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Abstract

We assess the effect of fiscal rules on sovereign bond yields over the short and medium-term, for 34 advanced countries and 21 emerging market economies, over the period 1980-2016. Our results, based on impulse response functions, show that the dynamic impact of fiscal rules on bond yields is negative and statistically significant, implying lower government's borrowing costs. This is a result stemming essentially from the advanced economies subsample. Moreover, in times of recession, a fiscal rule leads financial markets to reduce the risk premia on government bonds. Finally, when it comes to design features of fiscal rules, independent monitoring of compliance to the rule also reduces sovereign yields.

JEL: C33, E44, E62
Keywords: fiscal rules, sovereign yields, financing costs, impulse response functions, local projection

* The usual disclaimer applies and any remaining errors are the authors' sole responsibility. Moreover, the opinions expressed herein are those of the authors and do not necessarily those of their employers.

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1. Introduction

Fiscal rules have been shown to be an effective instrument to prevent the build-up of public debt. The literature on fiscal rules' effectiveness has been motivated by the establishment of tax and expenditure limits in US federal states since the end of the 1970s and the Maastricht fiscal rules in Europe in the 1990s. The effectiveness of two different types of rules has been studied: rules for the budgetary processes (Hallerberg and von Hagen, 1999 and von Hagen and Harden, 1995); and numerical fiscal rules.[1] Overall, this literature is reasonably positive about the fact that rules are effective to enforce fiscal discipline. Therefore, they are likely to influence the expectations of investors and, consequently, the level of the risk premia.[2]

Policy makers try to enhance their fiscal reputation through the establishment of national fiscal rules. The essential problem is that these rules may reflect stability-oriented preferences of a country's voters and politicians and, thus, the effect of fiscal rules on risk premia can be a result of a common-cause-interdependence: conservative fiscal preferences might have led both to the establishment of rules and to lower risk premia. This criticism is well known from the literature on the effectiveness of fiscal rules (Poterba, 1996): correlation of fiscal rules and low public deficits cannot necessarily be interpreted causally. Voters who dislike public debt will favor debt limits. If this is the case, the observed fiscal link between rules and fiscal policy outcomes could

[1] The impact of numerical fiscal rules has been looked at in several regional contexts: for the US (e.g. Eichengreen and Bayoumi, 1994 and Poterba, 1996), for Europe (e.g. Debrun, 2000, Lagona and Padovano, 2007 and Debrun et al., 2008), for OECD countries (e.g. Dahan and Strawczynski, 2010) and for Swiss cantons and municipalities (e.g. Feld and Kirchgässner, 2008).

[2] If such a link between rules and fiscal policy outcomes is anticipated by financial markets, the reaction of a rational investor is unambiguous: he should assess the sustainability of a country's fiscal stance more positively if it has a fiscal rule in place and demand a lower compensation for the default risk of the sovereign bond than for a comparable country without any fiscal rules in place. This should contribute to a lower level of risk premia for countries with fiscal rules.

be spurious. In fact, there might be a reverse causality issue were budgetary outcomes themselves (high debt and high yields) may lead to the adoption of fiscal rules.[3]

Hence, this methodological problem is of immediate policy relevance. The simple introduction of a new rule does not necessarily change preferences, in particular if it is established as a consequence of external pressure. If the markets rather pay attention to preferences than to written rules, they could remain skeptical regarding high debt countries and hence, do not lower risk premia.

Therefore, we add to the literature by assessing the effect of fiscal rules on sovereign bond yields over the short and medium-term for a sample of 55 countries, 34 advanced and 21 emerging markets, in the period covering 1980-2016. In order to find an answer to the title question, we check if the introduction of fiscal rules is associated with lower government's borrowing costs.

Our results based on impulse response functions stemming from applying the local projection method, show that the dynamic impact of fiscal rules on bond yields is negative and statistically significant at usual levels. This is a result coming essentially from the advanced economies subset. Moreover, with extremely low growth, a fiscal rule leads financial markets to reduce the risk premia on government bonds. Independent monitoring of compliance to the fiscal rules also reduces sovereign yields, suggesting that design matters.

The remainder of the paper is organized as follows. Section 2 reviews the most important related literature. Section 3 outlines the empirical methodology. Section 4 presents and discusses the main results. Section 5 concludes.

[3] For instance, Schaechter et al. (2012) report that several countries introduced fiscal rules after the 2008-2009 economic and financial crisis.

2. Literature Review

There are several studies addressing the relevance of fiscal rules for fiscal developments. For instance, Ayuso-i-Casals et al. (2009) report that in the EU countries from 1990 to 2005, an increase in the share of government finances covered by numerical fiscal rules lead to lower deficits. Debrun et al. (2008) mention that stricter and broader fiscal rules are associated with higher cyclically adjusted primary balances. Afonso and Hauptmeier (2009) find that fiscal rules and a lower degree of public spending decentralization in the EU contributes to a higher responsiveness of primary surpluses to government indebtedness (a Ricardian behaviour of the fiscal authorities).

