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The fiscal and macroeconomic effects of fiscal rules

Jonne Lehtimäki[1]

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Abstract
A majority of advanced and developing countries have adopted fiscal rules, which aim on managing fiscal aspects, such as government debt, government budget balances and other factors. Alongside national fiscal rules, many economic and monetary unions have implemented common fiscal rules, which affect all member countries and aim on controlling their fiscal aspects in a common way to address potential spillover effects from negative fiscal shocks and provide a more stable macro-fiscal environment. This study uses a fixed effect panel approach on a sample of 106 countries from 1985 to 2021 to study how national and supranational fiscal rules have affected the development of government debt, government budget balances, public investment and economic growth. The results imply that the effectiveness of different fiscal rules is highly heterogeneous and that supranational fiscal rules substantially outperform national fiscal rules. However, a majority of the effects from national fiscal rules remains unchanged when studied alongside supranational rules, suggesting that these rules act as complements rather than substitutes. The effects of fiscal rules are most significant for the studied fiscal variables, with some additional impacts observed for public investment and economic growth.

Keywords Fiscal rules · Fiscal policy · National budget, Deficit, And debt · International fiscal issues · Public investment · Economic growth

JEL Classification: E60 · E61 · E62 · H87

The views expressed in this paper are those of the author.

✉ Jonne Lehtimäki
jonne.lehtimaki@utu.fi

[1] University of Turku, Turku, Finland

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1 Introduction

A majority of advanced and developing countries have adopted fiscal rules, which target fiscal aspects, such as government debt, budget balances and other factors. They have become a key instrument of economic governance with their adoption and use becoming widespread around the world (Halac and Yared 2018, 2022). They are designed to address fiscal sustainability challenges by limiting government debt, constraining budget deficits, and promoting counter-cyclical fiscal policy (Von Hagen and Harden 1995; Kopits and Symansky 1998). Alongside national fiscal rules, many economic and monetary unions have implemented common fiscal rules, which affect all member countries and aim on controlling their fiscal aspects in a common way in order to address or restrict potential spillover effects from one member's negative fiscal shocks to other members as well as to provide a more stable macro-fiscal environment. Due to this development and the increasing amount of fiscal rules, a growing amount of literature, for example Badinger and Reuter (2017), Heinemann et al. (2018) and Vinturis (2023), studies different aspects, such as their design, implementation, compliance and effects.

Against this background, it is important to understand the broader global macroeconomic effects of fiscal rules as well as increase the understanding about the effectiveness of different forms of rules. Previous literature generally concentrates on studying individual fiscal variables for a restricted set of countries or a specific area. This paper extends previous studies on fiscal rules by examining a diverse set of economies at various stages of development and aims on filling a gap in the literature by providing a large-scale analysis of the macroeconomic effects of many different types of fiscal rules. Additionally, previous research has largely focused on rule effectiveness in the national or European context whereas this paper studies macroeconomic effects of national and supranational rules on government debt, budget balances, public investment, and economic growth using a cross-country empirical approach that includes multiple economic and monetary unions. By incorporating different institutional contexts, it provides new evidence on how fiscal rules function in diverse economic governance frameworks, offering a broader analysis on their economic effects.

Some broad-ranging approaches have been previously done by Caselli and Reynaud (2020), who emphasise the importance of rule design and enforcement mechanisms, and by Heinemann et al. (2018), who investigate the credibility aspects of fiscal frameworks. Additionally, Debrun et al. (2008) and Bergman and Hutchison (2015) have explored the effectiveness of fiscal rules across different economic contexts, but with more limited scopes of the types of rules or country coverage. By analysing a broader range of countries and rule types simultaneously, this study attempts to identify which fiscal rules are most effective under different economic conditions and institutional frameworks, thereby contributing to the development of more targeted policy recommendations for fiscal governance. While existing research, such as Tapsoba (2012), has increased understanding regarding how national numerical fiscal rules affect fiscal performance in

developing countries, this paper provides a more comprehensive cross-country perspective and studies a wider range of economic effects.

The approach of this paper is to use panel estimations with country and time fixed effects to study the effects of national and supranational fiscal rules. It combines macroeconomic data with country-level fiscal rules and explores several different time windows to provide a comprehensive picture of the effects. The paper aims on increasing the understanding about the design of fiscal rules as well as which types of fiscal rules are the most efficient for affecting the development of specific fiscal variables or for potentially enhancing economic growth or public investment.

The results of the study suggest that the effectiveness of different fiscal rules is very heterogenous and depends on the specific rule. Supranational fiscal rules seem to substantially outperform national ones and this can be either due to multilateral surveillance, more defined targets or a common methodology. However, a large majority of the effects from national fiscal rules remains unchanged when studied together with supranational rules. This implies that national and supranational rules act as complements rather than substitutes. The effects of fiscal rules are most significant for the studied fiscal variables but some can also be observed for public investment and economic growth.

The remainder of the paper is organised as follows: Sect. 2 presents some of the concepts used and summaries some general literature on fiscal rules, Sect. 3 introduces the approach of the study and Sect. 4 the data used. Section 5 presents the results of the study, Sect. 6 conducts some robustness tests and Sect. 7 concludes.

2 Background

This section presents a non-exhaustive list of research studying the general effects of fiscal rules. It also contains short descriptions of the supranational frameworks currently in place as well as of different types of fiscal rules and some examples of each.

Fiscal rules have become a useful tool for economic governance, helping in controlling various aspects of general government and public finances. Their effectiveness is based on long-term effects, extending across multiple years or parliamentary terms, as well as their ability to stabilise fiscal policy and to drive fiscal policy towards counter-cyclicality.

As fiscal rules have had observable effects across diverse aspects of public finances, the number of countries following at least some form of fiscal rules has increased rapidly over the past 30 years (Halac and Yared 2018, 2022). Figure 1 displays this increase for all four main types of rules used.

The increasing trend of fiscal rules begins from the 1990s and, subsequently, the amount of literature related to the subject has also grown. There is now a vast and expanding literature discussing the effects of fiscal rules on fiscal variables. Early studies, such as Von Hagen and Harden (1995), highlighted the relationship between budget processes, fiscal discipline, and government budget balances. The paper notes that political economy factors are vital at determining the commitment to fiscal rules as well as how effective they are. A similar conclusion is made by Kopits

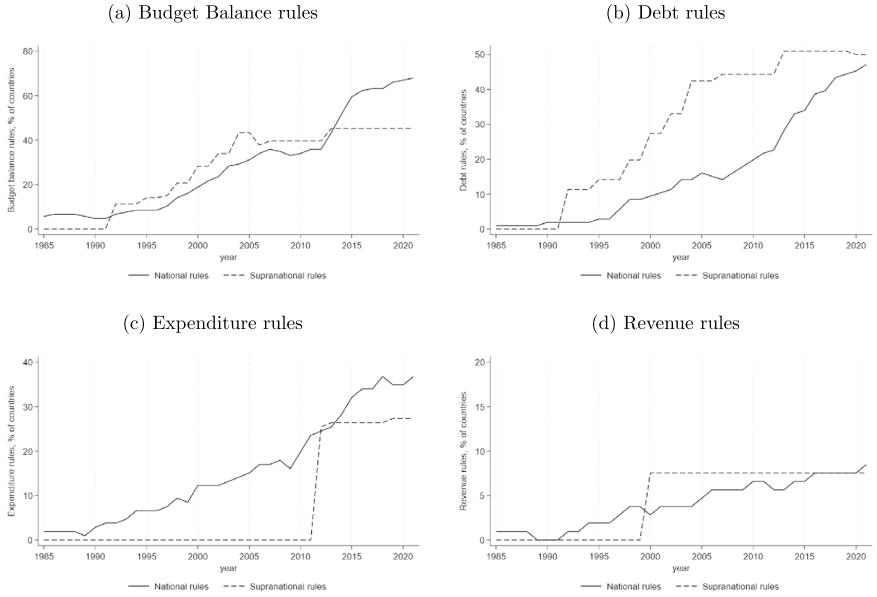

Fig. 1 The historical growth of fiscal rules. *Notes*: Share of countries of full sample (106 total) of the empirical section as described in Sect. 4 where national and supranational fiscal rules are in effect. Source: Author's calculations based on data from Davoodi et al. (2022)

and Symansky (1998), who note the importance of fiscal policy constraints, the built-in deficit-bias of governments as well as understanding of the key principles of fiscal rules and how to design and implement them.

Debrun et al. (2008) observe that fiscal rules seem to affect fiscal performance robustly but the type and design of rules are vital aspects of their effectiveness. Vinturis (2023) concludes that specific features of fiscal rules may enhance their disciplining effect, for example independent fiscal bodies, investment-friendly fiscal rules, supranational fiscal rules, or in most cases monitoring outside the government and a "hard" legal basis can enhance the effects whereas other features such as fiscal responsibility laws, a higher number of fiscal rules, national fiscal rules, or in most cases a "soft" legal basis as well as cyclically-adjusted budget balance rules or expenditure ceilings may weaken effectiveness. Price (2010) studies the political economy aspects of fiscal consolidation and notes fiscal rules as a potential tool for imposing fiscal discipline but also highlights that they are not completely immune to political influence. Some concerns about the future of rule-based frameworks are noted by Debrun and Jonung (2019), who suggest moving towards enhancing the reputational costs of breaching rules while also highlighting the failure of current arrangements in guiding fiscal policy and, therefore, undermining formal compliance with rules as well as their political support.

Other real economic effects from fiscal rules have also been observed in previous literature. Some examples are Thornton and Vasilakis (2018), who note that the introduction of numerical fiscal rules reduces government borrowing costs, and

Badinger et al. (2017) who study the relationship between fiscal rules and the occurrence of twin deficits (simultaneous fiscal and current account deficits) in different countries. Barbier-Gauchard et al. (2021) conclude that fiscal rules, in general, significantly improve the fiscal performance of a country, but the effects are dependent on the type of fiscal rule and structural factors. Heinemann et al. (2018) observe a constraining effect from fiscal rules to fiscal aggregates but also highlight a potential of endogeneneity issues and publication bias in previous research. Nerlich and Reuter (2016) find strong evidence for fiscal rules being associated with higher fiscal space for the European Union (EU) countries. Finally, Bergman and Hutchison (2015) conclude that fiscal rules are effective for reducing pro-cyclicality if combined with a minimum threshold of government efficiency, and Combes et al. (2017) come to a similar conclusion that fiscal rules can mitigate the pro-cyclicality of fiscal policy but they also note that, when debt levels are high, the cases where this happens are very specific.

Some of the literature concentrates on a vital aspect: whether the fiscal rules in effect are being complied with. Some prominent examples of this are Reuter (2015), who notes that compliance is significantly higher with rules constraining stock (rather than flow) variables, set out in coalitional agreements, and covering larger parts of general government finances and Hansen (2015), who concludes that the reasons for not complying with fiscal rules are usually based on economic need rather than relative political power, governing ideology or diffusion, at least when it comes to the EU's fiscal framework. Ardanaz et al. (2024) note that in emerging markets compliance with fiscal rules decreases in downturns but does not increase during upturns and developed institutional frameworks as well as specific forms of rules can increase compliance. Despite these observations, fiscal rules can also have observable effects during periods of non-compliance. Reuter (2015, 2019) finds that fiscal rules act as a benchmark for policymakers as well as the public, and that they still anchor fiscal policy to the numerical limits in times of non-compliance.

Alongside compliance, the stringency of fiscal rules has also been identified as an important factor for their effectiveness. For example Badinger and Reuter (2017) note that stringent fiscal rules improve fiscal balances and yield spreads and also lead to lower output volatility by reducing fiscal policy volatility. Doray-Demers and Foucault (2017) observe that fiscal stress prevents fiscal reform in the short term, and leads to stronger fiscal rules in the long term and that many EU countries were forced into adopting more stringent fiscal rules to obtain fiscal support after the sovereign debt crisis. Maltritz and Wuste (2015) conclude that countries with stringent fiscal rules have higher primary surpluses and the effects of fiscal rules are enhanced by fiscal councils and Potrafke (2023) notes that stringent rules are more effective, for example, to reduce budget deficits.

A large share of previous research concentrates on advanced countries but there is also a growing amount of studies done on developing countries such as Tapsoba (2012), who finds that the effect of fiscal rules on structural fiscal balance is significantly positive but somewhat dependent on country-specific characteristics such as government stability, time since the adoption of the rules, the number of rules and the presence of supranational rules. Bova et al. (2014) also provide a comprehensive analysis of fiscal rules in developing countries, noting that their use is, in

some respect, even more widespread than in advanced countries but also highlight that historically they have not helped in addressing pro-cyclicality in developing countries.

Some previous studies address the potential interaction between national and supranational fiscal rules and relationships between different levels of fiscal governance, particularly in the context of the EU. Debrun et al. (2008) analyse the role of national fiscal rules within the EU framework, highlighting how supranational constraints can affect the fiscal policy choices in member states. Similarly, Nerlich and Reuter (2016) study how the design of fiscal frameworks and how they affect budgetary aspects, while Afonso and Hauptmeier (2009) explore the effects of fiscal decentralisation on government debt. Different levels of fiscal governance are also studied in papers such as Kraemer and Lehtimaki (2023) concentrating on the EU and Brooks et al. (2016), who provide empirical evidence from US municipalities and how rule effectiveness is affected by different levels of governance.

Other studies, such as Beetsma and Debrun (2007), emphasise the coordination challenges between national and supranational fiscal policies, whereas Heinemann et al. (2018) provide a meta-regression-analysis on the effectiveness of fiscal rules at different governance levels. Reuter (2019) further investigates compliance with fiscal rules, showing how national compliance with rules can be influenced by supranational and multilateral surveillance. Eyraud et al. (2018) also address similar aspects by analysing fiscal rule design across multi-tiered governance systems, noting that institutional enforcement mechanisms can potentially affect rule effectiveness.

2.1 Supranational fiscal rules

Along with national fiscal rules, several supranational bodies consisting of different country groups have established supranational fiscal rules, which direct different fiscal aspects of all member states. These groups and their main features are:

- The European Union (EU)[1] has the most institutionalised supranational fiscal framework currently operational, embedded within its legal and economic governance structure. The Stability and Growth Pact (SGP) sets limits to the fiscal deficits (reference value of 3%) and government debt (reference value of 60%). The SGP clarifies the budgetary criteria of the Maastricht Treaty of 1992, which EU countries have to reach to adopt the common currency. The framework has been amended on several occasions since the SGP was established and it now includes elements of monitoring of both budgetary and economic policies as well as reinforced economic surveillance and coordination. The latest reform in 2024 adjusted the framework to a more medium-term approach through multi-year fiscal-structural plans setting country-specific debt sustainability and net

[1] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, and Sweden. The United Kingdom left the EU in 2020 but the country was also exempt from parts of the fiscal framework during its membership, most notably the requirements of the debt reduction rule.

expenditure paths with minimum requirements. Through these developments, the EU operates at a high level of fiscal integration, where fiscal rules are legally binding and supported by enforcement mechanisms, although they have been rarely used. As the most comprehensive set of supranational fiscal rules, the SGP and its effects have also been the most studied framework in previous literature.

