Documents de travail

« Rules Met, Goals Missed: The Compliance–Sustainability Gap »

Auteurs

Carolina Ulloa-Suárez, Oscar M. Valencia, Jorge Guerra, Gustavo Sánchez

Document de Travail n° 2025 – 50
(Version révisée du WP 2025-23)

Décembre 2025

Rules Met, Goals Missed: The Compliance–Sustainability Gap *

Carolina Ulloa-Suárez † Oscar M. Valencia ‡ Jorge Guerra §
Gustavo Sánchez ¶

Abstract

Fiscal rules are intended to support sustainable public finances, yet whether compliance with these rules actually improves fiscal sustainability remains an open question. This paper provides the first cross-country causal assessment of the effects of fiscal rule compliance on governments' fiscal behavior and borrowing conditions. We extend the fiscal reaction function to allow both the primary balance response and the growth-adjusted interest rate to depend on compliance, and address endogeneity using external instruments based on exogenous peer behavior across spatial and rating networks combined with System GMM. The results show that compliance substantially strengthens the fiscal response to rising debt and lowers the interest–growth differential, indicating that financial markets react to credible implementation rather than to the existence of rules alone. These effects intensify under high-debt conditions, where compliant governments adjust more forcefully and experience larger improvements in borrowing terms. Our analysis shows that compliance meaningfully enhances both fiscal reaction and financing conditions, but its contribution to sustainability ultimately depends on credible enforcement. Policy efforts should therefore prioritize the capacity and incentives needed for governments to effectively comply with their rules, not merely adopt them.

Keywords: Instrument variable (IV) estimation; Fiscal rules; Compliance; Sustainability.
JEL Codes: E62, H61, H68.

---

*The findings and interpretations in this paper are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank or the governments it represents.

† *Corresponding Author*, Inter-American Development Bank, Washington, DC, United States, and University of Strasbourg, BETA, CNRS, Strasbourg, France, ulloa.c3@gmail.com

‡ Inter-American Development Bank, Washington, DC, United States, oscarva@iadb.org

§ Inter-American Development Bank, Washington, DC, United States, and Universidad de los Andes, Bogota, Colombia, ja.guerrae@uniandes.edu.co

¶ Inter-American Development Bank, Washingon, DC, sanchezr.gustavo@hotmail.com

1 Introduction

Since their creation, fiscal rules have been considered essential for ensuring sustainable public finances. By curbing deficit bias and anchoring expectations, they aim to promote fiscal discipline and macroeconomic stability (Kopits and Symansky, 1998). Yet their effectiveness ultimately hinges not only on design but also on actual compliance. While most fiscal frameworks are tailored to country-specific objectives, they share a common purpose: safeguarding long-term fiscal sustainability. This purpose is increasingly tested as governments confront historically high debt levels, limited fiscal space, and heightened exposure to shocks such as tighter global financing conditions (IMF, 2024a).

The recent availability of cross-country compliance data has opened new avenues to assess how fiscal rules perform in practice, enabling researchers and policymakers to distinguish between their adoption and actual implementation (Ardanaz et al., 2024; Larch et al., 2023; Ulloa-Suárez, 2023). This distinction is essential because although many countries have formally adopted fiscal rules, compliance varies considerably, and its consequences are far from uniform. In this paper, we rely on the set of countries for which compliance is measured systematically and consistently over time, primarily in the European Union (EU) and Latin America and the Caribbean (LAC), to examine whether compliance with fiscal rules contributes to long-term fiscal sustainability.

In several countries covered by these datasets, compliance rates rose sharply in the immediate post-pandemic years even as debt burdens remained elevated or continued to increase (Ulloa-Suarez and Valencia, 2024a). This pattern reversed in 2024 and further in 2025, when many long-standing compliers began to face greater difficulty meeting their own targets. The resulting disconnect between high compliance and persistent fiscal pressures raises a central question: even when governments follow their rules, does compliance suffice to preserve long-term fiscal sustainability?

Debt dynamics over the past two decades highlight this tension clearly. Although many countries experienced a temporary improvement in fiscal positions during the mid-2000s, public debt rose sharply after the global financial crisis and again during the COVID-19 pandemic. In most economies, debt ratios now remain persistently high, constraining fiscal space and limiting governments' ability to respond to new shocks. Over the same period, compliance with fiscal rules has increased in many countries, even as fiscal risks remain elevated. The coexistence of higher compliance and sustained debt pressures raises a central question for both researchers and policymakers: if fiscal rules are intended to support sustainable public finances, why do high debt levels persist in countries that follow them?

The analysis that follows addresses the central question emerging from this disconnect: does compliance with fiscal rules actually contribute to long–term fiscal sustainability? More specifically, we ask whether governments that follow their rules have a greater capacity to react to increases in public debt and face better borrowing conditions than those that do not.

To answer this question, we introduce four innovations that meaningfully advance the study of fiscal rules and sustainability. First, we provide the first cross–country causal assessment of fiscal rule compliance, rather than of rule adoption or formal implementation. Although studies such as Caselli and Reynaud (2020), Reuter (2015, 2019), and Heinemann et al. (2018) address the endogeneity of adoption or evaluate implementation, none identify the causal effect of actual compliance. Second, we extend the fiscal reaction function by allowing both the primary balance response and the growth–adjusted interest rate to depend on compliance, thereby capturing the fiscal and financial channels through which rules may affect sustainability. Third, we introduce new external instruments based on spatial and reputational spillovers and combine them with a System GMM framework, moving beyond correlational associations. Fourth, we exploit the only two regions where compliance is measured consistently over time and document non–linear effects when debt is high.

In this way, our contribution builds on and connects three strands of literature: fiscal rule compliance, empirical approaches to fiscal sustainability using fiscal reaction functions (FRFs), and recent efforts to identify causal effects in institutional settings. While these literatures have evolved separately, few studies have examined whether compliance with fiscal rules leads to significant increases in fiscal reaction and, ultimately, more sustainable public finances, particularly once endogeneity concerns are addressed. Because compliance is not randomly assigned, failing to correct for selection may lead to misleading conclusions, as highlighted in studies assessing the effectiveness of fiscal rules more generally (Heinemann et al., 2018; Reuter, 2015).

Recent work has emphasized the importance of distinguishing between adopting fiscal rules and their actual implementation (IMF, 2024a; Galindo and Izquierdo, 2024). While many countries have fiscal frameworks in place, these are often circumvented, suspended, or revised, whether in response to shocks or for political convenience. Early studies such as Reuter (2015, 2019) and Delgado-Téllez et al. (2017) highlighted the political and institutional factors that shape compliance behavior. Building on these insights, more recent efforts have sought to systematize compliance measurement across countries and over time. Notably, Ulloa-Suarez and Valencia (2022) and Larch et al. (2023) developed cross-country compliance datasets for LAC and the EU, respectively. These datasets have supported a growing empirical literature, including Blanco et al. (2020); Ulloa-Suarez and Valencia (2022); Larch et al. (2023); Ardanaz et al. (2024), that investigates the determinants of compliance.

However, most of this work continues to treat compliance as an outcome rather than a causal driver of fiscal performance. Crucially, the literature has so far neglected to address the endogeneity of compliance when evaluating its impact on debt dynamics or fiscal sustainability. To our knowledge, no study has yet provided causal evidence on whether compliance with fiscal rules improves governments' fiscal behavior or strengthens the sustainability of public finances.

At the same time, the fiscal sustainability literature has developed a standard methodology to assess how governments react to rising debt: the fiscal reaction function. Following the foundational work of Bohn (1995, 1998, 2007), these models estimate whether primary balances increase when public debt rises, a necessary condition for long-term solvency. Positive and significant reaction coefficients are taken as evidence of sustainability. Later contributions, including Ostry et al. (2010) and Ghosh et al. (2013), extended this framework by incorporating fiscal space considerations and testing for non-linearities. Yet even in this literature, rule-based frameworks are often left in the background. There are no attempts to test whether compliance with fiscal rules strengthens the debt response mechanism, or whether rules are followed in form but fail to translate into substantive fiscal adjustment.

Following Bohn's fiscal reaction framework, we extend the standard model by allowing the primary balance response and the growth-adjusted interest rate to depend on fiscal rule compliance. Compliance eases the solvency constraint in two mutually reinforcing ways: it prompts governments to tighten their fiscal stance more vigorously as debt rises, and it lowers borrowing costs by enhancing credibility, thereby relaxing the conditions required for debt to stabilize. In this extension, the sustainability condition shows that debt can remain on a stable path even with a weaker fiscal response or a higher interest-growth differential, provided compliance is credible and maintained over time.

Building on these theoretical implications, we develop an empirical framework that tests whether compliance with fiscal rules enhances public debt sustainability through both fiscal and financial channels. To address the endogeneity of compliance, we implement an instrumental variable (IV) strategy that exploits exogenous peer behavior as a source of variation. This allows us to isolate the causal effect of compliance on both the primary balance response and market conditions. Specifically, we extend the FRF with interaction terms that capture whether governments that comply with fiscal rules adjust their fiscal stance more forcefully as debt increases, and whether compliance reduces the effective interest-growth differential by signaling credibility.

A key methodological contribution of this paper is the construction of a new set of external instruments for fiscal rule compliance. Building on the diffusion mechanism emphasised by Caselli and Reynaud (2020), we extend the notion of peer behavior to compliance along two conceptually grounded channels. The first is a spatial channel based on geographic proximity, operationalised through frontier neighbors, and, in robustness checks, a broader radius of 1,000 kilometres. The second is an institutional channel based on sovereign credit ratings, where countries that share the same rating form a relevant peer group because financial markets often benchmark their fiscal behaviour jointly. Compliance among these rating peers generates reputational spillovers that can influence governments' incentives to follow their own rules. By exploiting exogenous variation in compliance across these peer groups, our instruments allow us to identify the causal effect of compliance on fiscal reaction functions and borrowing conditions. To our knowledge, this is the first cross-country study to develop and use peer-based instruments specifically designed to identify the compliance channel in fiscal rule frameworks.

Our results yield four main findings. First, compliance emerges as a key driver of fiscal behaviour: governments that follow their rules adjust primary balances more strongly in response to rising debt, indicating a discipline effect that is systematic and economically meaningful. Second, compliance improves borrowing conditions by reducing the growth-adjusted interest rate, suggesting that financial markets respond not only to the presence of fiscal frameworks but also to their effective implementation. Third, these benefits holds even under high-debt conditions. When debt is elevated, compliant governments exhibit substantially stronger fiscal adjustments and experience a larger improvement in the interest–growth differential, helping to counteract fiscal fatigue. Fourth, these patterns are highly robust. They remain stable across alternative identification strategies, different definitions of the financial channel, and multiple sources of variation in compliance.

The remainder of the paper is structured as follows. Section 2 discusses the conceptual link between compliance and debt sustainability and the channels through which rules may affect both fiscal behavior and financing conditions. Section 3 presents the empirical strategy, including the extended theoretical framework, the identification design addressing endogeneity concerns, the construction of novel instruments, and the dataset used. Section 4 reports the main findings. Section 5 assesses the sensitivity of results to key assumptions, including additional instruments and alternative definitions of the interest-growth differential. Finally, Section 6 concludes with policy implications and recommendations for enhancing the credibility and effectiveness of fiscal rule frameworks.