However, empirical studies dealing with the direct impact of fiscal rules on risk premia are not abundant. As already mentioned, it remains an open question whether these rules are genuinely effective or, instead, are effective just because they mirror fiscal preferences of politicians and voters. For the US, Eichengreen and Bayoumi (1994) estimate the impact of several factors on the differential between the yields on the general obligation bonds of each US state relative to the lowest yielding general obligation bond. The estimated coefficient on the fiscal restraints suggests that, ceteris paribus, moving from no restraints to the most severe restraints reduces interest costs by nearly 50 basis points.[4] In a subsequent related paper, Bayoumi et al. (1995) show that the impact of constitutional controls on US state borrowing depends on the level of public debt; at average debt levels, the presence of fiscal restraints is found to be associated with a reduction of the interest cost by 50 basis points. Poterba and Rueben (1999) find that US states' fiscal rules play an important role in determining states' borrowing costs. States with strict fiscal rules on government spending or deficits have faced lower borrowing costs during the last two decades

[4] An interpretation of this result is that fiscal restraints lower the required return on general obligation bonds by reducing the likelihood of future surges of borrowing and hence the likelihood of default.

than those with looser fiscal rules. Moreover, according to the authors, if fiscal rules are an important determinant of market interest rates, and if some rules are thought to reduce risk for bondholders, then such rules will have a larger effect on borrowing costs in some circumstances than in others. In particular, the economic effect of tight fiscal rules may be greatest when states are experiencing fiscal stress. Poterba and Rueben (2001) focus on the interaction between deficits and rules. A sudden deficit increase lifts a state's financing costs, but the size of the rise is limited if the state has a strict rule. This result points to a credibility effect even in times of fiscal stress. Lowry and Alt (2001) show how laws that restrict state governments' ability to carry forward a deficit improve the ability of investors to extract information from noisy signals. This affects the response of bond markets to repeated deficits (by eroding credibility) in states that have these laws. Johnson and Kriz (2005) show that revenue limits have a direct impact on state government borrowing, while the effect of expenditure, budget balance, and debt rules is indirect via improved credit ratings. They only find a very modest effect of fiscal rules on bond spreads (between 2.4 and 3.3 basis points).

In the Euro area context, Hallerberg and Wolff (2008) show that fiscal institutions play an important role for government bond yields. The quality of fiscal governance (particularly the budgeting process) is found to be a significant determinant of sovereign spreads. Iara and Wolff (2011) do not find an overall significant effect of fiscal rules on risk spreads, but they do find a significant impact if they interact the fiscal rules indicator with the general risk aversion of the market. Thus, fiscal rules only have a negative effect on bond spreads in a market environment where risk sensitivity is high. They conclude that national fiscal rules are found to be beneficial for market assessments of governments' ability and willingness to timely service debt.

Feld et al. (2012) find a robust negative effect of fiscal rules on bond spreads for Swiss cantons; this effect is quantitatively relatively strong (more than 10 basis points for strong rules). They are, for instance, often associated with strong enforcement mechanisms in the form of automatic tax adjustments after non-compliance with the numerical targets of the rules.

In Heinemann et al.'s (2014) analysis of European bond spreads before the financial crisis, they shed light on this issue by employing several types of stability preference related proxies. These proxies refer to a country's past stability performance, government characteristics and survey results related to general trust. The authors find evidence that these preference indicators affect sovereign bond spreads and dampen the measurable impact of fiscal rules. Yet, the interaction of stability preferences and rules points to a particular potential of fiscal rules to restore market confidence in countries with a historical lack of stability culture.

On the other hand, Afonso and Guimarães (2015) find that fiscal rules reduce budget deficits especially expenditure rules, while countries with better fiscal rules, notably the European Commission Fiscal Rule Index, experienced lower sovereign bond yields of around 25-35 basis points, in the period 1990–2011. Finally, Debrun and Kinda (2017) report that the existence of (better) fiscal councils also go hand in hand with stronger fiscal performance and fiscal forecasts, notably within a fiscal "reaction function" to explain primary balances' developments in a sample of 28 mostly developed economies.

3. Methodology and Data Issues

Difficulties in identifying the effects of fiscal rules are well documented (see, for instance, Heinemann et al., 2014). With that in mind, we propose an alternative method to standard panel analysis to assess the impact of the introduction of fiscal rules on government's borrowing costs.

Our main testable hypothesis is that fiscal rules contribute to reduce government's borrowing costs (proxied by sovereign bond yields) and, hence, by reducing the burden associated with the interest bill, they allow for the creation of fiscal space.