- The Eastern Caribbean Currency Union (ECCU),[2] which have adopted the Eastern Caribbean dollar, originally established in 1965, as their common currency with the Eastern Caribbean Central Bank formed in 1983 following the Treaty of Basseterre, which established the Organisation of Eastern Caribbean States (OECS) in 1981. The ECCU has implemented a debt target of 60% for member countries by 2035, and has had a fiscal benchmark target of overall deficit of 3% of GDP, which was omitted in 2006. Unlike other supranational institutions, the ECCU lacks strong enforcement mechanisms. There are no formal penalties for non-compliance, and country surveillance relies on voluntary compliance with set rules. The Eastern Caribbean Central Bank (ECCB) provides guidance and technical assistance to help governments improve fiscal discipline, but its influence is limited. Given the small size and economic vulnerabilities of ECCU members, fiscal rule effectiveness is often challenged by external shocks, such as hurricanes and commodity price fluctuations. The level of fiscal integration in the ECCU is considerably lower than in other supranational institutions, making its fiscal rules less binding.
- The East African Monetary Union (EAMU),[3] which is a part of the East African Community (EAC) regional integration. In 2013 it set a goal of a common currency for the EAC during the following 10 years. It has set a ceiling of 50% of GDP on gross public debt for member countries as well as a budget balance rule with a ceiling on fiscal deficit of 3% of GDP. The EAMU remains in an early stage of fiscal integration, with fiscal rules serving as potential targets rather than legally binding constraints. The EAMU currently lacks a formal institutional authority to enforce compliance, making its fiscal rules primarily advisory. Fiscal coordination is currently quite limited, which is due to the lack of a common currency and the political heterogeneity of the member states.
- The Central African Economic and Monetary Community (CEMAC),[4] which has a set of budget balance rules as well as a debt rule on the stock of external plus domestic public debt, which should be kept below 70 % of GDP. CEMAC's fiscal rules were strengthened in 2017 after the region's economic crisis driven by oil price shocks. Since then, fiscal rules have been more significant in guiding fiscal policy. Enforcement mechanisms in CEMAC remain limited, and compliance with the common fiscal rules depends on political will and external pres-

[2] Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. Common currency also used by British Virgin Islands, which is not a member of ECCU.

[3] Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda.

[4] Cameroon, Central African Republic, Chad, the Republic of the Congo, Equatorial Guinea, and Gabon. Angola, Burundi, the Democratic Republic of the Congo, Rwanda, and São Tomé and Príncipe are members of the Economic Community of Central African States.

sure, particularly from the International Monetary Fund (IMF), which has supported fiscal consolidation efforts in the region.

- The West African Economic and Monetary Union (WAEMU),[5] which has different fiscal convergence criteria: a balanced budget rule (excluding budget grants and foreign-financed capital expenditures, including Heavily Indebted Poor Countries (HIPC) or Multilateral Debt Relief Initiative (MDRI) financed expenditures) and a 70% of GDP ceiling on public debt. These were complemented with less binding convergence targets, called 2nd tier, which included a 20 percent floor on revenues. Changes to the WAEMU convergence criteria were made in January 2015. The first order convergence criteria on balanced budgets now specifies that the overall fiscal deficit (including grants) should remain below 3% of GDP. The ceiling on the nominal debt-to-GDP ratio was kept at 70%. The second-order convergence criterion on tax revenue was revised upward to 20 % of GDP. The WAEMU treaty provides a legally-binding framework for fiscal rules but enforcement has been challenging. WAEMU member states must submit budgetary plans for regional surveillance purposes but sanctions for non-compliance have been rare. Enforcement of the rules depends largely on peer pressure and reputational costs.

The supranational fiscal rules in the EU, ECCU, EAMU, CEMAC and WAEMU vary considerably when it comes to their strength, institutional design, and enforcement mechanisms. However, they also share some common elements, which aim on enhancing fiscal discipline and macroeconomic stability. The EU framework is the most developed and stringent system, with comprehensive surveillance and potential sanctions, while the WAEMU and CEMAC frameworks feature less robust enforcement mechanisms despite also having similar numerical targets. The ECCU operates with moderate stringency and institutional support, while EAMU represents a framework at an early stage of development. The effectiveness of these supranational frameworks depends on the quality of domestic institutions, political commitment, and alignment with national fiscal frameworks, but their design can efficiently assist member states in improving fiscal sustainability and macroeconomic stability.

All supranational fiscal frameworks include deficit rules, with the EU, CEMAC and WAEMU having a reference value of 3% of GDP, while ECCU and EAMU have slightly different thresholds. Debt rules are similarly widespread and the EU's Maastricht criteria value of 60% of GDP ratio level has been adopted as a target for 2035 by ECCU whereas CEMAC and WAEMU have introduced a higher 70% rule and EAMU a lower 50% target with slightly varying definitions. Revenue rules are not included in any supranational framework outside WAEMU.

When it comes to enforcement mechanisms, the EU has implemented the most comprehensive framework, which includes medium-term fiscal-structural plans and Excessive Deficit Procedures with potential financial sanctions. WAEMU and CEMAC rely more on peer pressure and multilateral surveillance with limited formal consequences, while ECCU enforcement depends primarily on central bank surveillance. The EAMU, still in early stages of development when it comes to fiscal

[5] Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo.

frameworks, has established conceptual enforcement procedures but practical implementation is still under development. Escape clauses also vary significantly as the EU framework includes specific provisions for exceptional circumstances, while other unions either have less formalised exemptions or rely on discretionary interpretations during large economic shocks.

All supranational fiscal rules share common objectives such as limiting the growth of government debt and deficits, at least to some extent. When it comes to governance structures, the EU enforces fiscal rules through legally binding mechanisms, including potential sanctions for non-compliance. Other economic and monetary unions rely primarily on cooperative enforcement and multilateral surveillance, where sanctions are rare and flexibility is higher.

2.2 Different types of fiscal rules

2.2.1 Budget balance rules

Budget balance rules generally constrain the level of government deficit or set requirements for the budget of specific government subsectors. Usually they set a numerical limit of % of GDP, a multi-annual objective or define a requirement for a balanced budget. Sometimes budget balance rules account for the business cycle and target a structural budget balance.

When it comes to national fiscal rules, budget balance rules are the most common ones with about 2/3 of the countries having at least one in effect at the end of the sample of this study. Their use has grown at a stable speed until the financial crisis after which there was a substantial increase in the share of countries implementing national budget balance rules.

2.2.2 Debt rules

Debt rules usually set a specific limit on the stock of debt or a convergence requirement towards a specific level, often for subsections of the public sector or the general government.

Debt rules are the most common supranational fiscal rule with about half of the countries having one in effect at the end of the sample. National rules have a similar level to supranational rules at the end of the sample. Many countries have set national debt rules during and after the financial crisis, potentially to provide a mechanism to counteract the significant increases in government debt observed during the crisis.

2.2.3 Expenditure rules

Expenditure rules generally set limits on government spending by implementing a limit on growth, as a % of GDP or in absolute terms. They can be set for specific categories or sectors or as a common rule for the entire government.

Expenditure rules have been historically more common in the national fiscal frameworks whereas they have been very rare on a supranational level. There was a significant growth of supranational expenditure rules during the financial crisis, which was due to the EU introducing an expenditure benchmark in the reform of the SGP in the so called 'Six-Pack' set of measures.

2.2.4 Revenue rules

Revenue rules usually set a level of revenue in % of GDP or ratios of taxes-to-GDP. They usually set maximum or minimum levels on revenue or determine how windfall revenues are to be used.

Revenue rules are the least used for national as well as supranational fiscal rules with only about 10 % of the countries in the sample having any in effect at the end of the sample. The only supranational revenue rule is in effect for the WAEMU and sets a floor for government revenue. However, it is defined as a 2nd tier target and less binding than the main fiscal convergence criteria. National fiscal rules are not as concentrated and individual countries in Africa, Asia, Europe and Oceania have introduced them into their fiscal frameworks.

3 Methodology

The approach taken by the paper is designed to account for the many different facets of national and supranational fiscal rules as well as potential dynamic developments through different time horizons. The empirical approach of this study is to use country and time fixed effects and diagonal standard errors and covariance. It combines elements of previous literature on fiscal rules, especially Kraemer and Lehtimaki (2023, 2025a, 2025b).

Several different time windows are studied in order to assess the dynamics of macroeconomic aspects comprehensively as well as to get a sense of the persistence of the effects: 1-year change for short-term changes, 5-year centered moving average of change for medium-term, and 10-year centered moving average of change for long-term dynamics. The medium- and long-term forms are also expected to eliminate some of the potential short-term noise and business cycle effects from the data.

The empirical specification is a panel data estimation with country and time fixed effects, which has the following form:

$$\begin{aligned}\overline{\Delta MacroVar^{C}_{(t\pm x)}} = \alpha + \beta_1 MacroVar^{C}_{(t-1)} + \beta_2 CONT^{C}_{(t-1)} + \beta_3 \overline{\Delta CONT^{C}_{(t\pm x)}} \\ + \beta_4 FiscalRule^{C}_{(i,t-1)} + \epsilon^{C}_{t}\end{aligned} \tag{1}$$

where $\overline{\Delta MacroVar^{C}_{t\pm x}}$ is the change of the macroeconomic variable in country C studied for period t as well as $t \pm x$ for centered moving averages of five-year and ten-year periods. $MacroVar_{(t-1)}$ is the lagged value of the studied macroeconomic variable used to control for the previous level of the dependent variable, $CONT^{C}_{(t-1)}$ the set of lagged control variables and $\overline{CONT^{C}_{(t\pm x)}}$ the changes of specific control

variables corresponding to the changes in the dependent variable and $FiscalRule^{c}_{i,t-1}$ is a fiscal rule of type i in effect in period $t-1$. The effects will be studied first for all potential national fiscal rules, then for supranational fiscal rules and finally for both simultaneously to account for potential coeffects as well as to provide a more realistic picture of the results as the rules are in effect simultaneously. Additionally, results are provided for each type of fiscal rule individually with the same control variables in Appendix 2 as well as without any control variables in Appendix 3. The macroeconomic and fiscal variables studied in the empirical part are government debt, government budget balance, public investment and economic growth.

The used set of control variables is based on a two-tier approach: First the most important explanatory variables, and whether their changes or levels are more important, are identified by running a random forest model for the set of differences and lagged values of all control variables. After this, the important variables are used as explanatory variables in the fixed effect estimation and insignificant variables for all time windows are dropped until no completely insignificant explanatory variables remain. The full set of control variables consists of government debt, government expenditure, inflation, real interest rates, real GDP, government budget balance, public investment, private investment, trade openness, banking crises, age dependency ratio and unemployment. In addition other variables such as population, foreign direct investment, a democracy index, some subindicators of the Worldwide Governance Indicators and an index of economic freedom were also tested but were insignificant for all combinations of dependent variables and time windows.

It should be noted that the macro-level approach of the paper defines all fiscal rules of a specific type to be equal. However, there are notable differences in the implementation, characteristics and country-level effects as well as how specific rules are used in practice. There are also substantial differences in the effect of national fiscal rules of different sectors as well as rule types and these have been explored, amongst others, in Blesse et al. (2023), Brandle and Elsener (2023) and Kraemer and Lehtimaki (2023, 2025a, 2025b).

4 Data

This section describes the data used in the empirical study. It covers data sources and the sample and describes the data on national and supranational fiscal rules as well as the variables for macroeconomic effects. In addition, the variables used in the estimations to control for other factors are discussed.

The data used in the study is compiled from the public databases of the European Central Bank, the IMF and the World Bank. The data for fiscal rules is based on the Davoodi et al. (2022) fiscal rules data and the full sample runs from 1985 to 2021, which is the full coverage of the dataset. The database includes a total of 106 countries but the sample of the main results is lower due to restrictions in control variable data availability. Appendix 3 presents the results with only the

Table 1 Descriptive statistics of data used in the study

	Unit	Mean	StdDev	Min	Max
Age dependency ratio	pct	62.6	19.1	27.3	115.9
General government debt	pct of GDP	55.9	42.4	0.5	600.1
General government budget balance	pct of GDP	−3.2	16.4	−557.5	41.0
General government expenditure	pct of GDP	16.3	8.0	0.9	147.7
Inflation	change of GDP deflator	5.2	50.1	−83.7	2359.0
Private investment	pct of GDP	14.6	6.6	0.0	46.4
Public investment	pct of GDP	4.2	2.7	0.1	31.5
Real GDP	log	24.5	2.4	18.9	30.7
Real interest rate	pct (annual)	4.8	6.2	−0.8	59.3
Trade openness	pct of GDP	84.8	59.9	9.1	442.6
Unemployment	pct	8.1	5.6	0.0	57.0

fiscal rules as explanatory variables for the full sample with all countries. All sources as well as transformations used are presented in Appendix 1, Table 8.

The approach of coding fiscal rules is the same for national and supranational rules:

$$\begin{cases} 0 = \textit{a country does not have a fiscal rule of a certain type in the studied year} \\ 1 = \textit{a country has a fiscal rule of a certain type in the studied year} \end{cases}$$

The coding is done separately for national and supranational rules.

Table 1 lists the other data used in the study as well as descriptive statistics. The banking crisis dummy follows Laeven and Valencia (2020, 309), where a crisis exists if both of the following conditions are observed: 1. Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations), 2. Significant banking policy intervention measures in response to significant losses in the banking system.

5 Results

This section will study the macroeconomic effects of different national and supranational fiscal rules. The section is divided to subsections based on the dependent variable, beginning with government debt, followed by government budget balances, public investment and, finally, economic growth. Each subsection explains the mechanism and discusses some previous results.

