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SECULAR DECLINE IN PUBLIC INVESTMENT: ARE NATIONAL FISCAL RULES TO BLAME?



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ABBREVIATIONS

CABB – cyclically adjusted budget balance
 COFOG – classification of the functions of government
 EFTA – European Free Trade Association
 EMU – Economic and Monetary Union
 EU – European Union
 FE – fixed effect
 FRF – fiscal response function
 GDP – gross domestic product
 GMM – generalized method of moments
 IMF – International Monetary Fund
 LSDVC – least square dummy variable
 OECD – Organisation for Economic Co-operation and Development
 OLS – ordinary least squares
 POSET – partially ordered set
 pp – percentage point
 SGP – Stability and Growth Pact
 UK – United Kingdom
 US – United States of America
 WEO – World Economic Outlook

ABSTRACT

This study investigates the impact of national fiscal rules on public investment policy. Using data of 35 OECD countries for the period 1995–2015, the paper provides evidence of a negative effect of expenditure rules on the level and share of government investment expenditure in total outlays, particularly in economic affairs. The effect of budget balance rules is less certain and seems to stem from those rules that do not explicitly exclude investment from the assessment. The coefficient estimates however imply a relatively low magnitude of the negative effect of fiscal rules. Overall, our paper suggests that, while loosening fiscal rules will not solve the problem of underinvestment, properly designed rules can help to protect public capital stock to some extent only.

Keywords: fiscal rules, government expenditure, public investment, panel analysis

JEL codes: E62, H50, C23

The opinions expressed in this paper are those of the author and do not necessarily reflect the official viewpoint of Latvijas Banka.

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1. INTRODUCTION

Government spending on capital accumulation plays an important role in a country's economic development. Increased public investment leads to significant economic growth (Mourougane et al. (2016)) and helps to align incomes of poorer countries with those of the developed ones (Fournier (2016)). However, over the past few decades, advanced economies have constantly suffered from underinvestment. In G20 countries, for example, public investment fell from 5% of GDP in the late 1960s to 3% in the mid-2000s (OECD (2017)). Capital expenditure in many OECD countries continued to decline from 1995 to 2015, particularly in the four largest countries of the euro area (Germany, France, Italy and Spain) as well as in Japan and the US where further reductions were recorded. One third of the fiscal consolidation measures adopted in OECD countries during the recent sovereign debt crisis in 2010–2013 were achieved through a reduction in public investment (OECD (2015)). As a result, public capital in developed economies has declined significantly, resulting in a deterioration in the state and quality of public infrastructure (IMF (2014)). In more than half of the OECD countries, it currently accounts for about 50% of GDP or less, which is below the levels that are considered the minimum values for its optimal size (Fournier (2016)).¹

Recognition of the need to revitalize capital expenditure is growing. It is not only capital expenditure that is important for achieving long-term growth goals. Emerging issues related to climate change and the digital transition also require significant public investment (OECD (2017)).² Historically low government borrowing costs represent favourable conditions for raising public investment, particularly in the countries that do not suffer from unsustainable debt dynamics and where proper institutions are in place to safeguard against cost overruns and the implementation of inefficient projects.

Since fiscal authorities are prone to excessive deficits and the implementation of procyclical fiscal policies, numerical restrictions on fiscal indicators (such as debt, deficits and expenditure) have become very popular, with their number starting to rise rapidly in the 1990s. Although these so-called fiscal rules were mainly introduced to ensure fiscal sustainability, they can have a side effect on the structure of government spending. Given the need to adjust the fiscal variable in accordance with the target and maintain it at this level, government should choose the optimal combination of tax and expenditure measures. In addition, there is a trade-off between capital accumulation and current expenditure, in particular salaries for government employees, social transfers, etc. Political support for investment entrenchments or postponement seems to be easier to obtain (Drazen and Eslava (2010)), because the short-term benefits (both economic and political) entailed by investment projects are not obvious to society, while long-term output gains may be discounted by economic agents. It was previously shown that during the periods of fiscal consolidation, public investment is reduced (De Haan et al. (1996)), often surpassing cuts in public consumption (Bamba et al. (2019)). Thus, if fiscal constraints adversely affect public investment, for example, due to a political inability to raise taxes or reduce

¹ For example, Fournier (2016) gauges the optimal stock of public capital to be between 75% and 110% of GDP, Checherita-Westphal et al. (2014) argue it is between 50% and 80% of GDP.

² Investment needed to tackle climate change accounts for trillions of USD, e.g. in infrastructure alone – 6 trillion USD annually up to 2030 (IMF (2019)).

consumption, there is a trade-off between the need to comply with fiscal rules and long-term economic growth.

To date, no evidence has been provided of the effect of budget rules on the structure of public spending, in particular, on public investment. There are a number of studies that examine the impact of public spending patterns on economic growth, while the evidence on the determinants of expenditure composition, the composition effect of fiscal consolidation and fiscal rules is rather scarce.

We provide a new comprehensive evidence on the composition effect of fiscal restraint. To this end, we examine the effect of fiscal rules and their distinct design features on public investment. We strive to find out whether countries limited by fiscal rules adjust both the level and share of public investment in total government spending and whether this change is associated with the quality characteristics of the rules. A priori, the effect is unclear: the rules may force governments to prioritize and thus maintain the level of public investment by increasing their share in spending. In this regard, it is also unclear whether certain characteristics of the rules aimed at investment (such as in the so-called "golden rule") will increase or decrease public investment. Understanding of how national fiscal rules affect spending composition is important to improve their design and to protect certain expenditure components (such as investment).

For the purpose of the study, we use panel data for 35 OECD countries for the period 1995–2015. In our baseline econometric specification, we regress public investment on a number of explanatory factors, where we account for both the presence and the stringency of national fiscal rules. In addition, we distinguish between their main design features by taking into account the presence of a monitoring body, escape clauses and enforcement procedure and by distinguishing the "golden rules" that exclude investment expenditure from the assessment of the compliance with a benchmark. Finally, we examine whether there is a heterogeneous effect of fiscal rules depending on the purpose of investment projects. We check the robustness of our estimates with respect to the country composition of the sample, alternative time windows, different variants of fiscal rule variables and several specifications and estimation procedures.

The estimation results obtained in the study show that investment spending declines when a country follows the expenditure rule, but the evidence is less certain for budget balance rules. When the latter exclude public investment from the assessment, there appears to be no effect on both the level and the share of investment expenditure as governments have no incentive to cut capital expenditure. However, when the budget balance rule focuses on the overall balance, the effect on public investment is about the same as of the expenditure rule. Public investment is also found not to respond to those expenditure rules that tie spending to potential output developments. However, both results (particularly the latter) rest on a low number of observations and need further scrutiny as time passes by.

The coefficient estimates imply a relatively low magnitude of the effect of fiscal rules as their strengthening explains only a small share in the dynamics of investment. Even though the introduction and strengthening of fiscal rules have probably caused some investment restraints, there were other factors that had an economically more significant impact on investment policy. While loosening fiscal rules will not solve the problem of underinvestment, properly designed rules can to some extent help

protect government capital expenditure. The estimation results presented in this paper also provide guidelines in the context of the ongoing discussions on revisiting the EU supranational fiscal policy framework. The amended framework should put more emphasis on the design of rules so that they do not unduly reduce capital outlays.

The paper is structured in the following way. Section 2 reviews the related literature. Section 3 describes the data and methodology employed in the paper. Section 4 presents the estimation results. Finally, Section 5 concludes.

2. REVIEW OF LITERATURE

Empirical literature analyzing the composition of government expenditure has mainly concentrated on the effect of its structure on economic growth (d'Agostino et al. (2017), Fournier (2016), Gemmel et al. (2016), Alfonso and Jalles (2014), Teles and Mussolini (2014), Acosta-Ormaechea and Morozumi (2013) are examples of the most recent papers with Johansson (2016) providing the review of literature). In particular, public investment cuts are perceived to be detrimental to private investment (Aschauer (1989)), economic growth (Berg et al. (2012), Abiad et al. (2016), Fournier (2016), Mourougane et al. (2016)), income inequality (Fournier (2016)) and welfare (Heijdra and Meijdam (2002)).

With government spending structure playing an important role in economic development, it is important to find out what shapes the structure of public spending in the first place. The role of political budget cycles has received especially wide coverage in the literature. The theoretical justification of the effect of elections on the structure of public spending was first set forth by Rogoff (1990) and then empirically verified by a number of studies (among them Schuknecht (2000), Block (2001) and Vergne (2009) for developing economies, Katsimi and Sarantides (2012) for established democracies or developed economies and Gupta et al. (2016) for a broad sample of 67 democracies). Although the results mainly indicate the growing importance of more visible categories of public spending before the election, that is, spending on public consumption and social security, the level of capital spending may also get boosted. For instance, Gupta et al. (2016) find that in order to maximize electoral gains incumbent politicians raise public investment prior to elections. The peak in public investment growth is reached 28 months before elections. The role of other political variables, such as government ideology and fragmentation, as well as corruption, has also been acknowledged in a number of studies with a mixed evidence on their impact (Brauninger (2005), Franzese (2002), Mauro (1998)).

A limited empirical literature examined the role of public investment during the periods of fiscal consolidation. Among other authors, De Haan et al. (1996) show that fiscal authorities use capital spending cuts (as a percentage of GDP) as a tool. Bamba et al. (2019) report a decrease in the ratio of government investment to consumption, which implies that fiscal austerity affects investment more than public consumption. This composition effect is especially noticeable when consolidation is largely achieved by cutting expenditure rather than raising taxes, as well as during periods of high public debt, low economic growth and when austerity follows major debt and stock market crises. Castro (2017) explores the impact of fiscal consolidation on the functional structure of government spending. Expenditure growth gets slower with restraints mainly affecting spending on defense, public order, environment, housing, health, education and social protection.

