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How Do Fiscal Rules Shape Governments’ Spending Behavior?

Cezara VINTURIS*

Abstract: At odds with the large literature devoted to the fiscal discipline effects of fiscal rules, only few contributions investigate their impact on public spending. Using a large sample of 185 countries, estimations based on the entropy balancing method reveal the following causal effects: fiscal rules significantly reduce total public spending and public consumption, leave public investment mostly unaffected, and increase the public investment-to-public consumption ratio. Moreover, the type of fiscal rule and countries’ level of economic development influence the way fiscal rules affect public spending. Lastly, fiscal rules’ features seem to be a major driving force of the way governments change public spending—and, notably, total spending and public investment—in response to the adoption of fiscal rules. Consequently, the public investment decline during recent times should mostly be attributable to other things but fiscal rules (which sometimes even raise public investment); and increased attention should be given to the various fiscal rules’ features, which may enforce or, on the contrary, weaken their fiscal discipline performances.

Keywords: fiscal rules, public spending, public investment, fiscal rules’ features, developed and developing countries.

JEL Codes: E62, H62.

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1 Introduction

As a response to the fiscal legacy of the Great Recession, rules-based fiscal frameworks have become the new fashion for the conduct of fiscal policy. According to the IMF Fiscal Rules Dataset (2015), around 100 developed and developing countries adopted a form of fiscal rule (FR), namely "*a permanent constraint on fiscal policy, expressed in terms of a summary indicator of fiscal performance*" (Kopits and Symansky, 1998). Specifically, in the face of changing economic circumstances, FR are aimed at setting the course for a responsible fiscal policy. Even if FR may differ in terms of the fiscal aggregate constrained, most of them set specific limits on government's deficit or debt, as their primary objective is to correct or even suppress the *deficit bias* in the political process (Debrun et al., 2008).

Certainly, the increased popularity of FR is rooted into their fiscal performances, particularly regarding their capacity to support macroeconomic stability by improving fiscal outcomes (e.g. Tapsoba, 2012; Combes et al., 2018) and fiscal discipline (e.g. Debrun et al., 2008; Barbier-Gauchard et al., 2021), supporting more counter-cyclical policies (e.g. Combes et al., 2017; Guerguil et al., 2017; Larch et al., 2021) or reducing government borrowing costs (e.g. Thornton and Vasilakis, 2018). Nevertheless, in spite of this growing appetite for FR, other contributions point out to a more skeptical perspective regarding these potential benefits (e.g. Debrun and Kumar, 2009; Heinemann et al., 2018; Caselli and Reynaud, 2019; Vinturis, 2021).¹ This lack of consensus underlines the existential crises faced by the rule-based fiscal frameworks in the recent years (see Debrun and Jonung, 2019, for an excellent discussion on the so-called "*fiscal rules' trilemma*").

Such controversies are undoubtedly related to the way FR may influence government's behavior, particularly regarding public spending. Yet, the literature on FR and public spending is surprisingly scarce. Using data for 22 OECD countries, Dahan and Strawczynski (2013) show that FR mostly reduce the growth of total public expenditure, a result confirmed by Barbier-Gauchard et al. (2021). For disaggregated spending, consistent with Peree and Valila (2005) and Valila and Mehrotra (2005), Delgado-Tellez et al. (2020) find that FR do not significantly affect public investment in the developed world, in line with Dahan and Strawczynski (2013) for the ratio between various components of public spending (with the notable exception of expenditure rules). Taking stock of these studies, the goal of our paper is to investigate how do FR shape governments' spending behavior.

We contribute to the existing literature on several grounds. First, an important strand of literature suggests that the estimated effect of FR on fiscal policy may dramatically change if one does not properly account for endogeneity arising from reversed causality (see e.g. the meta-analysis of Heinemann et al., 2018). We tackle this issue using a treatment effect

¹Some studies even report detrimental effects of FR, including a governments' procyclical behavior (e.g. Alesina and Bayoumi, 1996; Lane, 2003; Dessus et al., 2016).

analysis, in which the adoption of FR is not considered to be exogenous but related to some observable macroeconomic characteristics. Second, compared with existing studies that focus exclusively on developed countries, we use a large database of 185 countries. This is particularly important, since the presence of many countries allows constructing quality counterfactuals that support a proper implementation of our treatment effect analysis. Third, we provide evidence for disaggregate measures of both public spending and FR, and for developed and developing countries. Lastly, we look at the various FR features.

Our results are as follows. First, the adoption of FR is found to significantly reduce total public spending relative to comparable countries that did not adopt FR. Moreover, regarding the composition of public spending, while public consumption significantly decreases, public investment is not significantly affected. As a result, the ratio between public investment and public consumption significantly increases.

Second, these findings differ with the type of FR. Contrary to expenditure rules (ER), both debt rules (DR) and balanced-budget rules (BBR) significantly reduce total spending. In addition, while all types of FR significantly reduce public consumption and mostly leave public investment statistically unchanged, the ratio of public investment-to-public consumption significantly increases only for DR and BBR.

Third, although the effect of all FR in developed and developing countries is comparable with their impact in the full sample, the level of economic development matters when differentiating between the various types of FR. Contrary to DR and BBR that reduce total spending in both groups of countries, ER significantly decrease it only in developing countries. Moreover, although all types of FR significantly reduce public consumption in both groups of countries, the strongest effect (in absolute value) is triggered by BBR in developed countries and by ER in developing countries. In addition, while public investment only weakly responds to ER in developed countries, DR and BBR significantly increase it in developing countries. As a result, the public investment-to-public consumption ratio increases in both groups of countries in response to the adoption of DR or BBR, but does not significantly change following the adoption of ER.

Lastly, we explore if and how fiscal rules' features influence their impact on public spending. By further reducing total spending, some FR features may enhance their fiscal discipline effect (e.g. independent fiscal bodies, investment-friendly FR, supranational FR, or in most cases monitoring outside the government and a "hard" legal basis); on the contrary, other features weaken the fiscal discipline-enhancing role of FR (e.g. fiscal responsibility laws, a higher number of FR, national FR, or in most cases a "soft" legal basis, as well as cyclically-adjusted BBR or expenditure ceilings for ER); and a last group of features (e.g. formal enforcement procedures or escape clauses) enhance or weaken the fiscal discipline effects of FR, depending on countries' level of economic development and the type of FR. In addition, while public consumption mostly responds similarly to total spending, we find that most

FR features have mixed effects on public investment notably depending on countries' level of economic development and the type of FR. However, some of them mostly penalize it (e.g. independent fiscal bodies or monitoring outside the government), and others mostly support public investment either by no longer decreasing it or even by increasing it (e.g. investment-friendly FR or expenditure ceilings for ER).

The key policy takeaways can be concisely described as follows. FR are found to promote fiscal discipline by significantly reducing total spending. Moreover, while public consumption is often significantly decreased, governments—particularly in developing countries—seem to protect public investment following the adoption of FR, particularly for DR and BBR that may even significantly increase it. Against some fears, going back at least to the early 2000s, that FR would result into public investment cuts, this finding shows that public investment slowdowns may be mostly related with other policies but FR (for example, fiscal consolidations may be a good candidate). Finally, not all the FR features are desirable from a fiscal discipline perspective. Enforcement and a strong legal basis usually promote the fiscal discipline effects of FR, while the impact of a high degree of flexibility and of supporting procedures or institutions is mixed. This calls for a careful assessment of these features, all the more for governments that may look at other goals beside fiscal discipline, and in particular at public investment.

The rest of the paper is organized as follows. Section 2 surveys the literature and builds the testable hypotheses, Section 3 describes the methodology, Section 4 presents the data, Section 5 reports our main results, Sections 6 investigates various types of fiscal rules, and compares developed and developing countries, Section 7 is devoted to fiscal rules' features, and Section 8 summarizes our findings and suggests several research perspectives.

2 Literature and testable hypotheses

2.1 The rationale of fiscal rules

One of the most important messages delivered by the post-1970s oil shocks literature was that rules may be preferred to discretionary policies (Kydland and Prescott, 1977). In light of the findings of Sargent and Wallace (1981), such "rules" were indeed assigned to the monetary policy as central banks became increasingly more independent (see e.g. the Volcker disinflation period of the early 1980s, the creation of the supranational European Central Bank in the 1990s, or the remarkable spread of the inflation targeting regime starting the early 1990s). This marked focus of monetary policy on monetary goals uplifted the burden placed on fiscal policy as a shock absorber. As a result, many countries around the world experienced long-lasting deficits that fueled upward-sloping public debt paths starting from the mid 1970s (see Minea and Villieu, 2012), whose levels reached unprecedented heights prior to the 2008-2009 crisis and, as highlighted by Eichengreen et al. (2019), have further

been increased by governments' response to it (and, more recently, by the Covid-related fiscal stimuli).

In face of the dangers raised by such a high indebtedness stance on fiscal sustainability, many countries around the world adopted FR: compared to only a handful of countries in the mid-1980, around 100 countries present currently at least a type of FR. Although they take various forms (for example, they may target the budget balance, the public debt, or the level of expenditure), FR are aimed at constraining governments' fiscal behavior. As such, they are expected to reduce governments' appetite for too high fiscal deficits, and promote fiscal discipline (e.g. Buchanan and Wagner, 1977; Debrun et al., 2008).

2.2 Fiscal rules and fiscal performance

Fiscal rules are a widely-accepted policy to promote fiscal discipline. Although there exist alternative policies that may equally support fiscal discipline, and particularly e.g. fiscal consolidations, the two policies are different in two important dimensions.

First, a fiscal consolidation is usually short-lived, i.e. a "shock therapy": according to Bamba et al. (2020), half of the 123 fiscal consolidations that they identify have a life of at most 2 years, and less than one in five is above 5 years. On the contrary, among the 185 countries in our study, only around a dozen dropped a FR after having adopted it, suggesting that FR are "*long-lasting constraint[s] on fiscal policy*" (Lledo et al., 2017, page 8).

Second, the fiscal discipline goals that they target are equally different. Fiscal consolidations are short-term operations whose goal is to avoid an imminent risk of large fiscal imbalance (e.g. a debt crisis or default, government's fiscal insolvency, and so forth). On the opposite, FR are designed as part of a new fiscal framework, whose goal is to achieve a lasting sustainable regime characterized by smaller deficits; contrary to fiscal consolidations that signal a disequilibrium situation, FR are meant to persist and drive the economy towards a new equilibrium.

Such a more long-term perspective of FR is equally embraced by the literature devoted to evaluating their effect on the deficit bias: as emphasized by e.g. Krogstrup and Wyplosz (2009), since FR are intended to fight governments' short-sightedness and tackle the common pool problem, they require a structural change in the conduct of the fiscal policy. Moreover, Debrun and Kumar (2009) conclude that the favorable influence of FR on fiscal performance rests upon their features of acting as commitment devices and signaling tools. Finally, Berganza (2012) finds that FR have been more effective precisely for long-term sustainability, rather than for coping with shocks.

2.3 Testable hypotheses

Based on our previous discussion, we can derive several hypotheses regarding the expected effect of FR on public spending.

(1) Since FR aim to improve fiscal discipline, they may act on *total government spending*. This potential effect may be supported by two important arguments. First, except for revenue rules (which are too few for a robust analysis), all types of FR enclose a goal of targeting public spending. Balanced-budget rules target the budget balance, whose improvement is related with government's capacity to reduce public spending. Debt rules target the public debt, whose control depends on governments' capacity to generate primary surpluses, which may be fostered by public spending cuts. Even in a more direct way, expenditure rules are precisely designed to keep public spending under control. Together with the established finding that taxes are significantly more elastic to output variations, and as such more endogenous than spending (see Girouard and André, 2005, for an analysis, and Bergman et al., 2016, and Schmidt-Hebbel and Soto, 2018, for a discussion), it comes that governments are more likely to adjust public spending to cope with the targets imposed by the FR.

Second, many theoretical and empirical studies support a favorable effect of FR on fiscal performance (see e.g. Hallerberg and von Hagen, 1999; Beetsma and Debrun, 2004, 2005; or Debrun et al., 2008, for theory; and Debrun et al., 2008; Tapsoba, 2012; Guerguil et al., 2017; Caselli et al., 2018; Combes et al., 2018, for empirical confirmations). This positive effect of FR may likely be supported by a decrease of public spending. The following hypothesis summarizes these arguments.

H1: The adoption of FR is expected to decrease total public spending.

(2) Fiscal rules may equally affect the various *components of public spending*. Assessing such effects may be inspired by the related studies on fiscal consolidations. A long-lasting literature reveals that fiscal consolidations are performed by reducing public investment (see e.g. Roubini and Sachs, 1989; Oxley and Martin, 1991; Alesina and Perotti, 1995; De Haan et al., 1996), and even by cutting public consumption (see Castro, 2017). Taking into account these two findings, Bamba et al. (2020) reveal a composition effect: although fiscal consolidations reduce both public investment and public consumption, the reduction of the former is significantly higher compared with that of the latter.

However, as previously outlined, FR are different from fiscal consolidations. The prevalence of large public investment cuts may be explained by the "shock therapy" nature of fiscal consolidations: since they are expected to be short-lived, short-termist governments may prefer to additionally cut public investment instead of public consumption spending that are more likely to damage their chances of being reelected. On the contrary, governments are aware that FR are reforms that will last for several electoral cycles. As such, compared with public consumption cuts, reducing public investment to respect FR may not only undermine their credibility, but also generate a long-lasting negative effect by decreasing the growth potential, and as such penalize the economic development over the forthcoming political terms. Such a view is not inconsistent with existing evidence. Turrini (2004) and Bacchiocchi et

al. (2011) report that public debt—rather than the Stability and Growth Pact fiscal rules—constrained public investment in EU countries. In addition, against the fears expressed by Balassone and Franco (2000) and Blanchard and Giavazzi (2004), empirical tests reported by Peree and Valila (2005) and Valila and Mehrotra (2005) conclude that the decline of public investment reductions is unrelated to EMU fiscal rules but rather to episodes of fiscal consolidations. This evidence can be summarized into the following hypotheses.

H2a: The adoption of FR is expected to decrease public consumption.

H2b: The adoption of FR is expected not to reduce (i.e. to leave statistically-unchanged or to increase) public investment.

The hypothesis **H2b** deserves some additional explanation. Since governments are aware that FR are reforms that will last, they may take advantage of FR adoption to reshape their fiscal policy. As such, if the reduction in public consumption arising from FR adoption is sufficiently vigorous, governments may conserve or even slightly increase public investment in search for an economic growth bonus. Such an assumption is consistent with the early evidence in Turrini (2004), who suggests that the EU fiscal rules may have created room for public investment in some EU countries, and may be equally supported by Ardanaz et al. (2021) who reveal that fiscal rules protect public investment in times of fiscal consolidations, and by Castro (2011) who concludes that the introduction of FR not only did not reduce economic growth but even raised it in some European Union countries.

Finally, when combining hypotheses H2a-b, we derive a hypothesis on the composition effect of FR on public spending.

H3: The adoption of FR is expected to increase (or to leave unchanged) the public investment-to-public consumption ratio.

From an economic standpoint, while hypotheses H2a and H2b focus on individual effects (i.e. the response of public consumption and public investment, respectively), **H3** looks at a potential composition effect: do governments significantly change the structure of their public spending following the adoption of FR with respect to comparable countries without FR? The statistical strength of this composition effect depends upon the strength of the two effects that compose it. Statistical significance is expected if the decline in public consumption and/or the increase in public investment is sufficiently strong, and conversely.

