationship between government revenues and expenditures, the Pedroni (1999, 2004) panel cointegration test is used. The Pedroni test allows for heterogeneity in the cointegrating vector across countries, making it particularly suitable for cross-country panel data. The test is based on residuals from the following long-run equilibrium relationship:

$$R_{it} = \alpha_i + \beta_i G_{it} + \epsilon_{it}$$

where G_{it} represents government expenditures for country i at time t , R_{it} represents government revenues for country i at time t , α_i is a country-specific intercept that accounts for unobserved heterogeneity across countries, β_i is the cointegrating vector (or long-run slope coefficient) which measures the relationship between revenues and expenditures, and ϵ_{it} is the error term, capturing short-run deviations from the long-run equilibrium.

Using this approach, we decide for presence or absence of fiscal sustainability. If government revenues and expenditures are cointegrated, it implies that fiscal sustainability is present, as revenues are adjusting in response to expenditures, preventing long-term fiscal imbalances.

Second, following the Pedroni panel cointegration test, we apply the Engle-Granger two-step cointegration test to each individual country within the EU-27 (Engle & Granger, 1987). While the Pedroni test assesses cointegration in a panel framework, the Engle-Granger procedure is used here to investigate the presence of a long-run relationship between government revenues and expenditures at the individual country-specific level. This approach allows for a more detailed understanding of fiscal sustainability separately for each member state.

The first step of the Engle-Granger procedure involves estimating the long-run relationship between government revenues and expenditures for each country using ordinary least squares (OLS). For each individual country of the EU-27 countries, we regress government expenditures on government revenues:

$$R_t = \alpha_i + \beta_i G_t + \epsilon_t$$

This regression captures the potential long-run relationship between the two variables, where the coefficient β indicates the responsiveness of government

expenditures to changes in revenues. A value of $\beta=1$ would suggest a perfectly sustainable fiscal policy where expenditures are fully matched by revenues. The residuals from this regression - ϵ_t indicate the short-term deviations from the long-run equilibrium and represent a key “parameter” entering to the next step of the Engle-Granger procedure.

In the second step, the residuals obtained from the long-run relationship in first step are tested for stationarity. If the residuals are found to be stationary, it implies for a stable long-run equilibrium relationship between government revenues and expenditures. In other words, any short-term deviations between revenues and expenditures will eventually correct themselves, indicating that the country’s fiscal policy is sustainable. The stationarity of the residuals is tested using the Augmented Dickey-Fuller (ADF) test. The null hypothesis of the ADF test is that the residuals have a unit root (i.e., they are non-stationary), while the alternative hypothesis is that the residuals are stationary. Rejection of the null hypothesis indicates that the residuals are stationary, and the two variables are cointegrated.

The ADF test equation for the residuals is specified as:

$$\Delta\epsilon_t = \gamma\epsilon_{t-1} + \sum_{i=1}^p \theta_i\Delta\epsilon_{t-i} + u_t$$

Where $\Delta\epsilon_t$ is the change in the residual at time t , ϵ_{t-1} is the lagged value of the residual, u_t is the error term, and p is the number of lags included in the test to account for autocorrelation.

The test statistic for γ is compared to critical values. If γ is significantly different from zero, we reject the null hypothesis of a unit root, confirming the stationarity of the residuals and the presence of cointegration relation.

This approach offers several strengths for analysing fiscal sustainability in EU-27, including the ability to detect long-run equilibrium relationship and partially address potential endogeneity. While these methods are sensitive to data limitations and the inherent heterogeneity of EU economies, their robustness makes them well-suited to this context. To address potential challenges, careful adjustments and interpretations were employed to account for cross-country differences, ensuring the validity of the findings.

Building on the cointegration analysis, which examines the long-run relationship between government revenues and expenditures – defined as an indicator of fiscal sustainability, we shift focus to a panel data analysis that explores the role

of fiscal rules and their impact on sustainability. Fiscal rules, defined as legal constraints that restrict fiscal policy through limits on budget deficits, debt, or expenditures, are designed to promote fiscal discipline. By incorporating fiscal rules into panel data model, along with other macroeconomic variables, we aim to assess their influence on the budget balance and fiscal sustainability across the EU-27 countries.

The model underpinning the panel data analysis is based on the idea that fiscal rules positively impact fiscal sustainability by improving budgetary outcomes (in accordance with Debrun et al., 2008; Badinger & Reuter, 2017; Bergman et al., 2016). In particular, the budget balance (BB)—defined as the difference between government revenues and expenditures—serves as the dependent variable, while fiscal rules (FR) and set of control variable serves as the explanatory variables.

