

Growth-friendly Fiscal Rules?

Safeguarding Public Investment from
Budget Cuts through Fiscal Rule Design

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Inter-American Development Bank
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Growth-friendly Fiscal Rules? Safeguarding Public Investment from Budget Cuts through Fiscal Rule Design*

Martín Ardanaz Eduardo Cavallo Alejandro Izquierdo Jorge Puig

Abstract

We show that some types of fiscal rules can mitigate the well-known procyclical bias in public capital expenditures. Past research has found that fiscal adjustment episodes coincide with large public investment cuts, a pattern we also document in a sample of 75 advanced and emerging economies during 1990-2018. However, we find that the behavior of public investment during fiscal consolidations differs significantly depending on fiscal rule design. Fiscal rules can be *flexible*, meaning that they include mechanisms to accommodate exogenous shocks (e.g., cyclically adjusted fiscal targets, well-defined escape clauses, and differential treatment of investment expenditures) or *rigid*, meaning they establish numerical limits on fiscal aggregates without taking into account flexible features. We find that in countries with either no fiscal rule or with a rigid fiscal rule, a fiscal consolidation of at least 2 percent of GDP is associated with an average 10 percent reduction in public investment. Under flexible fiscal rules, the negative effect of fiscal adjustments on public investment vanishes. These results hold after controlling for possible endogeneity bias in the estimations. We show that by reducing procyclical biases in public investment, flexible fiscal rules can add a growth-enhancing dimension to fiscal sustainability concerns that have typically been the focus of fiscal rules in the past.

JEL CODES: E32, E60, H12, H50, H54

KEYWORDS: fiscal rules, public investment, fiscal consolidations, spending cyclicalities

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1 Introduction

There is consensus in the economic literature about the growth-enhancing potential of public investment, especially during economic downturns (Abiad, Furceri, and Topalova, 2016), when investment efficiency is high (Furceri and Li, 2017), and when the initial stock of public capital is low (Izquierdo, Lama, Medina, et al., 2018). Building up a country’s public capital stock can increase private investment and productivity.¹ Yet, despite its growth-boosting potential, the literature has shown that when countries undertake fiscal adjustments, public investment cuts usually take a disproportionate share of the adjustment. This has been shown to be a common behavior across countries that is particularly strong among emerging economies (Easterly and Serven, 2003; Serven, 2007). This behavior in turn has been attributed to the fact that capital expenditure cuts may prove to be more politically palatable than cuts in current expenditures (Ardanaz and Izquierdo, 2017; Arezki and Ismail, 2013). In a context of sizable infrastructure gaps across emerging economies (McKinsey Global Institute, 2016), designing tools to protect productive public investment during fiscal adjustment periods is a relevant and timely policy issue.

Within the policy toolkit, rules-based fiscal frameworks have traditionally been under scrutiny for unintentionally encouraging fiscal procyclicality (Alesina and Bayouni, 1996; Clemens and Miran, 2012; Fatas and Mihov, 2006) and large cuts in public investment (Blanchard and Giavazzi, 2004). This is so because pressure to comply with aggregate numerical targets provides incentives for policymakers to reallocate spending away from spending items with longer-term benefits (Beetsma and Debrun, 2007; Peletier, Dur, and Swank, 1999). In the language of optimal fiscal rule theory, higher commitment to fiscal discipline, in the form of a fiscal rule, usually comes at the expense of lower adaptability to shocks, including less responsive public good provision in the short-run (Azzimonti, Battaglini, and Coate, 2016), such as, the over-compression of public investment during fiscal consolidations. However, this need not be the case in practice.

In fact, there is great variation in fiscal rule design around the world (Eyraud, Debrun, et al., 2018; Schaechter, Kinda, and Budina, et al., 2012; IMF, 2009). In response to concerns about the lack of adaptability to shocks and investment compression, countries have been incorporating flexible features in their fiscal frameworks, such as cyclically adjusted fiscal targets, well-defined escape clauses in the case of unanticipated shocks,² and investment-friendly provisions, which are

¹However, distortions in the public investment management process may generate countervailing (crowding out) effects (Cavallo and Daude, 2011).

²These include (i) a very limited range of factors that allow such escape clauses to be triggered in legislation, (ii)

rules that exclude capital expenditures from the numerical targets imposed on fiscal aggregates (Guerguil, Mandon, and Tapsoba, 2017; Schaechter et al., 2012). Figure 1 shows that these types of rules have become increasingly popular around the world. While by 1995 there were less than 15 countries that had adopted at least one such flexible feature, by 2015 the figure increased to 52 countries. By then, 57 percent of countries that had implemented a fiscal rule had adopted at least one flexible feature, and oftentimes more than one such feature at the same time (Figure 2). For example, 60 percent of countries with fiscal rules that incorporate escape clauses also have either investment-friendly provisions or cyclically adjusted targets, or both.

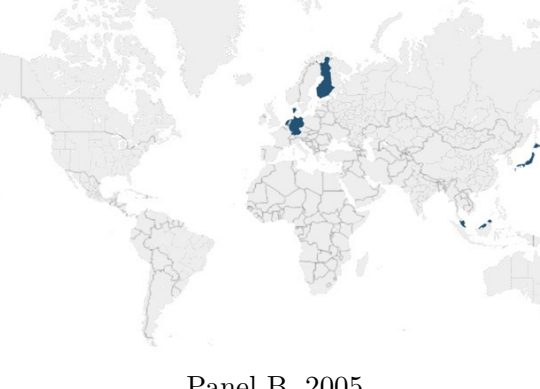
This paper explores if such flexibility mechanisms have been effective at safeguarding public investment from budget cuts. The empirical exercises are undertaken using a sample of 75 advanced and developing countries during 1990-2018. Results show that the response of public investment during fiscal adjustment episodes differs significantly depending on fiscal rule design. In countries without flexible fiscal rules, a fiscal consolidation episode equivalent to at least 2 percent of GDP is associated with an average 10 percent reduction in capital expenditures. However, in countries where the fiscal rule includes flexibility mechanisms, the ensuing decline in investment is less than 2 percent, and not statistically significant. These results are robust to a battery of sensitivity analyses and hold after controlling for possible endogeneity in estimations. Moreover, we show that flexibility features contribute to make public investment less procyclical. Finally, flexibility mechanisms do not seem to compromise a fiscal rules' sustainability objective: we find that flexible rules are as effective as any other typical rule in reducing the probability of a debt crisis.

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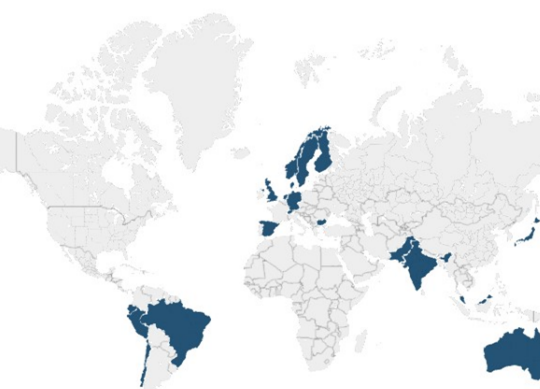
The remainder of the paper is organized as follows. Section 2 reviews previous research on fiscal rules and identifies our contribution to the literature. Section 3 presents the data and describes the empirical strategy. Sections 4 reports the main results. Sections 5 and 6 provide sensitivity analyses. Section 7 explores a possible mechanism linking fiscal rule design to improved public investment management over the business cycle. Section 8 explores whether there are trade-offs between the ability of fiscal rules to protect public investment and ensure fiscal sustainability. Section 9 concludes by discussing policy implications and avenues for future research.

clear guidelines on the interpretation and determination of events (including voting rules), and (iii) specification of the path back to the rule and treatment of accumulated deviations (see IMF, 2009).


Panel A. 1995



Panel B. 2005



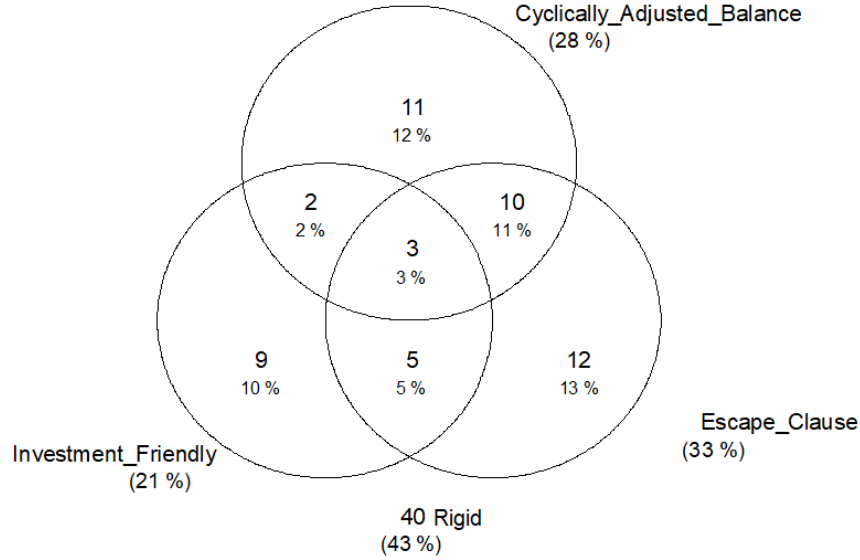
Panel C. 2015



The figure consists of three world maps, each showing the distribution of high GDP per capita (dark blue) across the globe for a specific year. The maps are arranged vertically, labeled Panel A, Panel B, and Panel C. Panel A (1995) shows high GDP per capita in Scandinavia (Norway, Sweden, Finland) and Japan. Panel B (2005) shows high GDP per capita in Scandinavia, Japan, India, and Australia. Panel C (2015) shows high GDP per capita in Scandinavia, Japan, India, Australia, and Russia. The maps use a light gray background for landmasses and white for oceans, with dark blue highlighting the high GDP per capita regions. The maps are centered on the Atlantic Ocean, showing the Americas on the left and Europe/Africa/Asia/Australia on the right.