3 Methodology

3.1 Description of the methodology

Our goal is to study how the adoption of FR influences public spending (PS) in countries that adopted FR compared to those that did not. However, since the adoption of FR may

not be a random process but correlated with a set of observable variables that may equally affect government’s spending behavior, a major empirical challenge is to establish a causal link between the adoption of FR and changes in PS.

To tackle this issue, we draw upon the Entropy Balancing method developed by Hainmueller (2012). As a generalization of conventional matching methods, entropy balancing allows estimating causal effects by constructing a pre-processing scheme. Accordingly, weights are used to adjust the control units such as a large set of covariates are balanced between the control and the treated group, leading to consistent estimates. This methodology has been recently employed by Neuenkirch and Neumeier (2016) to assess the causal impact of U.S. sanctions on poverty; Balima (2017) to estimate the effect of domestic sovereign bond market participation on financial dollarization; Neumeier (2018) to analyze the economic performance of US state governors with a business background; or Balima and Sy (2021) to evaluate the role of IMF-supported programs in mitigating sovereign defaults in borrowing countries.

Formally, entropy balancing allows estimating the causal effect of FR on PS, namely the average treatment effect on the treated (δ), computed as

$$\delta = \mathbb{E}[PS_{i(1)} | FR_i = 1] - \mathbb{E}[PS_{i(0)} | FR_i = 1], \quad (1)$$

where PS is our outcome variable (public spending) and FR indicates whether fiscal rules are in place (FR=1) or not (FR=0). Therefore, $\mathbb{E}[PS_{i(1)} | FR_i = 1]$ is the expected outcome for countries that adopted FR (treatment group), and $\mathbb{E}[PS_{i(0)} | FR_i = 1]$ is the ideal counterfactual—the outcome that these countries would have had in the absence of FR.

Unfortunately, the latter term is not observable, and the model must be reassessed. A simple approach would be to compare the PS average between countries that adopted FR and countries that did not; this could have been possible if the treatment assignment was a random event. However, as largely discussed by the literature devoted to FR (see e.g. Debrun and Kumar, 2009; Tapsoba, 2012; Barbier-Gauchard et al., 2021), the adoption of FR depends on several macroeconomic variables that may equally affect PS. To overcome this so-called ”self-selection problem” (which can lead to biased estimates), we replace the last term of equation (1) by the PS in countries that did not adopt FR but present similar pre-treatment characteristics. Following Neumeier (2018), we select relevant pre-treatment characteristics that are potentially correlated with a country’s decision to adopt FR and government’s spending behavior.

Hence, we estimate the impact of the adoption of fiscal rules by comparing FR and Non-FR countries that are as similar as possible in terms of observable characteristics

$$\delta = \mathbb{E}[PS_{i(1)} | FR_i = 1, X = x] - \mathbb{E}[PS_{i(0)} | FR_i = 0, X = x], \quad (2)$$

where $X = x$ is the vector of relevant observable covariates, and $\mathbb{E}[PS_{i(1)} | FR_i = 1, X = x]$ and $\mathbb{E}[PS_{i(0)} | FR_i = 0, X = x]$ are the PS for countries that adopted FR (i.e. the treatment group) and for the countries that did not, conditional on the pre-treatment characteristics (i.e. the synthetic control group). By balancing the treatment and the synthetic group based on observable characteristics, this matching approach mimics a randomized experiment.

3.2 Implementation and benefits

The entropy balancing framework is grounded in a simple two-step procedure. In the first step we implement a reweighting scheme by computing weights for non-treated units (i.e. Non-FR country-year observations). These weights should satisfy pre-balance constraints on the sample moments of pre-treatment characteristics (e.g. their mean). Following existing studies, our main estimations are based on balance constraints that require equal covariates' means: our synthetic control group comprises units not subject to the treatment (Non-FR countries) that are on average as close as possible to units that received the treatment (FR countries). In the second step, these weights are used to estimate the average treatment effect on the treated (δ), namely the average conditional difference in PS between FR and Non-FR countries. We do so by performing a regression with the FR (i.e. the treatment) as our main explanatory variable and the level of public spending (PS) as the dependent variable.

Because it combines *the matching approach* by assigning weights to the untreated group to ensure that the two groups are comparable (in the first step) and *the regression approach* (in the second step), entropy balancing presents some advantages over other common matching techniques (see e.g. Hainmueller, 2012; Neuenkirch and Neumeier, 2016; Balima, 2017). First, interpreted as a generalization of common matching methods such as e.g. propensity score matching, entropy balancing outperforms other matching techniques for ensuring a high covariate balance between the treatment and the control group (Hainmueller, 2012).² With conventional matching methods, the control group commonly comprises units that are not subject to the treatment and represent the "best matches" for the treated units to which they are assigned (e.g. Hainmueller, 2012; Diamond and Sekhon 2013; Neuenkirch and Neumeier, 2016). However, when the number of untreated units is limited and the number of pre-treatment characteristics is large, this procedure does not ensure an appropriate covariate balance between the treatment and control group, which may lead to biased estimates. Entropy balancing addresses these shortcomings by constructing a synthetic control group based on weights, which can be considered a picture-perfect counterfactual of the treatment group (Hainmueller, 2012). Instead of checking for the covariate balance after the pre-processing, entropy balance identifies a set of weights (which are as close as possible to

²Based on Monte Carlo simulations, Hainmueller (2012) shows that entropy balancing outperforms other matching techniques in terms of bias estimation and mean squared error.

uniform base weights) that allows balancing *ex-ante* the covariates, based on the imposed balance constraints. By including the auxiliary information about the known sample moments and adjusting the weights to obtain exact covariate balance for the moments comprised in the reweighting scheme, entropy balance prevents the loss of information. Besides, as these weights can vary smoothly across units, entropy balancing is effective in reducing covariates’ imbalance, and as such allows obtaining unbiased estimates of the treatment effects.

Second, compared with regression-based or matching approaches (including propensity score matching) that require a parametric specification, entropy balancing is a non-parametric technique. This is particularly important for our analysis, since it avoids imposing a specific model for the likelihood of FR adoption (treatment variable), i.e. it avoids a misspecification regarding the functional form of the model.

Finally, entropy balancing allows mitigating potential endogeneity issues arising from unobserved heterogeneity, by accounting in the second step of the model for both country- and time-fixed effects. The inclusion of country-fixed effects controls for country-specific time-invariant unobserved factors that may be a source of differences in governments’ spending behavior across countries. The use of time-fixed effects captures unobserved time-heterogeneity that may reflect time-specific shocks (various types of crises, wars, and so forth).

4 Data

We perform our estimations using a large panel of 185 countries, observed during a period of around three decades (1985-2015). Our two main variables are public spending (the dependent variable) and fiscal rules (the main independent variable, or the treatment). First, as highlighted by our hypotheses, we are interested in several measures of public spending. To test hypothesis **H1**, we consider total government spending, measured as total expense and net acquisition of nonfinancial assets (in ratio of GDP). Moreover, to test hypotheses **H2** and **H3**, we consider two types of public spending. Public consumption is approached by the general government final consumption expenditure, which includes all government current expenditures for purchases of goods and services, including the compensation of employees (in ratio of GDP). Public investment is approached by the general government investment, which includes the general government gross fixed capital formation (in ratio of GDP). Second, we measure fiscal rules (FR) by a dummy variable that equals 1 if a given country at a certain year presents a fiscal rule, and 0 if not. Beyond this aggregate measure, we will also look at the various types of FR, namely expenditure rules (ER), debt rules (DR), and balanced budget rules (BBR).

In addition, when estimating the effect of FR on public spending, we account—along with country- and time-fixed effects—for a wide vector of control variables. First, previous studies (e.g. Bamba et al., 2020) emphasize that fiscal policy, and particularly public spending, is

a persistent variable. Consequently, we include in the control variables the one-period *lag of the dependent variable*. Second, existing studies show that FR significantly affect fiscal discipline (e.g. Debrun et al., 2008), which depends upon both government spending and revenues. Since our goal is to measure the effect of FR on public spending, we neutralize potential changes in revenues by controlling for the one-period *lag of government revenues*. Third, we include the one-period *lag of public debt* (in ratio of GDP) to control for the influence of the fiscal stance on the impact of FR on public spending; since we equally control for fiscal revenues, the inclusion of public debt follows the logic of the so-called Bohn (1998)’s ”fiscal reaction function”. Fourth, we control for various facets of the domestic and external economic stance. Regarding the former, we include *real GDP growth* to capture real economic conditions and the demand for government spending (e.g. Dahan and Strawczynski, 2013), which are an important determinant of the fiscal policy behavior. For comparable reasons we include *private investment*, whose presence is equally likely to control for possible crowding-in/out effects between public and private spending, and *inflation* (GDP deflator) as a measure of prices’ dynamics, which are a long-standing determinant of government’s fiscal behavior (e.g. Combes et al., 2018). Regarding the latter, since more open economies are further exposed to external shocks that may equally affect the governments’ fiscal behavior (e.g. Barbier-Gauchard et al., 2021), we capture external conditions through the variable *trade*, computed as the sum between exports and imports in ratio of GDP. Finally, we complete our set of control variables with measures of the structural conditions. On the one hand, population dynamics, which we capture by the *growth rate of the population*, are an important determinant of fiscal policy (e.g. Calderon and Schmidt-Hebbel, 2008). On the other hand, we account for the bureaucracy quality as a measure of the quality of institutions, which can influence government’s fiscal behavior (e.g. Debrun et al., 2008). Definitions and sources of data are detailed in the *Supplementary Material*.

5 Fiscal rules and public spending: benchmark results

Our benchmark results are organized in three subsections devoted to the effect of FR on total public spending, public consumption and public investment, and the public investment-to-public consumption ratio (a composition effect), respectively.

5.1 Total public spending

5.1.1 Balancing results

The first stage of our estimation consists of building weights such as the sample moment—in our main estimations, the average—of each of our covariates is not statistically-different

between the treated group and the synthetic control group.³ Since this procedure is conditional upon the set of variables included, we consider the entire set of relevant covariates.

Table 1: Descriptive statistics *before* weighting

Variable	[1] FR	[2] Non-FR	[3]=[1]-[2] Difference	[4] t-test	[5] p-value
Lag total public spending	35.12	28.09	7.03	14.11	0.00
Lag government revenues	33.36	26.50	6.86	13.66	0.00
Lag debt	54.61	52.11	2.50	1.58	0.11
GDP growth	3.21	4.26	-1.05	-6.74	0.00
Private investment	17.23	13.48	3.75	14.84	0.00
Inflation	3.73	9.29	-5.56	-13.29	0.00
Trade	95.42	75.61	19.80	8.21	0.00
Population growth	1.06	1.81	-0.75	-12.42	0.00
Bureaucracy quality	2.81	2.08	0.72	16.69	0.00
Observations	1103	1342			

Table 2: Descriptive statistics *after* weighting

Variable	[1] FR	[2] Non-FR	[3]=[1]-[2] Difference	[4] t-test	[5] p-value
Lag total public spending	35.12	35.07	0.04	0.09	0.93
Lag government revenues	33.36	33.32	0.03	0.07	0.95
Lag debt	54.61	54.67	-0.05	-0.04	0.97
GDP growth	3.21	3.22	-0.01	-0.07	0.95
Private investment	17.23	17.20	0.04	0.15	0.88
Inflation	3.73	33.83	-0.10	-0.38	0.71
Trade	95.42	95.36	0.05	0.02	0.98
Population growth	1.06	1.07	-0.01	-0.01	0.83
Bureaucracy quality	2.81	2.80	0.01	0.16	0.88
Observations	1103	1103			

Note: Based on weights we build the synthetic control group that contains the same number of observations as the treated group.

As illustrated by Table 1, except for the public debt, all control variables present statistically-different averages in the group of countries with (column 1) and without FR (column 2). Columns 3-5 reveal that the presence of FR is associated with higher total public spending, government revenues, private investment, trade, and bureaucracy quality; and with lower real GDP growth, inflation, and population growth. Such important differences between the two groups may bias the estimation of the effect of FR on public spending.

To neutralize these differences, we perform the first step of our estimation by applying weights to the control group in order to select our synthetic control group based on the constraint of statistically-equal averages of covariates. Table 2 shows that the average values of the covariates in the synthetic control group (column 2) are no longer statistically-different from their corresponding values of the treated group (column 1), as illustrated by columns

³To increase the quality of our estimations and ensure the comparability between the two groups, we dropped from the control group the countries with a GDP per capita lower than that of the treated country with the lowest GDP, and a total population lower than that of the treated country with the lowest total population. After having dropped the ten countries concerned, we obtain our final sample of 185 countries.

3-5. Consequently, our synthetic control group provides an appropriate counterfactual such as differences in FR cannot be imputed to differences in the covariates.

5.1.2 Estimation results

In the second step, we use the weights previously obtained to estimate the effect of FR on public spending with a Weighted OLS model, in which we control for all the covariates used to balance the two groups. Estimations reported in Table 3 reveal the following.

Table 3: Fiscal rules and total public spending

	[1]	[2] ^a	[3] ^b
FR	-0.885*** (0.174)	-0.896*** (0.182)	-0.737*** (0.164)
Covariates (in the second step)	Yes	Yes	Yes
Country fixed effects (in the second step)	Yes	Yes	Yes
Year fixed effects (in the second step)	Yes	Yes	Yes
Observations	2445	2445	2445

Note: standard errors in brackets. ^atime-fixed effects added in the 1st stage. ^bbalancing performed both on the average and the variance in the 1st stage. *** $p < 0.01$.

Relative to comparable countries that do not present FR, countries that adopted FR experienced on average a significant decrease in their total public spending (in ratio of GDP), as shown by column 1. Notably, in column 1 we tackle a potentially-important source of endogeneity, namely unobserved heterogeneity, as we control for both country- and time-fixed effects. Moreover, the following two columns confirm the robustness of our finding when further tackling unobserved heterogeneity by adding time-fixed effects in the first stage (column 2) or when performing the balancing in the first step using both the average and the variance of the covariates (column 3).

In addition to being significant, the estimated effect is economically meaningful: according to our benchmark estimation (column 1), the adoption of FR reduces by around 0.9 percentage points (pp) on average the total public spending-to-GDP ratio. This enhancement of the government’s balance (expressed as a ratio of GDP) represents a sizeable improvement (recall that this effect is estimated under *ceteris paribus* conditions as regards government revenues, i.e. potential changes in government revenues are controlled for).

To summarize, estimations do not reject our hypothesis **H1**: the adoption of FR yields a discipline effect by significantly reducing total public spending. Importantly, since our method allows building an appropriate counterfactual group, the estimations point out to a causal effect of the adoption of FR on total public spending.

5.2 Public consumption and public investment

We now look at the effect of FR on different types of public spending, namely public consumption and public investment. Notice that, for each type of public spending, we perform again the balancing in the first stage where we replace the lag of total public spending

by the lag of the appropriate type of public spending (to save space, results are available upon request).

5.2.1 Public consumption

Estimations are reported in Table 4. According to column 1, in which we control for the full set of covariates and for country- and time-fixed effects, the presence of FR significantly decreases public consumption. This finding is confirmed by various robustness tests, namely when adding time-fixed effects in the first stage (column 2), performing the balancing on both the average and the variance of the covariates (column 3), or adding the one-period lag of public investment (in ratio of GDP) to account for the influence of its possible changes (following the FR adoption) on the behavior of public consumption (column 4).

These results do not reject our hypothesis **H2a**: with respect to comparable countries without FR, public consumption significantly decreases in countries that adopted FR. This causal effect shows that the previously-revealed discipline-enhancing impact of FR on total public spending is supported by a significant contraction of public consumption.

Table 4: Fiscal rules and public consumption

	[1]	[2] ^a	[3] ^b	[4] ^c
FR	-0.342*** (0.076)	-0.420*** (0.081)	-0.273*** (0.075)	-0.341*** (0.076)
Covariates (in the second step)	Yes	Yes	Yes	Yes
Country fixed effects (in the second step)	Yes	Yes	Yes	Yes
Year fixed effects (in the second step)	Yes	Yes	Yes	Yes
Observations	2405	2405	2405	2405

Note: standard errors in brackets. ^atime-fixed effects added in the 1st stage. ^bbalancing performed both on the average and the variance in the 1st stage. ^cone-period lagged public investment (in ratio of GDP) included in the specification (in both steps). *** $p < 0.01$.

5.2.2 Public investment

We now investigate the effect of FR on public investment. Column 1 in Table 5, in which we report the benchmark estimation, shows that the impact of FR on public investment is not significant. This lack of significant influence is confirmed by subsequent estimations with various robustness specifications (columns 2-4).

Table 5: Fiscal rules and public investment

	[1]	[2] ^a	[3] ^b	[4] ^c
FR	0.064 (0.073)	0.019 (0.078)	-0.022 (0.077)	0.037 (0.072)
Covariates (in the second step)	Yes	Yes	Yes	Yes
Country fixed effects (in the second step)	Yes	Yes	Yes	Yes
Year fixed effects (in the second step)	Yes	Yes	Yes	Yes
Observations	2452	2452	2452	2452

Note: standard errors in brackets. ^atime-fixed effects added in the 1st stage. ^bbalancing performed both on the average and the variance in the 1st stage. ^cone-period lagged public consumption (in ratio of GDP) included in the specification (in both steps).

These findings do not reject our hypothesis **H2b**: the adoption of FR is not harmful for public investment, whose dynamic is not statistically different in countries that enacted FR

with respect to comparable countries that did not. Consequently, the adjustment of total public spending following the adoption of FR is not found to be echoed by a significant change in public investment.

5.3 Composition effects

Our previous estimations revealed different responses of the different types of public spending following the adoption of FR: while public consumption significantly decreases in countries with FR, public investment is not found to be significantly affected by their introduction. To analyze the joint strength of these two effects we report in Table 6 estimations of the effect of FR on the public investment-to-public consumption ratio.

Table 6: Fiscal rules and the public investment-to-public consumption ratio

	[1]	[2] ^a	[3] ^b	[4] ^c
FR	1.517*** (0.580)	1.397** (0.602)	1.081* (0.596)	1.255* (0.691)
Covariates (in the second step)	Yes	Yes	Yes	Yes
Country fixed effects (in the second step)	Yes	Yes	Yes	Yes
Year fixed effects (in the second step)	Yes	Yes	Yes	Yes
Observations	2405	2405	2405	2405

Note: standard errors in brackets. ^atime-fixed effects added in the 1st stage. ^bbalancing performed both on the average and the variance in the 1st stage. ^cone-period lagged public consumption and public consumption (in ratio of GDP) included in the specification (in both steps) instead of the ratio public investment/public consumption. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.10$.

According to benchmark results reported in column 1, FR significantly increase the ratio of public investment-to-public consumption. This significant effect survives when adding time-fixed effects in the first stage (column 2), performing the balancing on covariates' both average and variance (column 3), or when using the lag of public consumption and public investment (both in ratio of GDP) instead of the lag of their ratio to perform the balancing and the regression (column 4).

These results, which do not reject the hypothesis **H3**, complete our global view on how FR shape government's spending behavior. FR adoption reduces total public spending and public consumption but leaves public investment statistically-unchanged. It is the statistical strength of the public consumption response that mainly drives a significant increase of the public investment-to-public consumption ratio. This positive composition effect suggests a policy reorientation towards public investment (in relative terms): against the public consumption decline, governments seem to protect public investment following the FR adoption.⁴

Our findings are consistent with the arguments developed previously. The adoption of FR does not cause a significant drop of public investment since FR are more long-term fiscal reforms. As such, their goal is not to restore fiscal sustainability in the short-run

⁴Comparable conclusions arise when changing the vector of control variables in various ways, e.g. reducing it, using alternative measures of some variables, or extending it to include additional control variables, or when using the growth rate of fiscal variables as the dependent variable (results are available upon request).

following shocks, but to provide—through their commitment and signaling features—an anchor towards long-term fiscal sustainability, as detailed in section 2.

6 The type of fiscal rule and the level of economic development

6.1 The type of fiscal rule

The existing literature emphasizes important differences in the effect of the various types of FR on fiscal discipline (see e.g. Tapsoba, 2012; Combes et al., 2018). Therefore, we investigate if the type of FR, namely expenditure rules (ER), debt rules (DR), or balanced-budget rules (BBR), matters as regards governments’ behavior in terms of public spending.

Table 7: Various types of fiscal rules and public spending

	[1]TPS	[2]C	[3]I	[4]I/C
ER	-0.129 (0.142)	-0.255*** (0.049)	-0.047 (0.058)	0.374 (0.396)
DR	-0.830*** (0.202)	-0.361*** (0.089)	0.082 (0.082)	1.629*** (0.586)
BBR	-0.957*** (0.172)	-0.327*** (0.074)	0.111 ^x (0.072)	1.719*** (0.580)
Observations	2445	2405	2452	2405
Covariates (2nd step)	Yes	Yes	Yes	Yes
Country FE (2nd step)	Yes	Yes	Yes	Yes
Year FE (2nd step)	Yes	Yes	Yes	Yes

Note: standard errors in brackets. TPS=total public spending, C=public consumption, I=public investment, and I/C=public investment-to-public consumption ratio. *** $p < 0.01$. ^x $p < 0.15$.

Table 7 presents the results. As shown by column 1, total public spending respond quite differently to the various types of FR. Compared with DR and BBR that are found to significantly reduce total public spending (similar to the effect of all FR), the effect of ER on total public spending is not statistically-significant in the full sample (subsequently, we will compare developed and developing countries). Besides, the strongest contraction of public spending arises following the adoption of BBR, namely around 1 pp on average.

Moreover, in columns 2-3 we look at the different types of public spending. As shown by column 2, all types of FR significantly reduce public consumption. The strongest effects arise for DR and BBR (around 0.35 pp), followed by ER (around 0.25 pp). Besides, as shown by column 3, none of the three FR significantly affect public investment. However, although not significant, the estimated response of public investment is slightly positive for DR and BBR (significant at the 15% significance level for the latter), and slightly negative for ER. As discussed in the next paragraph, these different responses of public investment contribute to differences in the significance of the public investment-to-public consumption ratio.

Finally, column 4 reports estimations for the composition effect of the various types of FR. Both DR and BBR significantly increase the public investment-to-public consumption

ratio. This significant change in the structure of public spending is driven by the public consumption decline and supported by a positive (although not significant) response of public investment. Conversely, ER do not trigger a significant composition effect: since they decrease both public consumption and public investment (the latter effect being not significant), ER leave statistically-unchanged the public investment-to-public consumption ratio.

Although broadly in line with our hypotheses **H1-2-3**, these findings reveal some particularities in the way the various types of FR affect public spending. Regarding **H1**, DR and BBR are the most efficient FR for fiscal discipline, as they significantly reduce total public spending. Regarding **H2a**, while all FR reduce public consumption, we detected some differences in the magnitude of this effect, notably between DR and BBR versus ER. Regarding **H2b**, although public investment is not significantly changed in response to the adoption of the various types of FR, the estimated coefficient is positive following DR or BBR adoption but negative following ER adoption.⁵ Consequently, BBR and DR—but not ER—cause a significant change in the public investment-to-public consumption ratio (hypothesis **H3**).

To summarize, these results show that governments adjust differently their public spending behavior following the adoption of BBR or DR versus ER. Due to their binding features, only the former contribute to a significant change of governments’ fiscal policy towards higher fiscal discipline, which results into a significant contraction of public consumption that allows public investment to be conserved.⁶

6.2 Developed versus developing countries

Using the IMF’s classification, we now investigate the effect of FR on public spending in developed compared with developing countries.

We first look at *all fiscal rules together* (the first line of results in Table 8). According to columns 1 and 5, FR adoption significantly decreases total public spending both in developed and developing countries, as this was the case for the entire sample. Moreover, the response of the different types of public spending is reported in columns 2-3 and 6-7. Public consumption is significantly reduced by FR in both developed and developing countries, with a slightly

⁵ To take a closer look at these differences, we model salient differences in the various FR. Specifically, while ER target only public spending, BBR and DR—by targeting overall fiscal aggregates—can affect both public spending *and* revenues. Therefore, we re-estimated column 3 of Table 7 when taking out government revenues. Interestingly, while the effect of ER on public investment does not change (it equals -0.008 and is still not significant), the effect of DR and BBR equals +0.149 (with a *p-value* of 0.06) and +0.134 (with a *p-value* of 0.06), respectively. These effects (which remain significant if we introduce e.g. time-fixed effects in the first stage or perform the balancing on covariates’ average and variance) suggest that government revenues may enforce a significant increase in public investment following the adoption of DR and BBR.

⁶In complement to our previous findings, Table A1a in the Supplementary Material reports estimations with combinations of two, and even all three FR. In sum, combining different FR still improves fiscal discipline but almost always with a lower magnitude compared with the individual effect of DR or BBR, while the previous responses of public consumption and public investment are only marginally affected.

higher magnitude in the latter group. Although the response of public investment is not found to be significant, the estimated coefficient presents a negative sign in developed countries but a positive sign in developing countries. Even though they are not significant, these opposite-sign coefficients may explain the significance of the composition effect: according to columns 4 and 8, the increase of the public investment-to-public consumption ratio is significant in developing countries, but significant only at the 15% significance level in developed countries.

Table 8: Fiscal rules and public spending: Developed versus Developing countries

	[1]TPS	[2]C	[3]I	[4]I/C	[5]TPS	[6]C	[7]I	[8]I/C
	Developed Countries				Developing Countries			
All Fiscal Rules (FR)	-0.827*** (0.221)	-0.276*** (0.071)	-0.044 (0.072)	0.694 ^x (0.441)	-0.771*** (0.259)	-0.367** (0.143)	0.169 (0.133)	2.358** (1.188)
ER	-0.135 (0.211)	-0.173*** (0.052)	-0.079 ^x (0.055)	0.058 (0.369)	-0.889*** (0.231)	-0.651*** (0.101)	-0.122 (0.107)	0.429 (0.690)
DR	-0.921*** (0.255)	-0.200** (0.081)	0.098 ^x (0.067)	0.765** (0.380)	-0.808** (0.324)	-0.456*** (0.174)	0.297* (0.170)	4.425*** (1.407)
BBR	-0.976*** (0.226)	-0.267*** (0.074)	0.034 (0.073)	1.065** (0.450)	-0.823*** (0.261)	-0.317** (0.144)	0.277** (0.138)	2.895** (1.271)
Covariates (2nd step)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE (2nd step)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE (2nd step)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	829	829	829	829	1616	1576	1623	1576

Note: standard errors in brackets. TPS=total public spending, C=public consumption, I=public investment, and I/C=public investment-to-public consumption ratio. *** $p < 0.01$. ** $p < 0.05$. * $p < 0.10$. ^x $p < 0.15$.

Consequently, governments of both developed and developing countries adjust in a comparable way their total and public consumption spending following the adoption of FR (hypotheses **H1** and **H2a** are not rejected for both types of countries). However, some differences are found regarding the sign of the response of public investment, which is negative (positive) in developed (developing) countries. Although, individually, these effects are not significant (hypothesis **H2b** is not rejected in both groups of countries), they contribute to a differentiated composition effect (hypothesis **H3**). Following the FR adoption, developing countries significantly change the structure of their public spending towards a higher public investment-to-public consumption ratio. However, since FR trigger a reduction in both public consumption and public investment, the change in the composition of public spending is not significant at conventional levels (but only at the 15% significance level) in developed countries.

Such differences suggest exploring the response of public spending in developed and developing countries following the adoption of the *various types of fiscal rules*, namely ER, DR, and BBR (the last three lines of results in Table 8). Columns 1 and 5 show that both DR and BBR significantly reduce total public spending in developed and developing countries. Moreover, the lack of effect of ER for the entire sample is supported by the evidence in developed countries, and may be consistent with some of the results of Barbier-Gauchard et al. (2021) emphasizing that expenditure rules do not significantly affect some measures of fiscal

performance in a sample of (mostly-developed) European countries. On the contrary, ER significantly reduce total public spending in developing countries, with a magnitude slightly stronger (in absolute value) than that of DR and BBR.

The different behavior of developed and developing countries is enforced when looking at disaggregated types of public spending in columns 2-3 and 6-7. Although all types of FR significantly reduce public consumption, the magnitude of this effect is stronger (in absolute value) for each type of FR in developing countries (i.e. up to almost four times for ER), and the strongest contraction of public consumption is observed for BBR for developed countries but for ER for developing countries. In turn, the reaction of public investment varies across both countries and fiscal rules. DR increase public investment in developing countries, while this positive effect is significant only at the 15% significance level in developed countries. BBR robustly increase public investment in developing countries, but do not significantly influence it in developed countries. Lastly, ER leave public investment mostly unchanged (a negative response significant at the 15% significance level is found in developed countries).

These findings influence the composition effect of FR, reported in columns 4 and 8. DR and BBR trigger a robust and high-magnitude change in the composition effect in developing countries: the decrease in public consumption corroborated with the increase in public investment significantly increases the public investment-to-public consumption ratio by up to 4.4 percentage points (column 8, for DR). Such a significant effect is also found in developed countries, but its magnitude is weaker (column 4, for BBR). ER are not found to generate a significant change in the composition effect in either developed or developing countries (i.e. the public consumption decline does not statistically outweigh that of public investment).

We can summarize these results as follows. Except for ER in developed countries, all FR are effective in improving fiscal discipline by significantly reducing total public spending. Moreover, while public consumption is reduced in both groups of countries, the magnitude of this effect is larger in developing countries. Interestingly, the public consumption reduction in developing countries is associated with a significant increase in public investment under DR and BBR, but not under ER. Instead, ER reduce public consumption and leaves public investment mostly unchanged (although a decrease significant at the 15% significance level is observed in developed countries).

Consequently, contrary to ER, whose exclusive focus on the spending side triggers a reduction of all types of spending, BBR and DR yield a reorganization of public spending: our findings suggest that governments may take advantage of a strong reduction of public consumption to restore public investment, an effect whose magnitude is more important in developing countries. These findings may be explained by the arguments developed in section 2: FR impose long-term changes in governments' fiscal behavior, and therefore may trigger changes towards improving fiscal sustainability (lower public consumption) and favoring the growth potential (higher public investment), except when their goal is to con-

strain all types of public spending—in particular, for ER. But even then, our results reveal that governments are still reluctant to significantly reduce public investment—particularly in developing countries—as part of the change of their fiscal policy following the ER adoption.⁷

7 Features of fiscal rules

The goal of this section is to identify the way the various FR features shape their effect on public spending. Based on Schaechter et al. (2012), the features that we analyze are: supporting procedures or institutions, enforcement procedures, flexibility, and the legal basis, to which we add three other features—namely, the number of FR, investment-friendly FR, and supranational versus national FR. Following the methodological discussion, we present our results in three blocks: (*i*) features for which we exploit aggregate data for all FR; (*ii*) features for which we exploit disaggregated data for each type of FR; and (*iii*) features that are specific to only one type of FR (BBR or ER).

7.1 Some methodological issues

Our main analysis computes the effect of FR on public spending in countries that adopted FR with respect to comparable countries that did not adopt FR. However, FR come together with features that are designed to influence their behavior, and as such may impact their effect on public spending. With respect to our methodology that models the adoption of a FR as a (first) treatment effect, such features can be understood as a second treatment effect, i.e. among all countries with FR, in some of them FR are backed-up by some features.

Consequently, our data can be divided in three groups: observations without FR (which can be labeled as 0), observations with FR but without features (labeled as 1), and observations with FR and with features (labeled as 2). While so far we compared countries with FR—be them supported by features or not—with countries without FR (namely, 1-and-2 versus 0), in this section we study the effect of the various FR features. Given our methodology in which the treatment variable must necessarily be a dummy variable (e.g. equal to one when treated and to zero when not treated), such an analysis may be performed as follows.

To conserve the *same* counterfactual group—from which the synthetic control group is chosen—as for the estimations performed so far, our strategy relies upon two dummy variables. On the one hand, a FRFEAT1 variable that equals 1 in countries with FR but *without* features, and 0 otherwise; in particular, to avoid polluting our estimations, we drop from FRFEAT1 the observations with FR and features. On the other hand, a FRFEAT2 variable

⁷We equally investigated the effect of combined types of FR. As illustrated by Table A1b in the Supplementary Material, combining different FR weaken their fiscal discipline effects, with some exceptions in developing countries where their joint effect may be of higher magnitude (in absolute value). Besides, while public consumption is always weaker, the response of public investment is mostly not significant; but when significant, it is higher when DR and BBR are combined (including with ER for developing countries).

that equals 1 in countries with FR *and* features, and 0 otherwise; in particular, to avoid polluting our estimations, we drop from FRFEAT2 the observations with FR but *without* features. As such, the comparison between FRFEAT1 and FRFEAT2 may provide the following information: how do features change the effect of FR on public spending with respect to countries without FR (coefficient of FRFEAT2)—*versus*—how do FR (without features) change public spending with respect to countries without FR (coefficient of FRFEAT1), namely what is the *contribution of FR features* to the effects of FR on public spending? Drawing upon this strategy, we investigate in the following how the various FR features may influence the impact of FR on public spending.

7.2 Features of all fiscal rules

We look at three features of all FR. First, independent fiscal bodies that set budget assumptions or monitor the implementation of FR are designed to support the corrective action of FR and better anchor future fiscal decisions to a sustainable path (Beetsma et al., 2018). Second, fiscal responsibility laws aim at further promoting fiscal discipline and setting out the principles for a sound fiscal management. Third, investment-friendly FR include features to protect public investment; for example, the UK defined a "golden rule" that excludes public investment from the target, and Germany limits the net borrowing to the level of investment (except in times of imbalances).

Using the IMF dataset, we build—for each of the three features—two dummy variables as explained in the methodological discussion. Estimations reported in Tables A2a-b-c in the Supplementary Material can be summarized as follows.

(1) The presence of *independent fiscal bodies* that set budget assumptions or monitor the implementation of FR further supports fiscal discipline by fostering the reduction of total spending (in absolute value). In addition, while the decrease of public consumption is no longer significant in developed countries and enforced in developing countries, public investment is significantly reduced in developed countries and no longer significantly increased in developing countries, suggesting that FR with such features penalize public investment.

(2) *Fiscal responsibility laws* reduce the fiscal discipline effect of FR, and even neutralize their impact in developed countries. This finding confirms the little support emphasized by the literature for a possible disciplining effect of fiscal responsibility (see e.g. Thornton, 2009), and shows that combining them with FR is not likely to improve the fiscal disciplining effect of the latter. Besides, while they turn into not significant the effect of FR on public consumption in developed countries, fiscal responsibility laws seem to support public investment (by increasing it) in developed countries and penalize it (by preventing public investment to increase) in developing countries.

(3) Enabling features that *protect public investment* always improves the fiscal-discipline effect of FR (i.e. in all, developed, and developing countries). In addition, while pub-

lic investment is not found to be significantly affected in all and in developed countries, it significantly increases in developing countries. As a result, the response of the public investment-to-public consumption ratio is no longer significant in developed countries, while in developing countries it changes from not significant to positive (and significant) owing to the significant increase in public investment.

Finally, we investigate if having *multiple FR* matters. Since our method requires a dummy variable to discriminate between countries with and without treatment, we build the dummy variables FRNUM2 and FRNUM 3 that equal one when in a country-year observation there are at least 2 and 3 FR in place, respectively. Estimations reported in Table A2d in the Supplementary Material show that having more than one FR always reduces the magnitude of the contraction of total public spending. However, as the number of FR increases, the decrease of public consumption is weaker in developed countries, but higher in developing countries. Besides, public investment is not significantly affected in the former, but increases in the latter group of countries. As a result, regarding the composition effect, having more than one FR increases the magnitude of the public investment-to-public consumption ratio in developing countries but has no significant effect on this ratio in developed countries. In a nutshell, while more FR reduce fiscal discipline in both developed and developing countries, they are equally found to increase public investment in the latter group of countries.

7.3 Features of each type of fiscal rule

We now turn to features available for each type of FR, namely monitoring outside the government, formal enforcement procedures, and well-defined escape clauses. Aside from being monitored, FR are subject sometimes to formal enforcement procedures that usually involve close monitoring of adjustment measures, automatic tightening of the targets affecting future budgets, and even correcting actions, with the goal of preventing governments' future reputational costs (Schaechter et al., 2012). Moreover, in search for more flexibility, some countries adopted well-defined escape clauses with the goal of managing unexpected events (Eyraud et al., 2018). Such escape clauses should be seen as a combination between two dimensions. On the hand, they allow countries to overlook (i.e. deviate) from the constraints imposed by the FR under such unexpected events. However, on the other hand, they allow to do so under very particular conditions, which imply clear procedures when the country could break the rule and when to return to the rule; this may improve the credibility of the FR itself—and hence the name *well-defined* escape clauses. These two dimensions may influence in a rather opposite way the governments' behavior in terms of public spending in the presence of FR with escape clauses.

Using the IMF's database, we compute two dummy variables for each of the three FR features and each of the three types of FR, namely ER, DR, and BBR. Estimations in Tables

3a-b-c in the Supplementary Material can be summarized as follows.

(1) The presence of *monitoring institutions outside the government* is mostly unimportant for the effect of ER, except for a significant contraction of public consumption in all and in developed countries. On the contrary, monitoring enforces the fiscal discipline-impact of DR and BBR by contributing to a stronger decrease of total public spending (in absolute value). While the contraction of public consumption is equally almost always stronger, monitoring has mixed effects on public investment: it may reduce the significance or the magnitude of the effect of some FR, but also turn the effect of some FR (i.e. DR and BBR) from not significant into positive in developing countries.

(2) The effect of *formal enforcement procedures* on total public spending and public consumption is mixed, as it strongly depends upon the type of FR. Such procedures support fiscal discipline when combined with ER and BBR, but the opposite is found for DR. In addition, while public investment is protected and even sometimes increased by ER combined with formal enforcement procedures, the opposite is found for DR (except for a significant increase in developed countries).

(3) Lastly, *well-defined escape clauses* yield opposite effects depending on both the type of FR and the group of countries. Escape clauses mostly reduce the fiscal discipline effects of BBR and DR, with reversed effects for ER. In addition, while public consumption is little affected, escape clauses notably influence the behavior of public investment. In developed countries, their presence makes ER to significantly decrease public investment, and DR and BBR to significantly increase it. However, the opposite is true in developing countries: the favorable impact of both DR and BBR on public investment becomes mostly not significant in the presence of well-defined escape clauses.