2 Compliance and the Path to Sustainability

Public debt is sustainable when governments adjust fiscal policy in response to rising debt in a way that satisfies their intertemporal budget constraint. In other words, for debt to be stable over time, the present value of future primary surpluses must at least match the existing stock of debt. A government that persistently runs deficits without adjustment will eventually need to default, inflate the debt away, or engage in abrupt consolidation. Thus, sustainability is not a matter of low debt levels today, but of dynamic *fiscal behavior* that is responsive to future debt burdens.

The FRF offers a reduced-form approximation of this logic (see Section 3). A positive and significant reaction of the primary balance to the debt ratio suggests that the government is, on average, taking corrective action as debt increases, consistent with intertemporal solvency. This stylized relationship forms the basis for most empirical tests of sustainability. However, the FRF captures only a portion of the broader dynamics: fiscal behavior is shaped by institutional constraints, political economy, macroeconomic shocks, and the credibility of adjustment paths.

In this regard, fiscal rules were introduced to discipline these dynamics by setting numerical constraints on key budgetary aggregates. Compliance with fiscal rules should support sustainability through three main channels:

Intertemporal Response Anchoring. Rules constraining key fiscal aggregates, such as debt, the primary balance, or the structural balance, can serve as automatic stabilizers, guiding fiscal behavior toward trajectories consistent with long-term sustainability. When such rules are credibly enforced and compliance is sustained, they help anchor expectations of future fiscal effort and support the creation of fiscal space when needed. However, if compliance is evaluated solely on an annual basis, or if rule design lacks a clear link to long-term objectives, this anchoring effect may be weak or transitory.

Borrowing Cost Reduction via Credibility. Sustained compliance may also improve market perceptions of fiscal discipline. In stylized frameworks with endogenous interest rates, where borrowing costs rise with perceived solvency risk, credible fiscal behavior lowers the effective interest rate and improves the interest-growth differential ($r - g$). A better differential reduces the required primary surplus for debt stabilization, effectively relaxing the sustainability constraint. In this way, compliance can affect sustainability indirectly, by improving financing conditions and reducing rollover risk.

Expenditure Smoothing and Buffer Accumulation. Particularly under expenditure rules, compliance can help limit excessive fiscal expansions during booms, especially when ceilings are linked to inflation or past expenditure growth. This design promotes a more gradual and predictable increase in spending, avoiding sharp surges followed by abrupt consolidations. By fostering a smoother expenditure path, such rules enable the accumulation of fiscal buffers during good times, thereby increasing fiscal space when downturns occur. This ability to smooth spending while maintaining credible rules not only reduces macroeconomic volatility and improves welfare, but also supports a more stable fiscal trajectory, one that is more compatible with long-term sustainability.

Despite these potential channels, the compliance–sustainability link is not guaranteed. Several factors weaken or distort it in practice:

- **Short-term compliance vs. long-term adjustment.** Year-to-year compliance may reflect favorable macroeconomic conditions rather than deliberate policy effort. In such cases, *pro forma compliance* masks underlying fragility. Without sustained commitment or corrective responses when debt rises, compliance may not translate into fiscal resilience.

- **Rule design and bindingness.** Rules vary in enforcement and clarity. Some are revised frequently or suspended in adverse times, weakening their ability to constrain behavior. In a stylized framework, weak rules generate low intertemporal weight on future fiscal efforts, diluting their disciplinary effect.

- **Non-linear responses and fiscal fatigue.** At high debt levels, the marginal cost of fiscal effort increases, while political feasibility declines. As shown by Ostry et al. (2010); Ghosh et al. (2013), *fiscal fatigue* leads to a convex cost of adjustment: the capacity to respond deteriorates as debt grows, even if rules are in place.

- **Market signaling with lags.** The benefits of compliance on borrowing costs are not immediate. In dynamic settings, credibility accumulates gradually through repeated behavior. One-off compliance may be discounted by markets, while sustained respect to the targets can shift expectations and improve financing terms.

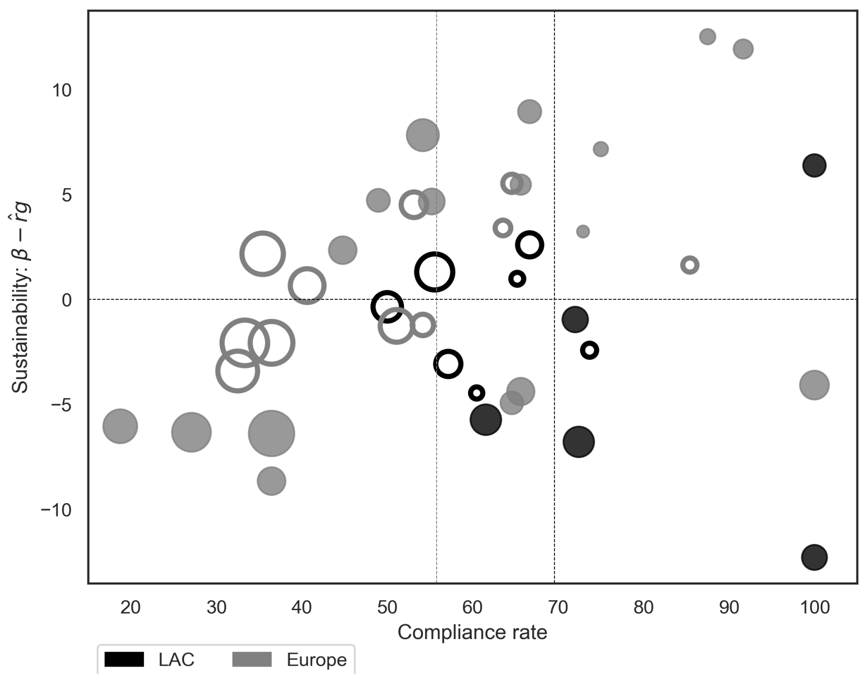
Despite the channels outlined, the empirical relationship between compliance and sustainability remains ambiguous. Figure 2 provides a stylized cross-country visualization for the set of countries for which long-run compliance and sustainability measures are available over the 2000–2023 period. Each bubble in the figure represents a country, plotted along two key dimensions. The horizontal axis shows the average fiscal rule compliance rate, measured as the share of years in which a country complied with the implemented rules, while the vertical axis captures a proxy for fiscal sustainability: the difference between the estimated fiscal reaction coefficient β and the average growth-adjusted interest rate $\hat{rg}$. Positive values on the vertical axis suggest that the government's primary balance response is sufficient to stabilize debt over time.

Bubble size reflects the country's average debt-to-GDP ratio, indicating the magnitude of the fiscal challenge. Filled bubbles correspond to countries where the fiscal reaction coefficient β is consistently positive and significant in over 70% of the specifications estimated using Leamer-style Extreme Bounds Analysis (EBA).[1] Hollow bubbles, by contrast, indicate weak or unstable estimates of responsiveness, pointing to potential uncertainty in the sustainability proxy.

Two reference lines guide interpretation. The horizontal line at zero marks the sustainability threshold: values above this level indicate that the average fiscal response is consistent with debt stabilisation. The vertical lines correspond to the average compliance rates observed within the two regions for which systematic data are available.

[1] Fiscal responsiveness is measured using a Leamer-style Extreme Bounds Analysis (EBA) (Leamer, 1985; Sala-i Martin, 1997), applied to over 4,000 model specifications to assess the robustness of the estimated fiscal reaction coefficient.

Figure 1: Public Debt Sustainability and Fiscal Rule Compliance (2000–2023)



Note: Sustainability is defined as $\beta - \hat{rg}$, where β is the fiscal reaction coefficient and $\hat{rg}$ is the average growth-adjusted interest rate. Compliance refers to the share of years a country complied with its fiscal rules. Filled bubbles indicate countries with robust fiscal responses based on EBA. Black = LAC; Gray = EU.

This multidimensional representation provides a compact view of how compliance, fiscal responsiveness, and debt dynamics interact across the countries for which systematic compliance data exist. The figure reveals substantial heterogeneity: some countries combine high compliance with strong and stable fiscal reactions, while others display similar compliance levels but fall below the sustainability threshold. In several cases, even full compliance coincides with hollow bubbles, signalling weak or uncertain fiscal responsiveness. This dispersion highlights that compliance does not automatically translate into effective fiscal adjustment and that the link between rule-following and sustainability varies considerably across national contexts.

To better illustrate this heterogeneity, we map countries into four stylized quadrants based on their average compliance and estimated fiscal sustainability:

- **Top-right quadrant (high compliance, high sustainability):** This group includes countries that combine sustained compliance with fiscal rules and strong, stable fiscal reactions to rising debt. In these cases, rule implementation appears closely aligned with underlying fiscal behaviour, suggesting that compliance is meaningfully associated with effective adjustment.
- **Bottom-right quadrant (high compliance, low sustainability):** Countries in this quadrant comply with fiscal rules, at least formally, yet their primary balances show

limited or insufficient responsiveness to debt accumulation. This disconnect may reflect lenient rule design, pro forma compliance during favourable periods, or structural and institutional constraints that restrict fiscal adjustment.

- **Top-left quadrant (low compliance, high sustainability):** Countries here achieve debt-stabilising fiscal responses despite low adherence to fiscal rules. Strong fundamentals or favourable macroeconomic conditions may partly explain these outcomes, although the absence of consistent compliance could limit resilience if conditions were to deteriorate.

- **Bottom-left quadrant (low compliance, low sustainability):** This group is characterised by both weak compliance and inadequate fiscal reactions to debt. Such cases often reflect broader macroeconomic, institutional, or political challenges that hinder both the effective use of rules and the capacity to adjust.

This stylized mapping highlights an important asymmetry in how compliance and sustainability relate across countries. In some cases, high compliance coincides with strong and reliable fiscal reactions, suggesting that rules operate within institutional settings that reinforce adjustment. In others, similar levels of compliance coexist with weak or unstable fiscal responses, indicating that formal adherence does not necessarily translate into effective fiscal behavior. This dispersion underscores a central insight: compliance is not, on its own, a guarantee of sustainability. Instead, fiscal rules must operate within institutional environments that give them credibility and ensure that compliance reflects meaningful policy adjustment rather than mechanical target fulfilment.

These findings motivate the empirical strategy developed in the next section, where we test whether fiscal rule compliance strengthens the fiscal response to debt and improves financing conditions, once endogeneity and country-specific heterogeneity are properly addressed.

3 Methodology

3.1 Theoretical Framework

The sustainability of public debt has long been debated in the fiscal policy literature. A foundational framework for assessing it was developed by Bohn (1995, 1998, 2007, 2008), who introduced the concept of a linear FRF to model how the primary fiscal balance responds to debt accumulation. This relationship is typically expressed as:

$$pb_t = \mu + \beta d_{t-1} + \varepsilon_t \tag{1}$$

where pb_t is the primary balance as a percentage of GDP, d_{t-1} is the lagged debt-to-GDP ratio, μ captures other structural or cyclical influences on the primary balance, ε_t is an i.i.d. error term, and β denotes the fiscal response coefficient. A positive fiscal response ($\beta > 0$) is considered a necessary condition for debt sustainability, as it implies that the government adjusts its fiscal stance as debt increases.