5.1 Government debt

Eichengreen et al. (2019, 1) note on sovereign debt that "In the best of times it relaxes the domestic constraint on savings, smooths consumption, and finances

Table 2 Results. Government Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules									
Budget Balance Rule(-1)	−0.004	−0.002	−0.004***				−0.007	−0.003	−0.004**
	(0.005)	(0.002)	(0.002)				(0.005)	(0.002)	(0.002)
Debt Rule(-1)	−0.002	0.001	0.002				−0.002	0.000	0.002
	(0.005)	(0.003)	(0.002)				(0.005)	(0.003)	(0.002)
Expenditure Rule(-1)	0.011*	−0.000	−0.000				0.010*	−0.001	−0.001
	(0.006)	(0.003)	(0.002)				(0.006)	(0.003)	(0.002)
Revenue Rule(-1)	−0.016**	−0.011***	−0.007***				−0.017**	−0.012***	−0.008***
	(0.007)	(0.003)	(0.002)				(0.007)	(0.003)	(0.002)
Supranational Fiscal Rules									
Budget Balance Rule(-1)				0.015	0.016**	0.017***	0.017	0.017**	0.018***
				(0.019)	(0.008)	(0.005)	(0.020)	(0.008)	(0.005)
Debt Rule(-1)				−0.016	−0.015*	−0.016***	−0.018	−0.016*	−0.017***
				(0.019)	(0.008)	(0.006)	(0.019)	(0.009)	(0.006)
Expenditure Rule(-1)				−0.011*	−0.016***	−0.017***	−0.010	−0.016***	−0.017***
				(0.006)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)
Revenue Rule(-1)				−0.125	−0.063**	−0.040**	−0.126	−0.065**	−0.041**
				(0.095)	(0.031)	(0.018)	(0.095)	(0.031)	(0.019)
Controls									
Government debt(-1)	−0.120***	−0.041***	−0.029***	−0.117***	−0.039***	−0.026***	−0.119***	−0.037***	−0.026***
	(0.022)	(0.011)	(0.007)	(0.022)	(0.011)	(0.007)	(0.022)	(0.011)	(0.007)
Government expenditure(-1)	0.386***	0.165**	0.096**	0.347***	0.138*	0.067	0.340***	0.137*	0.065
	(0.114)	(0.072)	(0.044)	(0.119)	(0.074)	(0.046)	(0.119)	(0.075)	(0.046)

Table 2 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
Inflation(-1)	−0.010	−0.006**	−0.002	−0.010*	−0.005**	−0.001	−0.011*	−0.006**	−0.002
	(0.006)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)
Interest rate(-1)	0.049	0.075***	0.046***	0.048	0.062***	0.027*	0.055	0.064***	0.029**
	(0.048)	(0.024)	(0.015)	(0.046)	(0.024)	(0.015)	(0.047)	(0.024)	(0.015)
Banking crisis(-1)	0.022*	0.019***	0.013***	0.021**	0.018***	0.012***	0.022**	0.018***	0.012***
	(0.009)	(0.005)	(0.003)	(0.009)	(0.004)	(0.003)	(0.009)	(0.004)	(0.003)
ΔReal GDP	−0.782***	−0.800***	−0.641***	−0.754***	−0.745***	−0.566***	−0.751***	−0.746***	−0.568***
	(0.106)	(0.090)	(0.067)	(0.115)	(0.083)	(0.063)	(0.114)	(0.082)	(0.063)
ΔGovernment balance	−0.297***	−0.652***	−0.781***	−0.287***	−0.610***	−0.687***	−0.289***	−0.607***	−0.673***
	(0.096)	(0.133)	0.185***	(0.095)	(0.129)	(0.190)	(0.094)	(0.130)	(0.189)
ΔPublic investment	−0.317*	−1.468***	−1.877***	−0.297**	−1.421***	−1.986***	−0.293*	−1.415***	−1.987***
	(0.166)	(0.272)	(0.353)	(0.169)	(0.263)	(0.339)	(0.169)	(0.262)	(0.338)
ΔPrivate investment	−0.195*	−0.786***	−1.036***	−0.205**	−0.796**	−1.008***	−0.201**	−0.803***	−1.012***
	(0.101)	(0.146)	(0.144)	(0.100)	(0.134)	(0.140)	(0.099)	(0.134)	(0.140)
Constant	0.029	0.023*	0.025***	0.042*	0.030*	0.030***	0.046*	0.032**	0.032***
	(0.020)	(0.014)	(0.009)	(0.024)	(0.016)	(0.010)	(0.024)	(0.016)	(0.010)
Countries	87	87	87	87	87	87	87	87	87
Observations	2187	2200	2206	2187	2200	2206	2187	2200	2206
adj. R^2	0.32	0.46	0.53	0.33	0.47	0.54	0.34	0.47	0.55
F-stat	8.9***	15.1***	19.5***	9.3***	15.9***	20.8***	9.0***	15.5***	20.4***

Fixed Effect (country and year) estimates of the relationship of the changes of government debt, national fiscal rules, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

investment" and "In the worst of times it is associated with debt overhangs, banking collapses, exchange-rate crises and inflationary explosions" and Boskin (2020) states that in the long run large debt ratios can lead to substantially higher taxes, lower future net incomes and intergenerational inequity.

Traditionally, a high level of government debt has been expected to slow down economic activity and growth when certain thresholds of debt-to-GDP are exceeded. Theoretically there must be some critical level where this effect will be observed, but based on recent literature, for example Reinhart and Rogoff (2010), Gomez-Puig and Sosvilla-Rivero (2015) and Lim (2019), it is very likely country-specific and depends on institutional aspects, the monetary policy environment as well as many other potential factors. Based on the experiences of the past decade it seems that, at least in a low interest rate environment, debt levels can be increased far more than was previously envisaged (Blanchard 2019). However, the surge in inflation observed in 2021 and the subsequent fast tightening of monetary policy by central banks around the world has left the very low (or even negative) interest rate environment in the past, at least for the time being. Based on a large majority of the research from the last decade (for example Rugy and Salmon (2020,2–8)), there exists at least some (state-dependent) threshold of debt above which economic growth will be negatively affected.

The results for the changes in government debt are presented in Table 2. When it comes to national fiscal rules, revenue rules have been the most efficient for lowering government debt with a negative statistically significant coefficient for all the studied time windows, at least at a 5% significance level. National budget balance rules have also had a lowering effect on government debt in the long-run time window whereas national expenditure rules have a debt-increasing effect in the short run, although only at a 10% significance.

When it comes to supranational fiscal rules, the effects are somewhat more varied. Budget balance rules have had a significant increasing effect in the medium-run and long-run time windows whereas debt rules, expenditure rules and revenue rules have all had statistically significant debt-lowering effects for some time windows.

The results of regressions (7)–(9) imply that national budget balance rules reduce government debt annually by approximately 0.4 percentage points of GDP over ten years while revenue rules have a somewhat larger effect, lowering debt by 0.8 percentage points over the same period, suggesting that revenue requirements may be more effective in lowering debt levels. Supranational debt and expenditure rules have somewhat stronger effects, decreasing government debt by about 1.7 percentage points over a ten year period. Supranational budget balance rules have had an increasing effect on government debt of 1.7–1.8 percentage points over the five and ten year periods, implying that they are generally not sufficient for controlling the dynamics of government debt.

When the fiscal rules are studied individually in Sec. 6, Table 9 for national fiscal rules and in Table 10 for supranational rules, the effects for national budget balance rules and revenue rules remain unchanged but expenditure rules lose their significance. For supranational rules the lowering effects remain unchanged for expenditure rules. Debt rules and revenue rules remain debt-lowering, although with a slightly weaker significance. The increasing effect of budget balance rules

disappears and they are only debt-lowering in the long-run time window and with a 10% significance level.

The results are broadly similar for fiscal rules individually without control variables presented in the Appendix Tables 17 and 18 with national expenditure rules being the most noteworthy exception with a significant debt-lowering effect for the medium-run and long-run time windows.

These findings are in line with a majority of prior research on the effects of fiscal rules on government debt. Debrun et al. (2008) and Badinger and Reuter (2017) have previously shown that stringent fiscal rules can help in achieving lower government debt levels, particularly when they include enforcement mechanisms such as independent fiscal institutions. The observed complementarity between national and supranational debt rules supports the argument of Vinturis (2023) about the credibility of fiscal rules being enhanced by supranational surveillance. However, the stronger effects from supranational rules suggests that external monitoring and multilateral surveillance might be more effective than only national fiscal constraints, which is consistent with the observations of Heinemann et al. (2018), who note that fiscal rule effectiveness varies by institutional enforcement. The results of this study match those of Kraemer and Lehtimaki (2023) and do not indicate strong effects of national expenditure rules on government debt, which is contrary to Maltritz and Wuste (2015).

5.2 Government budget balance

While government budget balance is similar to changes in government debt, there are some notable differences. Changes of government debt are affected by several other factors such as stock-flow adjustments and valuation changes.

Government budget balances are a key factor in the dynamics of fiscal development. While budget balances are somewhat dependent on macroeconomical trends and exhibit some level of hysteresis, they are also the outcome of political decisions on government revenue and expenditure. In addition to political economy factors, government budget balances are also affected in modern frameworks by automatic stabilisers and institutional setups. Fiscal rules are commonly used to set barriers on annual or multi-annual budget balances, usually through deficit limits.

The results for the government budget balance are presented in Table 3. For national fiscal rules, there are small statistically significant positive effects in the long-run for budget balance rules and negative effects for the debt rules in the medium-run. For supranational rules there are highly significant positive effects for expenditure rules for all time windows and negative effects for revenue rules in the medium-run and long-run.

Based on the results, national budget balance rules increase government budget balances by 0.2 percentage points of GDP over a ten year period but this effect disappears when supranational fiscal rules are accounted for. Supranational expenditure rules have a stronger effect, increasing budget balances by 0.7 to 0.8 percentage points over a time period of five to ten years, which could imply that externally set fiscal constraints are more effective. However, supranational revenue rules appear to

Table 3 Results Government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules									
Budget Balance Rule(-1)	0.000	0.001	0.002*				−0.000	0.000	0.001
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Debt Rule(-1)	−0.002	−0.002**	−0.001				−0.002	−0.002**	−0.001
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Expenditure Rule(-1)	0.002	0.001	−0.001				0.001	0.000	−0.002**
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Revenue Rule(-1)	0.002	0.002	0.001				0.002	0.003*	0.002
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Supranational Fiscal Rules									
Budget Balance Rule(-1)				−0.004	−0.002	−0.002	−0.004	−0.002	−0.002
				(0.009)	(0.005)	(0.002)	(0.009)	(0.006)	(0.005)
Debt Rule(-1)				0.006	0.006	0.006	0.006	0.005	0.005
				(0.009)	(0.005)	(0.005)	(0.009)	(0.005)	(0.005)
Expenditure Rule(-1)				0.007***	0.007***	0.007***	0.007***	0.007***	0.008***
				(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Revenue Rule(-1)				−0.009	−0.013**	−0.016***	−0.009	−0.013**	−0.016***
				(0.011)	(0.006)	(0.004)	(0.011)	(0.006)	(0.004)
Controls									
Government Balance(-1)	0.496***	0.441***	0.265***	0.491***	0.433***	0.255***	0.491***	0.432***	0.255***
	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.018)	(0.050)	(0.025)	(0.018)
Interest Rate(-1)	−0.028**	−0.030***	−0.036***	−0.018	−0.018***	−0.022***	−0.018	−0.018***	−0.022***
	(0.012)	(0.006)	(0.005)	(0.013)	(0.006)	(0.005)	(0.013)	(0.006)	(0.005)

Table 3 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
Trade(-1)	0.013***	0.013***	0.013***	0.009**	0.009***	0.009***	0.009**	0.008***	0.009***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Banking Crisis(-1)	−0.009***	−0.005***	−0.001	−0.009***	−0.004***	−0.000	−0.009***	−0.004***	−0.000
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
ΔReal GDP	0.072**	0.109***	0.111***	0.073**	0.113***	0.123***	0.074**	0.114***	0.121***
	(0.030)	(0.025)	(0.028)	(0.030)	(0.024)	(0.027)	(0.030)	(0.024)	(0.027)
ΔGovernment Debt	−0.075***	−0.083***	−0.110***	−0.075***	−0.083***	−0.110***	−0.075***	−0.083***	−0.111***
	(0.020)	(0.016)	(0.014)	(0.019)	(0.015)	(0.013)	(0.019)	(0.015)	(0.013)
ΔPublic Investment	−0.331***	−0.190	−0.017	−0.322***	−0.122	0.179	−0.322***	−0.119	0.171
	(0.112)	(0.146)	(0.209)	(0.112)	(0.146)	(0.206)	(0.112)	(0.146)	(0.206)
ΔGovernment	−0.343***	−0.025	0.154	−0.344***	−0.022	0.248**	−0.341***	−0.013	0.236**
Expenditure	(0.087)	(0.094)	(0.101)	(0.086)	(0.091)	(0.100)	(0.086)	(0.092)	(0.101)
Constant	−0.023***	−0.026***	−0.030***	−0.021***	−0.024***	−0.029***	−0.021***	−0.024***	−0.028***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Countries	87	87	87	87	87	87	87	87	87
Observations	2193	2277	2361	2193	2277	2361	2193	2277	2361
adj. R^2	0.68	0.85	0.85	0.68	0.86	0.86	0.68	0.86	0.86
F-stat	35.5***	100.6***	105.1***	35.7***	103.0***	109.7***	34.6***	100.1***	106.7***

Fixed Effect (country and year) estimates of the relationship of the government budget balance, national fiscal rules, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

weaken government budget balances, reducing them by 1.3 to 1.6 percentage points over the medium to long term, suggesting that certain revenue requirements may lead to inefficient tax policies, at least when it comes to budget balance.

When national fiscal rules are studied individually in Sec. 6, Tables 11 and 12, all rules are insignificant whereas there are positive effects for budget balance rules, debt rules and expenditure rules from supranational rules. Supranational revenue rules remain unchanged with a negative effect for the medium and long run time windows.

When studied without control variables in the Appendix Tables 19 and 20, there are substantial changes with significant negative effects from national fiscal rules for all types of rules for varying time windows. For supranational rules the results are similar for expenditure rules and revenue rules but budget balance rules and debt rules become significant with a positive sign.

The results on budget balance rules are consistent with Debrun et al. (2008), who noted that compliance and enforcement mechanisms are important in determining the effectiveness of fiscal targets. Badinger and Reuter (2017) find that stronger, legally binding fiscal rules lead to higher fiscal balances, which is in line with the statistically significant effects of supranational expenditure rules. Additionally, Caselli and Reynaud (2020) argue that revenue-based fiscal rules can improve fiscal sustainability. This somewhat holds for national fiscal rules but not for revenue rules at the supranational level, which might focus more on requirements to tax policy rather than on fiscal discipline. Furthermore, the non-robust effect for national budget balance rules when supranational rules are included suggests potential substitutability, which is somewhat in line with Reuter (2015) when it comes to rule compliance and effectiveness.

5.3 Public investment

Public investment is a key factor for economic and institutional development. Some papers have studied how fiscal rules have affected the level and dynamics of public investment. On a political level, there is a common view that fiscal rules tend to restrict public investment as they introduce limits to the level and dynamics of government spending. However, there is no broad consensus in the empirical literature of the effects, which vary based on the studied sample and approach.[6]

Table 4 presents the results for changes in public investment. National fiscal rules are largely insignificant outside of debt rules, which have a positive effect in the short run, although only at the 10 % level. This implies that they do not systematically constrain the capability of governments to invest. Supranational fiscal rules are also relatively insignificant with the notable exception of revenue rules, which have a strong positive statistically significant effect for all studied time windows. Expenditure rules have a negative effect in the short and long run and debt rules in the long run, both only at the 10 % level. The significant highly positive effect of

[6] Blesse et al. (2023) provide a more comprehensive summary of recent studies on the subject.