4

Figure 2: Overlaps between Flexibility Features, 2015



Source: Authors' elaboration based on IMF fiscal rules dataset (IMF, 2017).

2 Related Literature

There is a vast theoretical and empirical literature studying the effects of budget institutions on fiscal performance.³ The theoretical literature on optimal design of fiscal rules discusses the benefits and costs of rules-based fiscal frameworks, with a focus on the trade-off between commitment versus flexibility (Amador, Werning, and Angeletos, 2006; Azzimonti et al., 2016; Halac and Yared, 2014).⁴ On the one hand, **fiscal rules act as a commitment device to constrain excessive deficit accumulation arising from distorted political incentives, while on the other, rules reduce the scope for adjusting policy to unexpected shocks.**⁵

³Budget institutions affect fiscal policy outcomes by imposing restrictions on the results of the budget process (fiscal or numerical rules), by distributing agenda power and responsibilities among the various actors that participate in budget negotiations (procedural rules), or by increasing access to and quality of information (transparency rules). See Alesina and Perotti (1999) and von Hagen and Harden (1995) for seminal references. In this paper, we concentrate on numerical fiscal rules.

⁴In addition to flexibility and commitment, the international experience with fiscal rules suggests an additional desirable feature: simplicity. For complications in striving the right balance between such properties in practice, see Eyraud et al. (2018) and Debrun and Jonug (2018).

⁵Using subnational level data across the United States, Fatas and Mihov (2006) provide evidence that fiscal rules, even though they limit the ability to react to changes in economic conditions, are also useful in restricting discretionary policy changes.

Theoretical papers usually abstract from discussing the effects of fiscal rules on the behavior of specific expenditure categories. An exception is Peletier et al. (1999). The paper draws on Alesina and Tabellini’s (1990) seminal political economy model of budget deficits⁶ to assess the implications of balanced-budget rules on public investment outcomes; it shows that a balanced-budget rule can coexist with suboptimal levels of public investment. In a similar context, Basetto and Sargent (2006) assess the potential efficiency gains of “golden rules,” namely a type of balanced-budget rule that allows deficits to finance public investment but not current expenditures.

The empirical literature is mostly concentrated on the impacts of fiscal rules on aggregate level fiscal outcomes, such as the fiscal balance, public debt, or the size of government (Asatryan, Castellon, and Stratmann, 2018; Heinemann, Moessinger, and Yeter, 2018). More recently, the literature has turned to exploit variation in fiscal rule design (Caselli and Reynaud, 2019; IMF, 2009) to explain other dimensions of fiscal performance, such as procyclicality. For example, Bova, Carcenac, and Guerguil (2014) focus on so-called second-generation fiscal rules (e.g., rules that use cyclically adjusted fiscal targets or well-defined escape clauses), finding that these have **contributed to less procyclicality in the developing world**. Based on an index of fiscal rule strength, Bergman and Hutchison (2015) find conditional relationships between fiscal rules, government efficiency, and the degree of procyclicality of total expenditures, and Guerguil et al. (2017) show how different flexible features affect the cyclical behavior of public spending.

There is a limited number of empirical papers on the effects of fiscal rules on public investment outcomes, and they are mostly OECD-based. Such work examines the pros and cons of the so-called golden rule. For example, Blanchard and Giavazzi (2004) show that reformulating the Stability and Growth Pact in terms of a golden rule would allow European Union member countries to increase infrastructure investment without violating the deficit limits. However, Balassone and Franco (2000) suggest golden rules provide leeway for opportunistic politicians to engage in creative accounting, namely simply reporting what is really current spending as spending on infrastructure (Milesi-Ferreti, 2003).

This paper contributes to the literature on fiscal rules in four ways. First, it incorporates the behavior of public investment with the set of fiscal policy outcomes considered. Second, it exploits changes in fiscal rule design over time and across countries by distinguishing between flexible and rigid fiscal rules. Third, it explores the mechanism through which flexibility features affect the cyclical properties of public investment. Finally, it contributes to debates about the

⁶In the Alesina and Tabellini (1990) model, electoral uncertainty over the identity of future majorities leads the current median voter to run excessive deficits.

general equilibrium effects of fiscal rules by analyzing the implications of fiscal rule design in terms of the commitment versus flexibility trade-off surrounding fiscal policymaking.

3 Empirical Strategy and Data

The way flexible fiscal rules affect changes in public investment is estimated using the following empirical specification:

$$\Delta G_{i,t}^{PI} = \alpha_i + \phi_t + \beta_{flxr} FLXR_{i,t} + \beta_{fc} FC_{i,t} + \beta_{fcflxr} FC_{i,t} * FLXR_{i,t} + \theta X_{i,t} + \mu_{i,t} \quad (1)$$

where $G_{i,t}^{PI}$ is real public investment in country i at year t ; $FLXR_{i,t}$ is a dummy equaling 1 if a flexible rule is in place at time t and 0 otherwise; $FC_{i,t}$ is a dummy variable that equals 1 when country i has in place a fiscal consolidation in year t and 0 otherwise; $X_{i,t}$ is a vector of control variables, including population and the GDP growth rate (lagged one period to reduce endogeneity concerns), and the debt-to-GDP level; α_i are country fixed effects; and ϕ_t are time fixed effects.

Following Guerguil et al. (2017), we define a flexible fiscal rule as one with at least one of three features present: (i) provisions that exclude public investment from the perimeter of the rule; (ii) the rule includes cyclically adjusted fiscal targets; or (iii) the rule contains escape clauses to accommodate exogenous shocks of various sorts, such as natural disasters. In contrast, a fiscal rule that establishes numerical limits on fiscal targets but lacks flexible features is considered a rigid rule. In the case of fiscal consolidation episodes, we follow Alesina and Ardagna (2013) in defining a fiscal consolidation as a two-year period in which the cyclically adjusted primary balance-to-GDP ratio improves each year and the cumulative improvement is at least 2 percentage points of GDP.

The data covers 75 countries, spanning different regions and levels of economic development over the period 1990-2018. Public investment, cyclically adjusted primary balance, and control variables were obtained from the World Economic Outlook (WEO) dataset (October 2018). Data on fiscal rules was drawn from the IMF fiscal rules dataset (IMF, 2017).

There are 299 episodes of fiscal consolidations between 1990 and 2018 in the sample, of which approximately 60 percent accrue in developing economies (Figure A1). As shown by Table 1, the unconditional likelihood of a fiscal consolidation episode is larger in countries with fiscal rules (181 cases) than in countries without them (118 cases), which is not surprising considering that fiscal rules impose restrictions on fiscal outcomes. The median size of public investment cuts during fiscal consolidations is similar in countries with fiscal rules (-2.5 percent of GDP) and

without them (-3 percent of GDP). However, not all types of fiscal rules have equal impacts: the median drop in public investment is smaller in countries with flexible fiscal rules (-0.4 percent of GDP) than in countries with rigid fiscal rules (-4.6 percent of GDP). We probe deeper into this stylized fact through the regression analysis in the next section.

Table 1: Public Investment Growth Rates during Fiscal Consolidations Episodes

	All episodes	Episodes with fiscal rules		Episodes w/o fiscal rules
		Growth rate public investment		
Median	-2.6%	-2.5%		-3.0%
N	299	181		118
		With flexible	Without flexible	
		features	features	
Median		-0.4%	-4.6%	
N		102	79	

Source: Authors' elaboration based on WEO-IMF.

4 Results

Table 2 shows the results from the specification in Equation 1. Column 1 shows that public investment falls close to 11 percent during fiscal consolidations. This drop in public investment is reduced to 10 percent if control variables are introduced (Column 2). However, the size and sign of the interaction term suggest that flexible rules mitigate the negative effects of fiscal consolidation on public investment behavior. According to the marginal effects from Column 2, public investment falls by 1.8 percent during fiscal consolidations in countries with flexible fiscal rules, however such estimated effect is not statistically different from zero (Figure 3, panel A).

In our baseline definition, countries without a flexible fiscal rule (FLXR=0) include countries without fiscal rules and countries with rigid rules. Columns 3 and 4 separate these cases into two different default categories. Results show that public investment drops by 10.7 percent following a fiscal consolidation in countries with rigid rules and by 9.5 percent following a fiscal consolidation in countries without rules. In both cases, however, the fall in public investment is much less severe and not statistically significant in countries with flexible fiscal rules (see Figure 3, panels B and C).

Is it the *design* of the fiscal rule or the presence of a fiscal rule *per se* that is driving our

results? Column 5 shows that introducing any type of fiscal rule does not help to protect public investment. In this specification we define any type of fiscal rule with a dummy equal to 1 if a numerical constraint is imposed on any fiscal aggregate at time t and 0 otherwise. In the presence of fiscal rules, public investment falls by 5.6 percent (se=1.6 percent), and this effect cannot be distinguished from a situation without fiscal rules (see Figure 3, panel D).