Technically, to empirically estimate the dynamic impact on sovereign bond yields of fiscal rules over the short and medium-term, we follow the Jorda's (2005) method. This method consists of estimating impulse response functions (IRFs) directly from local projections. For each period *k* we estimate the following regression:

$$Y_{i,t+k} - Y_{i,t} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j^k \, \Delta Y_{i,t-j} + \beta_k rules_{i,t} + \boldsymbol{X}'_{i,t}\delta_k + \varepsilon_{i,t}^k \qquad (1)$$

with *k=1,…,4* (in years) and where *Y* corresponds to the sovereign 10-year bond yield; $rules_{i,t}$ is a binary-type dummy variable that takes the value equal to 1 for the starting date of any fiscal rule (these can be of four types: expenditure, revenue, budget balance or debt) (in country *i* at time *t*) and is 0 otherwise. Using the starting year relates to an explicit intention to better identify our shocks and also minimize reverse causation issues; $\boldsymbol{X}'_{i,t}$ is a vector of control variables; α_i^k are country fixed effects added to capture unobserved heterogeneity across countries and time-unvarying factors; γ_j^k and δ_k are coefficients to be estimated for the lagged dependent variable and set of controls, respectively; $\varepsilon_{i,t}^k$ is a disturbance term satisfying usual assumptions; and β_k measures the impact of fiscal rules for each future period *k*. The lag length (*l*) is set at 2 as selected by the Akaike-Information-Criteria, but our findings are strongly robust to different lag-structures.[5]

[5] Results are not shown for reasons of parsimony but are available upon request.

Equation (1) is estimated using the Arellano and Bond (1991) difference GMM estimator because the estimation includes lags of the dependent variable and also to partially correct for potential endogeneity issues (where the instruments used are lags of the included regressors). IRFs are obtained by collecting the estimated β_k with confidence intervals computed using β_k's standard errors.[6]

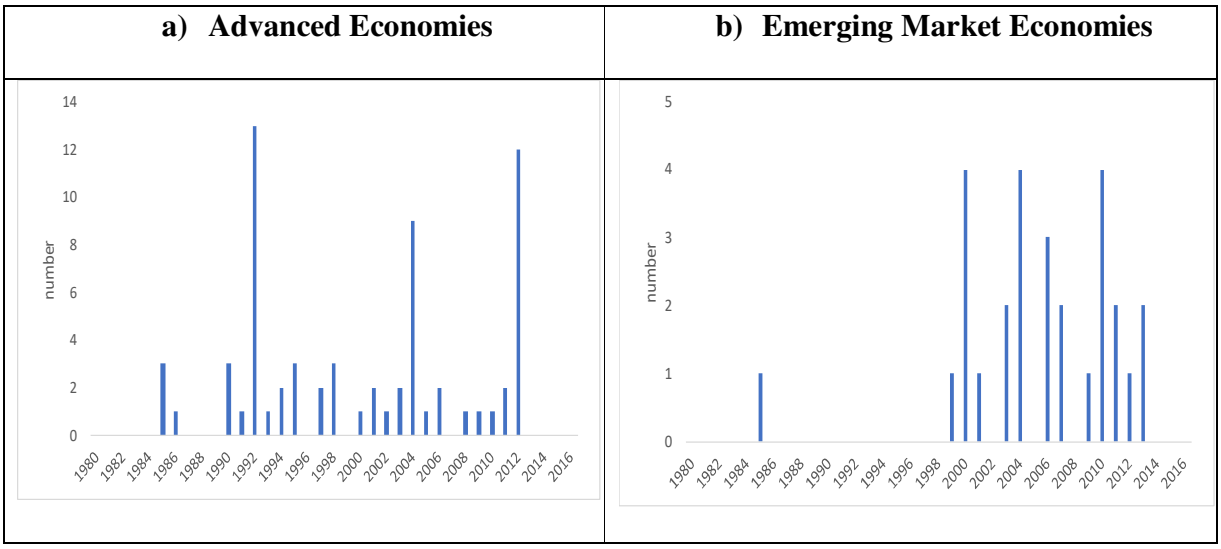
Our sample consists of a total of 55 countries, 34 advanced and 21 emerging markets for which the International Monetary Fund's fiscal rule dataset has information on (see IMF, 2009,[7] and also there is sufficient data on sovereign bond yields (these come from the IMF' International Financial Statistics and the OECD).[8] The time span covers the 1980-2016 period. In line with the literature on the determinants of sovereign bond yields (or spreads) (see e.g. Manganelli and Wolswijk, 2007; Constantini et al, 2014; Afonso et al., 2014; and Poghosyan, 2014) the vector of controls includes real GDP growth, inflation rate (CPI-based) and the lagged debt-to-GDP ratio. These variables are retrieved from the IMF's International Financial Statistics. Summary statistics of the main variables used in the empirical analysis are shown in Appendix' Table A1.