The empirical literature on fiscal rules is plentiful. However, it has mainly concentrated on their ability to eliminate deficit bias and enforce fiscal discipline (see, e.g. Debrun et al. (2008) among many others), reduce macroeconomic volatility (Reuter et al. (2018)), induce counter-cyclical fiscal policies (Manasse (2006)), lower risk premia on public debt (Iara and Wolff (2014)) and promote macroeconomic stability (Sacchi and Salotti (2015), Reuter et al. (2018)).³ The empirical analysis on the effects of rules on public investment and spending composition to the best of our knowledge is scant. Some of such papers study the role fiscal rules and institutions play in political budget cycles as they can shape the environment in which fiscal policy decisions are being made. Thus, the above cited Gupta et al. (2016) suggest that fiscal rules may attenuate the impact of political budget cycles on public investment. Tsai (2014) studies the effect of budget balance rules on the existence of political cycles in individual components of expenditure in US states. The findings confirm that politicians increase spending on more visible expenditure components before elections. However, such effects are less pronounced in the states with balanced budget requirements. Afonso and Jalles (2015) assess the relationship between fiscal policy and private and public investment. Among other issues, their paper briefly explores the effect of national fiscal rules on the level of public investment in EU countries. It uses three indices constructed by the European Commission (overall rule index, balance rule and expenditure rule indices) and finds a negative effect of numerical rules on public investment, particularly in a sample of countries with public debt levels beyond 60% of GDP threshold. The paper does not distinguish between different rule characteristics and does not explore the composition effect.⁴ The latter is explored by Venturini (2018) who studies subnational rules of Italian municipalities and their impact on spending composition. The estimation results point at shifting government spending away from investment in the municipalities subject to such rules (this confirms some earlier evidence on the effect of the SGP on municipal investment outlays, e.g. Valles and Zarate (2007) for Spain). The sharpest reductions are recorded in investment in human capital and infrastructure. Bacchiocchi et al. (2011) show that in the sample of EU countries with high levels of public debt further growth in debt encourages governments to reduce public investment and spending on health and education (investment in human capital), thereby hindering the long-term growth of their economies. The relationship is not significant for low-debt countries. This means that in terms of investment spending, EU countries are limited by debt sustainability issues, not by the restrictions set forth in the SGP. It can be argued that fiscal authorities take national restrictions more seriously than supranational SGP provisions because of allegedly higher obligations to society rather than to EU officials.

In addition to the existing literature, we provide a comprehensive analysis of the impact of fiscal rules on public investment and their share in total outlays. In particular, we examine the influence of specific design features of individual rules as well as their effect on the functional (COFOG) categories of capital spending. We also provide the extensive robustness analysis using variants of fiscal rule indices, addressing heterogeneity and endogeneity concerns and estimating regressions using both an annual dataset and 3-year average dataset to eliminate possible erratic short-

³ However, the results obtained in these studies have been recently questioned by Heinemann et al. (2018) who emphasized endogeneity concerns and showed that the constraining impact of rules is weaker once fiscal rule variables get properly instrumented.

⁴ The European Commission indices are calculated only for EU countries, and they account for a broader definition of a fiscal rule, such as medium-term frameworks or rules designed and enforced at sub-national levels and therefore not regarded as rules by the IMF.

term fluctuations in the data. In contrast to Afonso and Jalles (2015), in this study we consider only those fiscal rules that are applied at central or general government level and therefore cover a large part of public finance.

3. ECONOMETRIC ANALYSIS: FRAMEWORK, DATA AND METHODOLOGY

3.1 Estimation framework

The natural starting point of our estimation framework is the concept of the fiscal reaction function (Bohn (2008)), which is widely used in empirical studies of fiscal policy (see Tkačevs and Vilerts (2019) for a brief explanation of the FRF and an application). Bohn (2008) argued that fiscal policy can be considered sustainable if an intertemporal budget constraint is satisfied. He suggested using the following general form of fiscal reaction function:

$$PB_t = \alpha D_{t-1} + e_t \quad (1)$$

where PB_t denotes primary balance and D_{t-1} stands for public debt. For the intertemporal budget constraint to be satisfied, the estimate of α should be positive, e_t (a set of other determinants) as a share of GDP should be bounded and the equation itself – properly specified, i.e. all the relevant primary balance determinants should be included. In addition to traditional debt and cyclical variables, fiscal reaction functions may include the impact of other factors, in particular, fiscal policy rules.

Although indicators, whose performance is usually studied, include various definitions of the budget balance and government expenditure, we can think of the government investment ratio to GDP as well as its share in total government spending as likely response variables if introducing or strengthening fiscal rules entails disciplinary effect on fiscal authorities encouraging them to reconsider spending priorities.⁵

In order to assess the impact of fiscal rules as well as their main design features, we estimate the following specification:

$$Invest_{it} = \alpha + \beta * FR_{it} + \sum \gamma_k * X_{kit} + \delta * Trend + \varphi * Trend^2 + \vartheta_i + \varepsilon_{it} \quad (2)$$

where $i = 1, \dots, N$ and $t = 1, \dots, T$. Invest is either the public investment-to-GDP ratio or the ratio between public investment and total government spending. When analyzing the heterogeneous effect of fiscal rules on public investment by their function, detailed COFOG components are used. FR is one of the below discussed fiscal rule variables (IMF fiscal rule index in the baseline). X_k stands for k different control factors (described below). Trend and its squared transformation are added to account for the secular decline in public investment observed in previous decades. Following some of the above cited studies (e.g. Afonso and Jalles (2015)), we also replace the trend and its squared term with period dummies. This may prove sensible if the 2nd degree polynomial is not adequate in the presence of the severe economic recession in the sample and this have an impact on the coefficients of our interest.

⁵ Government investment is general government gross fixed capital formation and includes the acquisition of fixed assets, such as buildings, roads, airports, transport, water, telecommunication, etc. For the cross-country dynamics of government investment expenditure (both as ratio to GDP and a share in total government outlays) refer to Figure A1.

Finally, ϑ_i symbolizes country-specific unobserved factors affecting public investment (FEs) and ε_{it} is an iid error term.

In our paper we go beyond the impact of fiscal rules on total public investment and analyze their effect on the functional components of investment. This analysis is based on the COFOG that groups expenditure data into 10 categories according to their purpose of use (Eurostat (2019)). These groups are: 1) general public services, 2) defense, 3) public order and safety, 4) economic affairs, 5) environmental protection, 6) housing and community amenities, 7) health, 8) recreation, culture and religion, 9) education, 10) social protection.

Public investment and several explanatory variables contain a unit root.⁶ In time-series models it is important to distinguish between processes that are stationary $I(0)$ and non-stationary $I(1)$ because of the concerns that the resulting regression suffers from spurious relationship. This type of problem does not exist for panel data as the OLS estimator is consistent and has normal limiting distribution (Moon and Phillips (1999)). The cross-section dimension adds information compared to pure time-series data (Baltagi (2001)). Therefore, estimating panel regressions where non-stationary variables are expressed in levels rather than differences has so far been standard in the empirical literature.⁷

The equation is estimated using the FE estimator. The use of FE rather than random effect is standard in macro literature (see Judson and Owen (1999) for explanation) and in this study is confirmed by the results of the Hausman test.⁸ In the presence of non-stationary series it is important to use appropriate standard errors. In principle, we should use clustered standard errors (at individual level) of Arellano (1987). However, the results of the Pesaran test⁹ reject the null hypothesis of spatial independence¹⁰, which implies that Driscoll and Kraay (1998) standard errors¹¹ that account for the correlation of residuals between cross-sectional units (countries), are more appropriate. Cross-sectional dependence is a very widespread phenomenon in country panels (see, e.g. Arouri and Rault (2014)) and can be the result of using data for interconnected (neighbouring) countries with omitted common factors or spillover effects (Henningsen and Henningsen (2019)). Ignoring it may lead to a severe statistical bias in the estimation results (Hoechle (2007)). Importantly, Driscoll and Kraay (1998) standard error estimates are also heteroskedasticity and autocorrelation consistent.

3.2 Data and robustness exercises

It is important to include all plausible determinants of public investment in order to minimize the possibility of a statistical bias caused by an omitted variable. The control factors that we exploit in this paper are guided by existing literature on assessing the fiscal response function and public investment behaviour and can be grouped as follows. First, we consider several fiscal variables, such as ratios of public debt and

⁶ They are: public debt, cyclically-adjusted budget balance, GDP per capita, private investment ratio to GDP, population growth, openness, dependency ratio (stationary when differenced twice), government fragmentation, fiscal rule index (the results of the Fisher-type test are available upon request).

⁷ For example, among the studies of public investment determinants, surveyed in Section 2, only two papers (Castro (2017), Katsimi and Sarantides (2012)) used variables transformed into first differences.

⁸ Available upon request.

⁹ Pesaran (2004). Available upon request.

¹⁰ `xtcsd` command in Stata (de Hoyos and Sarafidis (2006)).

¹¹ `xtscc` command in Stata (Hoechle (2007)).

cyclically adjusted budget balance to GDP, to take into account the direct disciplinary effect of fiscal imbalance in the previous year on investment expenditure in the current year. We expect that the response of government investment will be negative for public debt and positive for a cyclically-adjusted budget balance if fiscal authorities use public investment as a tool of fiscal adjustment. Second, we include several macroeconomic variables, in particular, the growth rate of real GDP, GDP per capita, the ratio of private investment to GDP, openness to international trade and inflation. The inclusion of these variables is aimed at taking into account the macroeconomic environment in which the fiscal authorities operate. We assume that the response to GDP growth rates will be positive and to inflation and openness – negative, while we have no prior expectations for the rest of the relationships. For example, public and private investment can both replace and complement each other. Fiscal variables, GDP growth rate and GDP per capita enter the equation lagged to avoid simultaneity. Third, we control for demographic factors, such as population growth and dependency ratio (the share of population over 65), which may require additional investment in public infrastructure. We anticipate the positive relationship between these variables and fiscal rules. Finally, following previous literature, political and institutional factors are also included. Among these are the election dummy that takes the value 1 in the year of national parliamentary elections, the parties' dummy that receives the value 1 when the right-wing and centrist parties prevail in the government (due to their supposedly more positive attitude towards investment) and the government fragmentation index, calculated as the sum of the squared seat shares of the parties in the government. Table A1 documents the definition and sources of the variables used. Table A2 provides descriptive statistics.

The baseline results of our study are obtained using an unbalanced data panel for 35 countries that were OECD member states¹² at the time of this writing. However, a detailed functional decomposition of public investment is available only for European (EU and EFTA) countries. Thus, to analyze the impact of fiscal rules on functional components, we use the data panel for the OECD member states whose number is 26.¹³ We begin this exercise by re-estimating (2) for total public investment using this smaller sub-sample of more homogenous European countries with more similar fiscal framework.¹⁴ It allows for challenging the baseline estimates by accounting for possible heterogeneity in the larger sample of OECD countries. Then we proceed by estimating (2) for each functional category of public investment.