Table 4 Results public investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules									
Budget Balance Rule(-1)	−0.000	−0.000	0.000				0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
Debt Rule(-1)	0.001*	0.000	0.000				0.001	0.000	0.000
	(0.001)	(0.000)	(0.000)				(0.001)	(0.000)	(0.000)
Expenditure Rule(-1)	−0.000	−0.000	−0.000				−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
Revenue Rule(-1)	−0.000	0.000	0.000				−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)				(0.001)	(0.000)	(0.000)
Supranational Fiscal Rules									
Budget Balance Rule(-1)				0.000	0.002	0.001	0.000	0.002	0.001
				(0.006)	(0.002)	(0.001)	(0.006)	(0.002)	(0.001)
Debt Rule(-1)				−0.000	−0.002	−0.002*	−0.000	−0.002	−0.001*
				(0.006)	(0.002)	(0.001)	(0.006)	(0.002)	(0.001)
Expenditure Rule(-1)				−0.001*	−0.000	−0.000	−0.001*	−0.000	−0.000*
				(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Revenue Rule(-1)				0.005***	0.003***	0.001***	0.005***	0.003***	0.001***
				(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Controls									
Public Investment(-1)	−0.287***	−0.041***	0.009*	−0.289***	−0.040***	0.010*	−0.290***	−0.040***	0.010*
	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)
Government Debt(-1)	−0.003**	0.000	0.001***	−0.002**	0.000	0.001***	−0.002**	0.000	0.001***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)

Table 4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
Inflation(-1)	0.001**	0.000	−0.000	0.001**	0.000	−0.000	0.001**	0.000*	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Interest Rate(-1)	−0.008**	0.001	0.003***	−0.010**	0.000	0.002**	−0.011**	0.001	0.002**
	(0.004)	(0.001)	(0.001)	(0.005)	(0.002)	(0.001)	(0.005)	(0.015)	(0.001)
ΔReal GDP	0.037***	0.044***	0.040***	0.036***	0.043***	0.038***	0.036***	0.043***	0.038***
	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)
ΔGovernment Balance	−0.044***	−0.048***	−0.045***	−0.044***	−0.047***	−0.043***	−0.044***	−0.047***	−0.043***
	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)
ΔGovernment	0.062***	0.028	0.032*	0.064***	0.031	0.032*	0.063***	0.030	0.030
Expenditure	(0.022)	(0.020)	(0.019)	(0.022)	(0.019)	(0.019)	(0.022)	(0.020)	(0.020)
ΔPrivate Investment	−0.094***	−0.042*	−0.019	−0.093***	−0.040*	−0.017	−0.094***	−0.041*	−0.018
	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)
Constant	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Countries	87	87	87	87	87	87	87	87	87
Observations	2179	2213	2243	2179	2213	2243	2179	2213	2243
adj. R^2	0.22	0.24	0.43	0.22	0.25	0.43	0.22	0.25	0.43
F-stat	5.7***	6.4***	13.7***	5.7***	6.5***	14.0***	5.6***	6.3***	13.6***

Fixed Effect (country and year) estimates of the relationship of the change of public investment, national fiscal rules, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

supranational revenue rules is noteworthy, as these rules are still used quite rarely with only the WAEMU having them in place.

Supranational revenue rules lead to an increase in public investment by 0.1 to 0.5 percentage points of GDP over the different time windows, which potentially implies that they create additional fiscal space for governments. Supranational debt and expenditure rules reduce public investment by 0.1 percentage points of GDP in the long run, indicating that debt and expenditure limits may restrict investment.

When the rules are studied individually, all national fiscal rules are insignificant in Sec. 6 Table 13. The results are unchanged for supranational rules in Table 14 when it comes to revenue rules, which remain strongly positive whereas the effects for debt rules and expenditure rules remain negative in the 10-year time window.

When different types of rules are studied without control variables, the results are similar for national fiscal rules in the Appendix Table 21 with debt rules having a positive significant effect in the medium-run and long-run instead of the short-run. However, the effects of supranational fiscal rules presented in Table 22 are quite different as the effects for budget balance rules, debt rules and expenditure rules change to negative for different time windows. Revenue rules remain positive for the 5-year and 10-year windows.

The results imply that public investment is generally not affected by a majority of fiscal rules and is more of a policy choice. At the same time, they align with prior research which generally notes that well-designed fiscal rules can protect investment spending, but rigid constraints may instead lead to reductions. The positive effect of supranational revenue rules on public investment is in line with Ardanaz et al. (2021), who argue that flexible fiscal rules tend to allow for investment spending. Guerguil et al. (2017) similarly argue that fiscal rules designed with investment-friendly clauses can mitigate pro-cyclicality. A somewhat different result is obtained in Delgado-Tellez et al. (2022), who suggest that fiscal rules have forced governments to cut investment to comply with deficit targets, especially in the EU. Supranational rules in the sample of this study may allow more fiscal space for investment compared to rigid national constraints. Additionally, the lack of robust effects from national fiscal rules on public investment suggests that enforcement and design are more important than simple fiscal constraints, as suggested by Blesse et al. (2023).

5.4 Economic growth

Finally, this paper studies whether fiscal rules have observable effects on economic growth. Fiscal rules can affect the pro-cyclicality of fiscal policy and, therefore, potentially lower the volatility of fiscal policy. However, strict fiscal rules can potentially have a stifling effect on average economic growth through restricting government expenditure or use of debt to finance public investment and other expansionary fiscal policy measures during downturns. They might also not lead to sufficient fiscal contractions during boom periods.

Table 5 presents the results for economic growth. For national rules, there is a small statistically significant negative effect in the short run for expenditure rules and a positive effect for revenue rules in the medium-term but both only at the 10

Table 5 Results economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules									
Budget Balance Rule(-1)	−0.001	0.001	0.000				−0.001	0.000	0.000
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Debt Rule(-1)	0.003	0.001	0.000				0.003	0.000	−0.000
	(0.003)	(0.001)	(0.001)				(0.003)	(0.001)	(0.001)
Expenditure Rule(-1)	−0.003*	−0.001	−0.001				−0.003	−0.001	−0.001
	(0.002)	(0.001)	(0.001)				(0.002)	(0.001)	(0.001)
Revenue Rule(-1)	0.000	0.002*	0.001				0.000	0.003**	0.002
	(0.003)	(0.001)	(0.001)				(0.003)	(0.001)	(0.001)
Supranational Fiscal Rules									
Budget Balance Rule(-1)				−0.004	0.000	0.001	−0.004	0.000	0.001
				(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)
Debt Rule(-1)				−0.004	0.000	0.001	−0.004	0.000	0.001
				(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)
Expenditure Rule(-1)				0.001	0.008***	0.005***	0.000	0.008***	0.005***
				(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Revenue Rule(-1)				−0.028***	−0.009***	0.001	−0.028***	−0.009***	0.001
				(0.006)	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)
Controls									
Real GDP(-1)	−0.014*	0.002	−0.000	−0.012	0.006	0.003	−0.014	0.006	0.003
	(0.008)	(0.006)	(0.004)	(0.008)	(0.006)	(0.004)	(0.009)	(0.006)	(0.005)
Inflation(-1)	−0.002	−0.003***	−0.002***	−0.002	−0.002***	−0.002***	−0.002	−0.002**	−0.002***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)
Government Debt(-1)	−0.095***	−0.002*	−0.000	−0.096***	−0.003*	−0.000	−0.096***	−0.003*	−0.000

Table 5 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y
	(0.015)	(0.001)	(0.000)	(0.015)	(0.001)	(0.000)	(0.015)	(0.001)	(0.000)
Trade(-1)	0.009**	0.006	0.000	0.009**	0.003	−0.002	0.010**	0.003	−0.002
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)	(0.003)
Banking Crisis(-1)	−0.013***	−0.009***	−0.007***	−0.013***	−0.008***	−0.006***	−0.013***	−0.009***	−0.007***
	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)
ΔGovernment Balance	0.071**	−0.031	−0.341***	0.072**	−0.029	−0.340***	0.072**	−0.028	−0.335***
	(0.031)	(0.107)	(0.089)	(0.031)	(0.107)	(0.088)	(0.031)	(0.108)	(0.089)
ΔPublic Investment	0.469***	1.332***	2.865***	0.472***	1.346***	2.902***	0.465***	1.337***	2.893***
	(0.113)	(0.206)	(0.372)	(0.113)	(0.203)	(0.371)	(0.113)	(0.204)	(0.373)
ΔPrivate Investment	0.281***	0.680***	0.580***	0.281***	0.670***	0.564***	0.279***	0.668***	0.562***
	(0.075)	(0.105)	(0.116)	(0.075)	(0.105)	(0.118)	(0.075)	(0.106)	(0.118)
ΔAge Dependency Ratio	−0.717***	−0.800***	−0.528***	−0.681***	−0.809***	−0.544***	−0.679***	−0.819***	−0.546***
	(0.177)	(0.145)	(0.103)	(0.178)	(0.148)	(0.102)	(0.180)	(0.149)	(0.103)
ΔUnemployment	−0.463***	−0.426***	−0.835***	−0.462***	−0.416***	−0.819***	−0.461***	−0.419***	−0.826***
	(0.085)	(0.118)	(0.142)	(0.084)	(0.115)	(0.139)	(0.085)	(0.116)	(0.141)
Constant	0.377*	−0.014	0.031	0.339	−0.132	−0.040	0.385*	−0.129	−0.040
	(0.204)	(0.150)	(0.102)	(0.218)	(0.162)	(0.111)	(0.230)	(0.166)	(0.116)
Countries	82	82	82	82	82	82	82	82	82
Observations	1835	2070	2260	1835	2070	2260	1835	2070	2260
adj. R^2	0.60	0.56	0.61	0.60	0.56	0.62	0.60	0.56	0.62
F-stat	22.5***	21.5***	28.9***	22.7***	22.0***	29.4***	22.0***	21.3***	28.5***

Fixed Effect (country and year) estimates of the relationship of change of real GDP, national fiscal rules, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

% level. For supranational rules there is a statistically significant positive effect for expenditure rules for the medium-term and long-term windows and a negative effect for revenue rules for the 1-year and 5-year time windows.

When it comes to the real effects of fiscal rules on economic growth, national expenditure rules slightly reduce annual GDP growth in the short run by about 0.3 percentage points, though this effect disappears for the longer time windows and when studied together with supranational fiscal rules. Supranational expenditure rules appear to enhance long-term economic growth, increasing GDP by approximately 0.5 to 0.8 percentage points per year over a decade. This suggests that well-structured expenditure constraints at the supranational level can contribute to macroeconomic stability and growth. Supranational revenue rules reduce short-run GDP growth substantially, but this effect diminishes over time. These results imply that while expenditure constraints can promote long-term stability, certain revenue requirements may have adverse short-term effects on economic performance.

The results remain almost unchanged for national rules in Sec. 6 Table 15 when the rules are studied individually. For supranational fiscal rules in Table 16, expenditure rules remain unchanged but for revenue rules the long-term effects turn positive whereas the 1-year change remains negative. When only the rules are included, national debt rules have some significant positive effects whereas expenditure rules and revenue rules have some negative effects in the Appendix Table 23. For supranational fiscal rules in Table 24, budget balance rules and debt rules have some negative effects whereas expenditure rules and revenue rules have positive effects for economic growth.

The results are quite similar to previous studies where fiscal rules have been observed to influence economic growth through effects from the stability of fiscal policy. The positive effect of supranational expenditure rules on growth is consistent with Castro (2011), who found that compliance with fiscal frameworks does not slow economic performance and may even enhance it. Ilzetzki et al. (2013) suggest that fiscal rules can affect fiscal multipliers, which could explain the stronger effect of expenditure rules in this study. Also, Potrafke (2023) notes that stringent fiscal rules generally foster economic growth. The overall results suggest that expenditure rules, rather than budget balance or debt constraints, may be the most growth-enhancing, particularly when applied at the supranational level where enforcement is stronger.

6 Robustness of the results

The presence of endogeneity is an inherent concern when studying fiscal rules, as the adoption of such rules may be influenced by pre-existing fiscal conditions, institutional quality, or political considerations. The FE approach of this study presented in Sect. 5 mitigates some of these concerns by controlling for unobservable country-specific characteristics that remain constant over time. The results across different time horizons suggest that the identified relationships between fiscal rules and fiscal

macroeconomic outcomes are not driven by spurious correlation or omitted variable bias.

However, given the complexity of fiscal rules and their mechanics, it is important to study whether the results remain unchanged or similar under alternative estimation methods and model specifications. This section presents some tests for the robustness of the results with different econometric approaches, which can address potential issues such as heteroskedasticity, cross-sectional dependence and non-linearity in fiscal rule effectiveness.

This is done through three main robustness checks. First, Panel Estimated Generalized Least Squares (EGLS) is used to correct for potential heteroskedasticity and cross-sectional dependence, which might be present in the sample with very heterogeneous economies and may affect FE estimates. Second, an Average Treatment Effect (ATE) approach on the independent variables to evaluate the impact of fiscal rules using a methodology that does not rely on the linearity assumptions of standard FE models. This approach provides further validation of the causal interpretation of fiscal rule effectiveness across different institutional settings. Finally, quantile regressions are used to study whether fiscal rules have different effects for different percentiles depending on the level of a country's fiscal or economic status. Unlike standard regressions, quantile regressions reveal whether the effectiveness of fiscal rules varies across different segments of the sample.

When it comes to government debt, the results in Table 6 confirm the results in Sect. 5, although there are some differences in effectiveness based on the type of fiscal rule and economic conditions. In particular, the quantile regressions (4)–(6) point towards debt reduction effects from fiscal rules being slightly different depending on the level of government debt. The effects of supranational expenditure rules remain strong for all percentiles whereas the sign of debt rules changes for the top quantile, which might imply that they become inefficient in high-debt countries, at least in the short run. The EGLS estimates also confirm the debt-reducing effects of national revenue rules and supranational expenditure rules. The ATE estimates confirm that national expenditure rules may actually increase debt when implemented.

The robustness tests on government budget balances support the main results, which point towards fiscal rules improving fiscal discipline, leading to higher budget surpluses and reduced deficits. Specifically, the ATE estimates in regression (9) show that supranational fiscal rules have slightly broader positive effects on budget balances compared to national rules. When it comes to the quantile regressions (10) to (12), it is noteworthy that national budget balance rules have positive effects for all quantiles and expenditure rules in the countries with low or high fiscal balances, which was not evident in the main results. The coefficients for national budget balance rules grow for the higher quantiles, indicating they work best in countries with already stronger fiscal positions. Additionally, national debt rules have negative effects in all quantiles. Supranational expenditure rules have positive effects in countries where fiscal balances are low and negative effects when fiscal balances are high, suggesting that they may improve weak fiscal positions but potentially constrain strong ones.