Ghosh et al. (2013) extend this framework by introducing the concept of fiscal fatigue, highlighting that governments may face decreasing returns, or political limits, to fiscal consolidation at high debt levels. They emphasize the importance of accounting for the interaction between debt dynamics and fiscal effort. The evolution of debt can be expressed as:

$$\Delta d_t = d_t - d_{t-1} = \frac{r_t - g}{1+g} d_{t-1} - pb_t \tag{2}$$

where r_t is the effective real interest rate and g is the real GDP growth rate, assumed exogenous. Substituting equation (1) into equation (2) and assuming $\mu = 0$ for simplicity, yields:

$$\Delta d_t = \left(\frac{r-g}{1+g} - \beta \right) d_{t-1} \tag{3}$$

To avoid explosive debt dynamics ($\Delta d_t \leq 0$), the fiscal response must satisfy the following sustainability condition:

$$\boxed{\beta \geq \frac{r-g}{1+g} = \hat{rg}} \tag{4}$$

The condition implies that the fiscal response must be strong enough to offset the interest-growth differential, ensuring debt remains stable over time. We extend this framework by incorporating fiscal rule compliance in order to capture how adherence to rules can directly influence both fiscal discipline and borrowing costs. A growing body of literature shows that fiscal rules are associated with stronger fiscal discipline (e.g., Fatás et al. 2025; Caselli and Reynaud 2020; Okwuokei 2014; Nerlich and Reuter 2013), and also contribute to lower sovereign borrowing costs by enhancing credibility (Gomez-Gonzalez et al. 2022; Afonso and Jalles 2019).

To capture these effects, we modify the FRF to reflect the strengthening of fiscal behavior when rules are followed. Additionally, we account for the impact of compliance on sovereign risk by incorporating it into a reduced interest rate. The resulting system is:

$$pb_t = (\beta + \theta c_{t-1}) d_{t-1} + \varphi c_{t-1} \tag{5}$$

$$\Delta d_t = \hat{rg}_c d_{t-1} - pb_t \tag{6}$$

$$\hat{rg}_c = \frac{r - g + \psi c_{t-1}}{1+g} = \hat{rg} + \frac{\psi c_{t-1}}{1+g} \tag{7}$$

In this system, c_{t-1} is a binary indicator that equals one when the fiscal rule compliance is observed in period $t-1$ and zero otherwise. In Eq. (5), the coefficient θ gauges how compliance amplifies the responsiveness of the primary balance to lagged debt. When $c_{t-1} = 1$, the slope of the fiscal reaction function becomes steeper, consistent with the idea that credible governments consolidate more forcefully as indebtedness rises. In contrast, the parameter φ captures a pure level effect: even at low debt levels, complying with the rule shifts the primary balance upward. Conversely, ψ in Eq. (7) captures the credibility premium: rule compliance lowers sovereign risk and, hence, the growth-adjusted interest rate, implying $\psi < 0$.

Taking expectations over time and denoting long-run compliance by $\bar{c}$, average debt dynamics can be written as:

$$\Delta d_t = \left(\hat{rg} + \frac{\psi \bar{c}}{1+g} - \beta - \theta \bar{c} \right) d_{t-1} - \varphi \bar{c} \tag{8}$$

Thus, the extended sustainability condition becomes:

$$\boxed{\beta + \theta \bar{c} \geq \hat{rg} + \frac{\psi \bar{c}}{1+g} = \hat{rg}_c} \tag{9}$$

This formulation shows that fiscal rule compliance improves sustainability through two reinforcing channels: stronger fiscal adjustment (θ) and reduced borrowing costs (ψ). When rules are followed ($\bar{c} = 1$), both mechanisms operate to ease the sustainability constraint. Conversely, persistent non-compliance ($\bar{c} = 0$) weakens the adjustment effort and worsens financing conditions, making debt stabilization more difficult. In other words, in presence of compliance, the left-hand side of the sustainability inequality rises while the right-hand side falls, making the condition easier to satisfy.

3.2 Addressing Endogeneity

A central empirical challenge in estimating the effect of fiscal rule compliance on sustainability is the potential endogeneity of compliance. Governments do not comply with fiscal rules at random: compliance decisions are shaped by the same macroeconomic and institutional conditions that also drive debt dynamics. This creates three main sources of bias: *self-selection* (countries with stronger institutions, fiscal capacity, or a political preference for prudence are both more likely to comply and to sustain favorable debt trajectories); *reverse causality* (improvements in sustainability, such as declining debt ratios or favorable interest–growth differentials, may enable governments to meet targets ex post, rather than resulting from compliance per se); and *omitted variables* (unobserved shocks, including commodity price cycles, political incentives, or external financing conditions, can simultaneously influence compliance behavior and sustainability outcomes). Without an explicit identification strategy, these channels confound estimates of the causal effect of compliance.

This problem has long been recognized in the literature on fiscal rules. Early cross-country studies often reported a positive and significant association between the adoption of fiscal rules and stronger fiscal balances, but their findings were sensitive to empirical strategy and rarely addressed endogeneity directly (Heinemann et al., 2018). More recent contributions have shown that causal inference is possible when appropriate methods are used. For example, Caselli and Reynaud (2020) instrument for rule adoption using the geographical diffusion of fiscal rules, thereby isolating the causal impact of adoption on fiscal outcomes. Yet, as the years of fiscal rule experience accumulated, the central question shifted from adoption to compliance. The novelty was no longer whether a country had a rule on the books, but whether it respected the commitments embedded in those rules. Still, the literature on compliance remained scarce due to data limitations. Initial contributions examined compliance with national rules in the European Union (Reuter, 2015, 2019), at the subnational level (Delgado-Téllez et al., 2017), or in limited cross-country settings (Eyraud et al., 2018; Davoodi et al., 2022). In these studies, (non-)compliance was typically measured as the gap between the fiscal rule target and the realized outcome. However, this shift of perspective also brought new econometric challenges: the very factors used to explain compliance, such as growth forecasts, financing costs, or political conditions, are themselves shaped by compliance decisions and fiscal outcomes.

Both Reuter (2015) and Delgado-Téllez et al. (2017) explicitly acknowledge the possibility of endogeneity between compliance and fiscal performance. Delgado-Téllez et al. (2017) address this by estimating compliance margins using both first-difference GMM and two-stage least squares (2SLS), relying on lagged variables as instruments to mitigate simultaneity between forecast errors, financing costs, or political cycles and compliance. Reuter (2015) likewise recognizes that macroeconomic and political variables may be jointly determined with fiscal performance and deals with this by employing country, rule, and time fixed effects, together with robustness checks across alternative specifications. Thus, while both frameworks measure non-compliance in a comparable way, they differ in how they attempt to reduce bias from endogenous explanatory variables. However, none of these studies provides a causal estimate of the effect of *compliance itself* on fiscal sustainability.

The recent development of systematic compliance datasets has marked an important turning point. The European Commission's Compliance Tracker (Larch et al., 2023) and the Latin American and Caribbean Compliance Hub (Ulloa-Suarez and Valencia, 2022) have gather comparable data on whether countries adhere to their rules publicly available, enabling new lines of research. These data have facilitated studies of the determinants of compliance in both supranational frameworks (Larch et al., 2023) and national ones (Ardanaz et al., 2024; Ulloa-Suarez and Valencia, 2022; Ulloa-Suárez, 2023). More importantly, they open the door to using compliance not only as an outcome of interest but also as an explanatory variable in analyses of fiscal performance. This paper builds on that opportunity to provide the first cross-country causal evidence on the effect of compliance on fiscal sustainability.

Our framing requires addressing the empirical challenge directly: compliance is not exogenous. As discussed in Ulloa-Suarez and Valencia (2024b), compliance rates in Latin America and the Caribbean tend to rise in periods of strong economic activity, when higher revenues and favorable financing conditions make fiscal targets easier to meet, and to fall during downturns as tax receipts weaken and fiscal pressures intensify. The unusually high compliance observed in 2022, for example, largely reflected stronger-than-expected GDP growth and inflation that raised expenditure ceilings and enabled target attainment without significant fiscal adjustment. The subsequent decline in 2023 and the heightened risks projected for 2024 illustrate how short-term compliance dynamics often mirror cyclical conditions rather than underlying fiscal effort. This asymmetric response, with sharper deteriorations in recessions than improvements in expansions, highlights why compliance cannot be treated as exogenous to sustainability outcomes: the same shocks that facilitate or constrain compliance also shape debt trajectories.

While these dynamics partly reflect cyclical conditions, they also point to a broader omitted-variable concern. Unobserved institutional or political shocks may simultaneously affect both the likelihood of complying with a fiscal rule and the government's capacity to adjust fiscal policy as debt increases. To mitigate this risk, the empirical specification incorporates governance and institutional quality controls that capture slow-moving differences in administrative capacity, credibility, and rule enforcement across countries. These controls absorb institutional heterogeneity that could otherwise bias the estimated relationship between compliance and sustainability. Yet, although they reduce the influence of unobserved institutional variation, they cannot eliminate the endogeneity that arises when compliance is shaped by the same macroeconomic forces driving debt dynamics. This limitation underscores the need for an identification strategy that isolates variation in compliance that is plausibly exogenous to domestic fiscal conditions.

If left unaddressed, these sources of bias risk attributing to compliance what is in fact the consequence of favorable cyclical conditions or deeper institutional characteristics. The literature on fiscal rules has consistently shown that correlations between rules and fiscal performance often weaken or disappear once endogeneity is explicitly taken into account (Caselli and Reynaud, 2020). Our contribution is to extend this insight to the study of compliance itself. By adopting an IV strategy, we exploit sources of exogenous variation in compliance that are independent of contemporaneous fiscal pressures, thereby providing consistent estimates of its causal impact on sustainability. This allows us to bring the identification debate that has characterized studies of fiscal rule adoption into the newer literature on fiscal rule compliance.

3.2.1 Instruments

Our identification strategy generalizes the logic introduced by Caselli and Reynaud (2020), in which fiscal rule adoption in neighboring countries serves as an instrument for domestic adoption. Their intuition is that institutional reforms diffuse across countries through geographical or political proximity, but such diffusion is unlikely to directly affect a country's fiscal balance except through the adoption decision itself. We extend this idea from adoption to compliance and adapt the notion of neighbors to multiple relevant dimensions. Specifically, we leverage the fiscal rule compliance of other countries that are either geographically or institutionally proximate. The underlying assumption is that such peer effects influence the likelihood that a government adheres to its own fiscal rules through mechanisms of norm diffusion, reputational pressures, or regional benchmarking, while not directly determining that country's primary balance or borrowing costs except through its own compliance decision.

Building on this logic, we rely on two external sources of variation in compliance that operate through distinct but well-defined diffusion channels: geographic spillovers and reputational peer effects.

Spatial Instrument (Frontier-Based Compliance). The first instrument captures the average compliance of countries that share a land border with country i. This definition reflects direct regional spillovers that may arise when neighboring countries face similar political constraints, institutional diffusion, or coordination incentives. In regions with strong cross-border integration, governments may react to the fiscal behavior of immediate neighbors to preserve policy coherence or avoid reputational divergence.

Figure 2 illustrates this mechanism for Chile in 2019. The countries displayed with vertical hatch lines correspond to its land neighbors, whose compliance behavior forms the basis of the frontier-based instrument. Since neighboring countries do not directly determine domestic debt dynamics, compliance among frontier peers serves as a source of exogenous variation that influences a country's compliance decision without mechanically affecting its sustainability outcomes.

Rating Instrument (Peer Rating-Based Compliance). The second instrument exploits reputational spillovers among countries that, in year t, share the same sovereign credit rating according to the three major agencies (Fitch, Moody's, and Standard and Poor's). The theoretical motivation builds on evidence that compliance with fiscal rules operates as a credibility signal: countries that meet their fiscal targets enjoy lower spreads, fewer debt accelerations, and stronger credit ratings (Ardanaz et al., 2024), while deviations from fiscal frameworks, including the activation of escape clauses during systemic shocks, have measurable effects on financing costs (Ulloa-Suárez et al., 2025). Countries with the same credit rating, therefore, face common reputational benchmarks, as investors compare fiscal performance within these rating clusters and governments have incentives to emulate the compliance behavior of their rating peers.