Since the last year of the fiscal rules dataset is 2015, our sample does not extend beyond that. We are also limited in the use of data for the years up to 1995 since fiscal rules before this year are very rare.¹⁵ Therefore, our sample covers the time period between 1995 and 2015. In the baseline we use the annual dataset comprising a maximum of 20 years per country. To eliminate possible erratic short-term

¹² These countries are: Australia, Austria, Belgium, Canada, Chile, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK, US. Due to lack of data, Korea is excluded from the sample.

¹³ These countries are: Austria, Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK.

¹⁴ Most of these countries follow the provisions of the EU SGP that may have an impact on how governments react to national fiscal rules.

¹⁵ For instance, in 1990 budget balance rules were in force in two countries and expenditure rules – in three countries out of 35 OECD member states we consider in our study.

fluctuations in the data, we also check the robustness of the baseline estimates by employing the 3-year average dataset with a maximum of seven observations per country.

There might be well-founded concerns that fiscal rules are endogenous to public investment policy if the causality runs in the opposite direction. For example, fiscal authorities may be forced to loosen their rules if they perceive them as constraints on growth-enhancing investment. Alternatively, deep public preferences for fiscal discipline that can be achieved by cutting investment projects (whose benefits are not visible in the short term), may trigger the introduction/strengthening of fiscal rules (Debrun et al. (2008)). In practice, finding an instrument that is correlated with the fiscal rule variable but is independent from the fiscal variable of interest (public investment in our case) is complicated. Badinger and Reuter (2017) exploit government fragmentation, checks and balances and inflation targeting as instruments. Debrun et al. (2008) use a lagged value of a fiscal rule index and the variable identifying countries having adopted the commitment approach to centralize the budget process. Caselli and Reynaud (2019) construct an instrument for a country's fiscal rule index by calculating the average value of the fiscal rule index of neighbouring countries. It is argued that reforms of national fiscal frameworks can be triggered by good/bad examples from nearby countries. We build on both Debrun et al. (2008) and Caselli and Reynaud (2019) and instrument a fiscal variable using its own lag (as in Debrun et al. (2008)) and the average fiscal variable of the neighbouring countries (as in Caselli and Reynaud (2019)). We employ this instrument in the instrumental variable estimation framework with Driscoll–Kraay standard errors (bandwidth = 3).¹⁶

Finally, public investment may exhibit strong persistence meaning that the dynamic model could be more appropriate. Estimating the dynamic panel data model is challenging though as FE estimates produce biased results. The FE performs well only when the time dimension is large (Judson and Owen 1999). Even for $T = 20$ bias can be quite sizeable. This problem is usually addressed by employing the GMM technique. We decided against applying the GMM estimator due to high instability of the obtained results. Moreover, it is argued by Bruno (2005a) that the bias-corrected LSDVC dynamic panel estimator suggested by Kiviet (1995) and Bruno (2005b) outperforms the GMM system when N is moderately large. However, the LSDVC does not allow residual correction for cross-sectional dependence. All in all, bearing the above considerations in mind, we employ both the FE and LSDVC estimation of a dynamic panel regression as another robustness exercise, but keep in mind flaws related to using each of these estimators.¹⁷ Difficulties to design the appropriate estimation strategy is the main reason why the dynamic model is not our preferred baseline framework.

3.3 Fiscal rule variable used in the study

We use information on fiscal rules from the IMF dataset (IMF (2017)) that describes national fiscal rules in 96 countries from 1985 to 2015.¹⁸ In addition to a general description of the rules it provides information about their design properties (e.g.

¹⁶ `xtivreg2` command in Stata (Schaffer (2005)). The rule of thumb for bandwidth selection is $T^{1/4}$ (Newey and West (1994)).

¹⁷ `xtlsdvc` command in Stata (Bruno (2005a)).

¹⁸ Only the rules applied at the level of central or general government are covered in the dataset.

regarding the presence of a monitoring body, escape clauses and enforcement procedure as well as information on whether cyclical component and/or investment are included or excluded from the assessment of the compliance to a benchmark). This information is used in our study to examine the effect of the design features on expenditure composition.

The IMF dataset distinguishes four types of rules: 1) the budget balance rule, 2) the expenditure rule, 3) the revenue rule and 4) the government debt rule. While in our investigation we considered all four types of rules, the results we obtained using the rules aimed at government revenues or public debt appeared of no significance, probably because these rules are only loosely related to government spending decisions, particularly their composition dimension.¹⁹ Therefore, only the results obtained using the variables of budget balance and expenditure rules are reported in the present paper.

Expenditure composition may not only be affected by the presence/introduction of fiscal rules, but also by their stringency. Weak fiscal rules may not trigger any political action regarding the level and structure of government spending, while strict broad-based rules that involve independent institutions with stringent transparency and accountability procedures can shape fiscal policy decisions more closely. In our basic specification, to take into account the heterogeneity of fiscal rules, we use the IMF fiscal rules indices (Schaechter et al. (2012)). These indices account for the strength of fiscal rules and are based on their six properties (legal basis, coverage, formal enforcement procedure, expenditure ceilings, fiscal responsibility law, independent body). These properties are evaluated using scores ranging from 0 to 1 that are summed up with equal weights to create the overall fiscal rules index. In the robustness analysis, to check whether our results are resistant to how the fiscal rule index is constructed, we use indices based on the POSET theory (calculated by Badinger and Reuter (2015)) which takes a different approach to aggregation of fiscal rule features. Finally, we also employ fiscal rules dummies (that take the value 1 when the rule is present and zero when the rule does not exist) but for the reasons mentioned above, we do not overstate the results obtained using the dummy variable. Both stringency and the type of fiscal rule can influence decision-making.

The list of rules we consider in the estimation along with their design features are provided in Table A3, with but summary statistics – in Table 1 below. The cross-country dynamics of the IMF/POSET fiscal rule indices are drawn in Figure A2. It can be seen that over the two decades both the budget balance and expenditure rules were strengthened in most of the countries under consideration. This strengthening took place either gradually (e.g. Sweden, Chile) or immediately (e.g. Netherlands, Switzerland, several Central and Eastern European countries). In some countries the existing rules were temporarily relaxed or abrogated (budget balance rule in the UK, expenditure rule in the US). In Hungary, Canada and Iceland fiscal rules existed for some time but were eventually abolished and there are currently no numerical targets for either budget balance or government expenditure aggregate.

¹⁹ Debt and revenue rule variables as well as all their interactions turned statistically insignificant across all the specifications we tested. Results are available upon request.

Table 1

Main properties of fiscal rules

Design property	Time period	Budget balance rule (% of observation)	Budget balance rule (number of countries)	Expenditure rule (% of observations)	Expenditure rule (number of countries)
Monitoring outside government	1995–2015	24.7	20	35.0	14
	1995–2008	12.1	4	26.3	6
	2009–2015	41.8	18	45.5	11
Enforcement procedure	1995–2015	27.5	14	25.8	8
	1995–2008	18.1	4	22.9	4
	2009–2015	40.3	14	29.3	7
Escape clause	1995–2015	22.8	11	3.2	4
	1995–2008	15.9	4	0.0	0
	2009–2015	32.1	11	7.1	4
Structural rule	1995–2015	53.2	21	8.8	4
	1995–2008	44.5	9	1.7	1
	2009–2015	64.9	21	17.2	4
"Golden rule"	1995–2015	25.9	5	–	
	1995–2008	29.7	4	–	
	2009–2015	20.9	5	–	

Source: IMF (2017).

Notes. The figures in the table present the number of cases (in percentage of observations) when a rule over a respective period had a corresponding property and a number of countries with a corresponding property in at least one year.

Design properties of fiscal rules differ considerably across countries and periods. An independent monitoring body that monitors compliance with a rule and the presence of a formal enforcement procedure are embedded in at least 25% of observations of both budget balance and expenditure rules. Escape clauses have been present in 11 countries or approximately a quarter of budget balance rule observations, a feature far less common for expenditure rules. The financial crisis of 2007–2008 represents a border line that triggered the introduction of these properties in an increasing number of countries. In 2012, EU member states agreed on the Fiscal Compact²⁰ that further contributed to a considerable increase in the strength of national fiscal framework. In around half of observations, a budget balance rule is set in structural terms, with the number of countries adopting such a rule growing after the crisis. Expenditure rules that tie expenditure to the development in potential output were almost non-existent in the earlier subsample (except Denmark), but since 2008 the number of such rules has slightly increased, albeit remains low. Finally, as regards the exclusion of public investment from a budget balance rule, the number of countries that adopted this provision is small²¹, but these are rules established long ago, which explains their high proportion in the number of observations.

²⁰ Treaty on Stability, Coordination and Governance in the EMU.

²¹ Budget balance "golden rules" are found in Germany 1995–2009, Japan 1995–2015, Mexico 2009–2015, New Zealand 1995–2015, UK 1997–2008 and 2010–2015 (see Table A3).

4. PUBLIC INVESTMENT AND NATIONAL FISCAL RULES: EMPIRICAL ANALYSIS

In this section, we present the main findings of the study. First, we report the baseline effects of national fiscal rules on public investment (see Subsection 4.1). Second, we investigate the effect of main design properties of fiscal rules (see Subsection 4.2). Finally, we examine whether national fiscal rules affect the functional components of public investment in different ways (see Subsection 4.3). We present robustness checks of our results consequently in each subsection, rather than in a separate subsection.

4.1 The effect of national fiscal rules on public investment

The baseline results obtained by estimating equation (2) using both public investment and its share in total spending²² as a dependent variable are reported in Table 2. The results show that while both balance and expenditure rules have a negative effect on public investment, only the effect of expenditure rules appears statistically significant. Thus, an increase in the IMF index of national expenditure rules by one standard deviation (which corresponds to an increase in the rule index by 1.37; see Table A2) causes a decrease in the investment-to-GDP ratio by 0.09 percentage point (whose mean value is 3.65) and in the share of public investment by 0.23 percentage point (mean = 8.59). The fiscal rule coefficients obtained using time dummies instead of the trend do not deviate significantly from those obtained using the trend, hence, in what follows we proceed with the trend and its squared term in the regression.

Turning to the control variables, a higher rate of government investment is associated with lower public debt, faster population growth, lower openness and inflation. The CABB seems to be a significant factor in determining the level of public investment (albeit, surprisingly, with a negative coefficient), while the share of investment is higher in wealthier countries with larger GDP per capita. We also empirically confirm that public investment both in relation to GDP and as a share of total spending has been on the declining path during the years under review. As for political and institutional variables, none of them played a significant role, which contrasts with previous results of other studies (e.g. Katsimi and Sarantides (2012)). Similarly, the structure of the population, captured by the ratio of people over 65, does not seem to matter for public investment.