As far as fiscal rules are concerned we can plot the absolute number of new rules (of any type) over time by income group, and we get the pattern observed in Figure 1. Looking at advanced economies, while countries have implemented fiscal rules since the mid-1980s, most of them followed the Maastricht Treaty in 1992 (in adherence to the EU convergence criteria) as well as

[6] The presence of a lagged dependent variable and country fixed effects could bias the estimation of γ_j^k and β_k in small samples (Nickell, 1981). However, in our case, this is not a problem since the finite sample bias is close to zero.
[7] The update is available here: http://www.imf.org/external/datamapper/fiscalrules/map/map.htm).
[8] The list of countries is as follows. For advanced economies we have: US, UK, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Australia, New Zealand, Cyprus, Israel, Hong Kong, Singapore, Czech Republic Slovak Republic, Estonia, Latvia, Lithuania and Slovenia. For emerging markets we have: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, Iran, Sri Lanka, India, Indonesia, Malaysia, Pakistan, Russia, Hungary, Croatia, Poland and Romania.

after the Global Financial Crisis. In emerging market economies, the absolute number of fiscal rules is lower than the advanced economies sample, and most of them were implemented starting in the early 2000s.

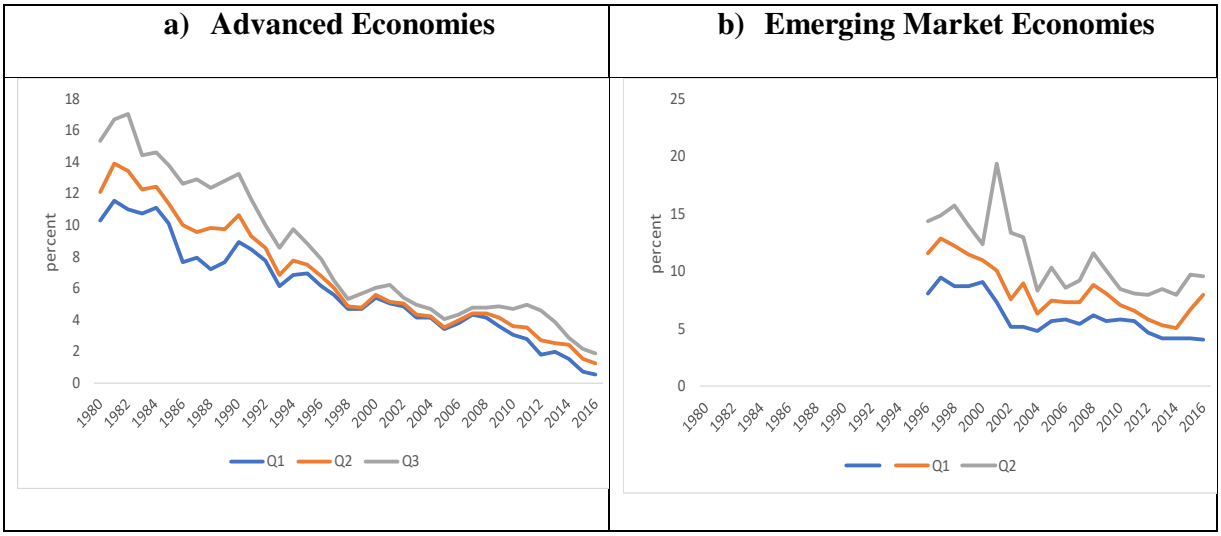
Figure 1. Distribution of New Fiscal Rules implemented over time by Income Group



Source: International Monetary Fund's fiscal rule dataset.

.Looking at government's borrowing costs (proxied by long-term (10-year) bond yields), Figure 2 shows that in both advanced and emerging market economies, there has been a convergence towards smaller and smaller yields. However, the downward speed in yields is faster for advanced than for emerging markets. During the global financial crisis period, the top quartile highlights the higher pricing of risk investors put on some stressed countries – a feature that has disappeared in the more recent years.

Figure 2. Interquartile Range of 10-year Government Bond Yields over time by Income Group



Source: the IMF' International Financial Statistics and OECD.