Figure 2: Frontier and Peer Rating Instrument for Chile in 2019

Note: The map illustrates Chile, the countries that share a land border with it (shown with horizontal hatch lines), and the set of countries that shared Chile's sovereign credit rating in the reference year (shown with vertical hatch lines). The figure displays the full set of geographical and rating peers for illustrative purposes. For the empirical construction of the instruments, only the countries for which compliance data are available are used.

To illustrate this logic, Figure 2 provides an example based on Chile. The frontier-based instrument is narrow in this case: the vertical hatch lines mark Chile's immediate neighbours, forming a small and regionally concentrated spatial peer group. In contrast, the rating-based instrument captures a far broader network. The horizontal hatch lines identify the set of countries that shared Chile's sovereign credit rating in the reference year, spanning economies across Asia, Europe, and the Middle East. This contrast illustrates the two diffusion channels: geographic spillovers operate through close neighbours, whereas reputational spillovers arise within a globally dispersed institutional cluster. It is precisely this broader structure that motivates the construction of the peer rating–based instrument.

The empirical construction of the instrument is based on sovereign credit rating data obtained through web scraping of the Datosmacro platform[2] , which reports annual ratings from the three agencies. For each year, we recover the rating assigned to every country in our sample and retain only those for which ratings are simultaneously available from Fitch, Moody's, and Standard and Poor's. This procedure yields an annual panel of comparable sovereign ratings from which rating peers are identified. For a given country i and year t, rating peers are defined as all other countries that share the same sovereign rating across the three agencies in that year. The instrumental variable is computed as the average compli-

[2]Source: https://datosmacro.expansion.com/ratings

ance at fiscal rule level, among these peers, excluding country i. This construction captures a reputational rather than macroeconomic mechanism: rating peers do not directly influence a country's debt dynamics, but they shape incentives to comply with fiscal rules in order to preserve credibility and avoid downgrades.

Both instruments are constructed separately and lagged one year to mitigate simultaneity concerns. In the first stage, we regress each country's compliance on the selected instrument(s), controlling for the full set of macroeconomic and institutional variables and including country–rule fixed effects.

A final consideration concerns the exclusion restriction. As in Caselli and Reynaud (2020), our identification strategy relies on the assumption that peer behaviour affects a country's fiscal outcomes only through its influence on domestic compliance. Although this assumption cannot be tested directly, it is possible to discuss the channels through which it may be violated and how our design mitigates those risks. A first concern is that spatially defined peers may be exposed to regional shocks that also shape domestic fiscal outcomes.

To mitigate this concern, all our first-stage specifications include the same set of controls employed by Caselli and Reynaud (2020), such as trade openness, governance indicators, and measures of institutional quality. These variables are designed to capture cross-border spillovers and common regional shocks, thereby reducing the likelihood that neighbouring countries' fiscal conditions directly affect domestic fiscal outcomes, such as primary balances or borrowing conditions, outside the compliance channel.

The reputational channel provides an even stronger safeguard for the exclusion restriction. Rating peers are typically located in different regions and face distinct macroeconomic and political shocks, which makes it unlikely that their compliance behaviour influences domestic fiscal outcomes except through its effect on incentives to comply. This feature limits the scope for geographical confounding that often arises with spatial diffusion strategies. Our robustness instruments reinforce this logic. The proximity-based measure widens the spatial radius to 1,000 kilometres, ensuring that results do not depend exclusively on narrow border relationships, while the upper-notch instrument relies on better-rated sovereigns whose macroeconomic shocks are even less correlated with those of the home country. These considerations strengthen the plausibility of the exclusion restriction and support the view that the instruments affect fiscal outcomes only through their impact on domestic compliance.

3.3 Empirical Approximation

As established in the theoretical framework, debt sustainability hinges on two core components: the FRF and the interest-growth differential. Fiscal rule compliance can influence both channels: by strengthening the government's fiscal response to rising debt and by improving market perceptions that lower borrowing costs. Our empirical strategy is designed to assess these two dimensions systematically.

To evaluate the specific role of fiscal rule compliance in enhancing sustainability, as described in equation 9 we seek to identify two key parameters: θ, capturing the effect of compliance on the strength of the fiscal response; and ψ, measuring the effect of compliance on the interest-growth differential. These effects are estimated separately in the next subsections. Section 3.3.1 focuses on identifying θ through an extended version of the FRF that includes compliance interactions. Section 3.3.2 turns to the estimation of ψ by analyzing how compliance influences the effective interest-growth differential. The table below summarizes the core estimations and their expected directional effects:

Table 1: Summary of Equations and Effects

Compliance Effect	**Equation**	**Parameter of Interest**	**Expected Sign**
Fiscal Reaction	eq. 5	θ	$+$
$\hat{rg}_c$	eq. 7	ψ	$-$

Our framework explicitly shifts the focus from the de jure adoption of rules to their de facto implementation. We argue that when fiscal rules are implemented, governments actively undertake the corrective fiscal measures required to counter rising debt, which strengthens the fiscal reaction function ($\theta > 0$). Simultaneously, markets are more likely to interpret compliance as a credible signal of fiscal discipline, reducing perceived risk and lowering borrowing costs, thus improving the interest-growth differential ($\psi < 0$). Capturing both of these channels empirically, and conditioning them on observed compliance, constitutes one of the core contributions of this paper.

The empirical strategy proceeds in three steps for the estimation of the parameters summarized in Table 1. We first report standard fixed-effects OLS estimates as a baseline characterization of the data, while recognizing that both debt and compliance may be endogenous to fiscal conditions. We therefore estimate fixed-effects instrumental variable (2SLS) models that address the endogeneity of compliance using two external instruments based on geographical proximity and sovereign rating peers. However, compliance is not the only potentially endogenous regressor: debt dynamics may also respond to contemporaneous policy shocks, creating a feedback loop that fixed effects and external instruments alone may not fully purge.

To address this, we rely on the System Generalized Method of Moments (System GMM), which is a standard estimator for short-T and large-N panels that allows for the inclusion of lagged dependent variable and mitigates endogeneity arising from simultaneity, reverse causality, and unobserved heterogeneity. Following Arellano and Bover (1995) and Blundell and Bond (1998) framework, we exploit the model's stacked system in first differences and levels, using restricted number of lagged values of endogenous and predetermined regressors as internal instruments. This setup addresses biases that persist under fixed-effects models under dynamic settings (Wooldridge, 2010), which cannot be eliminated by differencing alone (Nickell, 1981). Finally, we augment the standard internal instrument set with the external instruments described in section 3.2, strengthening identification of compliance-related variation in the fiscal reaction function. This final step follows the standard approach in the fiscal reaction literature, where System GMM is used to correct for the endogeneity of debt in dynamic fiscal response equations.

3.3.1 Compliance Effect on Fiscal Reaction

To assess the effect of fiscal rule compliance on debt sustainability, as formalized in the extended sustainability condition of equation 9, we begin by testing whether compliance strengthens the fiscal reaction to debt. Specifically, we estimate the extended FRF in equation 5 with the following baseline specification:

$$pb_{i,j,t} = \beta d_{i,j,t-1} + \varphi\, C_{i,j,t-1} + \theta\, d_{i,j,t-1} \times C_{i,j,t-1} + \Omega X_{i,j,t} + \gamma_{i,j} + \varepsilon_{i,j,t} \tag{10}$$

In this model, $pb_{i,j,t}$ is the primary balance as a percentage of GDP for country i, rule j, and year t, and $d_{i,j,t-1}$ is the lagged debt-to-GDP ratio. $X_{i,j,t}$ is a set of control variables described in Table 8 in Appendix A. The binary variable $C_{i,j,t-1}$ equals 1 if the country complied with rule j in year $t-1$, and 0 otherwise. Finally, $\gamma_{i,j}$ represents country-rule fixed effects.

In this framework, β captures the fiscal reaction under non-compliance and under compliance it becomes $\beta + \theta$. Thus, positive values for θ indicate that compliance enhances the responsiveness of primary balances to debt, thereby improving sustainability *ceteris paribus*.

3.3.2 Compliance Effect on Growth-Adjusted Interest Rate

The right-hand side of the sustainability condition in equation 9 incorporates the interest-growth differential under compliance, denoted as $\hat{rg}_c$. This growth-adjusted interest rate is computed following the standard methodology proposed by Mauro and Zhou (2021) and Escolano and Woo (2017):

$$\hat{rg}_t = \frac{r_t + \alpha_{t-1} e_t - \alpha_{t-1} g_t}{1 + \alpha_{t-1} g_t} \tag{11}$$

In this expression, r_t is the effective interest rate on public debt (approximated as interest payments over lagged debt), α_{t-1} is the share of foreign currency-denominated debt, e_t is the annual depreciation rate of the domestic currency against the U.S. dollar, and g_t is the nominal GDP growth rate. For each country, we compute the time-average of $\hat{rg}_t$ over the sample period 2000–2023. This $\hat{rg}$ specification mirrors the debt profile of LAC, where roughly 45% of public liabilities are denominated in foreign currency, making exchange-rate swings a critical determinant of borrowing costs and overall debt sustainability.

To empirically test whether compliance significantly influences this differential, as suggested in equation 7, we estimate the model:

$$\hat{rg}_{i,j,t} = \psi\, C_{i,j,t-1} + \Omega\, X_{i,j,t} + \gamma_{i,j} + \varepsilon_{i,j,t} \tag{12}$$

Here, $\hat{rg}_{i,j,t}$ denotes the interest-growth differential for country i, rule j, and year t. The binary variable $C_{i,j,t-1}$ equals 1 if the fiscal rule was complied with in the previous year, and 0 otherwise. $\gamma_{i,j}$ are country-rule fixed effects. $X_{i,j,t}$ represents the same vector of controls included in regression 10, added to annual change in public debt, following Mauro and Zhou (2021), to account for its potential direct influence on the interest-growth differential. This ensures that the estimated effect of compliance is not confounded by contemporaneous debt dynamics, which could independently affect both market confidence and financing costs.

The coefficient ψ captures the effect of compliance on the interest-growth differential. A negative and statistically significant ψ would suggest that fiscal rule compliance improves borrowing conditions, likely through enhanced policy credibility, reduced sovereign risk, and more favorable market perceptions. In turn, this would lower the effective interest rate, improving the fiscal sustainability condition *ceteris paribus*.

3.4 Data and Sample Characteristics

The empirical analysis relies on an unbalanced panel dataset covering 40 countries over the period 2000–2023. The sample includes 13 countries from LAC and 27 member states of the EU.[3] This dual-regional focus enables a comparative assessment of fiscal behavior under two distinct institutional settings, emerging versus advanced economies. The panel is unbalanced primarily due to staggered rule adoption and gaps in macro-fiscal data, particularly in the early 2000s. The unit of observation is defined at the country-rule-year level, allowing the dataset to capture instances in which multiple fiscal rules operate simultaneously within a single country.

The empirical exercises rely on a pool of control variables that capture fiscal, macroeconomic, external, and institutional conditions. Fiscal and macroeconomic variables, including public debt, primary balances, real GDP growth, inflation, interest payments, the effective interest rate on public debt, the output gap, and exchange rate changes, are sourced from the IMF (2024b) database. External sector indicators comprise direct investment, exports of goods and services, the financial account balance, the oil trade balance, and trade openness, defined as the sum of exports and imports as a share of GDP. Natural resource rents, expressed as a percentage of GDP, are taken from the World Bank (World Bank, 2024).