²² The results obtained by using public investment share in primary expenditure (in order to eliminate the possibility that changing borrowing costs impact the results) are almost identical to those obtained in the baseline and are not reported in the study for the sake of brevity.

Table 2

Public investment equation estimation results using the IMF fiscal rule index

Dependent variable	Public investment-to-GDP ratio				Public investment share in government expenditure			
	Budget balance rule (I)	Expenditure rule (I)	Budget balance rule (II)	Expenditure rule (II)	Budget balance rule (I)	Expenditure rule (I)	Budget balance rule (II)	Expenditure rule (II)
Fiscal rule IMF index	−0.032 (0.021)	−0.063*** (0.021)	−0.025 (0.025)	−0.056** (0.022)	−0.064 (0.039)	−0.165** (0.062)	−0.059 (0.047)	−0.156** (0.065)
Debt ratio (lagged)	−0.017*** (0.002)	−0.017*** (0.002)	−0.016*** (0.002)	−0.016*** (0.002)	−0.043*** (0.006)	−0.041*** (0.006)	−0.040*** (0.006)	−0.039*** (0.006)
CABB (lagged)	−0.051*** (0.011)	−0.050*** (0.012)	−0.044*** (0.012)	−0.042*** (0.013)	−0.013 (0.022)	−0.008 (0.024)	0.002 (0.026)	0.007 (0.029)
GDP growth (lagged)	0.007 (0.014)	0.006 (0.014)	0.040** (0.014)	0.038** (0.013)	0.090** (0.033)	0.087** (0.032)	0.159*** (0.023)	0.153*** (0.022)
Log GDP per capita (lagged)	1.216* (0.654)	1.321* (0.636)	1.026 (0.669)	1.128* (0.651)	3.760*** (1.260)	4.036*** (1.230)	3.866*** (1.243)	4.152*** (1.204)
Private investment (lagged)	0.001 (0.015)	0.001 (0.016)	−0.005 (0.015)	−0.004 (0.016)	−0.015 (0.027)	−0.014 (0.028)	−0.011 (0.027)	−0.007 (0.028)
Population growth	0.327*** (0.082)	0.321*** (0.081)	0.324*** (0.086)	0.320*** (0.084)	0.879*** (0.185)	0.866*** (0.189)	0.826*** (0.190)	0.817*** (0.190)
Dependency ratio	0.025 (0.032)	0.028 (0.030)	0.025 (0.033)	0.027 (0.031)	−0.010 (0.080)	−0.006 (0.077)	−0.024 (0.089)	−0.020 (0.085)
Openness	−0.006*** (0.002)	−0.006*** (0.002)	−0.006*** (0.002)	−0.006*** (0.002)	−0.013*** (0.004)	−0.013*** (0.004)	−0.014*** (0.004)	−0.014*** (0.004)
Inflation rate	−0.046** (0.018)	−0.046** (0.018)	−0.054*** (0.016)	−0.055*** (0.016)	−0.099* (0.048)	−0.100* (0.049)	−0.118** (0.045)	−0.120** (0.046)
Public employment	0.014 (0.039)	0.024 (0.041)	0.032 (0.038)	0.040 (0.041)	0.010 (0.087)	0.034 (0.089)	0.026 (0.082)	0.046 (0.084)
Election dummy	0.027 (0.041)	0.025 (0.041)	0.025 (0.040)	0.023 (0.040)	0.075 (0.087)	0.071 (0.087)	0.061 (0.081)	0.056 (0.081)
Right-wing parties	0.074 (0.047)	0.062 (0.046)	0.089* (0.048)	0.077 (0.047)	0.121 (0.109)	0.084 (0.108)	0.158 (0.118)	0.121 (0.118)
Government fragmentation	0.109 (0.515)	0.118 (0.474)	0.187 (0.514)	0.186 (0.465)	1.261 (1.043)	1.314 (0.935)	1.311 (1.033)	1.324 (0.909)
Trend	−0.083** (0.037)	−0.089** (0.036)	x	x	−0.161** (0.066)	−0.177** (0.064)	x	x
Trend squared	0.003** (0.001)	0.003** (0.001)	x	x	0.006** (0.002)	0.006*** (0.002)	x	x
Constant	−7.821 (6.630)	−8.969 (6.392)	x	x	−27.016** (12.767)	−29.974** (12.361)	x	x
Number of observations	625	625	625	625	625	625	625	625
R-squared (within)	0.326	0.331	0.362	0.366	0.438	0.445	0.469	0.475

Notes. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 35 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors, which are presented in parentheses. (I) stands for the baseline specification with trends and its squared term, (II) denotes specification with time FE.

To test the robustness of our baseline results, we employ the alternative POSET index of national fiscal rules as well as a simple binary dummy variable for the existence of rules. The results presented in Table A4 indicate that when using alternative variants

of fiscal rule indicators, both budget balance and expenditure rules turn out to be statistically significant factors of public investment.

The magnitude of the effect of the expenditure rule using alternative indices is comparable, since an increase in the POSET expenditure rule index by one standard deviation (which corresponds to an increase in the rule index by 0.26) leads to a comparable decline in public investment-to-GDP ratio (by 0.12 pp) and in the share of public investment (by 0.28 pp). When using the POSET index, the effect of budget balance rules becomes statistically significant, yet it is quantitatively weaker (0.07 pp decline in public investment ratio and 0.14 pp decline in its share induced by one standard deviation increase in the POSET balance index) than the effect of the expenditure rule.

We also replicate the estimates using the dataset that splits our sample into seven non-overlapping 3-year periods. That exercise aims to smooth out potential erratic short-term fluctuations in government expenditure. All rule variables appear with a negative sign and statistically significant. The magnitude of the fiscal rule effect is relatively unaffected compared to regressions in which the annual dataset is utilized.

A sizable part of our country sample is represented by the euro area countries whose fiscal policy is also constrained by supranational fiscal rules. Although these rules do not in any way replace national rules, they may have influenced government spending policies. Therefore, we performed the following robustness exercise: we included the dummy variable EMU that receives the value 1 for euro area countries in the years when they were part of the EMU.²³ The coefficients of this new variable appear insignificant in all specifications, and its inclusion does not affect estimates of the coefficients of the fiscal rule neither qualitatively nor quantitatively.

The estimation results are largely robust to dropping one OECD country at a time. The statistical significance of the IMF expenditure rule index weakens when Spain is excluded from the sample. However, this result is not confirmed when the POSET index or the dummy variable is used. In turn, the IMF index of budget balance rules becomes significant when three countries are dropped from the sample: Iceland, Slovakia and the UK. The budget balance IMF index remains insignificant when we employ the 10-year rolling window estimation starting from the period 1995–2005 to 2005–2015. The effect of the expenditure index obtains significance only when we add observations after the onset of the crisis, when most of the current expenditure rules were actually introduced.

We take into account that the FE estimates may suffer from endogeneity. Table A5 displays the regressions results using the instrumental variable estimator where fiscal rule indices are instrumented as explained above. Conventional exogeneity and (weak-) identification tests confirm validity and relevance of the chosen instruments.²⁴ While we clearly manage to confirm the negative relationship between both the IMF and the POSET expenditure indices and public investment, the relationship between the balance rule indices and investment expenditure remains weak with the low level

²³ For the initial euro area countries, it starts taking value 1 in 1995 to take into account several episodes of improved fiscal performance in the run-up years to the EMU. We do not apply the value 1 to non-EMU EU countries (such as Czechia and Poland) because of the lower fiscal obligations assumed by these countries.

²⁴ The results displayed in the last column may still be subject to reversed causality as suggested by the p-value of Hansen J-test.

of statistical significance. The magnitudes of the rule coefficients also appear similar to the baseline FE estimates.

Finally, we estimate the dynamic panel model using FE and LSDVC approach (see Table A6 and Table A7 respectively). Both sets of the estimation results unambiguously confirm our baseline results with expenditure rule variables clearly having a statistically significant negative impact on public investment.

Overall, the estimation results obtained so far reveal that the relation between public investment and a measure of the expenditure rule stringency is robust to the method adopted to construct the latter, to the dataset frequency and country sample used and to the estimator applied. Yet, this effect seems to have emerged relatively recently when most of such rules were introduced. Conclusions regarding the negative impact of the stringency of the budget balance rules are ambiguous and depend on the measure of rule stringency, the frequency of the dataset and the composition of the country sample. Since endogeneity does not seem to be a serious problem, in what follows, we proceed with the FE estimation. However, we continue to pay due attention to the estimation results obtained using variants of the expenditure and budget balance rule variables in order to get a more complete picture.

4.2 The role of fiscal rule design features

Fiscal rule indices are constructed using a fairly wide range of information about the design of individual rules. However, some elements of the rule may matter more for public investment policy than the others. For example, the exclusion of public investment from a rule compliance assessment can protect it from the negative impact. Similarly, the existence of escape clauses that are triggered in specific circumstances, the presence of a monitoring body or explicit enforcement procedures may be important for the impact of fiscal rules on the expenditure composition. Moreover, the limits imposed by the fiscal rules are badly known for not being met in around 40% of cases (Reuter et al. (2018)). Therefore, distinguishing between the rules that are compiled and not complied with as well as accounting for the distance to the target may have implications for the estimates of the rule effect. Therefore, we investigate the possible non-linearity of the reaction of public investment policy to fiscal rules. To this end, we re-estimate the baseline equation (2) adding an additional component, i.e. an interaction with the fiscal rule design feature.

For the sake of parsimony, for each re-estimated regression Table 3 reports only the coefficients of the IMF fiscal rule index and its interaction with the characteristics of the rule.²⁵ Table A8 reports estimates using POSET indices. The results obtained reveal that the instability of the budget balance rule effect in the baseline can actually be related to how the balance rule is designed. It turns out that the effect is significant as well as quantitatively somewhat stronger for those rules that target the overall balance. In contrast, the provision that allows public investment to be excluded from the reference value completely²⁶ eliminates the negative rule effect on public investment. Moreover, such "golden rules" can have a positive impact on public investment as the sum of two coefficients is positive. This finding is not surprising: when other expenditure components are subject to the rule, governments can

²⁵ Detailed results are available upon request.

²⁶ Budget balance "golden rules" are found in Germany 1995–2009, Japan 1995–2015, Mexico 2009–2015, New Zealand 1995–2015, UK 1997–2008 and 2010–2015 (see Table A3).

compensate their restraint in public spending by raising capital expenditure. Other findings on qualitative design features of budget balance rules are not robust to using two variants of the fiscal rule variable. Thus, although the coefficient of interaction with the presence of the monitoring body is positive and statistically significant in regressions of public investment share that use the IMF index, it loses significance in estimations with the POSET index.

Table 3

Fiscal rule IMF index interacted with several design features

Dependent variable	Public investment-to-GDP ratio		Public investment share in government expenditure	
Fiscal rule	Budget balance rule	Expenditure rule	Budget balance rule	Expenditure rule
Fiscal rule IMF index	−0.051 (0.038)	−0.089*** (0.022)	−0.120 (0.087)	−0.234*** (0.067)
Fiscal rule IMF index* Structural rule	0.024 (0.033)	0.117*** (0.031)	0.071 (0.085)	0.310*** (0.083)
Fiscal rule IMF index	−0.042* (0.021)		−0.081* (0.040)	
Fiscal rule IMF index* Golden balance rule	0.137*** (0.047)	NA	0.240*** (0.056)	NA
Fiscal rule IMF index	−0.039* (0.022)		−0.086* (0.044)	
Fiscal rule IMF index* Compliance dummy	0.026 (0.021)	NA	0.080 (0.051)	NA
Fiscal rule IMF index	−0.033 (0.021)		−0.064 (0.040)	
Fiscal rule IMF index* Distance to target	−0.008 (0.010)	NA	0.004 (0.022)	NA
Fiscal rule IMF index	−0.047* (0.022)		−0.089** (0.042)	
Fiscal rule IMF index* Escape clause	0.032 (0.028)	NA	0.052 (0.065)	NA
Fiscal rule IMF index	−0.090** (0.039)	−0.066* (0.033)	−0.183** (0.070)	−0.182** (0.069)
Fiscal rule IMF index* Monitoring body	0.070** (0.032)	0.004 (0.024)	0.145** (0.060)	0.020 (0.050)
Fiscal rule IMF index	−0.017 (0.044)	−0.075** (0.028)	−0.028 (0.087)	−0.231*** (0.077)
Fiscal rule IMF index* Enforcement procedure	−0.022 (0.043)	0.022 (0.035)	−0.054 (0.094)	0.121 (0.086)

Notes. This table presents the estimated coefficients of rule variables and their interactions with design properties in separate regressions. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 35 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors. These standard errors are presented in parentheses. NA denotes "not available".

As for the estimation results for expenditure rules, some coefficients are not reported because they are based on a negligible number of observations or on an incomplete dataset. For example, expenditure rules with a well-specified escape clause are not particularly common and, where they exist, they are only valid for one or two years.²⁷ We do not investigate whether compliance with expenditure rules has any influence on the results because the dataset for OECD non-EU member states is incomplete. Also, we were unable to unambiguously classify any of the expenditure rules listed in the IMF dataset as the "golden rule". Like the budget balance rules that limit the balance in structural terms, part of the expenditure rules relates expenditure to the

²⁷ Expenditure rules with escape clauses are found in Denmark in 2014–2015, Latvia in 2014–2015, Lithuania in 2015, Poland in 2014–2015 (see Table A3) resulting in seven observations carried out in two most recent years.

assessment of "potential" or "long-term" output (we call such rules "structural").²⁸ The coefficients for the interaction term of the IMF expenditure rules index, with the dummy taking the value 1 if the rule is "structural", appear to be positive and statistically significant, thus eliminating the negative effect of the expenditure rules. However, the small number of "structural" rules with only about 20 observations makes it difficult to distinguish their effect accurately.

4.3 Functional decomposition of public investment reaction to fiscal rules

The final aspect we explore in our paper is the study of the fiscal rule effect on the various functional categories of public investment. For this purpose, we estimate equation (2) in which the dependent variable is replaced by the ratio/share of public investment in each of 10 COFOG categories listed in Section 3. The respective estimation results using different variants of the fiscal rule variable are presented in Table 4. The set of control variables is the same as described previously. However, to save space their coefficients are not reported.

Table 4

The impact of budget balance and expenditure IMF indices on the functional components of public investment: summary of results

COFOG item	Total	General public services	Defense	Public order and safety	Economic affairs	Environmental protection	Housing	Health	Recreation, culture, religion	Education	Social protection
Dependent variable	Public investment-to-GDP ratio										
Balance rule IMF index	-0.040 (0.023)	0.000 (0.006)	-0.004 (0.005)	-0.004* (0.002)	-0.012 (0.010)	-0.014** (0.005)	-0.007*** (0.002)	-0.001 (0.004)	-0.008** (0.003)	-0.011 (0.008)	0.004 (0.003)
Balance rule IMF index, not a "golden rule"	-0.052* (0.026)	0.000 (0.007)	-0.005 (0.005)	-0.004* (0.002)	-0.017* (0.010)	-0.015** (0.006)	-0.007** (0.003)	-0.001 (0.004)	-0.008** (0.003)	-0.013 (0.009)	0.004 (0.003)
Expenditure rule IMF index	-0.078** (0.028)	-0.003 (0.009)	-0.024** (0.010)	0.003 (0.002)	-0.047*** (0.012)	-0.012* (0.007)	-0.015 (0.009)	0.001 (0.003)	-0.009** (0.003)	0.015*** (0.005)	0.000 (0.003)
Dependent variable	Public investment share in government expenditure										
Balance rule IMF index	-0.046 (0.037)	0.008 (0.012)	-0.007 (0.010)	-0.009* (0.005)	-0.028 (0.022)	-0.028** (0.012)	-0.016*** (0.005)	0.001 (0.008)	-0.014** (0.006)	-0.010 (0.015)	0.013* (0.008)
Balance rule IMF index, not a "golden rule"	-0.070 (0.043)	0.008 (0.013)	-0.008 (0.010)	-0.008 (0.005)	-0.038* (0.020)	-0.031** (0.013)	-0.015** (0.007)	0.001 (0.008)	-0.014** (0.007)	-0.015 (0.017)	0.013 (0.008)
Expenditure rule IMF index	-0.181** (0.082)	-0.005 (0.021)	-0.046* (0.026)	0.009* (0.005)	-0.097*** (0.026)	-0.025* (0.013)	-0.030 (0.020)	0.003 (0.008)	-0.016** (0.007)	0.051*** (0.013)	0.004 (0.007)

Notes. This table presents the estimated coefficients of alternative rule variables in separate regressions where functional components of public investment (% of total government expenditure) are dependent variables. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 26 OECD countries that were part of the EU or EFTA over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors, which are presented in parentheses.

First, in the case of total public investment we note that the estimated fiscal rule coefficients, their magnitude and significance resemble those obtained in the baseline with 35 OECD countries. This implies the reliability of the results obtained above for a sub-sample of OECD countries with a similar fiscal policy framework. Moving on to the COFOG results, the negative impact of the expenditure rule appears more evident in economic affairs, defense, recreation, culture and religion. Thus, an

²⁸ Expenditure rules that tie expenditure to potential output are found in Australia 2009–2015, Denmark 2007–2015, Latvia 2014–2015, Poland 2015 (see Table A3).

increase in the IMF index by 1 standard deviation results in a 0.06 pp (0.13 pp) decline in the public investment-to-GDP ratio (share in total spending) in economic affairs thus eroding capital stock in areas such as transport, energy, construction and communication. The estimates are very similar both qualitatively and quantitatively when the POSET index is employed (see Table A9). At the same time, governments keep investment in education unchanged, thereby increasing their share in total outlays.

Concerning the budget balance rule effect, it seems that cuts are more pronounced in environmental protection, housing and recreation, culture and religion irrespective of the regression specification. However, their quantitative effect is small. For instance, strengthening the rule design by 1 standard deviation of the IMF index implies a merely 0.02% decline in investment in environmental protection (as a percentage of GDP).

Qualitatively, these results correspond to the prediction that less salient categories of government spending suffer the most when it is necessary to cut expenditure. It is interesting to note that education is the only category where expenditure rule strengthening leads to increased rather than decreased public investment, probably, to counteract the effect of reductions in other areas, and also because education is considered a highly visible and sensitive category.

5. CONCLUSIONS

Over the previous decades, public investment has fallen considerably, bringing the level of public capital stock below or close to its critical level. This paper examines the impact of national fiscal rules on public investment to uncover their role in the secular decline in investment expenditure. For this purpose, it employs panel data for 35 OECD countries for the period 1995–2015 and estimates the effect of the budget balance and expenditure rule indices both on the level of government investment expenditure and its share in total outlays. The paper also explores whether the impact of rules differs depending on various qualitative characteristics of rules and on different functions of government spending.

The study demonstrates that fiscal rules may have indeed put constraints on public investment and contributed to its decline. However, the effect is not homogenous and depends on the design of individual rules and on public spending area. Thus, the study suggests that budget balance rules that exclude public investment from the assessment ("golden rules") and possibly expenditure rules that tie expenditure to potential output ("structural rules") may be more favourable to capital expenditure. However, the economic effect of fiscal rules should not be overstated as the magnitude of their contribution is estimated to have been small.

Overall, the findings of this paper suggest that properly designed fiscal rules may help protecting public investment. In this respect, the results of this study can contribute to the ongoing discussion of several proposals to amend the EU supranational fiscal policy framework that, *inter alia*, requires euro area countries to incorporate national numerical fiscal targets into their statutory legislation.

Several caveats mentioned in the study, especially with respect to the small number of observations of rules with some distinct features, should be kept in mind when interpreting the results.