4. Empirical Analysis

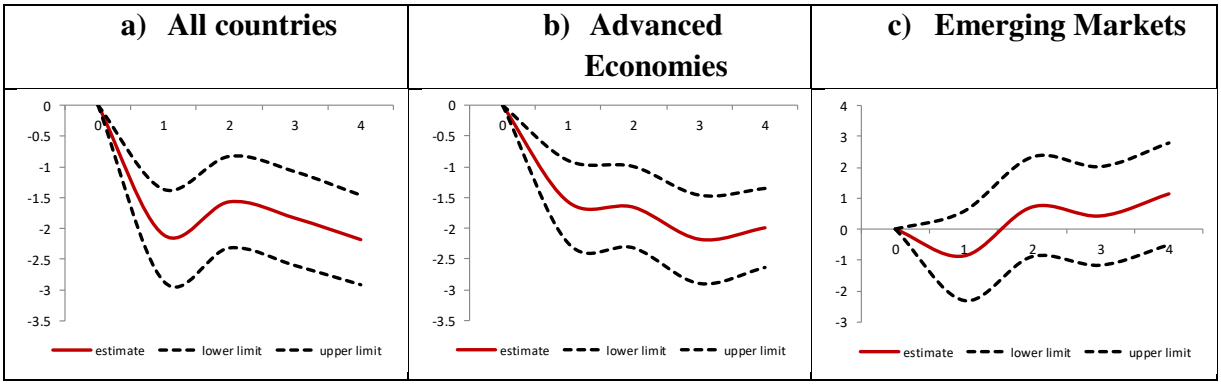
4.1. Are Fiscal Rules Associated with Lower Borrowing Costs?

Our main hypothesis is that the introduction of fiscal rules is associated with lower government's borrowing costs and, hence, by reducing the burden associated with the interest bill, they would allow for the reinforcement of fiscal space. In Figure 3 Panel a), we observe that our main hypothesis can be considered as valid since the IRF – displaying the dynamic impact of fiscal rules on bond yields – is negative and statistically significant at the 10 percent level. [9] This result is mostly driven by the impact rules have in the advanced economies sample, since for emerging market economies such effect is not statistically different from zero (confidence bands above and below the horizontal axis).

[9] Standard panel data regression analysis in the lines of Afonso and Guimaraes (2016) yield qualitatively similar robust results. Not shown but available upon request.

We also conducted sub-analysis by type of fiscal rule (not shown but available upon request) and found that, for the whole sample, the introduction of expenditure rules seems particularly relevant in lowering government's borrowing costs (implementing either revenue-based, or debt-based or budget balance-based rules, yielded insignificant or unclear results). As shown in Appendix Table's A2, one year after the introduction of any type of fiscal rule, there is a decreas in sovereign yields of around 1.5 and 2 percentage points. This effect is mostly sustained until a time horizon of four years, but essentially stemming from the advanced economies sub-sample. Indeed, in the case of the emerging markets economies, the adoption a fiscal rule only decreases the yields one-year ahead, and even then not in a statistically significant way.[10]

Figure 3. Dynamic impact on sovereign bond yields after the introduction of fiscal rules



Note: Dotted lines equal 90 percent confidence bands. The horizontal axis measures the number of years after the introduction of a given rule.

4.2. Are Fiscal Rules Solely a Signaling Device?

From the previous set of results one is left wondering if rules are indeed effective in reducing interest costs or whether there exists a hidden explanatory variable—which is the

[10] For reasons of parsimony the detailed results underlying the remainder of IRFs presented in the paper are omitted but these are available upon request.

preference for fiscal discipline (or government "type")—that can create an endogeneity bias. Indeed, it is not because fiscal rules are associated with lower borrowing costs that, on average, the introduction of fiscal rule can reduce borrowing costs (recall Poterba's (1996) causal criticism). Perhaps fiscal rules are simply revealing/signaling the government's (or voter's) type instead of changing deep-rooted underlying fiscal behaviors (see Poterba and Rueben, 1999 for the US states)

Our next exploratory step is to test the following (second) hypothesis: do rules have a stronger (negative) impact on borrowing costs in countries that are more fiscally responsible (or in a stronger fiscal position)?

Here we measure fiscal responsibility in two alternative ways:

- *definition 1*: with the level of debt-to-GDP ratio: countries with lower debt are associated with a sounder and healthier public finances;

- *definition 2:* with the degree of fiscal policy counter-cyclicality. The latter – which we call FISCO – stems from the analysis presented in IMF's (2015) April Fiscal Monitor Chapter 2 and Furceri and Jalles (2016) and covers 69 countries between 1980 and 2016.