The general form of the model is:

$$BB_{it} = \alpha_i + \beta_1 FR_{it} + \beta_2 X_{it} + \epsilon_{it}$$

where: BB_{it} is the budget balance for country i at time t , FR_{it} indicate the fiscal rules index for country i at time t , X_{it} is a vector of control variables, α_i is the country-specific fixed effect, capturing unobserved heterogeneity across countries, ϵ_{it} is the error term.

Using this panel model, we test the following hypothesis: stronger fiscal rules are associated with improved budget balances, indicating a positive effect of fiscal rules application on fiscal sustainability.

To control for other macroeconomic factors that potentially influence the budget balance, a set of control variables, including GDP per capita, government effectiveness, the output gap, and inflation, enter in the model. These variables have been selected in line with economic theory and are supported by findings from previous empirical studies (e.g. Afonso & Coelho, 2024; Bergman et al., 2016; Catão & Terrones, 2005; Galí & Perotti, 2003).

The methods selected for this study—Pedroni panel cointegration, Engle-Granger two-step cointegration, and panel data models—were chosen for their ability to address the study's objectives effectively. The Pedroni test is particularly suited for examining long-term fiscal relationships in heterogeneous panel data, as it accounts for variations across EU member states, a critical feature given the fiscal diversity of the region. The Engle-Granger two-step cointegration test, while a single-equation time series method, is used here to provide

detailed, country-specific insights into fiscal sustainability. Panel data models, incorporating fixed effects and dynamic controls, enable the analysis of fiscal rules' impact on fiscal outcomes while controlling for unobserved heterogeneity and dynamic interactions.

These methods were chosen over alternatives due to their specific strengths. While the Engle-Granger test is effective for analysing individual countries, it is less suitable for capturing cross-country relationships, which is why the Pedroni panel cointegration test was employed for the panel-level analysis. Alternative panel cointegration methods like the Kao or Johansen tests impose more restrictive assumptions on data homogeneity, limiting their applicability in the diverse EU context. By combining these approaches, this study achieves both breadth and depth in examining fiscal sustainability. Chosen methods, while dependent on data quality and availability, provide the flexibility and robustness needed to explore the complex dynamics of fiscal sustainability.

4. Results and Discussion

First, to investigate the long-run relationship between government revenues and expenditures, we report results of Pedroni's panel cointegration test using data from EU-27 countries over the period from 1995 to 2021. The results of the Pedroni's test (tab. 1) provide strong evidence supporting the presence of cointegration long-run equilibrium between government revenues and expenditures, suggesting that these two variables move together in the long run. The existence of this cointegration relation – a key indicator for fiscal sustainability – implies that, over time, government revenues tend to adjust to changes in government expenditures across the EU-27 countries.

Second, to examine the long-run relationship between government revenues and expenditures, a Panel Dynamic Ordinary Least Squares (PDOLS) estimation is performed. The results, reported in tab. 2, reveal a beta coefficient of 1.011 for expenditures, indicating that a 1-unit increase in government expenditures leads to a 1.011-unit increase in revenues in the long run. This near-proportional relationship suggests that government revenues adjust almost fully to changes in expenditures, which is consistent with fiscal sustainability.

Table 1. Results of Pedroni's cointegration tests for panel of EU-27 countries

Test Stats.	Panel	Group
v	5.29	
rho	-4,557	-1,937
t	-3,106	-2,056
adf	-2,559	-1,383

Note: The panel statistics provide pooled results across the panel, while the group statistics allow for heterogeneity across countries. The rejection of the null hypothesis of no cointegration indicates a long-run equilibrium relationship between government revenues and expenditures across the EU-27. For each test, we reject the null hypothesis of no cointegration when the test statistic is lower than the critical value (-1.65) at the 5% significance level. For the v-statistic, we reject the null hypothesis if the value is higher than +1.65.

Source: own processing based on AMECO Database - European Commission (2024)

Table 2. Results of Pedroni's PDOLS for panel of EU-27 countries

Variables	Beta	t-stat
expenditure	1.011	184.4

NOTE: The PDOLS method is used to estimate the long-run relationship between the variables, accounting for potential endogeneity and serial correlation.

Source: own processing based on AMECO Database - European Commission (2024)

Further, to evaluate the country-specific long-run relationship between government revenues and expenditures, the Engle-Granger cointegration test is applied individually to each of the EU-27 countries. The results are reported in table 3.

Table 3. Engle-Granger cointegration test for individual EU-27 countries

Country	Regression Coefficient	t-stat (regression)	ADF test statistic	p-value (ADF)
Austria	0.927	27.07	-3.478	0.0086
Belgium	0.028	31.65	-3.322	0.0139
Bulgaria	0.921	37.73	-2.391	0.1442

Croatia	0.964	23.07	-3.229	0.0183
Cyprus	0.945	23.62	-3.810	0.0028
Czech Rep.	0.975	28.12	-2.495	0.1168
Denmark	1.029	22.62	-2.429	0.1336
Estonia	0.935	54.61	-4.410	0.0003
Finland	0.870	24.90	-3.111	0.0257
France	0.875	34.39	-3.044	0.0310
Germany	1.038	19.78	-2.862	0.0499
Greece	0.763	12.73	-2.058	0.2616
Hungary	0.915	41.73	-1.795	0.3829
Ireland	0.699	9.07	-2.159	0.2213
Italy	0.879	20.28	-2.513	0.1124
Latvia	0.926	36.39	-1.875	0.3440
Lithuania	0.940	26.73	-3.479	0.0086
Luxembourg	0.987	46.98	-4.310	0.0004
Malta	0.896	15.69	-1.783	0.3891
Netherlands	0.957	23.42	-2.986	0.0363
Poland	0.943	43.33	-4.110	0.0009
Portugal	0.898	19.66	-2.561	0.1013
Romania	0.837	41.11	-2.426	0.1345
Slovakia	0.947	36.99	-2.687	0.0763
Slovenia	0.888	23.54	-3.541	0.0070
Spain	0.767	14.73	-2.236	0.1936
Sweden	0.996	37.66	-3.625	0.0053

NOTE: The regression coefficient reflects the long-run relationship between government expenditure and revenues. The ADF test statistic tests for cointegration, where a lower value rejects the null hypothesis of no cointegration.

Source: own processing based on AMECO Database - European Commission (2024)

The results of the Engle-Granger cointegration test provide strong evidence of cointegration equilibrium (suggesting for long-run equilibrium relation) for 14 countries in the sample: Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Lithuania, Luxembourg, Netherlands, Poland, Slovenia, and Sweden. In these countries, the Engle-Granger test results indicate that government revenues and expenditures move together in the long run, supporting the hypothesis of fiscal sustainability. However, for the remaining 13 countries (Bulgaria, Czech Republic, Denmark, Greece, Hungary, Ireland, Italy, Latvia, Malta, Portugal, Romania, Slovak Republic, and Spain), the evidence of cointegration relation is importantly weaker, suggesting a potential disconnect between government revenues and expenditures over time. This result suggests that government revenues and expenditures may not move together in the long run, indicating potential challenges to improve a fiscal sustainability in these countries.

Finally, the estimated panel data models investigate the impact of fiscal rules (FR) and other macroeconomic variables on the primary budget balance (BB) across all EU-27 countries, as well as for two individual sub-panels of countries categorized as fiscally sustainable and unsustainable. The categorization of countries into two panels is based on the results of the Engle-Granger cointegration test (see Table 3). This grouping allows for a more targeted analysis of how fiscal rules and macroeconomic factors impact the primary budget balance in different fiscal contexts, i.e. it allows for searching and uncovering differences in impact of fiscal rules on fiscal sustainability in fiscal sustainable and unsustainable countries. The results of this analysis are reported in table 4.

The results uncover that fiscal rules have a statistically significant and positive impact on the primary budget balance across all country groups. For the entire sample of EU-27 countries, the coefficient for fiscal rules is 0.82899, indicating that stronger fiscal rules are associated with an improved fiscal position. This result confirms an important role of fiscal rules in promoting fiscal discipline across the whole EU-27.

Table 4. Panel analysis results for EU-27 countries, for sustainable countries, and for unsustainable countries

Model	All countries	Sustainable	Unsustainable
Countries	EU-27	AUT, BEL, HRV, CYP, EST, FIN, FRA, DEU, LTU, LUX, NLD, POL, SVN, SWE	BGR, CZE, DNK, GRC, HUN, IRL, ITA, LVA, MLT, PRT, ROU, SVK, ESP
Dependent variable	BB (primary budget balance)		
Independent variable	Estimate	Estimate	Estimate
FR	0.82899 ***	0.75794 ***	0.83803 **
GDPPC	-0.00003	0.00006 **	-0.00001
GOVEFF	1.00050	0.28160	1.71060
GAP	0.40207 ***	0.53080 ***	0.32447 **
INF	0.00202	0.04897	0.00192
p-value of the model (F-test)	< 0.001	< 0.001	0.00611