Moreover, another FR feature that may influence their effect on public spending is their statutory or *legal basis*. According to the IMF data, FR may have five types of legal basis, namely: political commitment, coalition agreement, statutory, international treaty, and constitutional. Related to the methodological discussion, we create two dummy variables that exploit variations in the type of the legal basis. TFRLEG2LOW equals 1 if a country presents a type of FR with what we label as a "soft" legal basis, namely political commitment or coalition agreement, and TFRLEG2HIGH equals 1 if a country presents a type of FR with what we label as a "hard" legal basis, namely statutory, international treaty, or constitutional (for each TFR=ER, DR, BBR).⁸

Evidence in Table A3d in the Supplementary Material reveals that hard legal basis seems—contrary to soft legal basis—to be an important determinant of the fiscal discipline effect of FR (except in developing countries for DR and BBR). Moreover, this is equally the

⁸We report that following the strategy used so far is not appropriate given that all FR have a form of legal basis (i.e. the first dummy would always be equal to zero).

case for the decrease in public consumption (except in developing countries for BBR). Lastly, contrary to its impact when combined with ER, hard legal basis protects public investment following the adoption of DR and BBR, and even—against the negative effect observed for soft legal basis—increases it in developing countries.

Finally, we look at the international dimension of FR, by distinguishing between *supranational* FR (SFR), *national* FR (NFR), and *both* supranational and national FR (BFR). Using disaggregated data on each type of FR (ER, DR, and BBR) from the IMF database, estimations reported in Table A3e in the Supplementary Material illustrate the following.⁹ Although SFR and NFR mostly significantly reduce total spending, the former outperform the latter (8 out of 9 versus only 4 out of 8 significant coefficients). However, while SFR robustly reduce public consumption, NFR—both alone and when combined with SFR—trigger a slighter reduction of public consumption. Moreover, public investment is significantly reduced in developing countries by BFR irrespective of their type (namely, ER, DR, or BBR), and by ER that are both national and supranational irrespective of the group of countries (namely, all, developed, or developing). On the contrary, all types of SFR (namely, ER, DR, and BBR) significantly improve public investment in developing countries.

7.4 Features specific only to a type of fiscal rule

A particular feature of balanced-budget rules (BBR) is the fact that they can be expressed in *cyclically-adjusted terms* (or over the cycle) with the aim of combining the sustainability objective with the flexibility needed to face economic shocks. Using IMF data, we construct the two dummy variables related to BBR, as explained in the methodological section.

Estimations in Table A4a in the Supplementary Material show that the presence of cyclically-adjusted terms reduces the fiscal discipline effect of BBR, particularly in developing countries. Moreover, while public consumption is little affected, public investment is protected from decreasing in developed countries but prevented from increasing in developing countries. Even if such a stabilization feature of expressing the target in cyclically-adjusted terms could provide operational guidance for governments, our results suggest that too much “sophistication” may rather complicate the implementation of the rule, by making it more difficult to be monitored and communicated especially in countries with limited technical proficiency of the institutions responsible for policy implementation.

Finally, we look at *multi-year expenditure ceilings*. According to the IMF database, such ceilings are more popular at aggregate level, but sometimes they can be applied at ministry or even line-item level. The largest majority of multi-year expenditure ceilings come together

⁹The first three lines of Table A3e recall our benchmark findings for ER, DR, and BBR. Accordingly, fiscal rules mostly reduce total public spending (the coefficient is significant and negative in 7 out of 9 cases) and public consumption (in all 9 cases), leave public investment mostly unchanged (in 7 out of 9 cases), and mostly increase the public investment-to-public consumption ratio (in 6 out of 9 cases).

with ER, namely for around 75% of observations. Consequently, after dropping observations with ceilings but not ER, we create two dummy variables related to ER following the strategy presented in the methodological section.

As a baseline, we report in Table A4b in the Supplementary Material estimations based on the modified ER dummy (*ERnew*), from which we dropped observations in which multi-year expenditure ceilings did not coexist with ER (we observe their closeness to our benchmark findings based on all ER). Turning to the main results, the presence of multi-year expenditure ceilings is an important driver of the lack of significant effect of ER on total spending in all and developed countries (and trigger a reduction of this effect in developing countries). In addition, while findings for public consumption are comparable with those for total spending, public investment seems to benefit from the presence of multi-year expenditure ceilings: ER either no longer significantly reduce public investment (in developed countries) or significantly increase it (in developing countries).

7.5 Summary of the results

We can summarize the findings of this section as follows. First, by further reducing total spending, some FR features further support the fiscal discipline effect of FR, such as independent fiscal bodies, investment-friendly FR, supranational FR, or in most cases monitoring outside the government and a "hard" legal basis. On the contrary, other features weaken the fiscal discipline effect of FR, such as fiscal responsibility laws, a higher number of FR, national FR, or in most cases a "soft" legal basis; and also cyclically-adjusted BBR and expenditure ceilings for ER. Between them, some features enforce or weaken the fiscal discipline effects of FR depending on the type of FR, such as formal enforcement procedures or escape clauses.

Second, while the response of public consumption is comparable to that of total spending (although some differences can arise between developed and developing countries), the impact of most FR features on public investment is mixed. Opposite (in terms of significance or sign) responses of public investment are observed in developed versus developing countries, or across various types of FR for some features e.g. fiscal responsibility laws, supranational and national FR, monitoring outside the government, formal enforcement procedures, legal basis, or escape clauses. However, some features have more clear-cut effects. The presence of independent fiscal bodies (in developed countries) or a combination of both national and supranational FR (in developing countries) is detrimental for public investment. On the contrary, a higher number of FR, investment-friendly FR, and multi-year expenditure ceilings on ER are beneficial for public investment, as their presence either makes public investment to no longer significantly decrease (mostly in developed countries) or to significantly increase (mostly in developing countries).

These findings—mostly in line with hypotheses **H1** and **H2**—reveal that while the FR

features mainly determine the *magnitude* of the contraction of total spending and public consumption, they often determine the *significance* (and sometimes even the sign) of the change of public investment, thereby strongly affecting the significance of the public investment-to-public consumption ratio (i.e. the composition effect, hypothesis **H3**).

8 Concluding remarks

In this paper we investigated the way FR shape governments' spending behavior. Our main findings are that FR significantly reduce total spending and public consumption, leave public investment mostly unaffected, and increase the public investment-to-public consumption ratio (i.e. a composition effect).

Moreover, the strength and the magnitude of these effects were found to vary both with the type of FR and countries' level of economic development. Regarding the former, DR and BBR—but not ER—significantly reduce total public spending. Regarding the latter, a positive and strongly-significant composition effect is found only in developing countries. When combining them, ER reduce total spending in developing but not in developed countries, while DR and BBR increase public investment in developing but not in developed countries.

Lastly, our analysis provided a more detailed perspective by looking at the various FR features. In particular, while some features are found to further support the fiscal discipline effects of FR, others were shown to weaken and even cancel it. In the same vein, only some FR features are always detrimental or beneficial to public investment—in the latter case by either avoiding its decrease or triggering its significant increase.

By providing a systematic analysis of how FR shape public spending, our contribution can stimulate future work on FR. First, by suggesting that FR features can have contradicting fiscal consequences in terms of e.g. fiscal discipline or public investment, it can motivate more research on the optimal design of FR. Second, since different types of public spending—particularly public consumption and public investment—can have different effects on most macroeconomic outcomes (economic growth and inequality being first-order handful examples), our work may help clarifying the channels through which FR may exert such macroeconomic side-effects. Such issues are expected to receive major attention from researchers and policymakers in the post-Covid times.

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