[3]The LAC countries in the sample are Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Honduras, Mexico, Panama, Paraguay, Peru, The Bahamas, and Uruguay. The European countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom. Jamaica and Ecuador are excluded due to exceptionally high debt levels and ongoing or recent restructuring processes, which could bias fiscal reaction estimates and obscure the interpretation of sustainability dynamics.

Institutional controls include governance indicators from the World Bank's World Development Indicators (WDI) (World Bank, 2024), summarizing political stability, government effectiveness, and regulatory quality. These variables are incorporated to account for institutional heterogeneity that may influence fiscal outcomes and the likelihood of rule compliance.

Compliance with fiscal rules is measured using two complementary sources: the dataset developed by Ulloa-Suarez and Valencia (2022) for LAC and the numerical compliance database compiled by the European Commission (Larch et al., 2023) for EU countries. We define fiscal rule compliance as a binary outcome that captures whether a country met their numerical target of a given rule in a given year. Formally,

$$C_{i,r,t} = \begin{cases} 1 & \text{if country } i \text{ complied with rule } j \text{ in year } t, \\ 0 & \text{otherwise.} \end{cases}$$

Treating compliance as binary reflects the institutional nature of fiscal rules, which are written as pass–fail constraints rather than as continuous objectives. Using distances to the target or continuous deviations is not appropriate in this setting, because rules differ substantially in how their numerical limits are defined and adjusted over time. Across countries, targets may be timeless fixed ceilings, indexed limits, conditioned thresholds, hybrid designs, or convergence paths. These formats restrict the same macroeconomic aggregates but do so in ways that are not comparable in scale or interpretation (Ulloa-Suarez and Valencia, 2024a). As a result, a deviation of one percentage point from the target can signal very different institutional behaviors depending on the rule's structure, making it impossible to interpret deviations in a homogeneous cross–country manner. A binary definition therefore provides the only consistent and comparable measure of actual rule implementation across heterogeneous fiscal frameworks. This approach aligns with the construction of existing cross–country datasets and preserves the institutional meaning of compliance as meeting or not meeting the rule in force.

Summary statistics for all variables, including means, dispersion, and data sources, are reported in Appendix A. The average primary balance is close to zero, with a standard deviation of 3 percentage points. Public debt averages 56% of GDP but exhibits considerable cross-country and time variation. Compliance rates differ by rule type: debt rules show the highest average compliance (68%), followed by budget balance rules (62%), while structural balance and expenditure rules are met less frequently. Covariates fall within expected ranges across macroeconomic, external, fiscal, and institutional dimensions.

4 Results

This section presents the empirical results on the two channels that link fiscal rule compliance to fiscal sustainability. We begin by examining whether compliance strengthens governments' fiscal reaction to rising debt, focusing on the responsiveness of the primary balance to past debt accumulation. We then turn to the financial channel, assessing whether compliance improves borrowing conditions by lowering the interest–growth differential. Finally, we explore whether these effects become more pronounced when debt levels are high, a setting in which fiscal fatigue typically constrains governments' ability to adjust.

Before turning to the structural estimates, we assess the relevance of the two external instruments used to address the endogeneity of fiscal rule compliance. Table 2 reports the first stage coefficients from the 2SLS specifications. Each column corresponds to a different instrument set: frontier-based, rating-based, and the joint specification combining both sources of external variation.

Table 2: First Stage Estimates for External Instruments

	Compliance (L) (1)	Compliance (L) (2)	Compliance (L) (3)
Spatial (L)	0.356***		0.377***
	(0.036)		(0.038)
Rating (L)		0.326***	0.076***
		(0.044)	(0.048)
Controls	Yes	Yes	Yes
Kleibergen-Paap Wald F	101.33	54.94	55.01
Stock-Yogo CV (10%)	16.38	16.38	19.93
Observations	2,725	2,667	2,542
Country-rule	121	126	117
Countries	37	39	36

Note: Columns report 2SLS first stage estimates for the lagged compliance variable. "Spatial" corresponds to the average compliance of frontier neighbors, "Rating" corresponds to the average compliance of rating peers, and "Both" includes both external instruments jointly. All specifications include a set of controls. Robust standard errors in parentheses. The Kleibergen-Paap Wald F-statistic assesses instrument relevance, with Stock-Yogo critical values shown for the 10 percent maximal IV size. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. ***p<0.01, **p<0.05, *p<0.1.

The results point that both external instruments are strong predictors of fiscal rule compliance. The Spatial instrument yields highly significant coefficients and a Kleibergen–Paap Wald F-statistic well above the Stock–Yogo critical values, indicating that it passes conventional thresholds for instrument relevance. The Rating instrument also performs strongly when used alone, although its explanatory power naturally declines when both external instruments are included jointly. Across all specifications, the Kleibergen–Paap statistics consistently exceed the corresponding Stock–Yogo critical values, providing formal evidence that weak instrument concerns are unlikely to affect the subsequent structural estimations. The first stage results support the use of the spatial and rating-based instruments in the empirical strategy.

4.1 Fiscal Responses Strengthen with Compliance

We begin by examining whether compliance with fiscal rules strengthens governments' fiscal reaction to rising debt. The objective is to test whether compliant governments adjust their primary balances more forcefully in response to past debt accumulation, as predicted by the fiscal reaction function. Equation 10 provides a flexible structure that allows the fiscal response to vary according to compliance as well as across regions, thereby capturing potential heterogeneity in adjustment behavior.

Table 3 reports the estimates of the fiscal reaction function, where the primary balance responds to lagged debt, lagged compliance, and their interaction. Column (1) presents a baseline two-way fixed-effects specification estimated by OLS, which does not correct for the potential endogeneity of either debt or compliance. Columns (2) to (4) report fixed-effects instrumental variables (2SLS) estimates that address the endogeneity of compliance using two external sources of variation. Column (2) uses the spatial instrument based on frontier-neighbour compliance. Column (3) uses the peer rating-based instrument. Column (4) includes both instruments jointly. In the joint specification, debt is also instrumented, since its dynamics may respond to contemporaneous shocks that fixed effects alone cannot remove. Columns (5) to (7) re-estimate the same structure using System GMM, which combines equations in levels and first differences. In this framework, debt is treated as endogenous and instrumented using its internal lags, while compliance is instrumented using the spatial and rating-based instruments together with appropriate lags. This approach provides a more comprehensive correction for the endogeneity of both regressors.

Table 3 also reports the Hansen over-identification test, whose null hypothesis states that all instruments are valid, meaning that they are exogenous and correctly excluded from the estimated equation. A high p-value supports their joint validity. In addition, we report AR(1) and AR(2) tests on the differenced residuals. Significant AR(1) is expected by construction, whereas an insignificant AR(2) statistic indicates the absence of second-order serial correlation and validates the use of lagged variables as instruments. All coefficients are shown with robust standard errors in parentheses.

In the baseline fixed-effects OLS specification, the coefficient on lagged debt is positive (0.028) and statistically significant, consistent with a standard fiscal reaction in which higher debt prompts governments to generate stronger primary balances. Compliance also enters positively (0.010), and the interaction between debt and compliance (0.006) is significant. These results suggest that governments that comply with their fiscal rules exhibit a stronger fiscal response to rising debt. However, both debt and compliance are likely endogenous to underlying fiscal conditions, which implies that the magnitude, significance, and even the sign of the OLS coefficients may be biased.

Table 3: Estimates of Compliance Effect on Fiscal Reaction Function

	FE (OLS)	**FE-IV (2SLS)**			**System GMM**		
		Spatial	Rating	Both	Spatial	Rating	Both
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Debt (L)	0.028***	-0.003	0.061	-0.009	0.016*	0.026***	0.011***
	(0.004)	(0.008)	(0.060)	(0.007)	(0.009)	(0.009)	(0.004)
Compliance (L)	0.010***	0.029**	0.097	0.017	0.004	0.005	0.006
	(0.002)	(0.012)	(0.069)	(0.011)	(0.008)	(0.006)	(0.006)
Debt x Compliance (L)	0.006*	0.023**	-0.122	0.026**	0.015*	0.013***	0.011*
	(0.003)	(0.012)	(0.127)	(0.011)	(0.008)	(0.004)	(0.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)					0.000	0.000	0.000
AR(2)					0.841	0.758	0.929
Hansen				0.123	0.254	0.768	0.499
Observations	2,894	2,737	2,071	2,534	2,603	2,470	2,540
Country-rule	134	121	119	116	121	126	122
Countries	40	37	39	36	35	37	36

Note: Table 3 reports the estimated coefficients of lagged debt, lagged compliance, and their interaction on the primary balance. Growth-adjusted interest rate estimates include two lags of the dependent variable and use lags four to five as additional instruments. FRF specifications include one lag of the dependent variable and lags nine to eleven as additional instruments. All specifications include a set of controls. Robust standard errors in parentheses. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. ***p<0.01, **p<0.05, *p<0.1.

In the FE–IV (2SLS) specifications, instrumenting compliance with the spatial instrument renders the debt coefficient insignificant, while both the compliance coefficient (0.029) and the interaction term (0.023) remain positive and statistically significant. Their magnitudes increase considerably, roughly three to four times the size of the corresponding FE–OLS coefficients. This pattern suggests that failure to correct for endogeneity leads OLS to underestimate the role of compliance in shaping fiscal behavior. Under the rating-based instrument, none of the coefficients are statistically significant, which reflects the weaker performance of this instrument when used on its own. When both external instruments are included jointly, the interaction term remains significant, with a coefficient of 0.026, about four times larger than in the FE–OLS model, while the coefficients on debt and compliance lose significance. Although the Hansen test indicates that the external instruments are jointly valid, debt may still be endogenous in these 2SLS models.

Under the System GMM specifications, the results remain consistent and robust. Debt continues to be positively and significantly associated with the primary balance across all instrument sets, although its magnitude is smaller than in the FE–OLS benchmark. The coefficient on compliance alone is small and only weakly significant. By contrast, the interaction between debt and compliance remains positive and statistically significant in all cases, indicating that compliance strengthens the fiscal response to rising debt. Its magnitude, which ranges from 0.011 to 0.015, is lower than in the FE–IV estimates but still roughly twice as large as in the FE–OLS model. Diagnostic tests support the validity of these results. The AR(1) statistic shows the expected first-order serial correlation in differences, while the AR(2) test provides no evidence of second-order correlation. The Hansen p-values, which lie between 0.25 and 0.77, indicate that the instrument set is appropriately specified.

4.2 Compliance Effects on the Growth-Adjusted Interest Rate

We now turn to the second channel of the sustainability framework, which examines whether compliance improves borrowing conditions by lowering the growth-adjusted interest rate. Equation 12 formalizes the relationship between fiscal rule compliance and $\hat{rg}_c$, the interest–growth differential. The estimation strategy mirrors that used for the fiscal reaction function. Table 4 reports fixed-effects estimates, FE–IV (2SLS) specifications using spatial and rating-based instruments, and System GMM models that account for endogeneity in compliance and for dynamic panel bias due to lagged primary balance. The same diagnostic tests are reported as in the previous table, including AR(1), AR(2), and the Hansen overidentification test.

In the baseline fixed-effects OLS model, the coefficient on lagged compliance is small and statistically insignificant. This suggests that, without correcting for endogeneity, there is no clear association between compliance and the interest–growth differential. However, as discussed earlier, these OLS estimates likely suffer from substantial bias, since both compliance behaviour and borrowing conditions respond to underlying fiscal and macroeconomic conditions.

Under the FE–IV (2SLS) specifications, instrumenting compliance with the spatial instrument produces a negative but insignificant coefficient, while the rating-based instrument yields a positive and insignificant effect. The joint specification also produces an insignificant estimate. These patterns reflect the possibility that external instruments alone cannot fully purge the endogeneity in this financial channel.

The System GMM results provide a clearer picture. Across all three instrument sets, compliance significantly reduces the growth-adjusted interest rate. The estimated coefficients range from –0.015 to –0.029 and remain statistically significant at conventional levels. These magnitudes imply that compliance is associated with lower borrowing costs that more than compensate for differences in growth performance, thereby improving the sustainability condition. The negative sign is consistent with the idea that compliance sends a credible signal to financial markets, reducing perceived sovereign risk and tightening the interest–growth differential.

Table 4: Estimates of Compliance Effect on Growth-Adjusted Interest Rate

	FE (OLS)	**FE-IV (2SLS)**			**System GMM**		
		Spatial	Rating	Both	Spatial	Rating	Both
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Compliance (L)	-0.002	-0.006	0.010	0.005	-0.029***	-0.015*	-0.015*
	(0.003)	(0.014)	(0.019)	(0.013)	(0.008)	(0.008)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)					0.000	0.000	0.000
AR(2)					0.117	0.661	0.766
Hansen				0.525	0.518	0.438	0.667
Observations	2,882	2,725	2,667	2,530	2,468	2,363	2,244
Country-rule	134	121	126	116	121	126	116
Countries	40	37	39	36	35	37	33

Note: Table 4 reports the estimated coefficients of lagged compliance on the growth-adjusted interest rate. Fixed-effects IV (2SLS) specifications instrument compliance using the spatial and rating-based external instruments, either separately or jointly. System GMM estimates include two lags of the dependent variable and use lags four to five as additional instruments, while compliance is instrumented with the external instruments and the corresponding lag structure. All specifications include a set of controls. Robust standard errors in parentheses. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. ***p<0.01, **p<0.05, *p<0.1.

Diagnostic tests support the validity of the System GMM estimates. The AR(1) statistic shows the expected first-order serial correlation in differences, while the AR(2) test indicates no evidence of second-order correlation. Hansen p-values fall within acceptable ranges, suggesting that the instrument set is not overfitting the endogenous regressors. The results of the second channel of the sustainability condition point to a consistent and robust conclusion: fiscal rule compliance improves borrowing conditions by reducing the interest–growth differential, reinforcing its role as a credibility-enhancing mechanism.

4.3 Does Compliance Matter More When Debt Is High?

The previous results show that fiscal rule compliance strengthens the responsiveness of primary balances to rising debt and improves borrowing conditions through a lower growth–adjusted interest rate. In this subsection, we examine whether this effect varies with the level of indebtedness. The motivation is straightforward: when debt is already high, governments often face fiscal fatigue, which reflects political, economic, and institutional constraints that weaken the ability to generate further primary surpluses. If compliance helps overcome these constraints, its impact should be particularly pronounced at elevated debt levels.

To explore this possibility, we introduce a nonlinear specification that interacts compliance with a high-debt indicator, denoted $H_{i,j,t}$. This variable equals one when the debt-to-GDP ratio lies above the 90^{th} percentile of its own country-specific historical distribution, and zero otherwise. This design captures whether the compliance and sustainability link intensifies precisely when fiscal conditions are more fragile.

Formally, the augmented fiscal reaction function is given by:

$$\begin{aligned} pb_{i,j,t} = {} & \delta_1 \, d_{i,j,t-1} + \kappa \, C_{i,j,t-1} + \lambda_1 \, d_{i,j,t-1} \times C_{i,j,t-1} \\ & + \delta_2 \, d_{i,j,t-1} \times H_{i,j,t} + \lambda_2 \, d_{i,j,t-1} \times C_{i,j,t-1} \times H_{i,j,t} \\ & + \Omega X_{i,j,t} + \gamma_{i,j} + \gamma_t + \varepsilon_{i,j,t}. \end{aligned} \tag{13}$$

This structure allows us to recover four distinct fiscal reactions. For observations below the high-debt threshold, the baseline reaction under non-compliance is δ_1. Compliance increases that reaction to $\delta_1 + \lambda_1$. When debt is high, the reaction for non-compliers becomes $\delta_1 + \delta_2$, and the reaction for compliers rises to $\delta_1 + \delta_2 + \lambda_1 + \lambda_2$. A positive and statistically significant λ_2 would therefore indicate that compliance strengthens the fiscal response precisely when debt is elevated, helping to offset fiscal fatigue and reinforce sustainability.

To assess the corresponding financial channel, we also estimate whether compliance exerts a stronger effect on the interest and growth differential under high debt. The specification is:

$$\hat{rg}_{i,j,t} = \psi_1 \, C_{i,j,t-1} + \psi_2 \, C_{i,j,t-1} \times H_{i,j,t} + \Omega X_{i,j,t} + \gamma_{i,j} + \varepsilon_{i,j,t}. \tag{14}$$

Here, ψ_1 captures the average effect of compliance on borrowing conditions, while ψ_2 measures whether this effect becomes stronger when countries face higher debt levels.

The results are presented in Table 5. The structure of the table mirrors that of the previous results. Columns (1) to (3) report the fiscal reaction function estimates under the three instrument sets, and columns (4) to (6) present the corresponding effects on the growth-adjusted interest rate.

Table 5: Fiscal Reaction Function and Growth-Adjusted Interest Rate under High Debt Levels

	Fiscal Reaction Function			**Growth-Adjusted Interest Rate**		
	Spatial (1)	Rating (2)	Both (3)	Spacial (4)	Rating (5)	Both (6)
Debt (L)	0.025**	0.036***	0.071***			
	(0.011)	(0.013)	(0.015)			
Compliance (L)	0.012	0.018**	0.028***	-0.031***	-0.019**	-0.021***
	(0.008)	(0.009)	(0.010)	(0.007)	(0.007)	(0.006)
High Debt	0.029**	0.014	0.036***	0.030***	0.040***	0.031***
	(0.013)	(0.013)	(0.012)	(0.009)	(0.010)	(0.008)
Debt x Compliance (L)	-0.023**	-0.003	-0.025**			
	(0.011)	(0.012)	(0.012)			
Debt (L) x High Debt	-0.035***	-0.019	-0.053***			
	(0.013)	(0.013)	(0.012)			
Compliance (L) x High Debt	-0.061***	-0.050**	-0.063***	-0.064***	-0.077***	-0.067***
	(0.016)	(0.019)	(0.018)	(0.022)	(0.022)	(0.020)
Debt (L) x Compliance (L) x High Debt	0.076***	0.055***	0.091***			
	(0.018)	(0.020)	(0.024)			
	Joint significance					
Non-compliance with low debt	0.025**	0.036***	0.071***	-	-	-
	(0.011)	(0.013)	(0.015)			
Non-compliance with high debt	-0.099	0.017	0.004	-	-	-
	(0.013)	(0.146)	(0.135)			
Compliance with low debt	0.002	0.033***	0.034***	-0.031***	-0.019**	-0.021***
	(0.009)	(0.010)	(0.008)	(0.007)	(0.007)	(0.006)
Compliance with high debt	0.043***	0.070***	0.081***	-0.095***	-0.095***	-0.087***
	(0.016)	(0.016)	(0.018)	(0.023)	(0.020)	(0.020)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.432	0.593	0.202	0.986	0.117	0.583
Hansen	0.909	0.903	0.911	0.876	0.781	0.916
Observations	2399	2470	2351	2,468	2,363	2,244
Country-rule	121	126	116	121	126	116
Countries	35	37	33	35	37	33

Note: Table 5 reports the estimated coefficients of lagged debt, lagged compliance, and their interactions under high debt conditions. FRF specifications include one lag of the dependent variable and instrument it using internal lags (nine to eleven) together with the spatial and rating-based external instruments. Growth-adjusted interest rate estimates include two lags of the dependent variable and use lags four to five as additional instruments, while compliance is instrumented with the external instruments and the corresponding lag structure. All specifications include a set of controls. Robust standard errors in parentheses. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. ***p<0.01, **p<0.05, *p<0.1.

Across identification strategies, the coefficients exhibit consistent signs and magnitudes.

The key question is whether the fiscal response to debt differs between compliant and non-compliant governments once debt reaches high levels Using equation 13, we compute the implied marginal reactions for each instrument set[4]. Under the spatial instrument, the fiscal response at high debt is slightly negative in the absence of compliance ($\delta_1 + \delta_2 = -0.099$) but becomes positive once compliance is observed ($\delta_1 + \delta_2 + \lambda_1 + \lambda_2 = 0.043$).

Under the rating-based identification, the response increases from 0.017 for non-compliant governments to 0.070 for compliant ones, which is almost a fourfold difference. This again indicates that compliance significantly amplifies fiscal adjustment. In the joint specification combining both instruments, the marginal effect rises from 0.004 (non-compliance) to 0.081 (compliance), yielding the strongest and most robust adjustment across all models.

Turning to the growth-adjusted interest rate, columns (4) to (6) of Table 5 present the estimates from equation 14. Since this specification does not include the debt stock, its interpretation relies on level differences rather than marginal effects. The coefficient ψ_1 captures the average effect of compliance on the interest–growth differential when debt is below the high-debt threshold, while ψ_2 shows how this effect changes once a country enters a high-debt environment. Across all instrument sets, compliance is associated with a statistically significant reduction in the interest–growth differential, and this reduction becomes larger when the high-debt indicator equals one. For instance, under the joint instrument specification, compliance lowers the interest–growth differential by 0.021 when debt is below the high-debt threshold and by 0.088 (that is, $\psi_1 + \psi_2$) when debt is high. These results indicate that compliance improves borrowing conditions, and that this improvement is substantially stronger when debt is already high, reinforcing the sustainability channel through financial markets.

Diagnostic tests confirm the validity of these estimates. The AR(2) statistics show no evidence of second-order serial correlation, and the Hansen tests support the exogeneity of the instrument sets. The results indicate that fiscal rule compliance strengthens the fiscal response to rising debt precisely when debt is high, which suggests that countries with elevated debt fare considerably better when they adhere to their fiscal rules.

Our results point to a clear conclusion. Compliance remains beneficial even when fiscal conditions are strained, and in several cases its effects become stronger. Governments with high debt tend to face weaker fiscal responses and tighter financing conditions, yet compliance offsets part of this vulnerability by increasing fiscal adjustment and reducing the interest–growth differential. In other words, compliance continues to deliver discipline and credibility gains even at elevated debt levels. Far from losing effectiveness under fiscal pressure, rule implementation remains a valuable asset for governments navigating high-debt environments.

[4]Marginal effects of debt on the primary balance are computed as $\dfrac{\partial pb}{\partial D} = \delta_1 + \lambda_1 C + \delta_2 HD + \lambda_2 (C \times HD)$, and are evaluated at the relevant combinations of HD and compliance. For instance, $\frac{\partial pb}{\partial D}\,(HD = 0, C = 1)$ and $\frac{\partial pb}{\partial D}\,(HD = 1, C = 1)$ where HD stands for High Debt.

5 Robustness Checks

This section examines the sensitivity of our results to two potential sources of concern. The first relates to the construction of the external instruments used to address the endogeneity of fiscal rule compliance. Although our baseline identification relies on spatial and rating-based instruments, both mechanisms naturally admit broader or more selective variants. Testing these alternatives is not only a way to verify that compliance effects are not driven by specific implementation choices, but also to assess the robustness of the exclusion restriction. Broader spatial definitions and more selective reputational clusters provide settings in which the correlation between peers' shocks and domestic fiscal outcomes is even weaker. If the estimates remain stable across these alternative constructions, this strengthens the case that the instruments affect fiscal outcomes only through their impact on domestic compliance.