NOTE: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, . $p < 0.10$ indicate significance levels of 0.1%, 1%, 5%, and 10%, respectively. FR = Fiscal Rules, GDPPD = Gross domestic product per capita, GOVEFF = government effectiveness, GAP = Output gap, INF = inflation. Results of the Breusch-Godfrey/Wooldridge test for serial correlation: All countries: $\chi^2 = 257.13$; Sustainable countries: $\chi^2 = 93.949$; Unsustainable countries: $\chi^2 = 140.09$. Results of the Studentized Breusch-Pagan test for heteroscedasticity: All countries: BP = 15.978; Sustainable countries: BP = 21.056; Unsustainable countries: BP = 11.025. Estimated coefficients have been corrected using the Arellano-Bond method (1991) to address issues of heteroscedasticity and autocorrelation.

Source: own processing based on Eurostat Database (2024) and IMF Data (2024)

If the analysis is disaggregated into two panel data models separately for sustainable and unsustainable countries, some important distinctions emerge. For sustainable countries (Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Lithuania, Luxembourg, Netherlands, Poland, Slovenia, and Sweden), fiscal rules continue to exhibit a positive and significant effect on primary budget balance (the estimated coefficient is 0.75794, see tab. 4), although the magnitude of the effect is slightly lower

compared to the full sample of the EU-27. This result suggests that in fiscally sustainable countries, where prudent fiscal management is already in place, the additional effect of fiscal rules is still beneficial, but its marginal impact is somewhat reduced.

As far as unsustainable countries (Bulgaria, Czech Republic, Denmark, Greece, Hungary, Ireland, Italy, Latvia, Malta, Portugal, Romania, Slovakia, and Spain), the coefficient for fiscal rules is higher (0.83803, see Tab. 4), indicating that the impact of fiscal rules on primary budget balance is even more pronounced in countries facing fiscal sustainability challenges. This result highlights the critical role of fiscal rules in addressing fiscal imbalances and suggests that strict adherence to fiscal rules could be particularly effective in these countries, where fiscal discipline is weaker for the present.

To conclude, the results of the panel data analysis for whole EU-27 and two sub-samples of countries provide clear evidence that fiscal rules play a crucial role in promoting fiscal sustainability, particularly in countries where fiscal positions are weak. The stronger effect of fiscal rules in unsustainable countries underscores the importance of adopting and adhering to strict fiscal frameworks to prevent excessive budget deficits and ensure long-term fiscal health. As far as sustainable countries, while fiscal rules remain important for budget balance, broader macroeconomic factors such as economic performance measured by the output gap (GAP, see Tab. 4) and income levels (GDPPC, see tab. 4) appear to play a more significant role in maintaining fiscal stability.

Our results are in line with previous findings, such as those by Llorca and Redzepagic (2008), Westerlund and Prohl (2010), and Afonso and Coelho (2024), all confirmed the existence of a long-run cointegration relationship between government revenues and expenditures within the EU, supporting the notion of fiscal sustainability across the EU-27. Similarly, our findings are consistent with Brady and Magazzino (2018), who highlighted fiscal unsustainability in Portugal, Ireland, Italy, Greece, and Spain, corroborating our results from the Engle-Granger two-step cointegration test. Moreover, our analysis confirms Bravo and Silvestre (2002) results, who identify a cointegrated relationship between government revenues and expenditures, suggesting sustainable budget paths for Austria, France, Germany, the Netherlands, and the UK, but not for Belgium, Denmark, Ireland, Portugal, Italy, and Finland; even though, our findings differ slightly, as we observe fiscal sustainability in Belgium and Finland. Further, our findings align with those of Afonso and Coelho (2024), who demonstrate that fiscal sustainability

improves in the presence of fiscal rules and is influenced by the output gap, while the effects of inflation produce mixed results. Similarly, our analysis shows no statistically significant impact of inflation on fiscal sustainability, further supporting their conclusions. Finally, our results are consistent with those of Caseli and Reynaud (2020), who find that the implementation of fiscal rules is associated with lower fiscal deficits. This relation mirrors our findings, underscoring the importance of fiscal rules in promoting fiscal discipline and fiscal sustainability.

5. Conclusion

The paper makes a contribution to the growing body of empirical literature on fiscal sustainability within the European Union, particularly in light of recent economic challenges such as the global financial crisis, the European debt crisis, and the fiscal strains brought about by the Covid-19 pandemic and the war in Ukraine. By focusing on the long-run equilibrium relationship between government revenues and expenditures across EU-27 countries, our findings offer valuable insights into the dynamics of public finance and the pivotal role that fiscal rules play in promoting fiscal sustainability. We fill gap in recent empirical research by uncovering differences in effects of fiscal rules on budget balance separately for sustainable and unsustainable countries, which are identified by our results and grouped in two panels.