APPENDIX

Figure A1
Public investment developments in OECD countries (1995–2015)

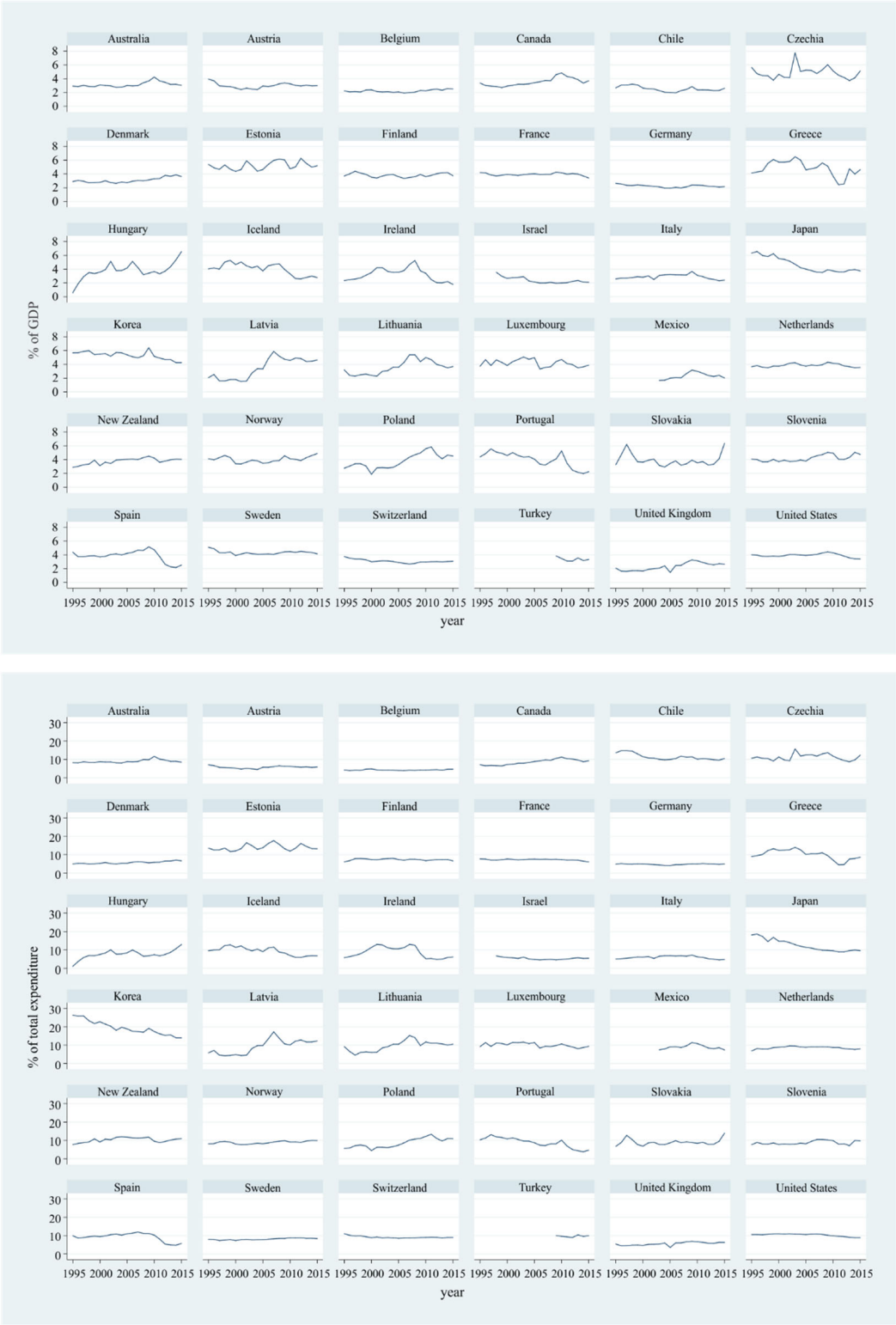


Figure A2
Fiscal rule indices in OECD countries (1995–2015)



*Table A1***List of variables used in the study, their definition and source**

Variable	Data source	Definition
Government investment	OECD, Economic Outlook No. 106; for Lithuania – Eurostat; for Chile – Central Bank of Chile	General government fixed capital formation (% of GDP)
Government investment by functional categories (COFOG)	Eurostat	General government fixed capital formation by function (COFOG; % of GDP)
Total expenditure	OECD, Economic Outlook No. 106	Total disbursements of general government (% of GDP)
Public debt	IMF, WEO, October 2019	General government gross debt (% of GDP)
CABB	IMF, WEO, October 2019	General government structural balance (% of potential GDP)
Real GDP	IMF, WEO, October 2019	Gross domestic product, constant prices (% change)
GDP per capita	IMF, WEO, October 2019	Gross domestic product per capita (constant prices, purchasing power parity; 2011 international dollar)
Total investment	IMF, WEO, October 2019	Total fixed capital formation (% of GDP)
Population growth	World Bank database	Annual growth in total population (midyear estimates)
Dependency ratio	World Bank database	Population aged 65 and above (% of total population)
Openness	OECD, Economic Outlook No. 106; for Lithuania – Eurostat	Sum of exports and imports of goods and services (% of GDP)
Inflation rate	IMF, WEO, October 2019	Consumer price index (% change)
Public employment		
Election dummy	The Database of Political Institutions	Takes the value 1 if there is a legislative election in this year
Right-wing dummy	The Database of Political Institutions	Takes the value 1 for parties that are defined as conservative, Christian democratic, or right-wing
Government fragmentation	The Database of Political Institutions	The sum of the squared seat shares of the parties in government (within-period average)
Budget balance rule	Schaechter et al. (2012) for IMF index, Badinger and Reuter (2015) for POSET index	IMF index of stringency; POSET index of stringency
Expenditure rules	Schaechter et al. (2012) for IMF index, Badinger and Reuter (2015) for POSET index	IMF index of stringency; POSET index of stringency
Compliance dummy	Badinger and Reuter (2017)	Takes the value 1 if a country complies with the fiscal rule
Distance	Badinger and Reuter (2017)	Distance from the recorded balance/expenditure level to the benchmark
Structural balance rule dummy	IMF (2017)	Takes the value 1 if budget balance target is set in cyclically-adjusted/structural terms or over the cycle
Budget balance "golden rule" dummy	IMF (2017)	Takes the value 1 if the budget balance rule excludes public investment
Escape clause dummy	IMF (2017)	Takes the value 1 if there are well specified escape clauses
Monitoring body dummy	IMF (2017)	Takes the value 1 if compliance is monitored outside government
Enforcement dummy	IMF (2017)	Takes the value 1 if there is formal enforcement procedure

Table A2
Descriptive statistics

Variable	Mean	Median	Standard deviation	Minimum	Maximum
Government investment ratio to GDP	3.649	3.697	1.057	0.561	7.731
General public services	0.529	0.480	0.299	0.002	2.458
Defense	0.284	0.238	0.216	0.006	1.338
Public order and safety	0.115	0.106	0.068	0.001	0.658
Economic affairs	1.271	1.206	0.572	0.219	4.229
Environmental protection	0.208	0.184	0.146	0.001	0.949
Housing	0.199	0.170	0.152	0.007	1.153
Health	0.274	0.287	0.174	0.006	0.769
Recreation, culture and religion	0.217	0.173	0.130	0.001	0.931
Education	0.471	0.413	0.266	0.062	1.405
Social protection	0.109	0.087	0.092	0.003	0.634
Government investment share	8.591	8.669	2.724	1.017	18.590
General public services	1.166	1.048	0.664	0.005	5.453
Defense	0.633	0.521	0.493	0.013	2.876
Public order and safety	0.267	0.234	0.181	0.001	1.667
Economic affairs	2.866	2.553	1.374	0.585	8.566
Environmental protection	0.468	0.413	0.330	0.002	2.334
Housing	0.458	0.369	0.393	0.018	3.207
Health	0.601	0.633	0.380	0.011	1.828
Recreation, culture and religion	0.489	0.375	0.324	0.003	2.069
Education	1.075	0.889	0.689	0.158	3.919
Social protection	0.246	0.188	0.237	0.005	1.795
Public debt	56.986	49.598	37.380	3.766	236.069
CABB	-2.427	-2.182	3.081	-15.000	5.933
Real GDP growth	2.724	2.748	3.301	-14.814	25.122
GDP per capita	33 773.76	33 519.20	14 707.23	8310.21	98 537.42
Private investment ratio to GDP	19.852	19.553	3.801	5.588	35.645
Population growth	0.541	0.477	0.784	-2.233	2.933
Dependency ratio	14.638	15.147	3.539	4.713	26.019
Openness	88.716	73.099	52.072	16.680	408.204
Inflation rate	3.961	2.288	8.202	-1.684	89.566
Public employment	6.421	6.164	1.774	3.265	14.246
Election dummy	0.286	0.000	0.452	0.000	1.000
Right-wing dummy	0.386	0.000	0.487	0.000	1.000
Government fragmentation	0.804	0.818	0.088	0.536	0.983
Budget balance rule, IMF index	1.047	0.000	1.414	0.000	5.891
Budget balance rule, POSET index	0.215	0.000	0.267	0.000	1.000
Expenditure rule, IMF index	0.796	0.000	1.368	0.000	6.125
Expenditure rule, POSET index	0.157	0.000	0.257	0.000	1.000
Compliance dummy	0.118	0.000	0.323	0.000	1.000
Distance	-0.038	0.000	-0.038	-8.958	6.131
Structural balance rule dummy	0.229	0.000	0.420	0.000	1.000
Budget balance "golden rule" dummy	0.116	0.000	0.315	0.000	1.000
Escape clause dummy for budget balance rule	0.098	0.000	0.297	0.000	1.000
Escape clause dummy for expenditure rule	0.010	0.000	0.097	0.000	1.000
Monitoring body dummy for budget balance rule	0.106	0.000	0.308	0.000	1.000
Monitoring body dummy for expenditure rule	0.103	0.000	0.304	0.000	1.000
Enforcement dummy for budget balance rule	0.118	0.000	0.323	0.000	1.000
Enforcement dummy for expenditure rule	0.076	0.000	0.265	0.000	1.000