The second source of potential sensitivity concerns the measurement of the growth-adjusted interest rate, which plays a central role in our extended sustainability framework. While the baseline specification follows equation 11, alternative definitions appear in the literature and may better capture specific macroeconomic environments. Re-estimating the compliance effect on the interest–growth differential using these alternative measures provides an additional test of robustness for the financial channel.

Across both dimensions, the results remain consistent with the baseline findings. Compliance continues to strengthen the fiscal response to rising debt and improves the interest–growth differential. These exercises confirm that the main conclusions of the paper are not sensitive to instrument construction or to the measurement of the financial channel.

5.1 Alternative Instruments

To assess whether our baseline results depend on the specific construction of the external instruments, we re-estimate the fiscal reaction function and the growth-adjusted interest rate equations using two additional instruments. Both build on the same conceptual channels as the baseline spatial and rating-based instruments but broaden or refine the underlying peer definitions. They are therefore not part of the primary identification strategy, but they provide an informative robustness check of the stability of the compliance effects.

Proximity-Based Compliance. The first robustness instrument extends the spatial diffusion channel by defining neighbors as all countries located within a radius of 1,000 kilometers from country i. This definition captures broader regional spillovers, including for island economies or geographically isolated countries that may not share a physical border with their closest economic partners. For each country-year, the instrument is constructed as the average lagged compliance among all countries within the distance threshold, excluding country i itself. Figure 3 illustrates this proximity grouping for Chile, where all countries within 1,000 kilometers are marked using horizontal shading. This measure reflects a wider and more heterogeneous regional context, which is particularly relevant for a geographically narrow country such as Chile, so it is used as a robustness check rather than as a core instrument.

Upper-Rating Compliance. The second robustness instrument refines the reputational channel by focusing on countries that occupy the upper notch of the sovereign rating category assigned to country i. This construction captures aspirational peer effects, since governments may seek to emulate the behavior of slightly better-rated sovereigns to strengthen credibility. For each country-year, the instrument is defined as the average lagged compliance among countries that received a higher grade within the same rating band, based on data from Fitch, Moody's, and Standard and Poor's. An example of these upper-rating peers is shown in Figure 3 using vertical shading, which highlights the broader institutional cluster from which reputational signals may diffuse.

Both robustness instruments are lagged one period and introduced separately in the first stage. The resulting IV estimates allow us to examine whether the main compliance effects are robust to broader or more selective peer definitions.

Figure 3: Proximity-Based and Upper-Rating Peers for Chile in 2019

Note: The map shows all countries located within 1,000 kilometers of Chile (indicated with horizontal hatch lines) and the set of countries with a higher sovereign credit rating within the same rating category (indicated with vertical hatch lines). The figure displays the full geographical and institutional peer groups for illustration. For the empirical construction of the instruments, only countries for which compliance data are available are included.

Table 6 reproduces the same specifications as the baseline tables and replaces the baseline instruments with the Proximity-based and Upper-rating instruments. All models are estimated using System GMM, with identical controls and diagnostic tests to maintain full comparability. Columns (1) and (5) present the results using the Frontier instrument; Columns (2) and (6) use the broader Proximity instrument; Columns (3) and (7) employ the baseline Peer-rating instrument; and Columns (4) and (8) present estimates using the Upper-rating instrument.

The estimates remain highly stable across identification schemes. The coefficient on lagged debt remains positive and statistically significant in all specifications, with values between 0.016 and 0.026. The interaction between debt and compliance also remains positive and statistically significant under all four instruments, with magnitudes between 0.013 and 0.022. These ranges mirror those obtained with the baseline Frontier and Peer-rating instruments.

Under the spatial instruments, the estimated fiscal response to debt is 0.016 with the Frontier instrument and 0.019 with the Proximity instrument. The interaction terms are 0.015 and 0.017, respectively, confirming that fiscal responsiveness increases with compliance regardless of whether neighbors are defined by borders or regional proximity. Under the rating-based instruments, the coefficient on debt declines slightly from 0.026 under the baseline Peer-rating instrument to 0.023 under the Upper-rating specification. Yet the interaction term strengthens markedly, rising from 0.013 to 0.022. This suggests that the amplification effect of compliance is even stronger when governments benchmark themselves against better-rated sovereigns, which is consistent with the aspirational logic of this grouping.

Table 6: Compliance Estimates with Alternative Instruments

	Fiscal Reaction Function				Growth-Adjusted Interest Rate			
	Spatial		Rating		Spatial		Rating	
	Frontier (1)	Proximity (2)	Peer (3)	Upper (4)	Frontier (5)	Proximity (6)	Peer (7)	Upper (8)
Debt (L)	0.016*	0.019**	0.026***	0.023**				
	(0.009)	(0.010)	(0.009)	(0.011)				
Compliance (L)	0.004	0.004	0.005	-0.007	-0.029***	-0.028***	-0.015*	-0.022**
	(0.008)	(0.005)	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)	(0.009)
Debt x Compliance (L)	0.015*	0.017***	0.013***	0.022***				
	(0.008)	(0.005)	(0.004)	(0.008)				
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.841	0.772	0.758	0.474	0.117	0.206	0.661	0.591
Hansen	0.254	0.630	0.768	0.147	0.518	0.359	0.438	0.643
Observations	2603	2735	2470	1888	2,468	2,596	2,363	1,787
Country-rule	121	131	126	119	121	131	126	119
Countries	35	39	37	36	35	39	37	36

Note: Table 6 reports the estimated coefficients of lagged debt, lagged compliance, and their interaction under alternative identification strategies. The FRF specifications include one lag of the dependent variable and instrument it using internal lags (nine to eleven) together with the spatial and rating-based external instruments. Growth-adjusted interest rate estimates include two lags of the dependent variable and use lags four to five as additional instruments, while compliance is instrumented with the external instruments and their corresponding lag structure. All specifications include a set of controls. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Appendix B reports results for additional combinations of the alternative instruments. Across these joint specifications, the coefficient on debt ranges between 0.014 and 0.018, while the interaction term lies between 0.010 and 0.011. These values are fully aligned with the main results and confirm that the strengthening effect of compliance on the fiscal reaction to debt is robust to a wide range of peer definitions. Diagnostic tests support the validity of these robustness specifications. The AR(2) test shows no evidence of second-order serial correlation, and the Hansen statistics indicate that the external instruments and lag structure satisfy the overidentification restrictions.

5.2 Robustness to Alternative Definitions of the Growth-Adjusted Interest Rate

To ensure that our main findings are not overly sensitive to the definition of the growth-adjusted interest rate ($\hat{rg}$), we replicate the estimation of equation 12 using two alternative specifications of $\hat{rg}$. First, we use the exact definition proposed by Mauro and Zhou (2021) described by:

$$\hat{rg}_t = r_t - \alpha_{t-1}e_t - \alpha_{t-1}g_t \tag{15}$$

As in equation 11, r_t is the effective interest rate on public debt, α_{t-1} represents the share of foreign currency-denominated debt, e_t is the annual depreciation rate, and g_t represents the nominal GDP growth. However, for economies with high inflation and strong depreciation episodes this definition and the one expressed in equation 11 leads the indicator to highly negative values. To address his matter, we replace nominal GDP growth by the real GDP growth.

Table 7 reports the compliance effect on the growth-adjusted interest rate under the two alternative definitions of $\hat{rg}$. The results are highly consistent with the baseline specification. Under the Mauro and Zhou (2021) formulation, compliance reduces the interest–growth differential by values that range from -0.029 to -0.014, depending on whether the spatial, rating-based, or combined instruments are used. When $\hat{rg}$ is instead computed using real GDP growth, the estimated compliance effect remains negative and statistically significant across all instruments, with magnitudes between -0.048 and -0.018. These coefficients are comparable to, and in some cases larger than, those obtained in the baseline results.

The consistency of these estimates confirms that the credibility-enhancing effect of fiscal rule compliance is not an artefact of the specific measure of $\hat{rg}$. Whether nominal or real growth is used, compliance is systematically associated with lower borrowing costs relative to growth. This reinforces the broader conclusion that adhering to fiscal rules improves market perceptions and supports more favorable debt dynamics.

Table 7: Estimates of Compliance Effect on Growth-Adjusted Interest Rate Under Alternative Definitions

	Mauro and Zhou (2021)			$\hat{rg}$ (with real growth)		
	Spatial (1)	Rating (2)	Both (3)	Spatial (4)	Rating (5)	Both (6)
Compliance (L)	-0.029***	-0.015*	-0.014*	-0.028***	-0.048***	-0.018***
	(0.008)	(0.009)	(0.008)	(0.007)	(0.009)	(0.007)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.201	0.564	0.868	0.583	0.154	0.229
Hansen	0.517	0.442	0.662	0.523	0.334	0.664
Observations	2,468	2,363	2,244	2,468	2,363	2,244
Country-rule	121	126	116	121	126	116
Countries	35	37	33	35	37	33

Note: Table 7 reports the estimated coefficients of lagged compliance on the growth-adjusted interest rate using System GMM. Spatial specifications use the average compliance of frontier neighbours as an external instrument, Rating specifications use the average compliance of peer rating countries, and Both includes spatial and rating-based instruments jointly. System GMM includes two lags of the dependent variable and uses lags four to five as additional instruments, while compliance is instrumented with the external instruments and the corresponding lag structure. All specifications include a set of controls. Country counts differ across specifications because lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

6 Conclusions

This paper examined whether compliance with fiscal rules contributes to public debt sustainability. Motivated by the persistent disconnect between rising compliance rates and sustained debt pressures in many countries, we developed an theoretical and empirical framework that embeds fiscal rule implementation directly into the fiscal reaction mechanism and the growth–adjusted interest rate. To address the inherent endogeneity of compliance, we proposed a new set of peer–based external instruments and combined them with a dynamic specification estimated using System GMM.

Three main conclusions emerge. First, fiscal rule compliance systematically strengthens governments' fiscal reaction to rising debt. Compliant governments adjust primary balances more forcefully, suggesting that implementation plays a central role in sustaining fiscal discipline. Second, compliance improves borrowing conditions by lowering the interest–growth differential, indicating that financial markets respond to credible implementation rather than to the formal existence of rules. Third, these two channels remain effective even when fiscal conditions deteriorate. High debt does not weaken the role of compliance. On the contrary, when debt is elevated, compliance continues to support stronger primary balance adjustments and generates meaningful reductions in the interest–growth differential. These are not gains that arise because debt is high, but gains that persist in spite of it, showing that compliance helps governments navigate adverse conditions. These results hold across identification strategies, definitions of the financial channel, and alternative peer constructions.

The findings carry several implications. Rule design remains important, but our evidence shows that enforcement capacity and the credibility of implementation are equally central for sustainability. Strengthening monitoring arrangements, improving transparency, and embedding rules within institutions capable of sustaining compliance over time may yield larger fiscal payoffs than modifying numerical targets alone.