Using Pedroni's panel cointegration test and the Engle-Granger test, our analysis indicates that fiscal sustainability is evident in 14 of the 27 EU member states, for which government revenues and expenditures demonstrate a stable long-run equilibrium cointegration relation. However, the remaining 13 countries show weaker evidence of cointegration, suggesting necessary future challenges in maintaining fiscal sustainability. This heterogeneity underscores the importance of tailored fiscal policies and governance mechanisms to address individual country-specific fiscal dynamics.

The results of the panel data models further highlight the positive impact of fiscal rules on the primary budget balance across both fiscally sustainable and unsustainable countries. Notably, the effect of fiscal rules is more pronounced in fiscally unsustainable countries, emphasizing the critical need for robust fiscal frameworks to mitigate fiscal imbalances. On the contrary, in fiscally sustainable countries, even though fiscal rules remain important for budget balance, other macroeconomic factors, such as economic performance and income levels, play a more substantial role in maintaining fiscal health.

To conclude, our results uncover an important heterogeneity in the EU-27 fiscal sustainability and therefore underscore the necessity of a differentiated approach to fiscal governance within the EU. For countries facing fiscal sustainability challenges, strict adherence to fiscal rules is essential to avoid excessive budget deficits and safeguard long-term economic stability. Meanwhile, for countries with stronger fiscal positions, a broader focus on macroeconomic performance may prove more effective in maintaining fiscal discipline. These findings have important implications for future EU fiscal governance reforms and the ongoing debate over the flexibility and enforcement of fiscal rules within the union. Finally, our results bring new insights for future research on responses of fiscal sustainability to fiscal rules when fiscal sustainability will change over the time and some countries could be categorised from fiscally unsustainable to fiscally sustainable and vice versa. It is therefore recommended that this analysis be repeated and extended in subsequent years in order to obtain a full picture of the phenomena under study. Future studies could expand this analysis to include multiple year's data, thereby providing an analysis of both cross-sectional and time-series variation. Other possibilities for future research repose on look at the effects of fiscal shocks within the relation between fiscal rules and fiscal sustainability in each individual country to consider the presence of heterogeneity in the EU fiscal sustainability. Additionally, given that our empirical analysis was conducted on EU countries, future studies could examine the impact of fiscal rules on fiscal sustainability in other economic and monetary areas.

This study has yielded valuable insights and methodologies, illuminating various assessment approaches. However, it is important to acknowledge the limitations of the presented research. One such limitation is the access to reliable and comparable statistical data. Furthermore, extrapolating the findings of this study to a global context may be challenging, given the specificity of the economic conditions under examination. Finally, the assumptions of adopted the methodology may introduce bias or affect the conclusions drawn. It is essential to recognize and address these limitations in order to gain a nuanced understanding of the study's findings and to direct future research efforts in the realm of fiscal sustainability.

Abstract

The paper examines fiscal sustainability in the European Union, focusing on the long-term cointegration relationship

between government revenues and expenditures as a key indicator. Addressing the critical issue of fiscal heterogeneity among EU member states, the study examines how differences in fiscal sustainability impact macroeconomic stability and governance within the union. In the EU's shared monetary framework, understanding fiscal sustainability at both union and member state level is essential for macroeconomic stability. First, using a cointegration analysis, the research assesses fiscal sustainability across EU countries from 1995 to 2021. The findings reveal significant disparities, with 14 member states demonstrating a strong cointegration relationship, indicating their fiscal sustainability, while 13 exhibit weaker evidence, highlighting ongoing challenges in achieving a fiscally sustainable environment. The paper further explores the role of fiscal rules in promoting fiscal discipline through panel data models. Results suggest that fiscal rules enhance fiscal discipline across the EU, with more pronounced effect in countries facing sustainability challenges. Further, in more fiscally stable economies, broader macroeconomic factors such as economic performance and income levels are found to play more important role in budget balance changes. The paper contributes to the ongoing debate on the effectiveness of fiscal rules and the future of fiscal governance in the EU, offering insights to strengthen long-term fiscal stability across member states.

Keywords: *fiscal rules, primary budget balance, fiscal sustainability, panel data, cointegration, EU-27.*

JEL codes: E61, E62, H62, H63, C33, F45.

Acknowledgement

This paper was elaborated within the project VEGA 1/0154/24.

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