Table A3

List of national fiscal rules used in the study

Country	Budget balance rule		Expenditure rule	
	Sample period when in force	Design features	Sample period when in force	Design features
Australia	1998–2015	structural	2009–2015	structural
Austria	1999–2015	monitoring, enforcement	–	–
Belgium	2013–2015	structural, monitoring, enforcement	1995–1998	monitoring, enforcement
Canada	1998–2005	monitoring	1998–2005	monitoring
Chile	2001–2015	structural, monitoring (in 2013–2015)	–	–
Czechia	–	–	–	–
Denmark	1995–2015	structural; escape, monitoring, enforcement (all three in 2014–2015)	1995–2015	structural (in 2007–2015); escape, monitoring, enforcement (all three in 2014–2015)
Estonia	1995–2015	structural (2014–2015), enforcement	–	–
Finland	1999–2015	structural, escape (2013–2015)	2003–2015	–
France	2013–2015	structural, escape, monitoring, enforcement	1998–2015	enforcement
Germany	1995–2015	structural (2011–2015), golden (1995–2009), escape, enforcement (2011–2015)	1995–2009; 2012–2015	–
Greece	–	–	2010–2015	enforcement, escape (both in 2014–2015)
Hungary	2004–2011	monitoring (2009–2011)	2010–2011	monitoring (2010–2011)
Iceland	–	–	2004–2008	monitoring
Ireland	–	–	–	–
Israel	1995–2015	monitoring (2009–2015)	2005–2015	monitoring (2009–2015)
Italy	2014–2015	structural, monitoring	–	–
Japan	1995–2015	golden	2006–2008; 2010–2012	–
Korea	–	–	–	–
Latvia	2013–2015	structural, escape, monitoring, enforcement	2014–2015	structural, escape, monitoring, enforcement
Lithuania	2015	structural, escape, monitoring, enforcement	2008–2015	enforcement, monitoring, escape (2015)
Luxembourg	2014–2015	structural, monitoring, enforcement	1995–2015	monitoring (2014–2015)
Mexico	2006–2015	golden (2009–2015), escape, enforcement	2013–2015	–
Netherlands	2014–2015	structural, monitoring, enforcement	1995–2015	enforcement
New Zealand	1995–2015	golden	–	–
Norway	2001–2015	structural	–	–
Poland	2006–2007	monitoring	2011–2015	structural (2015), escape, monitoring, enforcement (all three in 2014–2015)
Portugal	2015	structural, monitoring	–	–
Slovakia	2014–2015	structural, escape, monitoring	–	–
Slovenia	2015	structural, monitoring	–	–
Spain	2002–2015	structural, escape, monitoring (2014–2015), enforcement (2012–2015)	2011–2015	enforcement (2012–2015), monitoring (2014–2015)
Sweden	2000–2015	structural, monitoring (2007–2015)	1997–2015	monitoring (2007–2015)
Switzerland	2003–2015	structural, escape, enforcement	–	–
Turkey	–	–	–	–
UK	1998–2008; 2010–2015	structural, golden, monitoring (2010–2015)	–	–
US	–	–	1995–2002; 2011–2015	golden, enforcement, monitoring (2011–2015)

Table A4

Public investment equation estimation results using different fiscal rule variables and dataset frequencies

Dependent variable	Public investment-to-GDP ratio				Public investment share in government expenditure			
Dataset frequency	Annual dataset		3-year average dataset		Annual dataset		3-year average dataset	
Fiscal rule	Budget balance rule	Expenditure rule	Budget balance rule	Expenditure rule	Budget balance rule	Expenditure rule	Budget balance rule	Expenditure rule
Fiscal rule dummy	-0.175** (0.078)	-0.267*** (0.074)	-0.237*** (0.055)	-0.262*** (0.049)	-0.346** (0.139)	-0.671*** (0.186)	-0.477*** (0.093)	-0.532** (0.093)
Fiscal rule IMF index	-0.032 (0.021)	-0.063*** (0.021)	-0.060** (0.023)	-0.071** (0.021)	-0.064 (0.039)	-0.165** (0.062)	-0.141*** (0.037)	-0.137* (0.060)
Fiscal rule POSET index	-0.268** (0.1064)	-0.458*** (0.106)	-0.417*** (0.085)	-0.485*** (0.106)	-0.516** (0.181)	-1.094*** (0.305)	-0.885*** (0.103)	-0.876* (0.360)

Notes. This table presents the estimated coefficients of rule variables in separate regressions obtained using the annual dataset (as in the baseline) and the last two columns – using the dataset comprising seven non-overlapping 3-year periods. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 36 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors, which are presented in parentheses.

Table A5

Public investment equation estimation results using the instrumental variable estimator

Dependent variable	Public investment-to-GDP ratio				Public investment share in total government expenditure			
Instrument used	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index
Fiscal rule index	-0.044 (0.028)	-0.293** (0.136)	-0.092*** (0.026)	-0.654*** (0.150)	-0.088* (0.051)	-0.498* (0.257)	-0.232*** (0.083)	-1.494*** (0.442)
Debt ratio (lagged)	-0.017*** (0.002)	-0.017*** (0.002)	-0.016*** (0.002)	-0.016*** (0.002)	-0.043*** (0.006)	-0.042*** (0.006)	-0.041*** (0.006)	-0.041*** (0.006)
CABB (lagged)	-0.050*** (0.010)	-0.050*** (0.010)	-0.048*** (0.012)	-0.047*** (0.012)	-0.011 (0.020)	-0.011 (0.021)	-0.005 (0.025)	-0.003 (0.024)
GDP growth (lagged)	0.007 (0.013)	0.007 (0.014)	0.006 (0.013)	0.006 (0.013)	0.090*** (0.032)	0.091*** (0.032)	0.086*** (0.031)	0.088*** (0.030)
Log GDP per capita (lagged)	1.216* (0.630)	1.202* (0.635)	1.369** (0.613)	1.399** (0.610)	4.761*** (1.216)	3.737*** (1.221)	4.147*** (1.188)	4.179*** (1.187)
Private investment (lagged)	0.000 (0.015)	0.000 (0.015)	0.001 (0.015)	0.001 (0.015)	-0.016 (0.026)	-0.015 (0.026)	-0.014 (0.027)	-0.015 (0.028)
Population growth	0.329*** (0.079)	0.330*** (0.078)	0.321*** (0.078)	0.315*** (0.078)	0.883*** (0.179)	0.882*** (0.178)	0.866*** (0.183)	0.854*** (0.181)
Dependency ratio	0.024 (0.030)	0.019 (0.030)	0.027 (0.029)	0.023 (0.029)	-0.013 (0.076)	-0.019 (0.074)	-0.008 (0.074)	-0.017 (0.072)
Openness	-0.006*** (0.002)	-0.006*** (0.002)	-0.006*** (0.002)	-0.006*** (0.002)	-0.013*** (0.004)	-0.012*** (0.004)	-0.013*** (0.004)	-0.013*** (0.004)
Inflation rate	-0.046*** (0.017)	-0.046*** (0.017)	-0.046*** (0.019)	-0.045** (0.018)	-0.100** (0.046)	-0.099** (0.046)	-0.100** (0.048)	-0.097** (0.049)
Public employment	0.011 (0.038)	0.012 (0.037)	0.026 (0.039)	0.038 (0.037)	0.005 (0.083)	0.009 (0.082)	0.037 (0.084)	0.064 (0.085)
Election dummy	0.027 (0.039)	0.027 (0.039)	0.025 (0.039)	0.023 (0.040)	0.075 (0.084)	0.075 (0.085)	0.069 (0.084)	0.065 (0.085)
Right-wing parties	0.071* (0.043)	0.069* (0.041)	0.052 (0.043)	0.040 (0.042)	0.115 (0.100)	0.115 (0.097)	0.063 (0.105)	0.041 (0.102)
Government fragmentation	0.127 (0.500)	0.156 (0.485)	0.144 (0.437)	0.133 (0.398)	1.296 (1.012)	1.326 (0.985)	1.374 (0.864)	1.329* (0.785)
Trend	-0.083** (0.035)	-0.081** (0.035)	-0.092*** (0.034)	-0.092*** (0.034)	-0.161** (0.063)	-0.158** (0.058)	-0.183*** (0.060)	-0.183*** (0.059)
Trend squared	0.003*** (0.001)	0.003*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.007*** (0.002)
Number of observations	625	625	625	625	625	625	625	625
R-squared	0.326	0.329	0.330	0.335	0.438	0.440	0.443	0.448
Hansen J-stat	2.614	2.219	2.452	3.044*	1.772	1.081	2.556	3.140*
SW chi-squared stat	1024.03***	675.99***	188.87***	203.24***	1024.03***	675.99***	188.87***	203.24***
SW F-stat	473.94***	312.86***	87.41***	94.07***	473.94***	312.86***	87.41***	94.07***

Notes. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 36 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors with bandwidth = 3. These standard errors are presented in parentheses. Fiscal rule indices are assumed to be endogenous and are instrumented using their own lags and the average IMF/POSET fiscal rule index of the neighbouring countries. Other exogenous variables are also used as instruments. Hansen J-stat is a test of instrument validity (i.e. they are not correlated with the error term of the main equation). The failure to reject the null hypothesis implies that instruments are valid. The SW first-stage chi-squared and F-stat are tests of instrument relevance. The null of the SW chi-squared test means that fiscal rule index is unidentified, the null of the SW chi-squared F-test means that fiscal rule index is weakly identified.

Table A6

Public investment dynamic equation estimation results using the FE approach

Dependent variable	Public investment-to-GDP ratio				Public investment share in total government expenditure			
Instrument used	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index
Fiscal rule index	−0.022 (0.014)	−0.070 (0.108)	−0.051*** (0.017)	−0.318*** (0.117)	−0.049* (0.026)	−0.280* (0.136)	−0.125** (0.047)	−0.711*** (0.232)
Dependent variable (lagged)	0.646*** (0.063)	0.644*** (0.063)	0.644*** (0.062)	0.639*** (0.062)	0.657*** (0.051)	0.656*** (0.051)	0.654*** (0.051)	0.649*** (0.052)
Debt ratio (lagged)	−0.006 (0.001)	−0.006 (0.001)	−0.005 (0.001)	−0.005 (0.001)	−0.012*** (0.003)	−0.012*** (0.003)	−0.011*** (0.003)	−0.011*** (0.003)
CABB (lagged)	0.021** (0.009)	0.020** (0.009)	0.021** (0.009)	0.021** (0.009)	0.070*** (0.018)	0.069*** (0.018)	0.072*** (0.023)	0.072*** (0.019)
GDP growth (lagged)	0.011 (0.009)	0.011 (0.009)	0.010 (0.009)	0.010 (0.009)	0.072*** (0.024)	0.072*** (0.024)	0.070*** (0.023)	0.071*** (0.023)
Log GDP per capita (lagged)	0.065 (0.465)	0.063 (0.466)	0.153 (0.464)	0.166 (0.465)	−0.612 (1.039)	−0.615 (1.038)	−0.379 (1.044)	−0.358 (1.040)
Private investment (lagged)	0.012 (0.011)	0.012 (0.011)	0.012 (0.011)	0.012 (0.011)	−0.011 (0.026)	−0.010 (0.026)	−0.010 (0.026)	−0.010 (0.026)
Population growth	0.194** (0.070)	0.195** (0.069)	0.190** (0.068)	0.189** (0.067)	0.546*** (0.124)	0.546*** (0.124)	0.538*** (0.125)	0.535*** (0.124)
Dependency ratio	−0.004 (0.022)	−0.006 (0.023)	−0.003 (0.021)	−0.004 (0.021)	−0.035 (0.046)	−0.038 (0.047)	−0.032 (0.045)	−0.036 (0.045)
Openness	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.004)	−0.003 (0.004)	−0.003 (0.004)	−0.003 (0.004)
Inflation rate	−0.038*** (0.007)	−0.038*** (0.007)	−0.038*** (0.007)	−0.038*** (0.007)	−0.085*** (0.025)	−0.085*** (0.025)	−0.085*** (0.026)	−0.084*** (0.026)
Public employment	0.013 (0.031)	0.014 (0.030)	0.021 (0.030)	0.027 (0.030)	0.046 (0.065)	0.047 (0.064)	0.063 (0.064)	0.075 (0.065)
Election dummy	0.015 (0.029)	0.015 (0.029)	0.013 (0.030)	0.013 (0.030)	0.072 (0.060)	0.072 (0.060)	0.069 (0.062)	0.067 (0.062)
Right-wing parties	0.024 (0.027)	0.024 (0.027)	0.013 (0.027)	0.010 (0.027)	0.021 (0.069)	0.022 (0.068)	−0.006 (0.072)	−0.011 (0.072)
Government fragmentation	−0.454 (0.469)	−0.441 (0.462)	−0.439 (0.433)	−0.447 (0.419)	−0.403 (0.904)	−0.383 (0.893)	−0.354 (0.817)	−0.377 (0.788)
Trend	−0.024 (0.029)	−0.023 (0.029)	−0.029 (0.029)	−0.029 (0.028)	−0.023 (0.056)	−0.022 (0.056)	−0.036 (0.053)	−0.035 (0.053)
Trend squared	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)	0.002 (0.001)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)

Notes. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 36 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors. These standard errors are presented in parentheses.