Finally, Column 6 explores whether flexible fiscal rules are useful at protecting current expenditures. This type of expenditure is typically less prone to cuts during consolidation, as there are political economy pressures that naturally protect it, such as unions pressing for no cuts in either wages or employment, and pensioners pushing to keep their purchasing power (see Ardanaz and Izquierdo [2017] for asymmetries in the treatment of current vis-à-vis capital expenditures across different stages of the business cycle). This natural protection argument is validated by the fact that current spending cuts are much lower during consolidation periods (3.6 percent, on average), and that they do not vary as dramatically as cuts in capital expenditures in the presence of a flexible fiscal rule (see Figure 3, panel E). The bottom line is that fiscal rules that include flexibility features are useful to protect public investment from budget cuts during fiscal consolidations. This has the corollary that the design of fiscal rules can affect the growth-friendliness of fiscal adjustment strategies, provided public investment is productive.

Table 2: Baseline Panel Regressions: Effect of Fiscal Rules on Public Investment and Current Spending Growth Rate, During Fiscal Consolidations

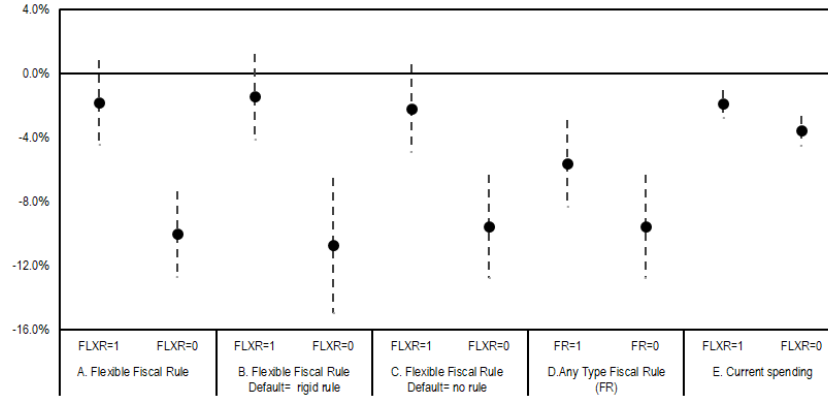
	Dependent Variable					
	Public investment					Current spending
	[1]	[2]	[3]	[4]	[5]	[6]
Fiscal consolidation (FC)	-0.107*** (0.0153)	-0.100*** (0.0164)	-0.107*** (0.0258)	-0.0951*** (0.0197)	-0.0952*** (0.0197)	-0.0356*** (0.00556)
Flexible fiscal rule (FLXR)	-0.00651 (0.0119)	-0.00817 (0.0118)	-0.0164 (0.0172)	-0.00368 (0.0158)		0.00359 (0.00500)
FC * FLXR	0.0829*** (0.0217)	0.0825*** (0.0217)				0.0169** (0.00759)
FC * FLXR (default = rigid)			0.0932*** (0.0305)			
FC * FLXR (default = none)				0.0737*** (0.0240)		
Any type of fiscal rule (FR)					-0.00441 (0.0128)	
FC * FR					0.0394 (0.0243)	
Population growth rate		1.377 (1.444)	0.569 (1.497)	2.175 (1.745)	1.483 (1.442)	0.191 (0.384)
Real GDP growth rate (t-1)		0.522** (0.251)	0.725*** (0.232)	0.569* (0.322)	0.544** (0.250)	0.303*** (0.101)
Debt to GDP		-0.00847 (0.0338)	-0.0136 (0.0344)	0.00794 (0.0381)	-0.00789 (0.0347)	-0.0476*** (0.0126)
Observations	1,530	1,507	844	1,145	1,507	1,457
R-squared	0.080	0.087	0.122	0.073	0.082	0.156
Number of countries	75	75	52	70	75	73
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Intercepts are included but not reported.

Figure 3: Marginal Effects: Effect of Fiscal Rules on Public Investment and Current Spending Growth Rate, During Fiscal Consolidations



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).
Notes: Marginal effects with 90 percent confidence interval (dashed line).

To study the persistence of the estimated effects, we introduce a dynamic version of our baseline specification. In particular, using the single-equation approach of Jorda (2005) and Stock and Watson (2007), we build impulse response functions (IRF) of fiscal consolidation episodes on public investment growth. The methodology consists of making linear local projections (LP) of public investment growth using lags and contemporaneous changes in the right hand side variables of the estimated equation.⁷ More specifically, the accumulated response of public investment growth at the horizon h is estimated by modifying Equation 1 as follows:

$$\Delta G_{i,t+h}^{PI} = \alpha_{i,h} + \phi_{t,h} + \beta_{flxr,h} FLXR_{i,t} + \beta_{fc,h} FC_{i,t} + \beta_{fcflxr,h} FC_{i,t} * FLXR_{i,t} + \theta_h(L)X_{i,t-1} + \lambda_h(L)\Delta G_{i,t-1}^{PI} + \mu_{i,t,h} \quad (2)$$

In this approach, each step in the accumulated IRF is obtained from a different individual regression (Riera-Crichton, Vegh, and Vuletin, 2014). We thus obtain the IRF values directly from the $\beta_{fc,h}$ estimated coefficients. The estimated coefficients $\lambda(L)$ and $\theta(L)$ are not used to build the IRF values, however they serve as controls, “cleaning” the $\beta_{fc,h}$ from dynamic effects.

Figure 4 shows the projections six years ahead under different scenarios. Panels A and B show the estimated behavior of public investment over time in countries with flexible rules

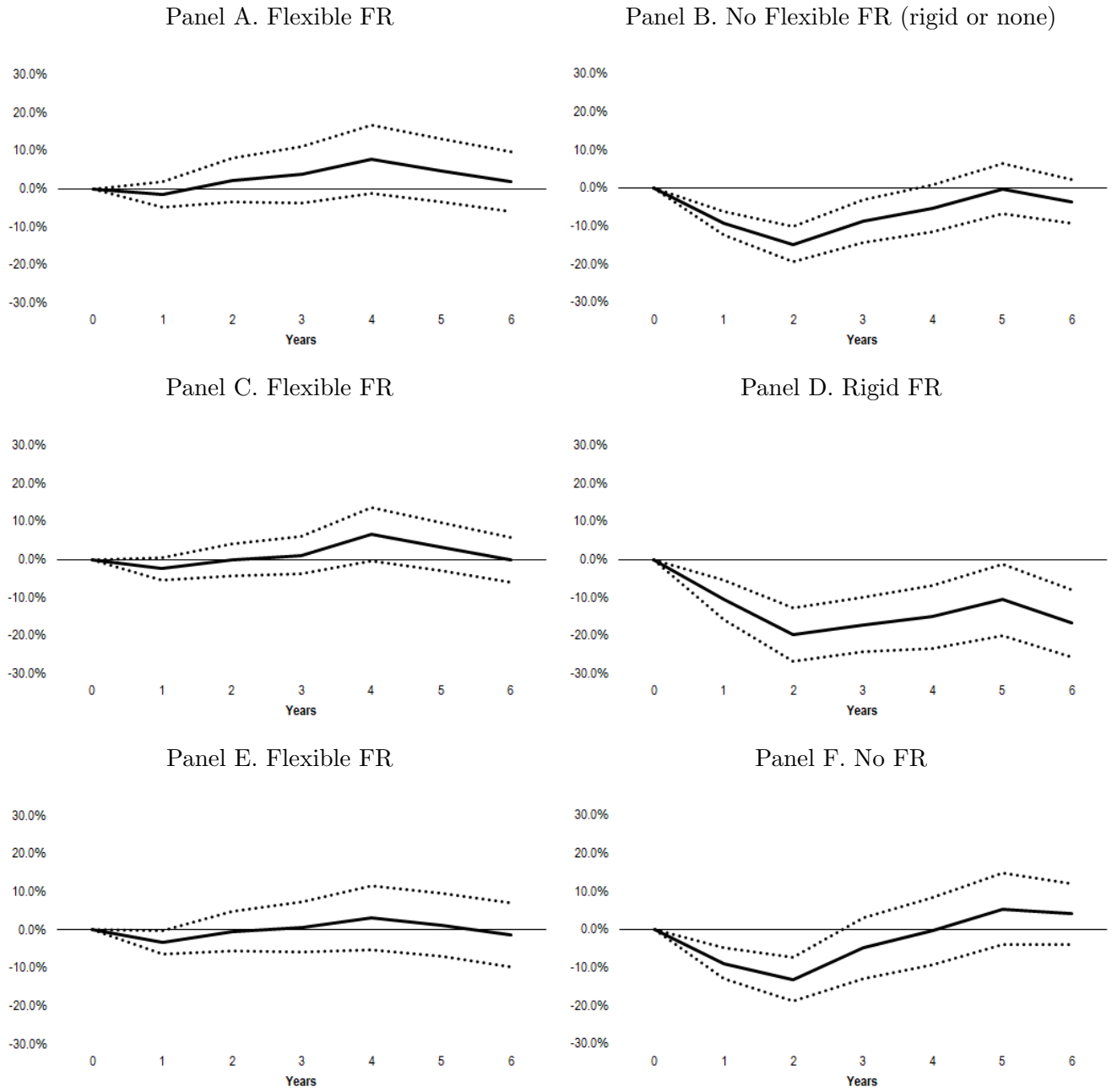
⁷As discussed in Jorda (2005), there are multiple advantages to using LP. In particular, LP (i) can be estimated by single-regression techniques (least-squares dummy variables), (ii) are more robust to potential mis-specifications, and (iii) can easily accommodate highly non-linear and flexible specifications.

versus that of countries without fiscal rules or those with rigid rules. Panels C and D compare the performance of public investment *across* fiscal rule adopters: that is, those countries with flexible rules versus those with rigid rules. Panels E and F do the same thing for the case of countries with flexible rules versus countries with no fiscal rules. In all panels, $t = 1$ is the year of the fiscal consolidation shock.

Results show that in countries with flexible fiscal rules, public investment does not fall during fiscal consolidation periods, neither in the year of consolidation nor in subsequent years. However, in countries without flexible features in their rules, or without rules, the drop in public investment is persistent. In particular, public investment falls at least during two consecutive years and does not revert back above zero in a statistically significant way.⁸

⁸In countries with flexible fiscal rules, public investment cuts are not statistically significantly different from zero, and in one case (Panel C) public investment starts *growing* after year 4 under the presence of flexible fiscal rules. Instead, public investment falls in $t=1$ and all consecutive years in the absence of flexibility mechanisms.

Figure 4: Dynamic Effect of Having a Flexible Fiscal Rule



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Marginal effects with 90 percent confidence interval (dashed line).

5 Robustness

We perform a battery of sensitivity analyses: (i) introducing additional control variables,⁹ (ii) using alternative definitions and measures of fiscal consolidations, (iii) using alternative definitions of the dependent variable, and (iv) checking whether there is a particular flexibility feature that is driving the results. Table A3 in the Appendix shows results from this robustness exercise, and Figure 5 presents the relevant marginal effects.¹⁰

In Panel A, we re-define a fiscal consolidation episode as a single year (1Y) in which the cyclically adjusted primary balance improves by at least 1.5 percent of GDP (Alesina and Ardagna, 2010).¹¹ Using this alternative definition, we find that public investment falls by 11.5 percent during fiscal consolidations in countries without fiscal rules or with rigid rules, however the negative effect is neutralized when there is a flexible fiscal rule in place (see Column 2, Table A3). Second, while keeping our baseline definition of adjustments, we use an alternative measure to identify fiscal consolidation episodes based on changes in the *observed*, rather than the cyclically adjusted, primary balance. Based on the observed balance (OB) measure available for more than 150 countries, we find that public investment contracts by 6.4 percent during fiscal consolidations in countries without flexible fiscal rules, but the adjustment is only 1.3 percent in the presence of flexibility mechanisms and is not statistically significant (see Column 3, Table A3).

Panel B shows the results for the coefficient estimates of interest after re-defining the dependent variable as the change in the public investment-to-GDP ratio from one year to the next (as opposed to the growth rate in the level of real public investment that is used in the baseline). It is estimated that a fiscal consolidation reduces the public investment-to-GDP ratio by 0.5 percentage points when there is no flexible fiscal rule in place (see Column 4, Table A3). In contrast, flexibility mechanisms help to neutralize the negative estimated effect. We also replicate the analysis using the share of public investment on total primary expenditure as a dependent variable and find that the results remain unchanged (see Column 5, Table A3).

Finally, Panel C shows the results from breaking up the flexible fiscal rules into sepa-

⁹We control for the per capita stock of public capital, old age dependency ratio, a measure of the quality of governance (control of corruption), and GDP per capita.

¹⁰We also checked whether the composition of fiscal adjustment affects our results. Results from restricting the analysis to expenditure-driven fiscal consolidations show results consistent with baseline findings (available on request).

¹¹See Yang, Fidrmuc, and Gosh (2015) for a review of different approaches to identify fiscal consolidation episodes.

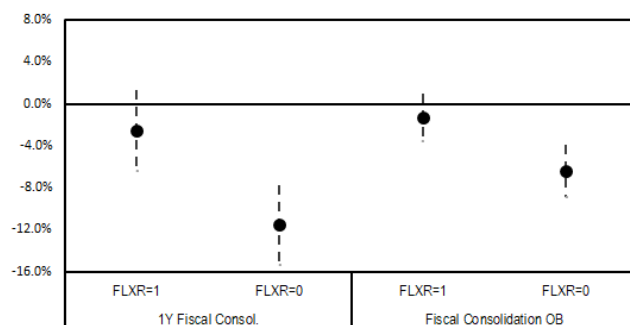
rate constituent parts. In this case, FLXR=1 considers each of the flexibility features separately. However, note that, as discussed in the *Introduction*, it is not uncommon to observe overlap in the adoption of flexibility features across countries, making it difficult to disentangle the effects of each mechanism separately.¹² In spite of this difficulty, results suggest that the three flexibility mechanisms appear to help counteract the negative effects of fiscal adjustments on public investment; however, due to the limited number of observation problem, the effects are less precisely estimated in the case of rules with escape clause provisions and balanced-budget rules with cyclically adjusted targets (see Columns 6-8, Table A3).¹³

¹²Concretely, the separation results in a substantial loss of observations across countries with more than one flexible feature. For example, in the case of investment-friendly rules, 196 observations take the value 1, and 214 become missing since they also register a rule with an escape clause or a cyclically adjusted balance rule. In the case of rules with escape clauses, observations that take the value 1 are 53 and 357 become missing. A similar loss of observations is obtained when considering only cyclically adjusted balanced-budget rules.

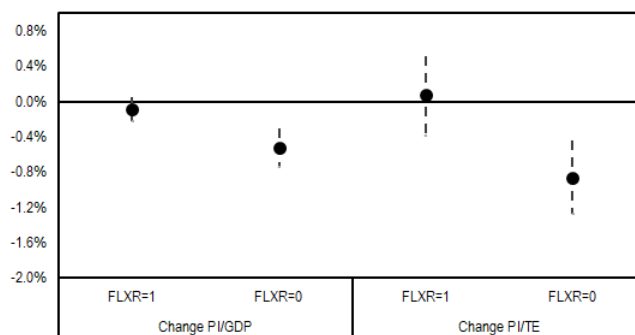
¹³We also checked whether results are affected by removing from our definition each of the three flexible features, one at a time. Results (available on request) suggest coefficients are in line but more precisely estimated than those presented in Panel C.

Figure 5: Robustness Checks: Marginal Effects Using Alternative Definitions of Independent and Dependent Variables and Considering Flexible Mechanisms Separately

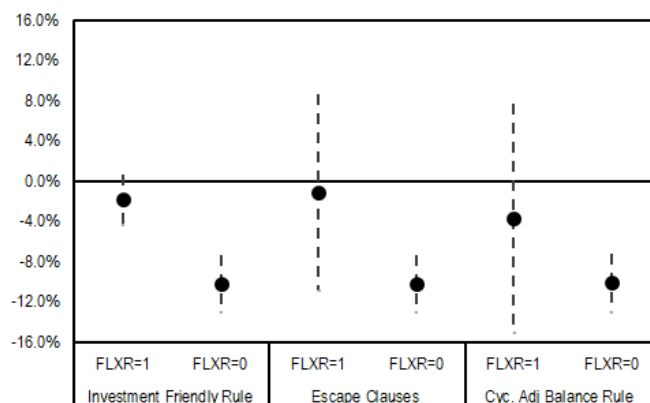
Panel A. Alternative Definition and Measure of Fiscal Consolidation



Panel B. Alternative Dependent Variables



Panel C. Considering Flexibility Features Separately



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Marginal effects computed from Table A3 (Columns 2-8), with 90 percent confidence interval (dashed line).

6 Addressing Endogeneity

Fiscal rules can be endogenous in empirical applications given politicians' incentives to change fiscal institutions in response to changes in fiscal outcomes (Asatryan et al., 2018; Badinger and Reuter, 2017; Poterba, 1994). Thus, in order to control for bias arising from possible reverse causality in this setting, we apply an instrumental variables approach.

We use a measure of institutional quality (IQ) as an instrument of flexible fiscal rules.¹⁴ IQ is potentially a good instrument because it is plausible that countries with stronger political institutions are more likely to adopt fiscal rules in the first place. IQ must satisfy the requirements of relevance and exogeneity to pass the filter of a good instrument. Relevance is tested in Table 3, Column 1. This table shows that IQ is a significant determinant of flexible fiscal rule presence in the first stage regression. The exogeneity condition cannot be tested directly; instead, we use the IQ value from 1984, which pre-dates the start of the sample by six years. A limitation of this approach is that we must exclude the country fixed effects from the regressions because the 1984 IQ value is a constant.

Table 3 presents the instrumental variable (IV) results. Column 2 reports the second-stage regression results, which show that public investment falls by more than 12 percent during fiscal consolidation episodes in countries without fiscal rules or with rigid rules. Moreover, in line with our baseline estimates, results show that having a flexible fiscal rule neutralizes the fall in public investment during fiscal consolidations. The resulting estimated marginal effect of fiscal consolidations in countries with flexible fiscal rules is not statistically different from zero (Figure 6, Panel A).

Column 3 presents the results from the exercises that use two additional instruments that have been used in the literature: proxies of government fragmentation and measures of checks and balances (Badinger and Reuter, 2017). The relevance condition is tested in Table 3, Column 3. While first-stage coefficient estimates for all the instruments have the expected signs, only the coefficient estimate of IQ is statistically significant. The exogeneity condition of the instruments in turn is targeted by using initial values that pre-date the beginning of the sample. Column 4 shows the second-stage IV regression results.¹⁵ Results show that public investment falls by 12.8

¹⁴Following Frankel, Vegh, and Vuletin (2012), we construct an index of IQ by calculating the average of four variables from the International Country Risk Guide dataset: investment profile, corruption, law and order, and bureaucratic quality.

¹⁵We cannot reject the null that FLXR can be treated as exogenous (see p-value for Wu–Hausman) in any of the specifications. The F statistic for testing weak instrument is significant at the typical 10 percent level, but is lower

percent during fiscal consolidation episodes in countries without flexible fiscal rules or with rigid rules. However, having a flexible fiscal rule neutralizes the negative effect of fiscal consolidations on public investment. The corresponding marginal effects are plotted in Figure 6, Panel B.

Table 3: IV Regressions: Effect of Fiscal Rules on Public Investment Growth Rate, During Fiscal Consolidations

	Instrumented: Flexible FR			
	IV: IQ		IV: IQ, Checks and balances and gov. fragmentation	
	First-stage flexible FR	Second-stage % change PI	First-stage flexible FR	Second-stage % change PI
	[1]	[2]	[3]	[4]
FC		-0.124*** (0.0355)		-0.128*** (0.0334)
FLXR		-0.0518* (0.0300)		-0.0440 (0.0283)
FC * FLXR		0.182** (0.0825)		0.201*** (0.0769)
Institutional quality	0.130*** (0.0394)		0.120** (0.0568)	
Institutional quality * FC	0.0121 (0.0127)		-0.0543 (0.0337)	
Government fragmentation			0.00585 (0.202)	
Checks and balances			0.0180 (0.0471)	
Government fragmentation * FC			-0.256 (0.214)	
Checks and balances * FC			0.101* (0.0509)	
Population growth rate	-2.294 (4.638)	0.372 (0.388)	-0.567 (5.545)	0.577 (0.431)
Real GDP growth rate (t-1)	-0.711 (1.015)	0.631*** (0.209)	-0.677 (0.976)	0.673*** (0.211)
Debt to GDP	-0.197 (0.151)	-0.0282*** (0.0108)	-0.157 (0.168)	-0.0254** (0.0101)
Observations	1,092	947	1,048	903
R-squared	0.225	0.128	0.231	0.137
Country fixed effect	Yes		Yes	Yes
Year dummies	Yes		Yes	Yes
Controls	Yes		Yes	Yes
Wu-Hausman (p-value)		0.493		0.720
Robust F (first stage)		3.648		2.114
Prob χ^2 F		0.034		0.072
Min. Eigenvalue stat		33.56		13.820
Sargan test (p-value)				0.857

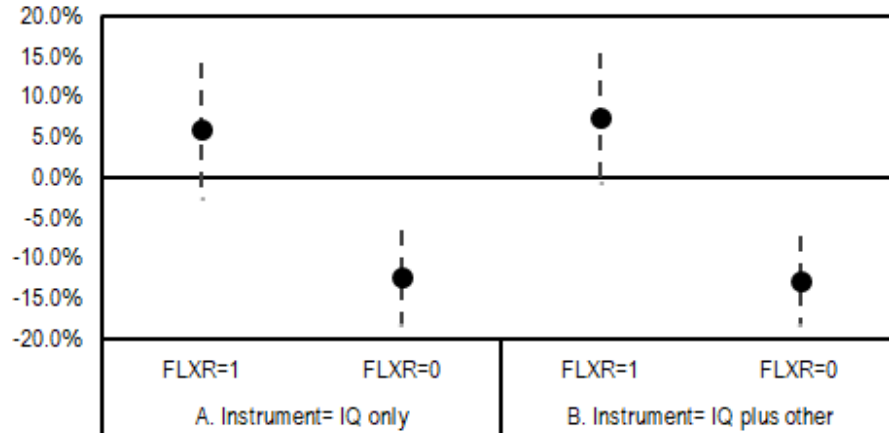
Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Intercepts are included but not reported. PI = public investment.

than 10, which is the threshold suggested by Stock, Wright, and Yogo (2002). If we are willing to accept at most a rejection rate of 15 percent of a nominal 5 percent Wald test, we can reject the null hypothesis that the instruments are weak because the Min. Eigenvalue statistic exceeds its critical value in both specifications (Stock and Yogo, 2005). In the case of the specification with several instruments, Sargan's (1958) test statistic is not significant at standard significance levels, which implies that the structural model is correctly specified.

Figure 6: Addressing Endogeneity: Marginal Effects Using Instrumental Variables



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Marginal effects computed from Table 3, Columns 2 and 4, with 90 percent confidence interval (dashed line).

7 Mechanisms: Fiscal Rules and Public Investment Procyclicality

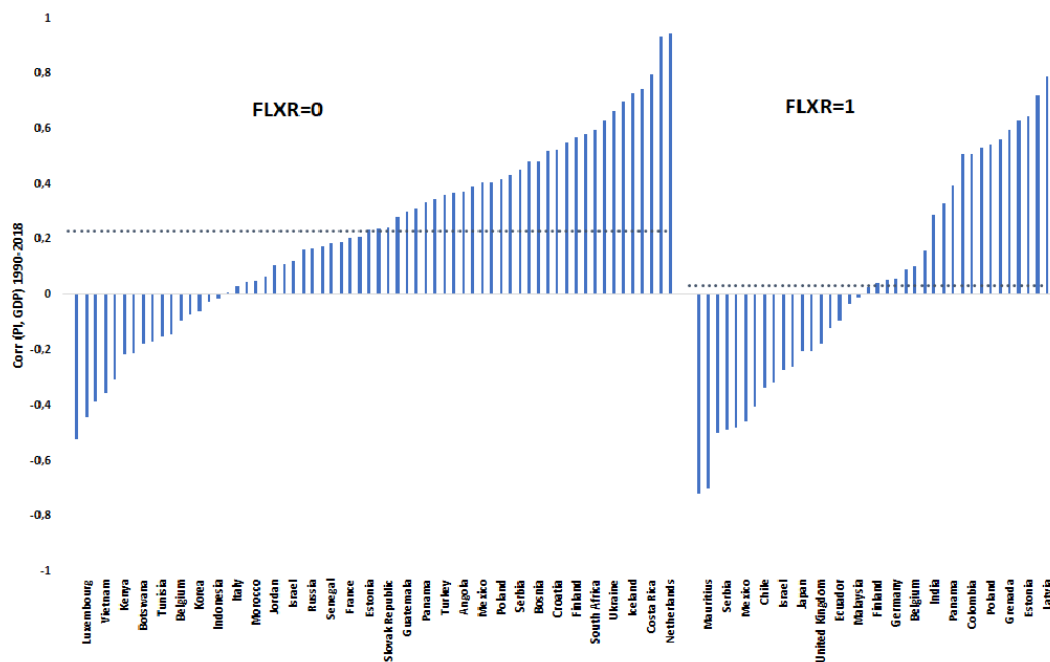
How can flexible fiscal rules help to protect public investment from budget cuts? One possibility is that such rules help to reduce the procyclicality of public investment. Consider each of the design features included in the definition of flexible rules and their implications in terms of the cyclical behavior of public spending. Rules with structural (as opposed to nominal) fiscal targets allow automatic stabilizers to operate over the business cycle. In the case of rules with escape clauses, they allow discretionary fiscal expansion in response to negative exogenous shocks. In the case of investment-friendly rules, they do not constrain public investment spending. In this section we examine the plausibility that flexible rules help to contain procyclical biases in public investment empirically. We do so while controlling for the traditional determinants of fiscal cyclicity usually discussed in the literature: limited creditworthiness (Gavin and Perotti, 1997); and political economy factors (Alesina, Campante, and Tabellini, 2008; Frankel et al., 2012).¹⁶

¹⁶The notion that flexible features affect the cyclical stance of fiscal policy was first discussed in Guerguil et al. (2017). The authors use propensity score matching techniques to estimate the effects of different fiscal rule features on public spending cyclicity. The exercise in this paper differs from Guerguil et al. (2017) in two main ways: we use panel regression techniques and we measure public investment cyclicity using alternative estimation strategies.

7.1 Cross-sectional Evidence

Following Kaminsky, Reinhart, and Vegh (2004), we measure variation in cyclicality levels across countries using the correlation coefficient between the cyclical component of output and public investment over the period 1990-2018 for each country in our sample. Figure 7 presents cyclicality coefficients by splitting the sample between countries with flexible fiscal rules (FLXR=1) and countries with either no rule or with a rigid rule (FLXR=0). The results show that public investment cyclicality is significantly lower in countries with flexible fiscal rules: the median correlation is 0.23 for countries without such features and only 0.03 for countries that include at least one flexible characteristic in their rule. Moreover, the frequency of countercyclical policy patterns is two times larger among countries with flexible rules compared to the rest: while only 25 percent of countries without flexible rules have a negative correlation between output and capital expenditures, the share is 50 percent among countries with flexible fiscal rules.

Figure 7: Country Correlations between Cyclical Components of Public Investment and GDP Conditional on Fiscal Rule Design



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Note: Dashed horizontal lines represent median levels of cyclicality in each sample.

7.2 Panel-Level Evidence

To exploit within-country variation in cyclicity levels over time, we estimate the following equation:

$$ccG_{i,t}^{PI} = \alpha_i + \phi_t + \beta_{ccY} ccY_{i,t} + \beta_{flxr} FLXR_{i,t} + \beta_{ccY flxr} ccY_{i,t} * FLXR_{i,t} + \theta X_{i,t} + \mu_{i,t} \quad (3)$$

where $ccG_{i,t}^{PI}$ and $ccY_{i,t}$ are the estimated cyclical components of public investment and output, respectively,¹⁷ $X_{i,t}$ is a vector of control variables, α_i are country fixed effects, and ϕ_t are time fixed effects. The coefficient estimate of interest, $\beta_{ccY flxr}$, is the interaction between the cycle and the flexible fiscal rule dummy. A positive sign of β_{ccY} would be consistent with a procyclical response of public investment in countries without a fiscal rule or with a rigid rule. Similarly, a negative $\beta_{ccY flxr}$ estimated coefficient would suggest that having a flexible fiscal rule reduces procyclical behavior.

We include two additional determinants of fiscal policy procyclicality that are related to borrowing constraints: the financial openness index from Chinn and Ito (2006) and the debt-to-GDP ratio. To allow for differences in the quality of governance over time, we draw on the World Bank's Governance Indicators and include a *Control of Corruption* variable, which has been found to ameliorate procyclical fiscal biases in the literature (Alesina et al., 2008).

We estimate Equation 3 using two econometric methods: Columns 1-5 in Table 4 show OLS results, and Columns 6-10 present IV estimations. The rationale for an IV strategy in this setting is that the output gap is affected by fiscal policy through the spending multiplier.¹⁸ To address this, the output gap of each country in the sample is instrumented using the export-weighted output gap of the trading partners.¹⁹ Each column reports results from variants of the regression that include the interactions sequentially. For inference, we cluster the standard errors at the level of countries.²⁰

¹⁷We use the the Hodrick-Prescott filtering technique to estimate output gaps, setting the lambda parameter to 6.25.

¹⁸The IV strategy follows Gali and Perotti (2003), Jaimovich and Panizza (2007), Lane (2003), and Lledo, Yackovlev, and Gadenne (2011), among others.

¹⁹The export-weighted output gaps are constructed using data from the Atlas of Economic complexity. See <http://atlas.cid.harvard.edu/data>.

²⁰See Table A4 (Appendix) for the first-stage regressions of IV estimates.

Table 4 shows that coefficient estimate $\beta_{ccYflxr}$ is negative, statistically significant, and economically large. In particular, **the estimated degree of procyclicality is significantly lower in countries with flexible fiscal rules**. For example, coefficient estimates from Column 1 suggest that, in the absence of flexible rules, a 1 percentage point deterioration in the output gap is associated with a decline in the cyclical component of public investment equivalent to 2.3 percentage points. However, this effect is neutralized for countries with flexible rules: the same output shock is associated with a 0.5 percentage point reduction in the cyclical component of public investment and is not statistically significant. Thus, **flexible fiscal rules allow public investment patterns to switch from procyclical to acyclical** (see Figure 8). Similar effects are obtained after accounting for possible reverse causality issues through the IV approach (Columns 6-10).²¹ Regarding the control variables, lower levels of financial openness (a proxy for credit constraints) are positively related to public investment cyclicality (Columns 2 and 5), while the effects of debt and quality of governance are less clear cut. Even after accounting for such standard determinants, fiscal rule design remains a significant predictor of cyclical behavior. This provides reinforcing evidence in favor of the role of flexible fiscal rules in protecting public investment from large budget cuts.

²¹In all IV estimations, we reject the null of no correlation in the underidentification test (Kleibergen-Paap rk LM statistic). To test weak instruments, we report the Kleibergen-Paap Wald rk F statistic. And, the critical values for the Stock and Yogo test are:: 10% = 7.03; 15% = 4.58; 20% = 3.95; 25% = 3.63. We can reject the null of weak instrument in estimations [6] and [7].

Table 4: Panel Fixed Effects Regressions between Cyclical Components of Public Investment and GDP
Conditional on Fiscal Rule Design

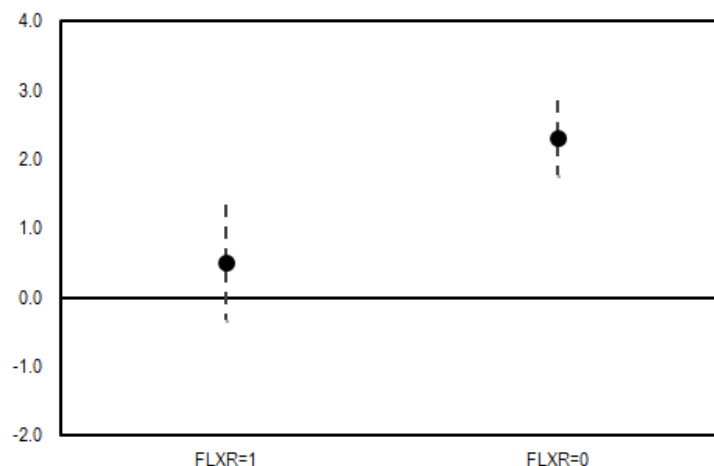
	Dependent Variable: cyclical component of public investment									
	OLS fixed effects					IV fixed effects				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Cyclical component of GDP	2.312*** (0.332)	2.616*** (0.341)	2.827*** (0.509)	2.330*** (0.390)	3.268*** (0.564)	3.789** (1.658)	4.586** (2.123)	2.563 (1.761)	3.904** (1.782)	3.443 (2.498)
FLXR	0.0157 (0.0181)	0.0143 (0.0167)	0.0179 (0.0182)	0.0241 (0.0194)	0.0183 (0.0167)	0.0188 (0.0169)	0.0189 (0.0154)	0.0204 (0.0174)	0.0300 (0.0216)	0.0236 (0.0185)
Cyclical component of GDP * FLXR	-1.809*** (0.587)	-1.456** (0.574)	-1.791*** (0.598)	-1.880** (0.758)	-1.600** (0.740)	-2.741** (1.228)	-2.196** (1.000)	-2.562* (1.458)	-2.537* (1.354)	-2.418* (1.253)
Financial openness		0.0203 (0.0230)			0.0325 (0.0280)		0.0209 (0.0238)			0.0357 (0.0297)
Cyclical component of GDP * financial openness		-0.359** (0.157)			-0.450** (0.185)		-0.577 (0.474)			-0.816 (0.632)
Debt to GDP			-0.0222 (0.0160)		-0.0397* (0.0216)			0.0711 (0.0943)		0.0854 (0.132)
Cyclical component of GDP * debt to GDP			-1.113 (0.672)		-1.448** (0.639)			3.907 (3.962)		4.661 (5.729)
Control of corruption				0.00529 (0.0378)	0.00825 (0.0339)				-0.0258 (0.0364)	-0.0401 (0.0411)
Cyclical component of GDP * control of corruption				-0.0609 (0.277)	0.383* (0.202)				-0.0315 (0.386)	0.0275 (0.958)
Observations	1,451	1,415	1,429	1,178	1,145	1,306	1,277	1,316	1,105	1,076
R-squared	0.041	0.047	0.042	0.039	0.048					
Number of countries	71	69	71	71	69	71	69	73	71	69
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Underidentification test						48.25	46.88	15.38	36.65	5.548
Chi-sq p-value						0.000	0.000	0.000	0.000	0.0185
Weak instrument test						15.92	11.97	3.526	7.392	0.876

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported.

Underidentification test: Kleibergen-Paap rk LM statistic. Weak instrument test: Kleibergen-Paap rk Wald F statistic.

Figure 8: Marginal Effects from Panel Fixed Effects Regressions between Cyclical Components of Public Investment and GDP Conditional on Fiscal Rule Design



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Marginal effects computed from Table 4, Column 1, with 90 percent confidence interval (dashed line).

8 Policy Trade-Offs? Growth Friendliness versus Fiscal Sustainability

The theoretical literature on optimal fiscal rules highlights the trade-off between commitment and flexibility. Up to this point, our analysis has focused on the implications of certain fiscal rule features on the ability to protect public investment during fiscal adjustments. To the extent that fiscal rule design can help to reduce procyclical biases in public investment, it would also enhance the quality of fiscal policy management over the business cycle, making it more growth friendly. However, does this positive feature come at the expense of reducing the effectiveness of fiscal rules in ensuring fiscal sustainability? The answer is No.

In order to show why, this section explores the relationship between fiscal rules and the frequency of sovereign debt crisis using data from Reinhart and Rogoff (2011). Following Asatryan et al. (2018), the probability of a debt crisis is modeled as a function of the presence of a fiscal rule. The innovation in this exercise is to separate between different types of rules along the flexibility versus rigidity dimension. The dependent variable is crisis events defined as periods when governments fail to meet an interest or principal payment on domestic and/or external debt.²² As in Asatryan et al. (2018), the control variables include population size, per capita

²²See Medas, Poghosyan, Xu, et al. (2018) for a broader measure of fiscal crisis.

income, the level of democracy,²³ and public debt-to-GDP ratios. Columns 1-4 in Table 5 present the results from pooled probit regressions, and Columns 5-8 introduce an IV setup in which rules are instrumented using initial institutional quality.^{24,25}

Results show that fiscal rules (FR) in general, and flexible rules in particular, are associated with a *lower* probability of debt crises. According to Columns 1-4, the magnitude of the average risk-reducing estimated effect oscillates between 10 and 13 percent. As shown by Figure 9, the marginal effects computed from the estimated coefficients for any type of fiscal rules, and for flexible fiscal rules, are of similar magnitude. This suggests that, when seen through the lens of the estimated probability of a debt crisis, flexibility does not imply that the rule yields less fiscal sustainability than standard fiscal rules.²⁶

Thus, while there may not be a significant difference between flexible and standard fiscal rules in terms of sustainability, previous results show that there is a significant difference in capital expenditure behavior. Given that flexible rules do not seem to undermine sustainability prospects (interpreted here as the probability of default) relative to standard rules but do have an advantage in terms of capital expenditure protection, they should definitely be considered a preferred option as long as other aspects of the institutional structure that ensure appropriate working of the flexible rule are in place.