Table 6 Robustness government debt and government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Method	EGLS	EGLS	ATE	QREG	QREG	QREG	EGLS	EGLS	ATE	QREG	QREG	QREG
	Government Debt						**Government Budget Balance**					
National Fiscal Rules												
Budget Balance Rule	0.001	0.001	0.006*	0.002	−0.003	−0.005	−0.001	−0.001**	0.019***	0.006**	0.008***	0.011***
	(0.002)	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)	(0.001)	(0.000)	(0.455)	(0.002)	(0.002)	(0.002)
Debt Rule	0.003	0.003***	0.003	0.004*	0.002	0.003	−0.001	−0.001	−0.001	−0.010***	−0.009***	−0.009***
	(0.003)	(0.001)	(0.004)	(0.002)	(0.002)	(0.004)	(0.001)	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)
Expenditure Rule	0.005*	0.003***	0.009**	0.003	0.001	0.006	0.001	−0.003***	0.015***	0.008***	0.002	0.006***
	(0.003)	(0.001)	(0.004)	(0.003)	(0.002)	(0.004)	(0.001)	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)
Revenue Rule	−0.010***	−0.007***	0.002	−0.002	−0.003	−0.011**	−0.000	0.003***	−0.013	−0.009**	−0.004	−0.004
	(0.004)	(0.001)	(0.004)	(0.002)	(0.004)	(0.004)	(0.002)	(0.001)	(0.081)	(0.005)	(0.004)	(0.004)
Supranational Fiscal Rules												
Budget Balance Rule	−0.045***	−0.003	0.006	0.023***	0.003	−0.004	0.013***	0.006*	0.012***	0.003	0.004	0.005
	(0.011)	(0.005)	(0.004)	(0.007)	(0.011)	(0.007)	(0.005)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)
Debt Rule	0.048***	−0.000	0.006	−0.020***	−0.001	0.014*	−0.008*	0.000	0.013***	−0.004	−0.007**	−0.005
	(0.009)	(0.005)	(0.004)	(0.007)	(0.010)	(0.007)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)
Expenditure Rule	−0.006	−0.004**	0.004	−0.006**	−0.009**	−0.013**	0.000	0.002	0.008**	0.009**	0.002	−0.010***
	(0.005)	(0.002)	(0.004)	(0.005)	(0.003)	(0.005)	(0.002)	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)
Revenue Rule	−0.020	0.001	−0.007	−0.012	0.009**	−0.001	−0.012	−0.024***	0.008*	0.008**	−0.001	−0.011***
	(0.037)	(0.009)	(0.011)	(0.011)	(0.005)	(0.005)	(0.013)	(0.003)	(0.003)	(0.005)	(0.002)	(0.003)

Table 6 (continued)

Method	(1) EGLS	(2) EGLS	(3) ATE	(4) QREG	(5) QREG	(6) QREG	(7) EGLS	(8) EGLS	(9) ATE	(10) QREG	(11) QREG	(12) QREG
Controls												
Government debt(-1)	−0.070***	−0.017***										
	(0.011)	(0.001)										
Government balance(-1)							0.623***	0.198***				
						(0.027)	(0.016)					
Government	0.607***	0.094***										
expenditure(-1)	(0.073)	(0.017)										
Inflation(-1)	−0.006	−0.001										
	(0.008)	(0.001)										
Interest rate(-1)	−0.064***	0.023**					−0.007	−0.022***				
	(0.032)	(0.009)					(0.012)	(0.003)				
Trade(-1)							0.005	0.008***				
							(0.003)	(0.002)				
Banking crisis(-1)	0.012***	0.004***					−0.004**	0.004***				
	(0.003)	(0.001)					(0.001)	(0.001)				
ΔReal GDP	−0.727***	−0.807***					0.185***	0.191***				
	(0.062)	(0.030)					(0.025)	(0.017)				
ΔGovernment debt							−0.095***	−0.169***				
							(0.022)	(0.014)				

Table 6 (continued)

Method	(1) EGLS	(2) EGLS	(3) ATE	(4) QREG	(5) QREG	(6) QREG	(7) EGLS	(8) EGLS	(9) ATE	(10) QREG	(11) QREG	(12) QREG
ΔGovernment balance	−0.421***	−0.819***										
	(0.094)	(0.070)										
ΔGovernment							−0.451***	0.093				
expenditure							(0.076)	(0.073)				
ΔPublic investment	−0.546***	−1.953***					−0.370***	0.341***				
	(0.156)	(0.187)					(0.074)	(0.116)				
ΔPrivate investment	−0.080	−0.793***										
	(0.082)	(0.081)										
Constant	−0.031***	0.024***		−0.026***	0.003**	0.029***	−0.019***	−0.030***		−0.049***	−0.024***	−0.002*
	(0.011)	(0.003)		(0.002)	(0.001)	(0.002)	(0.003)	(0.002)		(0.002)	(0.001)	(0.001)
Time period / Quantile	1 year	10 years		0.25	0.50	0.75	1 year	10 years		0.25	0.50	0.75
Countries	87	87	106	106	106	106	87	87	106	106	106	106
Observations	2206	2206	2789	2789	2789	2789	2361	2361	3161	3161	3161	3161
adj. R^2	0.50	0.76					0.79	0.89				
F-stat	21.9***	70.0***					84.0***	195.2				

Panel Estimated Generalized Least Squares with country cross-section weights, Average Treatment Effects with augmented inverse-probability weighting (logit treatment and linear by maximum likelihood outcome) and Quantile regression estimates of the relationship of (the change of) government debt, government budget balance and fiscal rules. Fiscal rules are studied individually with ATE and lagged in Panel EGLS. White robust standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

Table 7 Robustness public investment and economic growth

Method	(1) EGLS	(2) EGLS	(3) ATE	(4) QREG	(5) QREG	(6) QREG	(7) EGLS	(8) EGLS	(9) ATE	(10) QREG	(11) QREG	(12) QREG
	Public investment						Economic growth					
National Fiscal Rules												
Budget Balance Rule	0.002	0.002***	0.017	0.001***	0.000	−0.001*	0.000	0.001***	0.041***	0.005**	−0.001	−0.002
	(0.002)	(0.000)	(0.041)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.014)	(0.002)	(0.001)	(0.002)
Debt Rule	0.004	0.004	0.060	−0.001***	0.000	0.001**	0.002	−0.001	0.025**	0.008***	0.007***	0.003
	(0.003)	(0.005)	(0.055)	(0.000)	(0.000)	(0.001)	(0.003)	(0.001)	(0.010)	(0.002)	(0.002)	(0.002)
Expenditure Rule	0.002	0.002	−0.044	0.000	−0.000**	−0.001***	−0.000	−0.001***	0.032**	−0.001	−0.004**	−0.008***
	(0.002)	(0.004)	(0.037)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.014)	(0.002)	(0.002)	(0.002)
Revenue Rule	0.000	0.002***	0.017	0.001	−0.000	−0.003	0.000	−0.000	0.042*	−0.000	−0.006**	−0.011***
	(0.000)	(0.001)	(0.041)	(0.001)	(0.000)	(0.003)	(0.003)	(0.000	(0.025)	(0.003)	(0.003)	(0.003)
Supranational Fiscal Rules												
Budget Balance Rule	−0.005**	0.001	−0.007	0.004***	0.001	−0.003	0.003	−0.001	0.023*	0.013***	0.007	0.004
	(0.002)	(0.001)	(0.042)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.012)	(0.004)	(0.004)	(0.005)
Debt Rule	0.005**	−0.000	−0.017	−0.003***	−0.001	0.003	0.003	−0.001	0.021*	−0.016***	−0.015***	−0.015***
	(0.002)	(0.000)	(0.046)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.012)	(0.004)	(0.004)	(0.005)
Expenditure Rule	−0.002	−0.003***	−0.055	0.000	−0.001**	−0.001***	−0.001	−0.005***	0.010	−0.007***	−0.007**	−0.007**
	(0.002)	(0.000)	(0.045)	(0.000)	(0.000)	(0.000)	(0.007)	(0.001)	(0.009)	(0.003)	(0.002)	(0.003)
Revenue Rule	0.005***	0.001***	0.050	−0.001	0.001	0.002**	0.002**	0.003	0.031***	0.016***	0.015***	0.010**
	(0.001)	(0.000)	(0.073)	(0.001)	(0.001)	(0.001)	(0.006)	(0.002)	(0.009)	(0.004)	(0.002)	(0.003)

Table 7 (continued)

Method	(1) EGLS	(2) EGLS	(3) ATE	(4) QREG	(5) QREG	(6) QREG	(7) EGLS	(8) EGLS	(9) ATE	(10) QREG	(11) QREG	(12) QREG
Controls												
Public investment(-1)	−0.204***	−0.006**										
	(0.018)	(0.003)										
Economic growth(-1)							−0.013**	−0.008***				
							(0.006)	(0.001)				
Government debt(-1)	−0.003***	−0.000					−0.006	−0.000				
	(0.000)	(0.008)					(0.004)	(0.000)				
Inflation(-1)	0.001*	0.001***					−0.001	−0.003***				
	(0.000)	(0.000)					(0.005)	(0.001)				
Interest rate(-1)	−0.003	0.001										
	(0.002)	(0.000)										
Trade(-1)							0.005	−0.001				
							(0.007)	(0.001)				
Banking crisis(-1)							−0.003	−0.004***				
							(0.007)	(0.001)				
ΔReal GDP	0.029***	0.036***										
	(0.005)	(0.002)										
ΔGovernment balance	−0.020***	−0.047***					0.416***	−0.101***				
	(0.007)	(0.004)					(0.102)	(0.036)				
ΔGovernment	0.065***	0.039***										

Table 7 (continued)

Method	(1) EGLS	(2) EGLS	(3) ATE	(4) QREG	(5) QREG	(6) QREG	(7) EGLS	(8) EGLS	(9) ATE	(10) QREG	(11) QREG	(12) QREG
expenditure	(0.010)	(0.008)										
ΔPrivate investment	−0.059***	−0.002					0.613***	0.932***				
	(0.011)	(0.006)					(0.075)	(0.051)				
ΔPublic investment							0.633***	2.079***				
							(0.090)	(0.106)				
ΔAge Dependency Ratio							−0.451***	−0.427***				
							(0.135)	(0.044)				
ΔUnemployment							−0.598***	−0.770***				
							(0.089)	(0.053)				
Constant	0.009***	−0.001***		−0.003***	0.000	0.003***	0.164	0.236***		0.010***	0.038***	0.061***
	(0.001)	(0.000)		(0.000)	(0.000)	(0.000)	(0.102)	(0.023)		(0.002)	(0.001)	(0.001)
Time period / Quantile	1 year	10 years		0.25	0.50	0.75	1 year	10 years		0.25	0.50	0.75
Countries	87	87	106	106	106	106	82	82	106	106	106	106
Observations	2179	2243	3605	3605	3605	3605	1835	2260	3662	3662	3662	3662
adj. R^2	0.19	0.52					0.44	0.84				
F-stat	5.9***	24.4***					19.7***	121.3***				

Panel Estimated Generalized Least Squares with cross-section weights, Average Treatment Effects with augmented inverse-probability weighting (logit treatment and linear by maximum likelihood outcome) and Quantile regression estimates of the relationship of (the change of) public investment, (the change of) economic growth and fiscal rules. Fiscal rules are studied individually with ATE and lagged in Panel EGLS. White robust standard errors and covariance (degrees of freedom corrected) in parentheses. *** significant at 1% level, ** significant at 5%, * significant at 10%

The robustness tests on public investment Table 7 support the FE results and generally confirm the main result on national and supranational fiscal rules having low effects on public investment. However, they also suggest more varied effects than the results in Sect. 5 indicated. The long-term positive effects of supranational revenue rules remains unchanged in the EGLS results. The negative effects for supranational expenditure rules remain in the quantile regressions and national rules become negative as well for the upper quantiles. National and supranational budget balance rules increase public investment in the lower quantile but the sign changes for national rules for the upper quantile whereas an opposite effect takes place for national debt rules. Supranational and national debt rules seem to constrain public investment when it is low and the same effect is observed from expenditure rules when public investment is higher.

The effects on economic growth remain mixed with national budget balance and debt rules having largely positive effects similarly to supranational revenue rules. The positive effects can also be observed from the ATEs. However, the effects of national and supranational expenditure rules turns largely negative for the long-term EGLS as well as quantile regressions. The quantile regressions generally point towards fiscal rules slowing down economic growth when it is high whereas the effects are slightly more positive when economic growth is slow. This implies that fiscal rules have, on average, had a counter-cyclical effect on economic growth, which was not evident in the main results. The robustness tests reinforce the importance of allowing sufficient flexibility within the frameworks to provide sufficient fiscal space as well as opportunities for conducting growth-enhancing fiscal policy.

Overall, the robustness checks largely support the main results. There are also notable differences, some of which can be attributed to variations in methodology and sample. However, for example, the quantile regressions emphasise that fiscal rule effectiveness is not uniform across countries. Appendix 3, which excludes control variables, suggests that some fiscal rule effects may be overestimated if other macroeconomic conditions are not properly taken into account.

While causality cannot be definitively proven without an exogenous instrument for fiscal rule adoption, the consistency of findings across Sects. 5 and 6, as well as Appendices 2 and 3, strengthens confidence in the validity of the results and their policy implications. Additionally, the ATE approach supports the causal interpretation, especially on government budget balances and economic growth, by assessing rule effectiveness without imposing strong functional form assumptions.

7 Conclusions

This paper studies how different national and supranational fiscal rules have affected the development of government debt, government budget balance, public investment and economic growth.

Overall, the results suggest that specific types of fiscal rules can be used to directly or indirectly affect fiscal and macroeconomic variables. However, the effectiveness of different fiscal rules is very heterogenous and depends on the specific rule. Supranational rules seem to substantially outperform national fiscal rules and this can be either due to multilateral surveillance, more defined targets or a

common methodology. At the same time, almost all of the effects of national fiscal rules remain unchanged when studied simultaneously with supranational rules. This implies that the rules at national and supranational level act as complements rather than substitutes, which means that they reinforce each other, enhancing fiscal discipline when implemented together. This could potentially imply that supranational rules provide external enforcement while national rules, which often target country-specific aspects and adjust targets to domestic contexts.

More specifically, the results for government debt imply that national budget balance rules are more useful for lowering debt in the long run whereas supranational budget balance rules can even lead to increases in debt levels. Based on the results of this study, supranational rules should concentrate on debt rules and expenditure rules but also study the potential of revenue rules as they have a significant debt-lowering effect in the medium-run and long-run and are historically used very rarely. Their rare use might not be surprising, as it is challenging to design such rules fit for different institutional environments for different countries. However, they offer a potential unexplored avenue for addressing government debt levels for policymakers as a similar result is observed for national revenue rules.