Table A7

Public investment dynamic equation estimation results using the LSDVC approach

Dependent variable	Public investment-to-GDP ratio				Public investment share in total government expenditure			
Instrument used	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index	IMF balance rule index	POSET balance rule index	IMF expenditure rule index	POSET expenditure rule index
Fiscal rule index	−0.022 (0.020)	−0.070 (0.108)	−0.053** (0.023)	−0.313*** (0.117)	−0.060 (0.045)	−0.339 (0.247)	−0.124** (0.052)	−0.695** (0.264)
Dependent variable (lagged)	0.738*** (0.037)	0.736*** (0.037)	0.738*** (0.041)	0.731*** (0.037)	0.755*** (0.035)	0.754*** (0.035)	0.750*** (0.035)	0.745*** (0.034)
Debt ratio (lagged)	−0.004 (0.002)	−0.004 (0.002)	−0.003 (0.002)	−0.003 (0.002)	−0.010* (0.005)	−0.010* (0.005)	−0.009 (0.005)	−0.009 (0.005)
CABB (lagged)	0.022** (0.009)	0.022** (0.009)	0.024** (0.009)	0.023** (0.009)	0.061*** (0.021)	0.061*** (0.021)	0.064*** (0.021)	0.064*** (0.021)
GDP growth (lagged)	0.012 (0.008)	0.012 (0.008)	0.011 (0.008)	0.012 (0.008)	0.068*** (0.018)	0.068*** (0.018)	0.066*** (0.018)	0.067*** (0.018)
Log GDP per capita (lagged)	−0.003 (0.412)	−0.006 (0.411)	0.095 (0.411)	0.106 (0.407)	−0.599 (0.953)	−0.606 (0.953)	−0.333 (0.946)	−0.312 (0.940)
Private investment (lagged)	0.010 (0.011)	0.010 (0.011)	0.010 (0.011)	0.010 (0.011)	−0.020 (0.026)	−0.020 (0.026)	−0.019 (0.026)	−0.019 (0.026)
Population growth	0.218*** (0.082)	0.218*** (0.082)	0.213*** (0.082)	0.211*** (0.081)	0.604*** (0.189)	0.604*** (0.189)	0.591*** (0.188)	0.587*** (0.188)
Dependency ratio	−0.001 (0.038)	−0.002 (0.038)	0.001 (0.038)	−0.001 (0.038)	−0.013 (0.089)	−0.016 (0.090)	−0.008 (0.089)	−0.011 (0.089)
Openness	−0.002 (0.002)	−0.002 (0.002)	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.005)	−0.003 (0.005)	−0.004 (0.004)	−0.004 (0.004)
Inflation rate	−0.035*** (0.011)	−0.035*** (0.011)	−0.035*** (0.011)	−0.034*** (0.011)	−0.074*** (0.025)	−0.074*** (0.025)	−0.075*** (0.025)	−0.073*** (0.025)
Public employment	0.007 (0.033)	0.007 (0.033)	0.014 (0.032)	0.020 (0.032)	0.060 (0.077)	0.063 (0.076)	0.081 (0.075)	0.094 (0.075)
Election dummy	0.013 (0.040)	0.013 (0.040)	0.012 (0.040)	0.011 (0.039)	0.072 (0.092)	0.072 (0.091)	0.069 (0.091)	0.067 (0.091)
Right-wing parties	0.020 (0.049)	0.020 (0.049)	0.009 (0.050)	0.006 (0.050)	0.036 (0.113)	0.037 (0.113)	0.013 (0.114)	0.008 (0.114)
Government fragmentation	−0.543 (0.405)	−0.531 (0.405)	−0.526 (0.408)	−0.536 (0.404)	−0.594 (0.939)	−0.570 (0.937)	−0.563 (0.940)	−0.585 (0.935)
Trend	−0.022 (0.025)	−0.021 (0.025)	−0.027 (0.025)	−0.027 (0.025)	−0.027 (0.057)	−0.026 (0.057)	−0.040 (0.058)	−0.039 (0.057)
Trend squared	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)

Notes. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 36 OECD countries over the period 1995–2015. Anderson-Hsiao estimator is used to initialize the bias correction. Bootstrap variance-covariance matrix is estimated using 100 repetitions. The accuracy of the approximation is up to $O(1/NT^2)$. The standard errors are presented in parentheses.

Table A8

Fiscal rule POSET index interacted with several design features

Dependent variable	Public investment-to-GDP ratio		Public investment share in government expenditure	
Fiscal rule	Budget balance rule	Expenditure rule	Budget balance rule	Expenditure rule
Fiscal rule POSET index	−0.420** (0.180)	−0.560*** (0.119)	−0.880** (0.395)	−1.357*** (0.337)
Fiscal rule POSET index* Structural rule	0.227 (0.194)	0.696*** (0.191)	0.544 (0.468)	1.792*** (0.476)
Fiscal rule POSET index	−0.340*** (0.108)		−0.649*** (0.190)	
Fiscal rule POSET index* Golden balance rule	0.914*** (0.265)	NA	1.695*** (0.343)	NA
Fiscal rule POSET index	−0.324*** (0.114)		−0.672*** (0.216)	
Fiscal rule POSET index* Compliance dummy	0.163 (0.114)	NA	0.455 (0.283)	NA
Fiscal rule POSET index	−0.267** (0.104)		−0.518*** (0.178)	
Fiscal rule POSET index* Distance to target	−0.030 (0.054)	NA	0.049 (0.117)	NA
Fiscal rule POSET index	−0.335*** (0.112)		−0.626*** (0.201)	
Fiscal rule POSET index* Escape clause	0.191 (0.177)	NA	0.312 (0.413)	NA
Fiscal rule POSET index	−0.452* (0.225)	−0.408** (0.158)	−0.922** (0.417)	−1.056*** (0.333)
Fiscal rule POSET index* Monitoring body	0.213 (0.209)	−0.065 (0.126)	0.469 (0.397)	−0.049 (0.271)
Fiscal rule POSET index	−0.256 (0.189)	−0.562*** (0.144)	−0.462 (0.363)	−1.444*** (0.367)
Fiscal rule POSET index* Enforcement procedure	−0.020 (0.210)	0.227 (0.203)	−0.094 (0.471)	0.767 (0.477)

Notes. This table presents the estimated coefficients of rule variables and their interactions with design properties in separate regressions. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 36 OECD countries over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors, which are presented in parentheses. NA denotes "not available".

Table A9

The impact of budget balance and expenditure POSET indices on the functional components of public investment: summary of results

COFOG item	Total	General public services	Defense	Public order and safety	Economic affairs	Environmental protection	Housing	Health	Recreation, culture, religion	Education	Social protection
Dependent variable	Public investment-to-GDP ratio										
Balance rule POSET index	-0.262* (0.127)	-0.016 (0.039)	-0.019 (0.028)	-0.027* (0.013)	-0.073 (0.060)	-0.081*** (0.027)	-0.036*** (0.012)	-0.016 (0.022)	-0.051*** (0.016)	-0.070* (0.040)	0.028 (0.018)
Balance rule POSET index, not a "golden rule"	-0.341** (0.146)	-0.019 (0.042)	-0.022 (0.029)	-0.025* (0.013)	-0.104 (0.062)	-0.089*** (0.031)	-0.036** (0.015)	-0.017 (0.020)	-0.052*** (0.018)	-0.082 (0.046)	0.027 (0.020)
Expenditure rule POSET index	-0.464*** (0.155)	-0.026 (0.052)	-0.132** (0.055)	0.015 (0.011)	-0.271*** (0.078)	-0.061 (0.040)	-0.076 (0.052)	0.001 (0.023)	-0.054*** (0.018)	0.069** (0.027)	0.000 (0.017)
Dependent variable	Public investment share in government expenditure										
Balance rule POSET index	-0.275 (0.205)	0.013 (0.076)	-0.020 (0.056)	-0.055* (0.028)	-0.141 (0.127)	-0.161** (0.062)	-0.073** (0.029)	-0.013 (0.044)	-0.089** (0.032)	-0.074 (0.077)	0.087* (0.047)
Balance rule POSET index, not a "golden rule"	-0.437* (0.234)	0.007 (0.080)	-0.023 (0.057)	-0.051* (0.028)	-0.213 (0.127)	-0.180** (0.068)	-0.073* (0.036)	-0.014 (0.043)	-0.089** (0.034)	-0.099 (0.089)	0.087 (0.050)
Expenditure rule POSET index	-1.013** (0.453)	-0.036 (0.118)	-0.254* (0.137)	0.044* (0.025)	-0.552*** (0.163)	-0.126 (0.080)	-0.148 (0.113)	0.013 (0.050)	-0.102** (0.036)	0.246*** (0.073)	0.026 (0.044)

Notes. This table presents the estimated coefficients of alternative rule variables in separate. * indicates significance at a 10% level, ** indicates significance at a 5% level, *** indicates significance at a 1% level. The sample covers 26 OECD countries that are part of the EU or EFTA over the period 1995–2015. Cross-sectional FEs are included. Coefficient t-test results are based on Driscoll–Kraay standard errors, which are presented in parentheses.

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