The analysis also has limitations that point to avenues for future work. While our instruments capture exogenous variation in peer behavior, country–specific political dynamics and intra–annual fiscal adjustments remain difficult to observe. Moreover, the construction of the instruments is conceptually grounded in global diffusion channels, yet their empirical implementation is constrained by the availability of systematic cross–country compliance data. As broader datasets become available, such as the recent update of the IMF Fiscal Rules Dataset by Alonso et al. (2025), future work will be able to extend these instruments to a wider set of countries and explore more granular mechanisms of institutional diffusion. In addition, the channels through which markets react to compliance deserve closer examination, particularly in environments characterized by repeated suspensions or revisions of fiscal frameworks.

Finally, the findings of this paper indicate that compliance meaningfully enhances both fiscal adjustment and borrowing conditions, particularly when debt is high. Fiscal rules can support sustainability, but only insofar as they are implemented credibly and embedded within institutions that create and maintain incentives to follow them.

References

Afonso, A. and Jalles, J. T. (2019). Fiscal rules and government financing costs. *Fiscal Studies, The Journal of Applied Public Economics*, 40:71–90.

Alonso, V., Arroyo, C., Aydin, O., Balasundharam, V., Davoodi, H. R., Hegab, G., Lam, W. R., Nguyen, A., Salazar Ferro, N., Sher, G., Solovyeva, A., and Tchelishvili, N. (2025). Fiscal rules dataset: 1985–2024. Technical report, International Monetary Fund, Washington, DC.

Ardanaz, M., Ulloa-Suárez, C., and Valencia, O. (2024). Why don't we follow the rules? drivers of compliance with fiscal policy rules in emerging markets. *Journal of International Money and Finance*, 142:103046.

Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68:29–51.

Blanco, F., Saavedra, P., Koehler-Geib, F., and Skrok, E. (2020). *Fiscal Rules and Economic Size in Latin America and the Caribbean*. World Bank Publications.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87:115–143.

Bohn, H. (1995). The sustainability of budget deficits in a stochastic economy. *Journal of Money, Credit and Banking*, 27(1):257–271.

Bohn, H. (1998). The behavior of US public debt and deficits. *The Quarterly Journal of Economics*, 113(3):949–963.

Bohn, H. (2007). Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint? *Journal of Monetary Economics*, 54(7):1837–1847.

Bohn, H. (2008). The sustainability of fiscal policy in the united states. in sustainability of public debt. *The MIT Press*.

Caselli, F. and Reynaud, J. (2020). Do fiscal rules cause better fiscal balances? a new instrumental variable strategy. *European Journal of Political Economy*, 63:101873.

Davoodi, H., Elger, P., Fotiou, A., Garcia-Macia, M. D., Han, X., Lagerborg, A., and Lam, W. R. (2022). Fiscal rules and fiscal councils: Recent trends and performance during the covid-19 pandemic.

Delgado-Téllez, M., Lledo, V. D., and Pérez, J. J. (2017). *On the Determinants of Fiscal Non-Compliance: An Empirical Analysis of Spain's Regions*. International Monetary Fund.

Escolano, Julio, S. A. and Woo, J. (2017). The puzzle of persistently negative interest-rate–growth differentials: Financial repression or income catch-up? *Fiscal Studies*, 38.

Eyraud, L., Debrun, M. X., Hodge, A., Lledo, V. D., and Pattillo, M. C. A. (2018). *Second-generation fiscal rules: Balancing simplicity, flexibility, and enforceability*. International Monetary Fund.

Fatás, A., Gootjes, B., and Mawejje, J. (2025). Dynamic effects of fiscal rules: Do initial conditions matter? *World Bank, Policy Research Working Paper*, 11066.

Galindo, A. and Izquierdo, A. (2024). *2024 Latin American and Caribbean Macroeconomic Report: Ready for Take-Off? Building on Macroeconomic Stability for Growth*. Inter-American Development Bank.

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., and Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, 123(566):F4–F30.

Gomez-Gonzalez, J. E., Valencia, O. M., and Sánchez, G. (2022). How fiscal rules can reduce sovereign debt default risk. *Emerging Markets Review*, 50:100839.

Heinemann, F., Moessinger, M.-D., and Yeter, M. (2018). Do fiscal rules constrain fiscal policy? a meta-regression-analysis. *European Journal of Political Economy*, 51:69–92.

IMF (2024a). Background paper 2: Public debt dynamics in Latin America. In *Fiscal Monitor: Latin America and Caribbean*, chapter 3, pages 1–10. International Monetary Fund.

IMF (2024b). World economic outlook database, october 2024. International Monetary Fund.

IMF (2024). World economic outlook, october 2024.

Kopits, G. and Symansky, S. A. (1998). *Fiscal Policy Rules*. International Monetary Fund.

Larch, M., Malzubris, J., and Santacroce, S. (2023). Numerical compliance with EU fiscal rules: Facts and figures from a new database. *Intereconomics*, 58(1):32–42.

Leamer, E. E. (1985). Sensitivity analyses would help. *The American Economic Review*, 75(3):308–313.

Mauro, P. and Zhou, J. (2021). r-g<0: Can we sleep more soundly? *IMF Economic Review*, 69:197–229.

Nerlich, C. and Reuter, W. H. (2013). The design of national fiscal frameworks and their budgetary impact. *European Central Bank, Woking Paper Series*, 1588.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49:1417–1426.

Okwuokei, J. C. (2014). Chaper 11. fiscal policy rules and fiscal performance: Evidence form microstates. In Yartey, C. A. and Therese, T.-J., editors, *Caribbean Renewal: Tackling Fiscal and Debt Challenges*. International Monetary Fund.

Ostry, J. D., Ghosh, A. R., Kim, J. I., and Qureshi, M. S. (2010). Fiscal space. IMF Staff Position Note SPN/10/11, International Monetary Fund.

Reuter, W. H. (2015). National numerical fiscal rules: Not complied with, but still effective? *European Journal of Political Economy*, 39:67–81.

Reuter, W. H. (2019). When and why do countries break their national fiscal rules? *European Journal of Political Economy*, 57:125–141.

Sala-i Martin, X. (1997). I just ran four million regressions. *The American Economic Review*, 78:102399.

Ulloa-Suárez, C. (2023). Determinants of compliance with fiscal rules: Misplaced efforts or hidden motivations? *European Journal of Political Economy*, 78:102399.

Ulloa-Suarez, C. and Valencia, O. (2022). Do governments stick to their announced fiscal rules? a study of latin american and the caribbean countries. *Journal of Government and Economics*, 8:100058.

Ulloa-Suarez, C. and Valencia, O. (2024a). *Sustaining Compliance with Fiscal Rules: A Future at Risk?* Inter-American Development Bank.

Ulloa-Suarez, C. and Valencia, O. M. (2024b). Sustaining compliance with fiscal rules in the future of risk. IDB Technical Note 3028, Inter-American Development Bank.

Ulloa-Suárez, C., Valencia, O., and Guerra, J. (2025). Flexible boundaries: Evaluating the effect of escape clause activation. Technical Report 2025-05, BETA (Burô de Recherche en Économie, Université de Strasbourg / Université de Lorraine).

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press.

World Bank (2024). World Development Indicators. https://databank.worldbank.org/source/world-development-indicators.

Appendices

A Variable Definitions and Descriptive Statistics

Table 8 reports the summary statistics for all variables used in the empirical analysis. The set of covariates captures macroeconomic conditions, external balances, governance indicators, and structural characteristics. The table also includes the measures of compliance with fiscal rules that form the core of the empirical strategy. he sources for each variable are indicated in last column.

Table 8: Summary Statistics of Variables Used in the Empirical Analysis

Variable	**Mean**	**Std**	**Min**	**Max**	**Source**
A. Dependent					
Primary Balance (% GDP)	-0.01	0.03	-0.30	0.08	IMF (2024)
B. Independent					
Gross Debt (% GDP)	0.56	0.33	0.04	2.13	IMF (2024)
C. Covariates					
Direct investment, net (% GDP)	-0.01	0.17	-2.34	1.91	
Exports of goods and services (% GDP)	0.49	0.30	0.10	2.16	
Financial Account Balance (% GDP)	-0.01	0.05	-0.32	0.17	
Oil trade balance (% GDP)	-0.03	0.03	-0.27	0.07	
Trade Openness: Exports + Imports (% GDP)	0.98	0.54	0.20	3.94	
Interest Expense (% GDP)	0.02	0.02	-0.01	0.09	
Effective interest rate on gross debt (%)	0.03	0.03	-0.18	0.18	IMF (2024)
Inflation Rate (%)	0.04	0.07	-0.02	1.33	
Governance Indicators	0.74	0.69	-0.97	1.97	
Real GDP Growth (%)	0.03	0.04	-0.21	0.25	
Exchange rate change (%)	0.02	0.13	-0.19	2.11	
Output Gap (%)	0.00	0.04	-0.21	0.19	
Natural resources rents (% GDP)	0.01	0.02	0.00	0.17	World Bank (2024)
D. Compliance Year by Year					
Budget Balance Rule	0.62	0.49	0.00	1.00	
Structural Balance Rule	0.48	0.50	0.00	1.00	Larch et al. (2023)
Expenditure Rule	0.41	0.49	0.00	1.00	Ulloa-Suarez and Valencia (2022)
Debt Rule	0.68	0.47	0.00	1.00	

B Compliance Estimates with Combinations of Alternative Instruments

Table 9 reports the estimated coefficients of lagged debt, lagged compliance, and their interaction for all combinations of the alternative spatial and rating-based instruments. The table follows the same structure as the robustness results in the main text. Columns (1) to (3) present the fiscal reaction function estimates using combinations of the spatial and rating instruments: Column (1) combines the Spatial Frontier and Rating Upper instruments, Column (2) combines Spatial Proximity with Rating Peer, and Column (3) combines Spatial Proximity with Rating Upper. Columns (4) to (6) report the corresponding estimates for the growth-adjusted interest rate, using the same instrument pairs. Spatial Frontier uses the average compliance of frontier neighbours as an external instrument, while Spatial Proximity uses the average compliance of countries located within a 1,000-kilometre radius. Rating Peer relies on the average compliance of countries sharing the same rating, and Rating Upper includes countries in the upper notch of the same rating category. These combinations allow us to assess whether the main results remain stable across a wide range of spatial and reputational peer definitions.

Table 9: Compliance Estimates with Combinations of Alternative Instruments

	Fiscal Reaction Function			**Growth-Adjusted Interest Rate**		
	Frontier & Upper (1)	Proximity & Peer (2)	Proximity & Upper (3)	Frontier & Upper (4)	Proximity & Peer (5)	Proximity & Upper (6)
Debt (L)	0.014***	0.014***	0.018***			
	(0.004)	(0.004)	(0.004)			
Compliance (L)	0.001	0.010**	0.004	-0.022**	-0.016**	-0.023***
	(0.004)	(0.005)	(0.005)	(0.008)	(0.008)	(0.009)
Debt x Compliance (L)	0.011**	0.010*	0.010*			
	(0.005)	(0.006)	(0.005)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.650	0.882	0.412	0.177	0.728	0.498
Hansen	0.728	0.369	0.485	0.839	0.54	0.707
Observations	1,942	2,667	2,064	1,680	2,357	1,781
Country-rule	111	129	121	109	123	116
Countries	33	39	37	32	36	35

Note: Table 9 reports the estimated coefficients of lagged debt, lagged compliance, and their interaction under combinations of the alternative spatial and rating-based instruments. Growth-adjusted interest rate specifications include two lags of the dependent variable and use lags four to five as additional instruments. FRF specifications include one lag of the dependent variable and instrument it using internal lags (two to seven) together with the corresponding spatial and rating instruments. All specifications include a set of controls. Country counts differ across columns because the lag structure and instrument availability reduce the number of usable observations relative to the full sample of 40 countries. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.