For general government budget balances, national fiscal rules are largely insignificant whereas supranational expenditure rules are the most effective option with budget balance increasing significant effects for all studied time windows. Supranational revenue rules are significant for the longer time windows but they lead to lower budget balances.

The results of this study are largely in line with prior studies on public investment with very minor effects from fiscal rules. The long-term effects of supranational debt rules and expenditure rules are significantfly negative. However, a more noteworthy exception is observed for supranational revenue rules, which are significant and have positive effects for all studied time windows. As mentioned with regards to the results for government debt, this form of rules is used quite rarely but they also seem offer a potential avenue of encouraging public investment for policymakers.

The results for economic growth are largely insignificant with three exceptions. Supranational expenditure rules and national revenue rules have positive effects whereas supranational revenue rules have a negative effect for the short-run and medium-run time windows. However, the effects on economic growth also appear to be somewhat state-dependent. The robustness study indicates that fiscal rules can potentially have a stabilising effect when growth is weak and impose constraints when growth is high by limiting expansionary fiscal policy. Therefore, fiscal rules seem to have, at least on average, supported counter-cyclical fiscal policy.

Throughout the paper, the control variables act as expected and their signs remain unchanged independent of what approach is used for fiscal rules. The results for different types of rules are generally quite robust when studied individually in Appendix 2. The only broad difference is that supranational rules appear even more significant when compared to national rules. Appendix 3 contains results from all 106 countries of the IMF fiscal rules database without any control variables. When studied individually, varying fiscal rules have significant effects for government debt, government budget balance and economic growth for all time windows whereas the effects for public investment are lower, although significant for the longer time

windows. There are some changes in the signs of coefficients compared to the results with control variables. While this could be due to the complete sample, it can also imply that the development of the dependent variables of the study are not completely independent from control variables.

One important aspect in studying the macroeconomic effects of fiscal rules is to address whether the results capture causality. Endogeneity, omitted variable bias, and reverse causality all complicate this, as countries with stronger fiscal institutions may adopt stricter rules or implement new elements into frameworks in response to worsening fiscal conditions. Although the approach taken in this study of using lagged fiscal rules and extensive control variables can help in establishing causality, external factors and differences in rule design can also affect the results. However, this study as well as previous literature suggests that well-designed fiscal rules can have real effects on fiscal outcomes and macroeconomic stability, even while further research is needed to refine causal claims.

Some careful policy recommendations can be drawn from the results of the study. When it comes to designing fiscal frameworks, the supranational institutions should take into account potential interactions with national fiscal rules and both can be used effectively to affect fiscal policymaking. Additionally, fiscal frameworks could be designed to better incorporate cyclical flexibility, for example with structural balance rules or by enhancing counter-cyclical fiscal buffers. Given the greater effectiveness of supranational fiscal rules in reducing government debt and improving government budget balances, enforcement mechanisms and multilateral surveillance should be designed to enhance rule compliance. Minimum requirements for fiscal frameworks within monetary unions can also help in avoiding conflicting objectives, ensuring national fiscal policies complement rather than undermine broader macroeconomic stability goals. Finally, fiscal rules should be designed to be as realistic and enforceable as possible to discourage non-compliance or using creative accounting approaches and governments should try to design fiscal rules with broad political consensus to ensure long-term commitment to fiscal targets.

Future research could take a more comprehensive and detailed look at individual fiscal rules and whether their effects are heterogenous for different countries or country groups. Another potential way forward would be to take a more granular look at how national fiscal rules set for different sectors of the government affect the development of key fiscal variables or apply more advanced contrafactual methods for studying specific fiscal rules or frameworks as done in Strong (2023) on studying government debt in CFA zone in Africa or Kraemer and Lehtimaki (2024) on how EU membership and the SGP have affected government debt dynamics. Additionally, the level of institutions and their quality, especially aspects such as rule of law and political stability, could have effects on how well fiscal rules are complied with.

Appendix

See Table 8

Data description and sources

Table 8 Variables

Variable	Unit/Transformation	Source
Age dependency ratio	pct of working-age population	WB
Banking crisis	[0, 1]	IMF Laeven and Valencia (2020)
Fiscal rules	[0, 1]	IMF Davoodi et al. (2022)
General Government debt	pct of GDP	ECB, IMF
General Government budget balance	pct of GDP	WB
General Government expenditure	pct of GDP	WB
Inflation	annual change of GDP deflator	WB
Private investment	pct of GDP	IMF
Public investment	pct of GDP	IMF
Real GDP	log	WB
Real interest rate	pct (annual)	ECB, IMF
Trade	pct of GDP	WB
Unemployment	pct of total labor force	WB

ECB stands for European Central Bank, IMF for International Monetary Fund and WB for World Bank

Results

This section presents the results for each type of national and supranational fiscal rule individually. The control variables are the same as in section 5.

Table 9 Results government debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	−0.004	−0.002	−0.003**									
	(0.005)	(0.002)	(0.002)									
Debt Rule(-1)				−0.003	−0.001	−0.000						
				(0.005)	(0.003)	(0.002)						
Expenditure Rule(-1)							0.008	−0.001	−0.001			
							(0.006)	(0.002)	(0.002)			
Revenue Rule(-1)										−0.013**	−0.011***	−0.007***
										(0.006)	(0.003)	(0.002)
Controls												
Government Debt(-1)	−0.117***	−0.041***	−0.029***	−0.117***	−0.041***	−0.029***	−0.119***	−0.041***	−0.029***	−0.117***	−0.041***	−0.029***
	(0.021)	(0.011)	(0.007)	(0.021)	(0.011)	(0.006)	(0.022)	(0.011)	(0.007)	(0.021)	(0.011)	(0.006)
Government Expenditure(-1)	0.381***	0.162**	0.092**	0.383***	0.164**	0.097**	0.389***	0.165**	0.096**	0.390***	0.168**	0.099**
	(0.113)	(0.072)	(0.044)	(0.113)	(0.072)	(0.044)	(0.113)	(0.072)	(0.044)	(0.113)	(0.072)	(0.044)
Inflation(-1)	−0.010	−0.006**	−0.002	−0.009	−0.005**	−0.001	−0.009	−0.005**	−0.001	−0.009	−0.005**	−0.001
	(0.006)	(0.002)	(0.002)	(0.006)	(0.002)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)
Interest Rate(-1)	0.047	0.076***	0.046***	0.045	0.075***	0.044***	0.046	0.074***	0.044***	0.044	0.074***	0.044***
	(0.048)	(0.023)	(0.015)	(0.047)	(0.023)	(0.014)	(0.047)	(0.023)	(0.015)	(0.047)	(0.023)	(0.014)
Banking Crisis(-1)	0.021**	0.019***	0.012***	0.021**	0.019***	0.012***	0.022**	0.019***	0.012***	0.021**	0.019***	0.012***
	(0.009)	(0.005)	(0.003)	(0.009)	(0.005)	(0.003)	(0.009)	(0.005)	(0.003)	(0.009)	(0.005)	(0.003)
ΔReal GDP	−0.785***	−0.799***	−0.640***	−0.786***	−0.800***	−0.639***	−0.782***	−0.801***	−0.640***	−0.787***	−0.801***	−0.641***

Table 9 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
	(0.106)	(0.090)	(0.067)	(0.106)	(0.090)	(0.067)	(0.106)	(0.090)	(0.067)	(0.106)	(0.090)	(0.067)
ΔGovernment Balance	−0.298***	−0.656***	−0.790***	−0.297***	−0.653***	−0.786***	−0.296***	−0.651***	−0.780***	−0.296***	−0.649***	−0.777***
	(0.097)	(0.133)	(0.185)	(0.097)	(0.133)	(0.185)	(0.096)	(0.133)	(0.185)	(0.097)	(0.133)	(0.186)
ΔPublic Investment	−0.320*	−1.472***	−1.879***	−0.320*	−1.472***	−1.878***	−0.320*	−1.475***	−1.885***	−0.320*	−1.467***	−1.869***
	(0.166)	(0.273)	(0.353)	(0.166)	(0.272)	(0.353)	(0.166)	(0.272)	(0.353)	(0.166)	(0.272)	(0.353)
ΔPrivate Investment	−0.197*	−0.775***	−1.019***	−0.197*	−0.779***	−1.039***	−0.197*	−0.783***	−1.046***	−0.200**	−0.789***	−1.055***
	(0.102)	(0.145)	(0.144)	(0.102)	(0.146)	(0.144)	(0.101)	(0.146)	(0.144)	(0.102)	(0.146)	(0.145)
Constant	0.030	0.024*	0.026***	0.028	0.022	0.023***	0.25	0.022	0.024***	0.027	0.022	0.024***
	(0.020)	(0.014)	(0.009)	(0.020)	(0.014)	(0.009)	(0.020)	(0.014)	(0.009)	(0.020)	(0.014)	(0.009)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2187	2200	2206	2187	2200	2206	2187	2200	2206	2187	2200	2206
adj. R^2	0.32	0.46	0.53	0.32	0.46	0.53	0.32	0.46	0.53	0.32	0.46	0.53
F-stat	9.0***	15.4***	19.9***	9.0***	15.4***	19.8***	9.0***	15.4***	19.8***	9.0***	15.5***	19.9***

Fixed Effect (country and year) estimates of the relationship of the changes of government debt, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 10 Results. Government Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational												
Fiscal Rules												
Budget Balance Rule(-1)	−0.013	−0.006	−0.005*									
	(0.011)	(0.004)	(0.003)									
Debt Rule(-1)				−0.014	−0.008	−0.006**						
				(0.011)	(0.005)	(0.003)						
Expenditure Rule(-1)							−0.008	−0.014***	−0.016***			
							(0.006)	(0.003)	(0.002)			
Revenue Rule(-1)										−0.123	−0.060*	−0.036*
										(0.095)	(0.031)	(0.018)
Controls												
Government Debt(-1)	−0.117***	−0.041***	−0.029***	0.118***	−0.041***	−0.029***	−0.116***	−0.038***	−0.026***	−0.118***	−0.042***	−0.029***
	(0.021)	(0.011)	(0.007)	(0.021)	(0.011)	(0.007)	(0.022)	(0.011)	(0.007)	(0.021)	(0.011)	(0.007)
Government	0.370***	0.157**	0.091**	0.361***	0.151**	0.086*	0.378***	0.150**	0.079*	0.369***	0.162**	0.095**
Expenditure(-1)	(0.115)	(0.075)	(0.046)	(0.117)	(0.077)	(0.047)	(0.113)	(0.072)	(0.044)	(0.115)	(0.081)	(0.044)
Inflation(-1)	−0.009	−0.005**	−0.001	−0.009	−0.005**	−0.001	−0.009	−0.005*	−0.001	0.010*	−0.006**	−0.002
	(0.006)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.006)	(0.002)	(0.002)
Interest Rate(-1)	0.027	0.066***	0.038**	0.027	0.065***	0.038**	0.032	0.053**	0.021	0.062	0.082***	0.049***
	(0.053)	(0.025)	(0.015)	(0.052)	(0.024)	(0.015)	(0.048)	(0.024)	(0.015)	(0.045)	(0.023)	(0.014)
Banking Crisis(-1)	0.021**	0.019***	0.012***	0.021**	0.019***	0.012***	0.021**	0.018***	0.012***	0.021**	0.019***	0.013***
	(0.009)	(0.004)	(0.003)	(0.009)	(0.004)	(0.003)	(0.009)	(0.005)	(0.003)	(0.009)	(0.004)	(0.003)

Table 10 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔReal GDP	−0.787***	−0.802***	−0.639***	−0.787***	−0.803***	−0.639***	−0.783***	−0.777***	−0.599***	−0.758***	−0.771***	−0.613***
	(0.021)	(0.091)	(0.067)	(0.106)	(0.091)	(0.067)	(0.107)	(0.092)	(0.068)	(0.114)	(0.081)	(0.063)
ΔGovernment Balance	−0.295***	−0.642***	−0.767***	−0.294***	−0.637***	−0.753***	−0.297***	−0.652***	−0.773***	−0.288***	−0.618***	−0.730***
	(0.097)	(0.132)	(0.186)	(0.096)	(0.132)	(0.187)	(0.096)	(0.133)	(0.186)	(0.115)	(0.128)	(0.185)
ΔPublic Investment	−0.326*	−1.477**	−1.877***	−0.331**	−1.493***	−1.920***	−0.322*	−1.487***	−1.995***	−0.290*	−1.381***	−1.757***
	(0.166)	(0.274)	(0.356)	(0.167)	(0.274)	(0.358)	(0.166)	(0.273)	(0.351)	(0.169)	(0.264)	(0.345)
ΔPrivate Investment	−0.207**	−0.797***	−1.071***	−0.209**	−0.802***	−1.080***	−0.198*	−0.761***	−0.983***	−0.204**	−0.814***	−1.071***
	(0.101)	(0.143)	(0.143)	(0.101)	(0.142)	(0.143)	(0.102)	(0.146)	(0.145)	(0.101)	(0.135)	(0.139)
Constant	0.035	0.026	0.027***	0.038	0.028*	0.028***	0.029	0.025*	0.026***	0.037	0.026*	0.025***
	(0.023)	(0.016)	(0.010)	(0.023)	(0.017)	(0.010)	(0.020)	(0.014)	(0.009)	(0.023)	(0.014)	(0.009)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2187	2200	2206	2187	2200	2206	2187	2200	2206	2187	2200	2206
adj. R^2	0.32	0.46	0.53	0.32	0.46	0.53	0.32	0.46	0.54	0.33	0.47	0.53
F-stat	9.1***	15.4***	19.9***	9.1***	15.5***	19.9***	9.0***	15.6***	29.6***	9.5***	15.9***	20.3***

Fixed Effect (country and year) estimates of the relationship of the changes of government debt, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 11 Results government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	−0.000	0.000	0.001									
	(0.002)	(0.001)	(0.001)									
Debt Rule(-1)				−0.001	−0.001	−0.000						
				(0.002)	(0.001)	(0.001)						
Expenditure Rule(-1)							0.002	0.001	−0.001			
							(0.002)	(0.001)	(0.001)			
Revenue Rule(-1)										0.002	0.002	0.001
										(0.002)	(0.001)	(0.001)
Controls												
Government Balance(-1)	0.497***	0.442***	0.265***	0.497***	0.442***	0.265***	0.497***	0.442***	0.266***	0.496***	0.442***	0.265***
	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.019)
Interest Rate(-1)	−0.028**	−0.030***	−0.035***	−0.028**	−0.030***	−0.035***	−0.028**	−0.030***	−0.035***	−0.028**	−0.030***	−0.035***
	(0.012)	(0.006)	(0.005)	(0.012)	(0.006)	(0.005)	(0.012)	(0.006)	(0.005)	(0.012)	(0.006)	(0.005)
Trade(-1)	0.013***	0.013***	0.013***	0.013***	0.013***	0.014***	0.013***	0.013***	0.014***	0.013***	0.013***	0.014***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Banking Crisis(-1)	−0.010***	−0.005***	−0.001	−0.010***	−0.005***	−0.001	−0.010***	−0.005***	−0.001	−0.010***	−0.005***	−0.001
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
ΔReal GDP	0.071**	0.106***	0.112***	0.071**	0.106***	0.112***	0.072**	0.108***	0.110***	0.071**	0.107***	0.112***
	(0.030)	(0.024)	(0.028)	(0.030)	(0.024)	(0.028)	(0.030)	(0.024)	(0.028)	(0.030)	(0.024)	(0.028)

Table 11 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Debt(-1)	−0.075***	−0.083***	−0.110***	−0.075***	−0.083***	−0.110***	−0.075***	−0.083***	−0.111***	−0.075***	−0.083***	−0.110***
	(0.020)	(0.016)	(0.014)	(0.020)	(0.016)	(0.014)	(0.020)	(0.016)	(0.014)	(0.020)	(0.016)	(0.014)
ΔPublic Investment	−0.332***	−0.194	−0.010	−0.331***	−0.193	−0.013	−0.332***	−0.192	−0.019	−0.332***	−0.195	−0.015
	(0.112)	(0.146)	(0.209)	(0.112)	(0.147)	(0.209)	(0.111)	(0.146)	(0.209)	(0.111)	(0.146)	(0.209)
ΔGovernment Expenditure	−0.345***	−0.035	0.159	−0.344***	−0.029	0.160	−0.345***	−0.031	0.148	−0.346***	−0.035	0.157
	(0.087)	(0.093)	(0.100)	(0.088)	(0.094)	(0.101)	(0.087)	(0.093)	(0.101)	(0.087)	(0.093)	(0.100)
Constant	−0.023***	−0.026***	−0.031***	−0.023***	−0.025***	−0.030***	−0.023***	−0.026***	−0.030***	−0.023***	−0.026***	−0.030***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2193	2277	2361	2193	2277	2361	2193	2277	2361	2193	2277	2361
adj. R^2	0.68	0.85	0.85	0.68	0.85	0.85	0.68	0.85	0.85	0.68	0.85	0.85
F-stat	36.3***	102.7***	107.5***	36.4***	102.8***	107.4***	36.4***	96.8***	107.4***	36.4***	102.8***	107.4***

Fixed Effect (country and year) estimates of the relationship of the government budget balance, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 12 Results government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational												
Fiscal Rules												
Budget Balance Rule(-1)	0.001	0.002*	0.002									
	(0.002)	(0.001)	(0.001)									
Debt Rule(-1)				0.002	0.003**	0.002*						
				(0.002)	(0.001)	(0.001)						
Expenditure Rule(-1)							0.007***	0.008***	0.008***			
							(0.002)	(0.001)	(0.001)			
Revenue Rule(-1)										−0.008	−0.011**	−0.014***
										(0.011)	(0.005)	(0.004)
Controls												
Government Balance(-1)	0.496***	0.442***	0.265***	0.496***	0.442***	0.265***	0.492***	0.437***	0.260***	0.496***	0.439***	0.260***
	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.019)	(0.050)	(0.025)	(0.018)
Interest Rate(-1)	−0.027**	−0.028***	−0.033***	−0.026**	−0.028***	−0.033***	−0.021*	−0.022***	−0.026***	−0.027**	−0.029***	−0.033***
	(0.013)	(0.007)	(0.005)	(0.013)	(0.007)	(0.005)	(0.012)	(0.006)	(0.005)	(0.012)	(0.006)	(0.005)
Trade(-1)	0.013***	0.013***	0.013***	0.013***	0.013***	0.014***	0.009**	0.009***	0.010***	0.013***	0.013***	0.013***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Banking Crisis(-1)	−0.009***	−0.005***	−0.001	−0.009***	−0.005***	−0.001	−0.009***	−0.004***	−0.001	−0.010***	−0.005***	−0.000
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.012)	(0.001)	(0.001)
ΔReal GDP	0.071**	0.108***	0.112***	0.071**	0.108***	0.112***	0.071**	0.106***	0.111***	0.072**	0.110***	0.122***
	(0.030)	(0.024)	(0.028)	(0.030)	(0.024)	(0.028)	(0.030)	(0.024)	(0.027)	(0.030)	(0.024)	(0.027)

Table 12 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Debt	−0.075***	−0.083***	−0.109***	−0.075***	−0.082***	−0.109***	−0.074***	−0.079***	−0.102***	−0.076***	−0.088***	−0.120***
	(0.020)	(0.017)	(0.014)	(0.020)	(0.017)	(0.014)	(0.020)	(0.016)	(0.014)	(0.019)	(0.015)	(0.013)
ΔPublic Investment	−0.331***	−0.191	−0.013	−0.331***	−0.185	0.002	−0.327***	−0.162	0.074	−0.329***	−0.171	0.050
	(0.112)	(0.147)	(0.210)	(0.111)	(0.146)	(0.209)	(0.111)	(0.145)	(0.211)	(0.112)	(0.147)	(0.208)
ΔGovernment Expenditure	−0.345***	−0.037	0.140	−0.346***	−0.038	0.137	−0.342***	−0.023	0.184*	−0.346***	−0.029	0.247**
	(0.087)	(0.093)	(0.101)	(0.088)	(0.093)	(0.101)	(0.087)	(0.092)	(0.098)	(0.087)	(0.092)	(0.102)
Constant	−0.023***	−0.026***	−0.031***	−0.023***	−0.027***	−0.031***	−0.021***	−0.024***	−0.029***	−0.022***	−0.025***	−0.029***
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2193	2277	2361	2193	2277	2361	2193	2277	2361	2193	2277	2361
adj. R^2	0.68	0.85	0.85	0.68	0.85	0.85	0.68	0.86	0.86	0.68	0.85	0.86
F-stat	36.3***	102.9***	107.5***	36.4***	103.0***	107.6***	36.5***	104.6***	110.1***	36.4***	103.3***	109.2***

Fixed Effect (country and year) estimates of the relationship of the government budget balance, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 13 Results public investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	0.000	0.000	0.000									
	(0.001)	(0.000)	(0.000)									
Debt Rule(-1)				0.001	0.000	0.000						
				(0.001)	(0.000)	(0.000)						
Expenditure Rule(-1)							−0.000	−0.000	−0.000			
							(0.000)	(0.000)	(0.000)			
Revenue Rule(-1)										−0.000	0.000	0.000
										(0.001)	(0.000)	(0.000)
Controls												
Public Investment(-1)	−0.287***	−0.041***	0.009*	−0.287***	−0.041***	0.009*	−0.287***	−0.041***	0.009*	−0.287***	−0.041***	0.009*
	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)
Government Debt(-1)	−0.003***	0.002	0.001***	−0.003***	0.002	0.001***	−0.003**	0.002	0.001***	−0.003***	0.000	0.001***
	(0.001)	(0.004)	(0.000)	(0.001)	(0.004)	(0.000)	(0.001)	(0.004)	(0.000)	(0.001)	(0.000)	(0.000)
Inflation(-1)	0.001**	0.001	−0.000	0.001**	0.001	−0.000	0.001**	0.001	−0.000	0.001**	0.000	−0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Interest Rate(-1)	−0.009**	0.001	0.003***	−0.008**	0.001	0.003***	−0.008**	0.001	0.003***	−0.008**	0.001	0.003***
	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
ΔReal GDP	0.037***	0.044***	0.040***	0.037***	0.044***	0.040***	0.037***	0.044***	0.039***	0.037***	0.044***	0.040***
	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)

Table 13 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Balance	−0.044***	−0.048***	−0.045***	−0.044***	−0.048***	ö−0.045***	−0.044***	−0.048***	−0.045***	−0.044***	−0.048***	−0.045***
	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)
ΔGovernment Expenditure	0.063***	0.029	0.034*	0.062***	0.028	0.033*	0.063***	0.029	0.033*	0.063***	0.029	0.034*
	(0.022)	(0.020)	(0.019)	(0.022)	(0.020)	(0.019)	(0.022)	(0.020)	(0.019)	(0.022)	(0.020)	(0.019)
ΔPrivate Investment	−0.094***	−0.041*	−0.019	−0.094***	−0.042*	−0.019	−0.094***	−0.041*	−0.019	−0.094***	−0.041*	−0.018
	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)
Constant	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2179	2213	2243	2179	2213	2243	2179	2213	2243	2179	2213	2243
adj. R^2	0.22	0.24	0.43	0.22	0.24	0.43	0.22	0.24	0.43	0.22	0.24	0.43
F-stat	5.8***	6.5***	14.0***	5.8***	6.5***	14.0***	5.8***	6.5***	14.0***	5.8***	6.5***	14.0***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 14 Results public investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational												
Fiscal Rules												
Budget Balance Rule(-1)	0.001	0.000	−0.000									
	(0.001)	(0.000)	(0.000)									
Debt Rule(-1)				0.001	−0.000	−0.000*						
				(0.001)	(0.000)	(0.000)						
Expenditure Rule(-1)							−0.001	−0.000	−0.000*			
							(0.001)	(0.000)	(0.000)			
Revenue Rule(-1)										0.005***	0.002***	0.001***
										(0.002)	(0.001)	(0.000)
Controls												
Public Investment(-1)	−0.287***	−0.041***	0.009*	−0.288***	−0.040***	0.009*	−0.288***	−0.041***	0.008	−0.288***	−0.041***	0.008
	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)	(0.035)	(0.010)	(0.005)
Government Debt(-1)	−0.003***	0.000	0.001***	−0.003***	0.000	0.001**	−0.003**	0.000	0.001***	−0.003***	0.000	0.001***
	(0.001)	(0.000)	(0.000)	(0.022)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Inflation(-1)	0.001**	0.000	−0.000	0.001**	0.000	−0.000	0.001**	0.000	−0.000	0.001**	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Interest Rate(-1)	−0.007*	0.001	0.003***	−0.008*	0.001	0.002***	−0.010**	0.001	0.002**	−0.009**	0.001	0.002***
	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
ΔReal GDP	0.037***	0.044***	0.040***	0.037***	0.044***	0.040***	0.038***	0.044***	0.040***	0.036***	0.043***	0.038***
	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)	(0.008)	(0.005)	(0.004)

Table 14 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Balance	−0.044***	−0.048***	−0.045***	−0.044***	−0.048***	−0.033***	−0.044***	−0.048***	−0.045***	−0.044***	−0.049***	−0.048***
	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)	(0.013)	(0.013)	(0.011)
ΔGovernment Expenditure	0.063***	0.029	0.034*	0.063***	0.029	0.035*	0.063***	0.029	0.034*	0.064***	0.030	0.030
	(0.022)	(0.020)	(0.019)	(0.022)	(0.020)	(0.019)	(0.022)	(0.020)	(0.019)	(0.022)	(0.019)	(0.019)
ΔPrivate Investment	−0.094***	−0.041*	−0.019	−0.093***	−0.042*	0.020	−0.094***	−0.041*	−0.018	−0.093***	−0.040*	−0.018
	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)	(0.029)	(0.023)	(0.015)
Constant	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***	0.012***	0.000	−0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
Countries	87	87	87	87	87	87	87	87	87	87	87	87
Observations	2179	2213	2243	2179	2213	2243	2179	2213	2243	2179	2213	2243
adj. R^2	0.22	0.24	0.43	0.22	0.24	0.43	0.22	0.24	0.43	0.22	0.25	0.43
F-stat	5.8***	6.5***	14.0***	5.8***	6.5***	14.0***	5.8***	6.5***	14.0***	5.8***	6.6***	14.1***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 15 Results economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	0.000	0.001	0.000									
	(0.002)	(0.001)	(0.098)									
Debt Rule(-1)				0.002	0.001	0.000						
				(0.002)	(0.001)	(0.001)						
Expenditure Rule(-1)							−0.003	−0.001	−0.001			
							(0.002)	(0.001)	(0.001)			
Revenue Rule(-1)										0.001	0.002*	0.001
										(0.003)	(0.001)	(0.001)
Controls												
Real GDP(-1)	−0.023**	0.002	0.000	−0.02**	0.002	−0.000	−0.023***	0.002	−0.000	−0.023**	0.002	0.000
	(0.009)	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)
Inflation(-1)	−0.001	−0.003***	−0.002***	−0.001	−0.003***	−0.002***	−0.002	−0.003***	−0.002***	−0.002	−0.003***	−0.002***
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Government Debt(-1)	−0.008*	−0.002*	−0.000	−0.008*	−0.002*	−0.000	−0.007*	−0.002*	−0.000	−0.008*	−0.003*	−0.000
	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)
Trade(-1)	0.012***	0.006	0.000	0.012***	0.006	0.000	0.012***	0.006	0.000	0.012***	0.006	0.000
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Banking Crisis(-1)	−0.014***	−0.009***	−0.007***	−0.014***	−0.009***	−0.007***	−0.015***	−0.009***	−0.007***	−0.014***	−0.009***	−0.007***
	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)

Table 15 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Balance	0.113***	−0.032	−0.346***	0.113***	−0.033	−0.347***	0.113***	−0.031	−0.341***	0.113***	−0.034	−0.347***
	(0.032)	(0.107)	(0.088)	(0.032)	(0.106)	(0.088)	(0.032)	(0.106)	(0.089)	(0.032)	(0.106)	(0.088)
ΔPublic Investment	0.556***	1.140***	2.874***	0.553***	1.338***	2.873***	0.555***	1.343***	2.873***	0.555***	1.341***	2.873***
	(0.111)	(0.206)	(0.372)	(0.111)	(0.207)	(0.373)	(0.111)	(0.205)	(0.370)	(0.111)	(0.104)	(0.371)
ΔPrivate Investment	0.333***	0.682***	0.582***	0.332***	0.683***	0.583***	0.332***	0.682***	0.580***	0.333***	0.685***	0.584***
	(0.076)	(0.104)	(0.116)	(0.076)	(0.104)	(0.116)	(0.076)	(0.104)	(0.117)	(0.076)	(0.104)	(0.116)
ΔAge Dependency Ratio	−0.624***	−0.792***	−0.527***	−0.632***	−0.798***	−0.530***	−0.609***	−0.787***	−0.521***	−0.629***	−0.801***	−0.534***
	(0.197)	(0.144)	(0.101)	(0.196)	(0.142)	(0.100)	(0.197)	(0.144)	(0.100)	(0.198)	(0.145)	(0.103)
ΔUnemployment	−0.523***	−0.424***	−0.829***	−0.521***	−0.431***	−0.827***	−0.525***	−0.425***	−0.832***	−0.523***	−0.425***	−0.830***
	(0.086)	(0.117)	(0.139)	(0.086)	(0.117)	(0.141)	(0.086)	(0.118)	(0.141)	(0.086)	(0.117)	(0.140)
Constant	0.612***	−0.020	0.029	0.624***	−0.014	0.031	0.617***	−0.017	0.032	0.612***	−0.021	0.028
	(0.232)	(0.147)	(0.098)	(0.238)	(0.150)	(0.101)	(0.231)	(0.147)	(0.098)	(0.231)	(0.147)	(0.098)
Countries	82	82	82	82	82	82	82	82	82	82	82	82
Observations	1835	2070	2260	1835	2070	2260	1835	2070	2260	1835	2070	2260
adj. R^2	0.58	0.56	0.62	0.58	0.56	0.62	0.58	0.56	0.62	0.58	0.56	0.62
F-stat	20.9***	22.0***	29.6***	20.9***	22.0***	29.6***	20.9***	22.0***	29.7***	20.9***	22.0***	29.6***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 16 Results economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational												
Fiscal Rules												
Budget Balance Rule(-1)	−0.001	0.002	0.002									
	(0.003)	(0.002)	(0.001)									
Debt Rule(-1)				−0.001	0.002	0.002						
				(0.003)	(0.002)	(0.001)						
Expenditure Rule(-1)							0.001	0.008***	0.005***			
							(0.003)	(0.002)	(0.002)			
Revenue Rule(-1)										−0.012**	−0.002	0.006**
										(0.006)	(0.004)	(0.003)
Controls												
Real GDP(-1)	−0.023***	0.002	0.000	−0.023**	0.002	0.000	−0.022**	−0.006	0.003	−0.023**	0.002	0.000
	(0.009)	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)	(0.010)	(0.006)	(0.004)	(0.009)	(0.006)	(0.004)
Inflation(-1)	−0.002	−0.003***	−0.002***	−0.002	−0.003***	−0.002***	−0.001	−0.002***	−0.002***	−0.001	−0.003***	−0.002***
	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.000)	(0.003)	(0.001)	(0.001)
Government Debt(-1)	−0.008*	−0.003*	−0.000	−0.008*	−0.003*	−0.000	−0.008*	−0.003*	−0.000	−0.008*	−0.003*	−0.000
	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)	(0.004)	(0.001)	(0.000)
Trade(-1)	0.012***	0.005	−0.000	0.012***	0.005	−0.000	0.012***	0.003	−0.002	0.012***	0.006	0.000
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Banking Crisis(-1)	−0.014***	−0.009***	−0.007***	−0.014***	−0.009***	−0.007***	−0.014***	−0.008***	−0.006***	−0.014***	−0.009***	−0.007***
	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)

Table 16 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
ΔGovernment Balance	0.113***	−0.036	−0.351***	0.113***	−0.036	−0.351***	0.113***	−0.030	−0.338***	0.112***	−0.033	−0.347***
	(0.032)	(0.107)	(0.088)	(0.032)	(0.107)	(0.088)	(0.032)	(0.106)	(0.088)	(0.032)	(0.106)	(0.088)
ΔPublic Investment	0.554***	1.353***	2.895***	0.554***	1.353***	2.895***	0.556***	1.345***	2.896***	0.555***	1.344***	2.878***
	(0.111)	(0.205)	(0.370)	(0.111)	(0.205)	(0.088)	(0.111)	(0.203)	(0.372)	(0.111)	(0.205)	(0.371)
ΔPrivate Investment	0.332***	0.690***	0.590***	0.332***	0.690***	0.590***	0.333***	0.670***	0.561***	0.333***	0.684***	0.583***
	(0.076)	(0.105)	(0.116)	(0.076)	(0.105)	(0.370)	(0.076)	(0.103)	(0.117)	(0.076)	(0.104)	(0.116)
ΔAge Dependency Ratio	−0.607***	−0.814***	−0.540***	−0.607***	−0.814***	−0.540***	−0.626***	−0.807***	−0.541***	−0.626***	−0.792***	−0.527***
	(0.201)	(0.150)	(0.102)	(0.201)	(0.150)	(0.102)	(0.199)	(0.145)	(0.101)	(0.198)	(0.144)	(0.101
ΔUnemployment	−0.523***	−0.424***	−0.827***	−0.523***	−0.424***	−0.827***	−0.522***	−0.416***	−0.819***	−0.523***	−0.424***	−0.828***
	(0.086)	(0.117)	(0.139)	(0.086)	(0.117)	(0.139)	(0.086)	(0.115)	(0.139)	(0.086)	(0.117)	(0.140)
Constant	0.618***	−0.031	0.021	0.618***	−0.031	0.021	0.592**	−0.131	−0.040	0.610***	−0.020	0.029
	(0.232)	(0.148)	(0.099)	(0.232)	(0.148)	(0.099)	(0.254)	(0.162)	(0.111)	(0.232)	(0.147)	(0.098)
Countries	82	82	82	82	82	82	82	82	82	82	82	82
Observations	1835	2070	2260	1835	2070	2260	1835	2070	2260	1835	2070	2260
adj. R^2	0.58	0.56	0.62	0.58	0.56	0.62	0.58	0.57	0.62	0.58	0.56	0.62
F-stat	20.9***	22.0***	29.7***	20.9***	22.0***	29.7***	20.9***	22.3***	29.9***	20.9***	22.0***	29.6***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Results for fiscal rules only

Government debt

See Tables 17, 18

Table 17 Results. Government debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	−0.004	−0.002	−0.001									
	(0.006)	(0.003)	(0.003)									
Debt Rule(-1)				0.002	0.005	0.005						
				(0.009)	(0.005)	(0.004)						
Expenditure Rule(-1)							−0.007***	−0.009***	−0.007***			
							(0.006)	(0.003)	(0.002)			
Revenue Rule(-1)										−0.011*	−0.010***	−0.007***
										(0.006)	(0.004)	(0.003)
Constant	0.006**	0.005***	0.004***	0.004	0.003*	0.002*	0.006***	0.006***	0.004***	0.005**	0.005***	0.004***
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	2776	2962	3235	2776	2962	3235	2776	2962	3235	2776	2962	3235
adj. R^2	0.09	0.15	0.23	0.09	0.16	0.23	0.09	0.16	0.23	0.09	0.16	0.23
F-stat	2.8***	4.8***	8.0***	2.8***	4.9***	8.0***	2.8***	4.9***	8.0***	2.8***	4.9***	8.0***

Fixed Effect (country and year) estimates of the relationship of the change of government debt and national fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 18 Results government debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational Fiscal Rules												
Budget Balance Rule(-1)	−0.002	−0.003	−0.003									
	(0.010)	(0.005)	(0.003)									
Debt Rule(-1)				−0.012	−0.012**	−0.012***						
				(0.010)	(0.005)	(0.004)						
Expenditure Rule(-1)							−0.041***	−0.038***	−0.026***			
							(0.006)	(0.004)	(0.003)			
Revenue Rule(-1)										−0.110	−0.049	−0.034*
										(0.080)	(0.031)	(0.019)
Constant	0.005	0.005**	0.004***	0.009**	0.009***	0.007***	0.008***	0.007***	0.005***	0.011**	0.007***	0.005***
	(0.004)	(0.002)	(0.001)	(0.005)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.005)	(0.002)	(0.001)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	2776	2962	3235	2776	2962	3235	2776	2962	3235	2776	2962	3235
adj. R^2	0.09	0.15	0.23	0.09	0.16	0.24	0.09	0.17	0.24	0.09	0.16	0.24
F-stat	2.8***	4.8***	8.0***	2.9***	4.9***	8.1***	3.0***	5.2***	8.3***	3.0***	5.0***	8.2***

Fixed Effect (country and year) estimates of the relationship of the change of government debt and supranational fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Government budget balance

See Tables 19, 20

Table 19 Results. Government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	−0.014**	−0.012**	−0.011**									
	(0.007)	(0.005)	(0.004)									
Debt Rule(-1)				−0.011**	−0.013***	−0.014***						
				(0.005)	(0.004)	(0.004)						
Expenditure Rule(-1)							−0.010*	−0.009**	−0.010***			
							(0.005)	(0.004)	(0.003)			
Revenue Rule(-1)										−0.024***	−0.026***	−0.027***
										(0.008)	(0.002)	(0.005)
Constant	−0.027***	−0.027***	−0.027***	−0.029***	−0.028***	−0.028***	−0.030***	−0.029***	−0.028***	−0.030***	−0.030***	−0.029***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	3136	3296	3497	3136	3296	3497	3136	3296	3497	3136	3296	3497
adj. R^2	0.17	0.25	0.33	0.17	0.25	0.33	0.17	0.25	0.33	0.17	0.25	0.33
F-stat	5.6***	8.8***	13.0***	5.6***	8.8***	13.0***	5.6***	8.8***	12.9***	5.6***	8.8***	13.0***

Fixed Effect (country and year) estimates of the relationship of the change of government budget balance and national fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 20 Results. Government budget balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational Fiscal Rules												
Budget Balance Rule(-1)	0.031***	0.031***	0.031***									
	(0.012)	(0.009)	(0.006)									
Debt Rule(-1)				0.034***	0.034***	0.033***						
				(0.012)	(0.009)	(0.006)						
Expenditure Rule(-1)							0.014**	0.014***	0.010**			
							(0.005)	(0.005)	(0.004)			
Revenue Rule(-1)										−0.034***	−0.034***	−0.031***
										(0.010)	(0.007)	(0.005)
Constant	−0.041***	−0.040***	−0.039***	−0.043***	−0.042***	−0.041***	−0.032***	−0.032***	−0.031***	−0.029***	−0.029***	−0.029***
	(0.006)	(0.004)	(0.003)	(0.006)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	3136	3296	3497	3136	3296	3497	3136	3296	3497	3136	3296	3497
adj. R^2	0.17	0.25	0.33	0.17	0.25	0.33	0.17	0.25	0.32	0.17	0.25	0.33
F-stat	5.7***	9.0***	13.2***	5.7***	9.0***	13.2***	5.6***	8.8***	12.9***	5.6***	8.8***	13.0***

Fixed Effect (country and year) estimates of the relationship of the change of government budget balance and supranational fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Public investment

See Table 21

Table 21 Results. Public Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	0.000	0.000	0.000									
	(0.001)	(0.000)	(0.000)									
Debt Rule(-1)				0.001	0.001***	0.001***						
				(0.001)	(0.000)	(0.000)						
Expenditure Rule(-1)							−0.000	−0.000	−0.000			
							(0.001)	(0.000)	(0.000)			
Revenue Rule(-1)										−0.000	−0.000	−0.000
										(0.001)	(0.000)	(0.000)
Constant	−0.000	−0.000	−0.000	−0.000	−0.000*	−0.000***	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Countries	100	100	100	100	100	100	100	100	100	100	100	100
Observations	3524	3558	3600	3524	3558	3600	3524	3558	3600	3524	3558	3600
adj. R^2	−0.02	0.07	0.20	−0.02	0.07	0.20	−0.02	0.07	0.20	−0.02	0.07	0.20
F-stat	0.5	3.0***	7.7***	0.6	3.1***	7.8***	0.5	3.0***	7.7***	0.5	3.0***	7.7***

Fixed Effect (country and year) estimates of the relationship of the change of public investment and national fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 22 Results public investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational Fiscal Rules												
Budget Balance Rule(-1)	−0.001	−0.001**	−0.001***									
	(0.001)	(0.000)	(0.000)									
Debt Rule(-1)				−0.001	−0.001***	−0.001***						
				(0.001)	(0.000)	(0.000)						
Expenditure Rule(-1)							−0.000	−0.000	−0.001***			
							(0.001)	(0.000)	(0.000)			
Revenue Rule(-1)										0.001	0.001*	0.001***
										(0.001)	(0.000)	(0.000)
Constant	0.000	0.000	0.000**	0.000	0.000***	0.000***	0.000	−0.000	−0.000	−0.000	−0.000	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Countries	100	100	100	100	100	100	100	100	100	100	100	100
Observations	3524	3558	3600	3524	3558	3600	3524	3558	3600	3524	3558	3600
adj. R^2	−0.02	0.07	0.20	−0.02	0.08	0.21	−0.02	0.07	0.20	−0.02	0.07	0.20
F-stat	0.5	3.1***	7.9***	0.6	3.2***	8.0***	0.5	3.0***	7.8***	0.5	3.0***	7.8***

Fixed Effect (country and year) estimates of the relationship of the change of public investment and supranational fiscal rules. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Economic growth

See Table 23

Table 23 Results economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
National Fiscal Rules												
Budget Balance Rule(-1)	0.000	0.001	0.002									
	(0.002)	(0.002)	(0.001)									
Debt Rule(-1)				0.002	0.003*	0.005***						
				(0.003)	(0.002)	(0.002)						
Expenditure Rule(-1)							−0.003	−0.003*	−0.003***			
							(0.002)	(0.001)	(0.001)			
Revenue Rule(-1)										−0.003	−0.004	−0.005**
										(0.004)	(0.003)	(0.002)
Constant	0.031***	0.030***	0.030***	0.031***	0.030***	0.029***	0.032***	0.031***	0.031***	0.031***	0.031***	0.030***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	3582	3632	3704	3582	3632	3704	3582	3632	3704	3582	3632	3704
adj. R^2	0.18	0.24	0.31	0.18	0.24	0.31	0.18	0.24	0.31	0.18	0.24	0.31
F-stat	6.6***	9.3***	12.8***	6.6***	9.3***	12.9***	6.6***	9.3***	12.9***	6.6***	9.3***	12.8***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, national fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

Table 24 Results. Economic Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Period horizon	1y	5y	10y	1y	5y	10y	1y	5y	10y	1y	5y	10y
Supranational												
Fiscal Rules												
Budget Balance Rule(-1)	−0.005	−0.006***	−0.007***									
	(0.003)	(0.002)	(0.002)									
Debt Rule(-1)				−0.010***	−0.011***	−0.012***						
				(0.003)	(0.002)	(0.002)						
Expenditure Rule(-1)							0.008***	0.008***	0.004**			
							(0.003)	(0.002)	(0.002)			
Revenue Rule(-1)										0.014**	0.012***	0.011***
										(0.006)	(0.003)	(0.002)
Constant	0.033***	0.032***	0.032***	0.034***	0.034***	0.034***	0.031***	0.030***	0.030***	0.031***	0.030***	0.030***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Countries	106	106	106	106	106	106	106	106	106	106	106	106
Observations	3582	3632	3704	3582	3632	3704	3582	3632	3704	3582	3632	3704
adj. R^2	0.18	0.25	0.31	0.18	0.25	0.32	0.18	0.25	0.31	0.18	0.25	0.31
F-stat	6.6***	9.4***	13.0***	6.7***	9.6***	13.3***	6.6***	9.4***	12.9***	6.7***	9.4***	12.9***

Fixed Effect (country and year) estimates of the relationship of the change of real GDP, supranational fiscal rules and control variables. 1y = 1-year change, 5y = 5-year change, centered moving average, 10y = 10-year change, centered moving average. White diagonal standard errors and covariance (degrees of freedom corrected) in parentheses.

*** significant at 1% level, ** significant at 5%, * significant at 10%

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