To empirically test this second hypothesis, we run the following alternative regression:

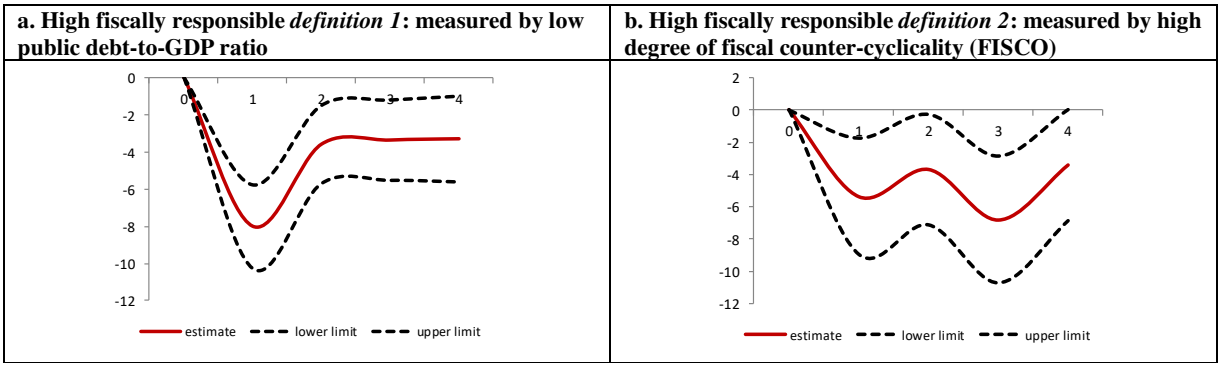
$$Y_{i,t+k} - Y_{i,t} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j^k \, \Delta Y_{i,t-j} + \rho_k V(z) + \beta_k^{fiscally\_irresp} \cdot V(z) \cdot rules_{i,t} + \beta_k^{fiscally\_resp} \cdot \big(1 - V(z)\big) \cdot rules_{i,t} + \boldsymbol{X}'_{i,t}\delta_k + \varepsilon_{i,t}^k \quad (2)$$

with $V(z_{it}) = \frac{\exp(-\gamma z_{it})}{1+\exp(-\gamma z_{it})}$, $\gamma = 1.5$, where z is an indicator of the degree of fiscal responsibility (using either *definition 1* or *definition 2* defined above) normalized to have zero mean and unit

variance.[11] The remainder of the variables and coefficients are defined as in Equation (1). This method is equivalent to Granger and Teravistra's (1993) smooth transition autoregressive model. The main advantage of this approach relative to estimating SVARs for each regime is that it uses a larger number of observations to compute the impulse response functions of only the dependent variables of interest, improving the stability and precision of the estimates. This estimation strategy can also more easily handle the potential correlation of the standard errors within countries, by clustering at the country level.[12]

In Figure 4, we plot the estimated coefficients coming from two separate regressions, one carried out for the debt-to-GDP ratio (*definition 1*) and another for the FISCO (*definition 2*). Countries that are fiscally more responsible (using either definition) are indeed those for which the introduction of a fiscal rule reduces government's borrowing costs. The IRFs are negative and statistically significant throughout the 4-year horizon. Results for fiscally irresponsible countries yield IRFs that are statistically not different from zero (not shown).

Figure 4. Dynamic impact on sovereign bond yields after the introduction of fiscal rules, fiscally responsible countries, all countries



Note: Dotted lines equal 90 percent confidence bands. The horizontal axis measures the number of years after the introduction of a given rule.

[11] Changing the value for γ does not qualitatively alter our main results.

[12] This approach has been applied to model non-linearities in number of different economic issues such as exchange rates dynamics (Sarrno and Taylor, 2002); sectoral performance during the business cycle (Fok et al. 2005); money demand (Chen and Wu, 2005) fiscal multipliers (Auerbach and Gorodnichenko, 2012).

4.3. Does The Effect of Fiscal Rules Vary Over the Economic Cycle?

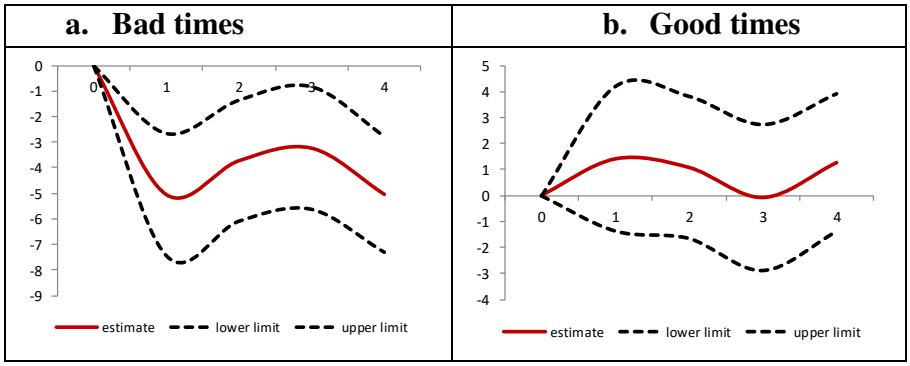
The credibility impact on sovereign yields following the introduction of fiscal rules has particularly relevance depending on the phase of the business cycle. In order to explore whether changes in sovereign bond yields to fiscal rules shocks vary depending on the phase of the business cycle, the following alternative regression will be estimated:

$$Y_{i,t+k} - Y_{i,t} = \alpha_i^k + \delta_t^k + \sum_{j=1}^{l} \gamma_j^k \, \Delta Y_{i,t-j} + \rho_k H(z) + \beta_k^{bad} \cdot H(z) \cdot rules_{i,t} + \beta_k^{good} \cdot \left(1 - H(z)\right) \cdot rules_{i,t} + \boldsymbol{X}_{i,t}' \delta_k + \varepsilon_{i,t}^k \quad (3)$$

with $H(z_{it}) = \frac{\exp(-\gamma z_{it})}{1+\exp(-\gamma z_{it})}, \quad \gamma = 1.5$, where z is an indicator of the state of the economy (using the real GDP growth rate) normalized to have zero mean and unit variance.[13] The remainder of the variables and coefficients are defined as in Equation (1). Figure 5 plots, for all countries, the results for both good and bad times and we can observe that in periods of extremely low growth, introducing a fiscal rule leads financial markets to reduce the risk premia on government bonds. The effect is statistically not different from zero in good times.

[13] Following Auerbach and Gorodnichenko (2013), δ = 1.5 is used for the analysis of recessions and expansions. Periods of very low (high) growth identified in this analysis also correspond to periods of large negative (positive) output gaps. Similar results are indeed found when the output gap rather than GDP growth is used.

Figure 5. Dynamic impact on sovereign bond yields after the introduction of fiscal rules, good versus bad times, all countries



Note: Dotted lines equal 90 percent confidence bands. The horizontal axis measures the number of years after the introduction of a given rule.

4.4. Does Design Matter?

Finally, our last testable hypothesis is whether fiscal rules help to reduce bond yields for those countries that are fiscally less responsible (the "poor" performers) but whose rules present some desired design features.

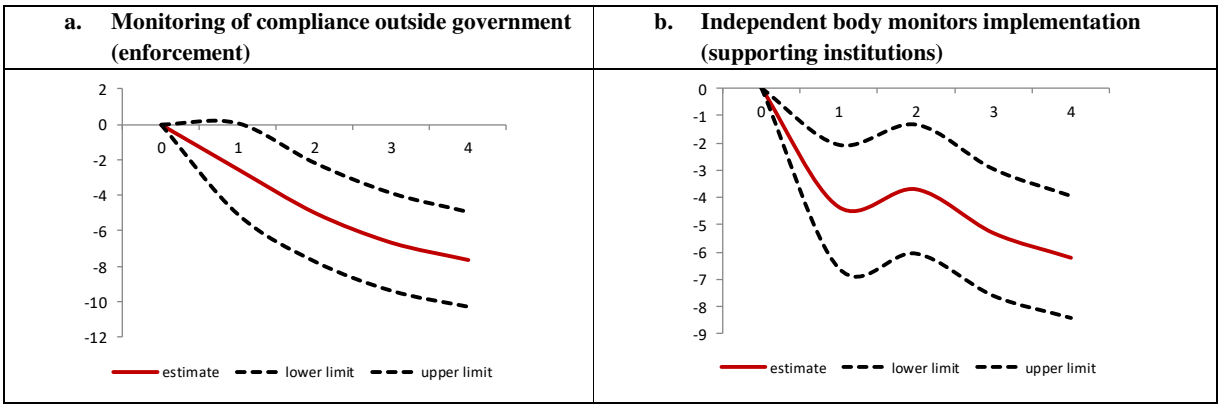
$$Y_{i,t+k} - Y_{i,t} = \alpha_i^k + \delta_t^k + \sum_{j=1}^{l} \gamma_j^k \, \Delta Y_{i,t-j} + \rho_k G(z) + \beta_k \cdot design \cdot rules_{i,t} + \boldsymbol{X}'_{i,t}\delta_k + \varepsilon_{i,t}^k \quad (4)$$

with $design$ taking the value 1 when: i) the monitoring of compliance to the fiscal rule is done outside the government; ii) there exists a well specified escape clause in the rule; iii) there is an independent body that monitors the implementation of the rule; iv) there exists transparency and accountability in managing the rule; v) the rule includes a provision to adapt to business cycle conditions for stabilization purposes. These dummies characterizing a given fiscal rule take the value zero otherwise.

Out of these 5 characteristics, the ones for which estimating equation (4) yields statistically significant results are i) and iii). Results for the sub-sample of "poor" performers (here measured

as having an average debt-to-GDP ratio over the 1980-2016 period above the respective country group's (advanced economies or emerging markets) median for the same period) are displayed in Figure 6. We observe that, all countries considered, even for this group of "poor" performers, the introduction of fiscal rules can indeed help to create fiscal space by lowering borrowing costs if the design of the rules includes sufficiently strong enforcement and the assistance of independent supporting institutions.