²³As measured by Polity2 scores, which subtract the country's score in an "autocracy" index from its score in a "democracy" index (resulting in a range from -10 to 10).

²⁴We tried using a generalized diff-in-diff design following Equations 1 and 2 as in previous sections, but the fact that in several countries sovereign debt crises are never observed results in a significant loss of observations.

²⁵See Table A5 (Appendix) for the first-stage regressions of IV estimates.

²⁶In future research, this analysis can be expanded in several ways, such as using different measures of fiscal performance (e.g., debt levels or government size).

Table 5: Determinants of the Probability of Debt Crises

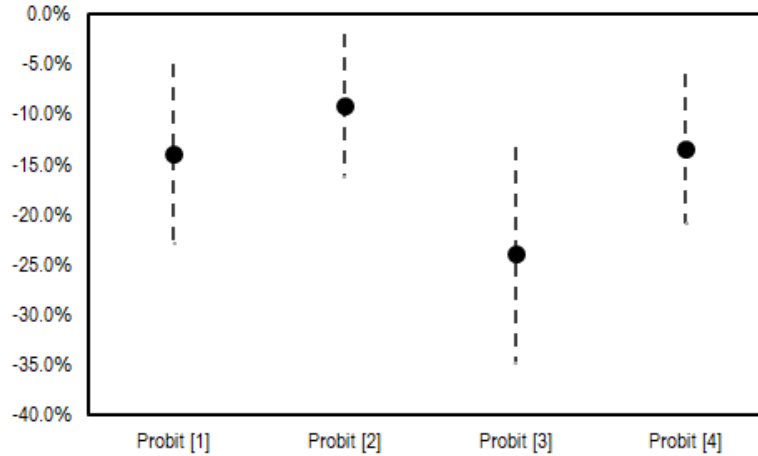
	Dependent Variable: probability of debt crisis							
	Probit				IV probit			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
FR	-0.745** (0.294)	-0.764** (0.358)			-2.420*** (0.213)	-2.320*** (0.180)		
FLXR			-1.484*** (0.423)	-1.399*** (0.491)			-2.500*** (0.226)	-2.268*** (0.268)
Real GDP per capita	-0.0263 (0.0244)	0.00460 (0.0327)	-0.0372 (0.0230)	-0.00424 (0.0326)	-0.00713 (0.0316)	0.00406 (0.0319)	-0.00398 (0.0296)	0.0172 (0.0355)
Population	-0.237** (0.115)	-0.335** (0.133)	-0.267** (0.120)	-0.386*** (0.142)	-0.141 (0.0939)	-0.187** (0.0924)	-0.101 (0.116)	-0.143 (0.131)
Polity2	-0.0560** (0.0251)	-0.0626** (0.0303)	-0.0627** (0.0247)	-0.0770*** (0.0285)	0.0349 (0.0259)	0.0428 (0.0295)	-0.0169 (0.0270)	-0.0333 (0.0310)
Debt to GDP		0.419 (0.349)		0.184 (0.326)		0.343 (0.332)		-0.599 (0.397)
Observations	1,309	1,054	1,309	1,054	979	800	979	800
Country fixed effect	No	No	No	No	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald (p value)					0.000	0.000	0.000	0.000

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Intercepts are included but not reported.

Figure 9: Marginal Effects: Probability of Having a Debt Crisis as a Function of Fiscal Rules



Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Marginal effects computed from Table 5, Columns 1-4, with 90 percent confidence interval (dashed line).

9 Conclusions

This paper has shown how certain features of fiscal rules can help safeguard public investment during fiscal consolidation periods. Further results show that introducing flexibility features does not come at the expense of making the rule less effective on the fiscal sustainability dimension. These results may have important policy implications. In recent years, across emerging economies, there is growing concern about the decline in public investment, which, on average, has fallen below 1 percent of GDP for the first time in 20 years.²⁷ At the same time, several countries have either recently introduced fiscal rules or are considering strengthening the policy management toolkit through rules-based fiscal frameworks. Including elements related to the protection of public investment in the design of these rules can add a growth-enhancing dimension to the fiscal sustainability concerns that have typically been the focus of fiscal rules in the past, since flexible rules do protect public investment during consolidation episodes.

However, reforms in rules-based fiscal frameworks aimed at safeguarding growth-friendly expenditure items should be accompanied by several safeguards. First, to ensure that additional capital expenditures effectively contribute to increasing potential GDP growth, improvements to public investment management institutions are needed in all phases of the cycle from project appraisal through selection and implementation (Gupta, Kangur, Papageorgiou, et al., 2014). Second, investment-friendly fiscal rules should mitigate opportunistic classifications of capital expen-

²⁷ *Financial Times*: Investment in emerging markets falls to historic low (May 10, 2019).

ditures (e.g., reporting what is in fact current spending as spending on infrastructure) by strengthening international transparency standards in government finance statistics. Third, strengthening medium-term fiscal frameworks would support an effective implementation of fiscal rules. Finally, enforcement and monitoring mechanisms should be in place to foster rule compliance. For instance, independent fiscal councils can verify whether rules are being complied with or provide ex-ante regular quality control to macroeconomic and fiscal assumptions underpinning the budget process. Further research on how these features interact at the country level could help advance our understanding of the general equilibrium effects of fiscal rules.

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Appendix

Table A1: List of Countries

Advanced Economies	Developing Asia	Developing Europe and Ex-USSR	Latin America and Caribbean	Middle East, North Africa and Sub-Saharan Africa
Australia	China	Bosnia	Argentina	Algeria
Austria	India	Bulgaria	Barbados	Egypt
Belgium	Indonesia	Croatia	Brazil	Jordan
Canada	Malaysia	Lithuania	Chile	Lebanon
Czech Republic	Philippines	Poland	Colombia	Morocco
Estonia	Thailand	Romania	Costa Rica	Tunisia
Finland	Vietnam	Serbia	Dominican Republ	Angola
France		Turkey	Ecuador	Botswana
Germany		Georgia	El Salvador	Kenya
Greece		Kazakhstan	Grenada	Mauritius
Hong Kong		Russia	Guatemala	Senegal
Iceland		Ukraine	Guyana	South Africa
Ireland			Mexico	
Israel			Panama	
Italy			Paraguay	
Japan			Peru	
Korea			Suriname	
Latvia			Uruguay	
Luxembourg				
Netherlands				
New Zealand				
Portugal				
Slovak Republic				
Switzerland				
United Kingdom				
United States				

Source: Authors' elaboration based on WEO-IMF country classification.

Table A2: Descriptive Statistics

	Mean	Sd	Min	10th pct	90th pct	Max	Observations	Source
Public Investment Growth Rate	0.03	0.18	-1.09	-0.15	0.21	1.75	1530	WEO-IMF, October 2018
Fiscal Consolidation (2 Year definition)	0.20	0.40	0.00	0.00	1.00	1.00	1530	WEO-IMF, October 2018
Fiscal Rule (FR)	0.55	0.50	0.00	0.00	1.00	1.00	1530	IMF Fiscal Rules Dataset
Flexible FR	0.32	0.46	0.00	0.00	1.00	1.00	1530	IMF Fiscal Rules Dataset
Other Design FR	0.13	0.33	0.00	0.00	1.00	1.00	700	IMF Fiscal Rules Dataset
Population Growth Rate	0.01	0.01	-0.06	0.00	0.02	0.05	1530	WEO-IMF, October 2018
Real GDP Growth Rate	0.03	0.03	-0.16	0.00	0.07	0.22	1530	WEO-IMF, October 2018
Debt to GDP Ratio	0.54	0.36	0.00	0.17	1.00	2.38	1508	WEO-IMF, October 2018
Current Spending Growth Rate	0.04	0.07	-0.33	-0.02	0.11	0.46	1480	WEO-IMF, October 2018
Institutional Quality	4.14	1.17	1.85	2.78	5.87	6.45	1281	International Country Risk Guide
Stock of Public Capital per Capita	13.76	10.64	0.62	2.87	28.63	57.01	1290	IMF (2015)
Old Age Dependency	17.24	8.06	4.53	7.51	27.64	45.03	1085	World Bank
Control of Corruption	0.42	0.99	-1.39	-0.73	1.94	2.46	1245	World Bank
Real GDP per Capita (log)	18.12	2.26	13.91	15.89	22.07	24.39	1530	WEO-IMF, October 2018
Fiscal Consolidation (1 Year Definition)	0.15	0.36	0.00	0.00	1.00	1.00	1530	WEO-IMF, October 2018
Fiscal Consolidation OB	0.22	0.416	0.00	0.00	1.00	1.00	1520	WEO-IMF, October 2019
Change in Share of Public Investment over GDP from t-1 to t	0.00	0.01	-0.06	-0.01	0.01	0.06	1530	WEO-IMF, October 2018
Change in Share of Public Investment over Total Expenditure from t-1 to t	0.00	0.02	-0.17	-0.03	0.02	0.19	1480	WEO-IMF, October 2018
Government Fragmentation	0.28	0.28	0.00	0.00	0.69	0.91	1413	Database of Political Institutions IADB
Checks and Balances	3.48	1.74	1.00	1.00	5.00	18.00	1414	Database of Political Institutions IADB
Financial Openness	1.01	1.48	-1.91	-1.20	2.36	2.36	1494	Chinn-Ito Financial Openness Index
Polity2	7.04	4.62	-7.00	-2.00	10.00	10.00	1328	Center for Systemic Peace

Source: Authors' elaboration.

Table A3: Robustness of Baseline Results: Effects of Fiscal Rules on Public Investment, During Fiscal Consolidations

	Dependent Variable							
	% Change PI			Change PI/GDP	Change PI/TE	% Change PI		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
FC	-0.0941*** (0.0256)			-0.00526*** (0.00132)	-0.00859*** (0.00250)	-0.102*** (0.0170)	-0.102*** (0.0173)	-0.101*** (0.0172)
FLXR	0.0160 (0.0194)	-0.00386 (0.0126)	0.0146 (0.0128)	-0.000267 (0.000706)	-0.00112 (0.00224)			
FC * FLXR	0.0832** (0.0315)			0.00437*** (0.00165)	0.00930** (0.00375)			
Control of Corruption	0.0400 (0.0314)							
Stock of Capital per Capita	-0.0242*** (0.00522)							
Old Age Dependency	0.00603 (0.00533)							
Real GDP per Capita (log)	0.109 (0.0821)							
One-Year Fiscal Consolidation (1Y FC)		-0.115*** (0.0229)						
1Y FC * Flexible FR		0.0902*** (0.0316)						
Fiscal Consolidation Observed Balance (OB)			-0.0636*** (0.0153)					
Fiscal Consolidation OB * Flexible FR			0.0507** (0.0197)					
Investment Friendly Fiscal Rule (IFR)						0.00941 (0.0186)		
FC * IFR						0.0833*** (0.0227)		
Escape Clause (EC)							0.0210 (0.0298)	
FC * EC							0.0911 (0.0627)	
Cyc. Adj. Balance (CAB)								-0.00855 (0.0231)
FC * CAB								0.0648 (0.0697)
Population Growth Rate	-1.002 (1.826)	1.356 (1.426)	0.165 (0.396)	-0.0288 (0.0473)	-0.0837 (0.126)	1.324 (1.518)	0.880 (1.651)	0.994 (1.673)
Real GDP Growth Rate (t-1)	0.132 (0.268)	0.556** (0.245)	0.141 (0.314)	0.00399 (0.0134)	0.0187 (0.0374)	0.403 (0.278)	0.372 (0.308)	0.429 (0.304)
Debt to GDP	-0.0712 (0.0685)	-0.0121 (0.0337)	-0.0472** (0.0192)	0.000186 (0.00166)	0.00113 (0.00627)	-0.00852 (0.0355)	-0.0447 (0.0431)	-0.0309 (0.0412)
Observations	858	1,507	3,319	1,524	1,474	1,293	1,150	1,149
R-squared	0.126	0.094	0.033	0.072	0.032	0.095	0.105	0.113
Number of countries	72	75	156	75	73	75	71	71
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Intercepts are included but not reported. PI/TE = public investment to total primary expenditure.

Table A4: First-Stage Regression of Instrumental Variable Regressions between Cyclical Components (cyc. comp.) of Public Investment and GDP Conditional on Fiscal Rule Design (refer to Table 4 in the main text)

	First-Stage Regression						
	Column 6 at Table 4		Column 10 at Table 4				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Cyc. Comp. of GDP	Cyc. Comp. of GDP*FLXR	Cyc. Comp. of GDP	Cyc. Comp. of GDP*FLXR	Cyc. Comp. of GDP*Financial Openness	Cyc. Comp. of GDP*Debt to GDP	Cyc. Comp. of GDP*Control of Corruption
TP Cyc. Comp.	0.988*** (0.277)	0.0361 (0.0428)	1.401*** (0.316)	0.00481 (0.0513)	0.728 (0.622)	0.181 (0.210)	0.0978 (0.240)
TP Cyc. Comp.*FLXR	0.135 (0.150)	1.137*** (0.103)	-0.0940 (0.170)	1.094*** (0.0881)	-0.0194 (0.299)	0.0180 (0.105)	-0.0867 (0.169)
TP Cyc. Comp.*Financial openness			0.0615 (0.0788)	0.0115 (0.00908)	1.143*** (0.169)	-0.00482 (0.0270)	-0.0407 (0.0744)
TP Cyc. Comp.*Control of Corruption			0.151* (0.0874)	-0.00177 (0.0332)	0.0886 (0.147)	0.155*** (0.0540)	1.149*** (0.145)
TP Cyc. Comp.*Debt to GDP			-0.971*** (0.311)	-0.0151 (0.0608)	-1.507** (0.610)	0.221 (0.339)	0.125 (0.266)
Financial Openness			-0.00116 (0.000747)	-8.44e-05 (0.000377)	0.000223 (0.00117)	-0.000704 (0.000698)	8.38e-05 (0.000911)
Control of Corruption			0.00535* (0.00298)	0.000618 (0.000772)	0.00466 (0.00543)	0.00450** (0.00198)	0.00406 (0.00294)
Debt to GDP			-0.0256*** (0.00474)	-0.00247** (0.000976)	-0.0316*** (0.0112)	-0.0226*** (0.00469)	-0.00725 (0.00735)
FLXR	-0.000788 (0.00136)	-0.000414 (0.000820)	-0.00173 (0.00150)	-0.00133 (0.000903)	-0.00273 (0.00339)	-0.000313 (0.00118)	-0.000126 (0.00111)
Observations	1,306	1,306	1,076	1,076	1,076	1,076	1,076
R-squared	0.382	0.554	0.471	0.588	0.489	0.320	0.510
Number of countries	71	71	69	69	69	69	69
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported. TP = Trading partners. First stages associated with Columns 7 -9 are not reported for brevity.

Table A5: First-Stage Regression of Instrumental Variable Regressions between Probability of Having a Debt Crisis and Fiscal Rule Design (refer to Table 5 in the main text)

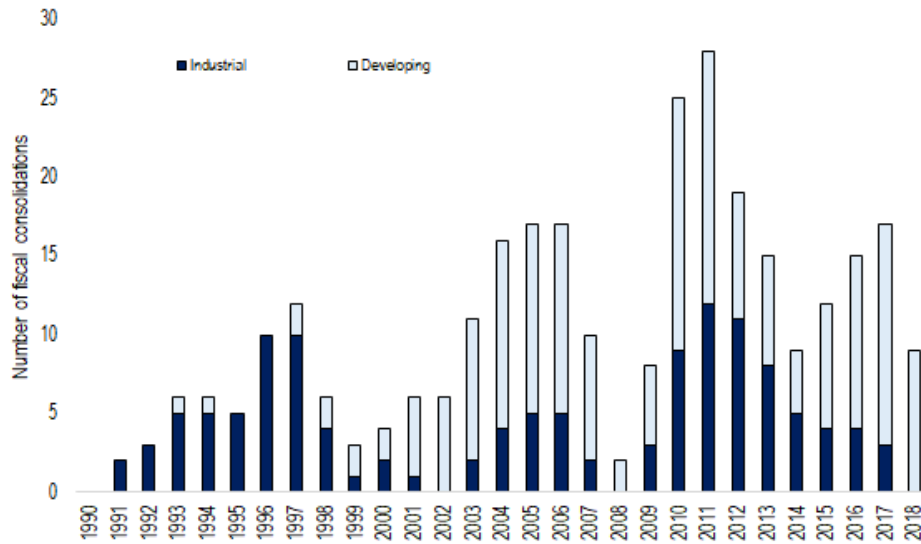
	First-Stage Regressions: Columns 5-8 at Table 5			
	Dep. Var. FR		Dep. Var. FLXR	
	[1]	[2]	[3]	[4]
Institutional Quality	0.117*** (0.0336)	0.0883** (0.0383)	0.126*** (0.0388)	0.131*** (0.0423)
Real GDP per Capita (log)	0.00885 (0.0105)	0.00929 (0.0132)	0.0115 (0.0105)	0.0190 (0.0150)
Population (log)	-0.0238 (0.0238)	-0.0438 (0.0296)	-0.00337 (0.0294)	-0.0111 (0.0382)
Polity2	0.0183** (0.00797)	0.0255*** (0.00929)	-0.00335 (0.00859)	-0.00480 (0.0109)
Debt to GDP		0.217** (0.102)		-0.164 (0.154)
Observations	979	800	979	800
Country fixed effect	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Source: Authors' elaboration based on WEO-IMF and IMF fiscal rules dataset (IMF, 2017).

Notes: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively.

Intercepts are included but not reported.

Figure A1: Distribution of Fiscal Consolidations Over Time, Developing and Industrial Countries, 1990 -2018



Source: Authors' elaboration based on WEO-IMF.