Figure 6. Dynamic impact on sovereign bond yields after the introduction of fiscal rules, specific design characteristics, all countries, "poor" performers



Note: Dotted lines equal 90 percent confidence bands. The horizontal axis measures the number of years after the introduction of a given rule.

5. Conclusion and Policy Implications

We have studied the effect of fiscal rules on sovereign bond yields over the short and medium-term, for 34 advanced countries and 21 emerging markets, in the period 1980-2016. We have assessed how the existence of such spending, revenue or debt rules help reducing government's borrowing costs.

Based on our results, from estimated impulse response functions, we find that the dynamic impact of fiscal rules on bond yields is negative and statistically significant, implying lower

government's borrowing costs. This is a result that rest mostly on the advanced economies country subset. Also, with extremely low growth, the existence of a fiscal rule leads financial markets to reduce the risk premia on government bonds. Moreover, if there is place an independent institution that monitors the compliance to the fiscal rules, this also contributes to reduce the government's borrowing costs.

From a policy perspective, we can then highlight that the existence of binding fiscal rules, clearly observable notably by capital markets, signal a lower sovereign default risk and institutional lenders can then demand a lower yield to the government. Therefore, it is worthwhile for the fiscal authorities to use such rules since there is a gain notably in terms of borrowing costs, and also in terms of signalling to the voters the government's commitment to sounder and less costly fiscal policies.

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APPENDIX

Table A1. Summary Statistics of main variables

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Bond_10y	1403	7.38	6.42	-0.34	96.88
Real GDP growth	2562	3.07	5.55	-96.95	71.53
Inflation rate	2534	12.20	33.68	-10.38	432.83
Debt-to-GDP ratio	1827	51.05	33.06	0.06	236.10
Expenditure rule	1643	0.24	0.43	0	1
Revenue rule	1643	0.05	0.22	0	1
Budget balance rule	1643	0.52	0.49	0	1
Debt rule	1643	0.39	0.48	0	1
Any Fiscal rule	1643	0.57	0.49	0	1
FISCO	1204	0.28	0.28	-0.61	2.17

Table A2. Details of regressions underlying IRFs displayed in Figure 3

Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Year after shock (t=0)	1	2	3	4	1	2	3	4	1	2	3	4
Regressors/sample	All countries				Advanced economies				Emerging market economies			
L.ltbondyield	0.619***	0.585***	0.528***	0.413***	0.645***	0.599***	0.501***	0.431***	0.516***	0.451***	0.356***	0.195***
	(0.031)	(0.031)	(0.033)	(0.036)	(0.031)	(0.031)	(0.036)	(0.040)	(0.066)	(0.073)	(0.069)	(0.070)
L2.ltbondyield	-0.234***	-0.282***	-0.265***	-0.248***	-0.463***	-0.614***	-0.576***	-0.597***	-0.089**	-0.100**	-0.097**	-0.046
	(0.023)	(0.024)	(0.025)	(0.025)	(0.032)	(0.034)	(0.039)	(0.039)	(0.037)	(0.041)	(0.039)	(0.038)
anyrule_start	-2.109***	-1.572***	-1.839***	-2.187***	-1.565***	-1.655***	-2.175***	-1.990***	-0.872	0.716	0.418	1.133
	(0.455)	(0.454)	(0.465)	(0.444)	(0.409)	(0.403)	(0.438)	(0.392)	(0.878)	(0.978)	(0.968)	(0.999)
Inflation_rate	-0.045	-0.155***	-0.188***	-0.243***	0.098**	0.007	-0.043	-0.091**	-0.245**	-0.220*	-0.175	-0.203
	(0.040)	(0.040)	(0.042)	(0.039)	(0.038)	(0.038)	(0.042)	(0.038)	(0.112)	(0.133)	(0.132)	(0.135)
Real GDP growth	0.221***	0.219***	0.149***	0.146***	0.071**	0.076**	0.039	0.040	0.293***	0.260***	0.250***	0.265***
	(0.036)	(0.036)	(0.036)	(0.034)	(0.035)	(0.034)	(0.037)	(0.033)	(0.076)	(0.083)	(0.079)	(0.077)
Debt-to-GDP	-0.058	0.011	0.118***	0.178***	-0.015	0.057	0.200***	0.288***	0.159	0.194	0.146	0.009
	(0.042)	(0.042)	(0.043)	(0.041)	(0.038)	(0.038)	(0.041)	(0.037)	(0.114)	(0.130)	(0.124)	(0.124)
Observations	943	898	853	807	798	765	732	699	145	133	121	108

Note: constant estimated but omitted for reasons of parsimony. Robust standard errors in parenthesis below each coefficient estimate. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively.