Government Debt Expansion and Bank Capitalization: The Conditioning Role of Institutional Quality

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Abstract

This paper studies how banks' capital ratios respond to government debt-to-GDP shocks and how this response varies with regulatory quality. Using local projections for a large panel of advanced and non-advanced economies, we document that increases in public debt are followed, on average, by declines in banks' capital-to-assets ratios. This aggregate pattern conceals important heterogeneity. When regulatory quality is introduced as a conditioning variable, capital adjustment becomes state dependent. Banks operating in weaker regulatory environments incorporate fiscal pressures more slowly and may raise capital ratios in the medium term, whereas those in stronger systems record losses earlier and experience an immediate decline in capital, followed by a recovery in advanced economies as conditions stabilize. These results show that institutional quality shapes the transmission of fiscal shocks to bank balance sheets and that simple capital measures capture this adjustment more reliably than risk-weighted ratios. The findings highlight the need to account for fiscal conditions in macroprudential assessments and underscore the importance of supervisory capacity for maintaining bank resilience when public debt rises.

Keywords: bank capital, sovereign risk, public debt, regulatory quality, macroprudential policy, local projections.

JEL Classification: G21, G28, E32, E44, H63.

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Content

1. Introduction

Bank capital is a central element of financial stability, and its behavior over the business cycle has received considerable attention in the macroprudential literature. Earlier work shows that the adjustment of capital buffers depends strongly on institutional strength and regulatory design. Jokipii and Milne (2008) document that banks in advanced European countries tend to adjust capital countercyclically, whereas banks operating under weaker supervisory frameworks behave procyclically. Similar patterns for emerging economies have been reported by Carvallo et al. (2015) and Valencia and Bolaños (2018), who show that capital buffers often decline during expansions and increase during downturns. More recent work highlights the role of regulatory requirements in shaping these dynamics. Brei et al. (2016) show that leverage-based measures act as a stabilizing counterweight to the procyclical tendencies of risk-weighted ratios, while Benbouzid et al. (2022) and Lang and Menno (2025) examine how adjustments to countercyclical buffers influence bank lending and risk-taking. Studies of crisis episodes, such as Neef et al. (2023), Avezum et al. (2024), and Sivec and Volk (2023), show that capital buffers played a significant role in preserving credit supply and supporting healthier firms during recent global shocks. These contributions underscore that capital ratios respond not only to macroeconomic conditions but also to the quality of institutions and the broader regulatory environment.

A second body of research studies the interaction between fiscal conditions and banking stability. Work on the European debt crisis, including De Grauwe (2012) and the overview in Gómez-Puig and Sosvilla-Rivero (2024), shows how sovereign stress undermines bank balance sheets through valuation losses on government securities, impaired collateral, and tighter funding conditions. Earlier studies of emerging markets, such as Kaminsky and Reinhart (1999) and Reinhart and Rogoff (2011), emphasize the recurrent coincidence of banking and sovereign crises, especially when currency mismatches or weak fiscal positions are present. More recent theoretical work, including Dell'Ariccia et al. (2018) and Farhi and Tirole (2018), provides formal foundations for understanding how weak institutions and delayed loss recognition can amplify the transmission of fiscal stress to banks. The relevance of these mechanisms has increased following the large rise in public debt after the COVID-19 pandemic. Gomez-Gonzalez et al. (2025) show that sovereign risk now spills over more strongly to banks in emerging markets, even when direct exposures are limited, and that the resilience of the financial system depends heavily on credible fiscal policy and effective supervisory oversight. Related evidence in Deghi et al. (2022) shows that institutional strength is central in determining how fiscal pressures translate into banking sector risk.

Although these studies deepen our understanding of the sovereign–bank nexus, there is limited empirical evidence on how fiscal shocks affect banks' capital ratios directly. Much of the existing work focuses on market-based channels such as CDS spreads, sovereign yields, or bank equity returns, or on lending behavior.

Far fewer contributions examine how public debt influences the solvency position of banks through changes in the capital buffer itself, and even fewer explore how regulatory quality shapes this adjustment. As a result, a key dimension of the sovereign–bank interaction remains insufficiently understood.

This paper addresses this gap by studying how banks adjust their capital ratios after an increase in public debt, and how these adjustments differ across institutional environments. Using a panel of banks from advanced and non-advanced economies and a local projections framework, we first document the average response of the capital-to-assets ratio to a debt-to-GDP shock. Across both country groups, higher public debt reduces bank capital, consistent with the channels emphasized in the sovereign–bank literature: valuation losses on sovereign holdings, deterioration in borrower quality, and tighter financial conditions that weaken bank balance sheets.

To study these dynamics, the paper employs a panel local projections framework that traces how banks' capital ratios evolve after a government debt shock. This approach offers several advantages for the question at hand. It allows the adjustment path to differ across horizons without the tight restrictions imposed by VAR structures, which is important when banks in different institutional settings may respond at different speeds. Local projections also accommodate the unbalanced nature of cross-country bank data and allow for a straightforward inclusion of bank and country fixed effects, helping to control for persistent differences in balance-sheet practices and supervisory regimes. Introducing regulatory quality as a conditioning variable within this framework provides a direct way to compare environments with markedly different institutional capacities. Standard errors are adjusted for serial correlation using Newey–West procedures, and the main patterns are shown to remain visible under alternative estimators, including System GMM, although local projections avoid the instrument proliferation and convergence problems that often arise in dynamic panel settings. These features make the approach well suited to examining how fiscal conditions shape banks' capital positions over time.

A central feature of our analysis is the choice of capital-to-assets as the solvency measure. This ratio is particularly suited to capture how fiscal shocks affect bank resilience. When public debt rises or when sovereigns face funding pressures, banks typically experience valuation losses on government bond portfolios, shifts in the risk profile of private borrowers, and changes in the size and composition of their assets. These mechanisms affect both the numerator and the denominator of the capital-to-assets ratio. Risk-weighted assets, by contrast, often barely move when sovereign risk increases because domestic government bonds carry a zero-risk weight in many regulatory frameworks. As a result, regulatory capital ratios may give the misleading impression of stability even when balance sheets are weakening. The capital-to-assets ratio reflects these developments directly. Its empirical properties also support its use: following Gambacorta and Karmakar

(2018), we rely on simple leverage-based measures, which tend to be more informative and less susceptible to procyclical biases than risk-weighted ratios. These properties make the capital-to-assets ratio especially valuable for comparing banking systems across countries with different regulatory practices and Basel implementation schedules.

Our main findings reveal a pronounced state dependence in how capital adjusts to fiscal shocks. In countries with low regulatory quality, an increase in public debt leads to a rise in capital ratios in the medium term, suggesting that banks rebuild buffers gradually in settings where supervisors are less effective and loss recognition tends to be delayed. In advanced economies with weaker institutions, however, this increase proves temporary and is followed by a decline, indicating that delayed adjustment allows sovereign stress to erode capital more sharply later. In countries with high regulatory quality, the response is reversed: banks reduce capital promptly after a debt shock, consistent with earlier loss recognition and closer supervisory oversight, and in advanced economies this early decline is followed by a gradual recovery.

These patterns speak directly to the sovereign–bank nexus literature. They show that the strength of regulation determines not only the magnitude of the transmission from fiscal stress to banks but also the timing and direction of the adjustment. They also extend the capital-buffer literature by identifying fiscal conditions, specifically, increases in public debt, as an underexplored but important determinant of capital dynamics. In doing so, the paper fills a gap between these two strands of research: it shows that bank solvency responses to fiscal shocks depend crucially on institutional quality, and that sovereign distress affects banks through channels not fully captured by risk-weighted capital measures.

The rest of the paper proceeds as follows. Section 2 reviews the relevant literature. Section 3 describes the empirical approach. Section 4 describes the Data. Section 5 presents the main results. The final section concludes with policy implications.

2. Literature Review

This paper relates to two strands of research. One examines how banks manage their capital buffers over the cycle, while the other studies how fiscal developments affect banking stability. Although these areas evolved independently, both point to the importance of institutional quality in shaping the resilience of banks. Our contribution lies at their intersection.

2.1. Capital buffers and their adjustment

A substantial body of work analyzes how banks set and adjust their capital buffers. Early empirical evidence shows that capital ratios do not move uniformly across banking systems. Jokipii and Milne (2008) report that banks in well-established regulatory environments tend to strengthen their capital positions in downturns, whereas banks in jurisdictions with weaker supervisory practices often behave in a more procyclical manner. Studies focused on emerging and developing economies reach related conclusions. Carvallo et al. (2015) and Valencia and Bolaños (2018) show that capital buffers in Latin America and similar regions grow when credit conditions tighten, but they frequently shrink during periods of rapid credit expansion and rising profitability. These findings suggest that adjustment costs, the structure of bank balance sheets, and differences in oversight play important roles in shaping how capital evolves over time.

A separate set of studies examines how regulatory design affects the movement of capital. Because risk-weighted assets reflect internal assessments and supervisory choices, risk-weighted capital ratios can move in ways that are only loosely connected to underlying solvency conditions. Brei et al. (2016) show that leverage-based requirements offer a more stable constraint. Research on countercyclical capital buffers adds another dimension. Benbouzid et al. (2022) document that buffer tightening tends to increase capital and reduce credit risk, while releases have weaker effects on balance sheet rebuilding. Lang and Menno (2025) show that the consequences of buffer adjustments depend on banks' initial conditions, including profitability and the extent of voluntary buffers. Evidence from crisis episodes supports the idea that capital buffers act as shock absorbers. For instance, Neef et al. (2023) and Avezum et al. (2024) show that buffer releases during the pandemic helped sustain lending in Europe and Brazil, and Sivec and Volk (2023) find similar stabilizing effects during the global financial crisis.

Although this literature is extensive, much of it focuses on the interaction between capital and the business cycle. Comparatively less attention has been given to how fiscal conditions, particularly the buildup of public debt, shape banks' capital decisions.

2.2. Fiscal stress and the sovereign–bank nexus

A second line of research examines how sovereign risk feeds into the banking sector. Studies of the European debt crisis highlight that fiscal stress can weaken banks through several channels. Losses on sovereign bond holdings, deteriorating collateral, and strains in funding markets all play a role, as documented by De Grauwe

(2012) and summarized in Gómez-Puig and Sosvilla-Rivero (2024). Earlier work on emerging markets, including Kaminsky and Reinhart (1999) and Reinhart and Rogoff (2011), shows that sovereign and banking crises often reinforce each other, especially where currency mismatches or fragile fiscal positions are present. Theoretical contributions such as Dell'Ariccia et al. (2018) and Farhi and Tirole (2018) clarify why these links may be particularly strong in environments with weaker institutions or slower recognition of losses.

Recent developments have renewed interest in these channels. The sharp increase in public debt after the COVID-19 crisis heightened the exposure of many banking systems to fiscal developments. Gomez-Gonzalez et al. (2025) provide evidence that sovereign conditions now exert a stronger influence on banks in emerging markets, even where direct exposures are modest. They show that sovereign risk affects banks through the valuation of government securities, the broader macroeconomic environment, and investor perceptions. Their results also emphasize the role of institutions: countries with stronger regulatory frameworks tend to experience smaller spillovers. Deghi et al. (2022) present related findings, showing that supervisory strength helps shape how sovereign shocks feed into financial sector risk.

While this literature offers important insights, its focus is often on market-based indicators—such as bank equity returns, bond spreads, or CDS prices—or on the behavior of bank lending. Far fewer studies examine how fiscal shocks influence bank capital ratios, even though capital is the component of the balance sheet closest to solvency. Moreover, very little empirical work explores whether institutions condition the way bank capital responds to fiscal stress.

This study brings these literatures together. We examine how banks adjust their capital ratios when public debt rises and how this response varies with regulatory quality. The analysis shows that the average effect of debt increases is a decline in capital, which accords with the mechanisms described in the sovereign–bank nexus literature. More important, however, is the heterogeneity uncovered when institutional quality is considered. In weaker regulatory environments, capital tends to rise in the medium term following a debt increase, consistent with delayed loss recognition and gradual buffer rebuilding. In stronger regulatory settings, banks recognize losses earlier and capital falls promptly, but banks in advanced economies subsequently rebuild capital once fiscal conditions stabilize.

These results extend the capital-buffer literature by highlighting fiscal developments as an important determinant of capital adjustment. They also add to the sovereign–bank nexus literature by showing that solvency responses to fiscal shocks depend on the institutional environment and by documenting clear differences between advanced and non-advanced economies. In doing so, the paper provides evidence on a mechanism that has not been examined systematically: the state-dependent adjustment of bank capital to fiscal shocks.

3. Methodology

We employ a linear and non-linear local projections for panel data model with country fixed effects (see Jordà, 2005; Jordà et al., 2020; Adämmer, 2019). In short, Jordà (2005) proposes an alternative to traditional VAR models for estimating impulse−response functions (IRFs). Their approach involves running separate OLS regressions for each forecasting horizon when constructing the IRFs, instead of recovering the dynamics from the joint estimation of the reduced form VAR model. In our specific case the dynamic effects on Capital Ratios can be described as follows:

$$CapitalRatio_{i,t+h} = \alpha_{i,h} + Debt_{c,t}\beta_{1,h} + Growth_{c,t}\beta_{2,h} + Inf_{c,t}\beta_{3,h} + ROE_{i,t}\gamma_{1,h} +$$

$$Res_{i,t}\gamma_{2,h} + Size_{i,t}\gamma_{3,h} + NPL_{i,t}\gamma_{4,h} + \varepsilon_{i,t+h}, h = 0,1,\dots,H-1. \qquad (1)$$

In Eq. (1), $\alpha_{i,h}$ represents a vector of constants for cross-sectional fixed effects at the bank level, $Debt_{c,t}$ is the government debt-to-GDP ratio, our main treatment variable, $Growth_{c,t}$ and $Inf_{c,t}$ are other macro-economic variables acting as controls, corresponding to annual real GDP growth and annual inflation rate, respectively. Coefficients from γ_1 to γ_4 are associated with bank-level covariates, including $ROE_{i,t}$, the return on assets, $Res_{i,t}$ which are reserves on impaired loans, $Size_{i,t}$, which is the natural logarithm of a bank's total assets, and $NPL_{i,t}$, the non-performing loans of the banks as a percentage of total assets. Note that coefficients $\{\beta_{k,h}, \gamma_{s,h}\}$, correspond to forecast horizon h. The vector $\varepsilon_{i,t+h}$ is possibly autocorrelated and heteroscedastic, which requires using a robust standard error framework, which in our case is implemented following Newey and West's (1987) correction.

We also contrast our main results with an estimation of the model parameters using System GMM. System GMM was originally introduced by Arellano and Bover (1995), who proposed augmenting the traditional diffe-rence GMM estimator with additional moment conditions that use lagged differences as instruments for the level equation. This innovation addressed flaws that arise when instruments in the differenced equation are weak, particularly in panels with persistent variables. Blundell and Bond (1998) further developed this approach into the full System GMM estimator, which jointly estimates a system consisting of the equation in first differen-ces (instrumented with lagged levels) and the equation in levels (instrumented with lagged differences).

Our analysis aims to understand the mediating role of institutions on the effect of government debt changes on banks' capital. We extend the panel specification in Equation (1) to a nonlinear framework.

Following Auerbach and Gorodnichenko (2012, 2013), we model the economy as functioning under two diffe-rent states, with a logistic function governing transition between the two of them. This approach makes an

optimal use of sample information, as both states are estimated using the entire sample rather than splitting the data into separate subsamples with distinct parameter estimates. In our case, the logistic transition function can be described as follows:

$$F(z_t) = \frac{e^{(-\gamma z_t)}}{(1+e^{(-\gamma z_t)})}, \tag{2}$$

$$var(z_t) = 1, E(z_t) = 0, \tag{3}$$

where z_t is a standardized switching variable such that $\gamma (> 0)$ is scale-invariant. We establish a value of $\gamma = 0.5$, which guarantees a smooth transition between the two states: high and low institutional quality, measured by the regulatory quality indicator of the World Bank. The Regulatory Quality indicator is part of the Worldwide Governance Indicators, and it evaluates the extent to which governments develop and implement sound policies that enable private-sector growth. It reflects perceptions of how predictable, transparent, and market-supportive a country's regulatory environment is (Kaufmann, et al. 2011).

In our main results we report the Impulse-Response functions using debt-to-GDP ratio as the *shock* variable that generates the following impulse:

$$\widehat{IR}(t, h) = \beta_h, h = 0,1, \ldots, H - 1. \tag{4}$$

Where the statistic above is defined for two states, the first one at 75th percentile of the regulatory-quality indicator and the second one at 25th percentile, such that we have $\widehat{IR}(t, h)^{low-quality}$ and $\widehat{IR}(t, h)^{high-quality}$, governed by switching function with a state parameter $\gamma = 0.5$.

4. Data

The analysis combines bank-level information with macroeconomic and institutional indicators to study how capital ratios respond to movements in public debt. Table 1 reports summary statistics for the variables used in the empirical work. The capital ratio, equity expressed as a share of total assets, is drawn from BankFocus and is the central balance-sheet measure in the paper. Its distribution is consistent with the range observed in commercial banking: the mean stands at roughly 10 percent, and the trimming of extreme values ensures that the sample reflects realistic capitalization levels rather than outliers generated by reporting errors. Bank size, measured as the logarithm of total assets, exhibits substantial variation, which is expected given the

inclusion of banks from both large, mature financial systems and much smaller, less diversified institutions in lower-income economies. Measures of asset quality and profitability also span a wide range. The ratio of non-performing loans to assets displays the skewness typical of banking datasets that include episodes of financial stress, while the return on assets clusters around relatively modest medians, reflecting the diversity of bank business models and operating environments.

Country-level variables come from the IMF's World Economic Outlook and the World Bank's World Development Indicators. Real GDP growth, inflation, and the debt-to-GDP ratio capture the macroeconomic and fiscal setting in which each bank operates. The range of the debt measure is wide, covering countries with very low public indebtedness and others that have faced protracted fiscal difficulties. This variation is important for the empirical strategy, which seeks to identify how changes in public debt filter into bank balance sheets. The Regulatory Quality Index, also reported in Table 1, provides a measure of the broader institutional environment. It summarizes perceptions of the government's ability to formulate and implement sound policies, and it varies considerably across the sample. Its breadth is particularly useful for documenting the state dependence that emerges in the results, since it allows banks from high- and low-quality regulatory environments to be compared within a unified empirical framework.

Table 2 describes the composition of the sample. The dataset includes 2,462 banks in 139 countries, yielding more than 23,000 bank-year observations. Coverage is intentionally broad to capture the diverse institutional and fiscal conditions that shape banks' exposure to sovereign developments. Advanced economies represent only a small share of the sample, 362 banks from six countries, but they constitute an important benchmark given their established supervisory regimes and relatively stable macroeconomic environments. The bulk of the data comes from emerging and developing economies, which together supply more than 18,000 observations. These banking systems differ widely in size, structure, and sovereign exposure, and they exhibit the institutional heterogeneity that is central to the paper's identification strategy.

The regional distribution reinforces this diversity. African, Asian, and non-developed European countries account for a large share of the sample and bring substantial variation in regulatory quality, the depth of financial markets, and the role of domestic banks in public debt financing. Advanced economies in Europe, Asia, and the Americas provide well-defined comparison groups where supervisory capacity is stronger, and banks' sovereign exposures follow different patterns. The breadth of the dataset is thus essential for the main empirical findings: without substantial variation in both fiscal conditions and institutional quality, it would not be possible to document the systematic differences in capital adjustment that appear in the results section.

Table 1. Summary Statistics of Variables in Our Sample

Indicator	Abbreviation	Source	Median	Mean	Std.Dev	Max.	Min.
Capital Ratio (% of Bank's Total Assets)	capital_ratio	BankFocus	11.02	10.34	5.2	29.87	0.01
Natural Log of Bank's Total Assets	log_total_assets	BankFocus	14.85	14.77	2.05	22.52	7.86
Bank's Total Non-Performing (Impaired) Loans as a percent of Total Assets	npl_ratio_assets	BankFocus	3.97	1.87	20.17	1606.52	0
Return on Equity using Net Income	roa	BankFocus	0.9	0.79	2.02	18.35	-67.5
Annual Real Growth Rate	gdp_growth	WEO-IMF	3.14	3.32	4.19	63.33	-32.91
Government Debt (% GDP)	govt_debt_gdp	WEO-IMF	82.48	59.44	65.5	358.19	1.11
Annual Inflation Rate	inflation	WEO-IMF	5.4	3.32	11.98	557.21	-7.71
Regulatory Quality Index	regulatory_quality	WDI-WB	0.18	-0.01	0.76	1.88	-2.07

Note: All variables are measured at the bank-year level unless otherwise specified. Capital ratio, return on equity (ROE), non-performing loans, loan loss reserves, and bank size are sourced from BankFocus. Capital ratios have been trimmed to include only values between 0% and 30%, which are realistic for commercial banks. Government Debt to GDP, Inflation and real GDP growth are obtained from the IMF's World Economic Outlook (WEO), while the Regulatory Quality Index was obtained from the World Bank's World Development Indicators (WDI).

Table 2. Sample Composition by Income Group and Region

Group	Status	Number of Banks	Number of Countries	Number of Observations
Whole Sample	All	2,462	139	23,305
Whole Sample	Developed	362	6	4,511
Whole Sample	Non-Developed	2,100	133	18,794
Africa	Non developed	417	49	3,334
Americas	Developed	13	1	117
Americas	Non developed	365	27	3,099
Asia	Developed	125	1	2,257
Asia	Non developed	772	41	7,393
Europe	Developed	224	4	2,137
Europe	Non developed	539	14	4,911
Oceania	Non developed	7	2	57

Note: This table reports the number of countries, banks, and bank-year observations in the sample. Income groups are classified according to the IMFs definition of Advanced Economies. Regional groups reflect the geographical location of banks' home countries. The whole sample includes all 139 countries in the study.

5. Results

This section presents empirical evidence on the relationship between government debt-to-GDP shocks and bank capitalization, emphasizing both the average linear effects and the state-dependent dynamics shaped by the quality of regulatory institutions. Across specifications, the analysis relies on the unweighted capital-to-assets ratio, which provides a clearer view of balance-sheet resilience in environments where risk-weighted assets may not fully reflect underlying exposures. This is particularly relevant in emerging and low-income economies where domestic sovereign bonds carry zero risk weights, despite being subject to valuation losses and liquidity declines during fiscal stress. Our empirical strategy therefore captures adjustments in total assets and capital buffers that would be obscured by risk-weighted measures.

5.1. Linear Effects

We begin by examining the average response of bank capital ratios to an increase in the public debt to GDP ratio, without yet accounting for differences in institutional quality. Figure 1 shows that the capital to assets ratio declines immediately after the shock, although the response becomes statistically significant only around years 2 and 3, when the confidence band lies clearly below zero. This early significance suggests that fiscal stress has an immediate effect on banks, most likely through valuation losses on sovereign securities and through tighter financial conditions that begin to erode capital buffers. After this initial period, the confidence bands widen and include zero for several years, indicating that the adjustment is gradual and that the effect is not precisely estimated over the middle part of the horizon. Statistical significance reappears in the medium and long run, specifically between years 7 and 10, when the decline becomes larger and approaches values close to minus 0.06 to minus 0.07. This renewed significance indicates that the accumulation of fiscal pressure continues to weaken bank capitalization well beyond the initial impact period. Although the point estimate begins to recover slightly toward the end of the horizon, it remains negative and does not return to its initial level.

Figures 2 and 3 reveal that the strength and precision of these effects differ between advanced and non-advanced economies. In advanced economies, the response remains negative throughout the horizon, but statistical significance is limited. The confidence interval excludes zero only briefly around years 3 or 4, and uncertainty increases considerably at longer horizons. This pattern suggests that fiscal shocks still reduce bank capital in these economies, but the effect is smaller and less persistent. Deeper financial markets, greater diversification of bank portfolios, and stronger supervisory frameworks are likely to help soften the transmission of fiscal risk to bank balance sheets.

The pattern is stronger in non-advanced economies. Figure 3 shows that the decline in capital becomes statistically significant soon after the shock, again around years 2 and 3, and significance returns between years 7 and 10, when the decline reaches values near minus 0.07 to minus 0.08. These results are consistent with the structure of financial systems in non-advanced economies, where banks often hold a large share of their assets in domestic sovereign bonds. Because sovereign risk is usually higher and more volatile in these countries, increases in public debt translate more directly into valuation losses and funding pressures. Limited opportunities for diversification and shallow financial markets further magnify this effect, leading to a more pronounced and persistent deterioration in bank capitalization. The medium-term significance suggests that fiscal imbalances accumulate gradually and impose sustained pressure on bank balance sheets in environments with weaker financial and institutional foundations.

Summing-up, the linear results indicate that increases in public debt reduce bank capitalization in an economically meaningful and statistically significant way. The fact that significance appears both in the short run and again in the medium term suggests that fiscal shocks affect banks through more than one channel: an immediate channel linked to sovereign asset valuations and a slower channel associated with the ongoing accumulation of fiscal risk. These findings provide the basis for examining how differences in institutional quality shape the sovereign bank interaction, which is the focus of the next subsection.

Figure 1. Local Projection Estimates of Bank Capital Ratios Following a Positive Debt-to-GDP Shock (Full Sample)
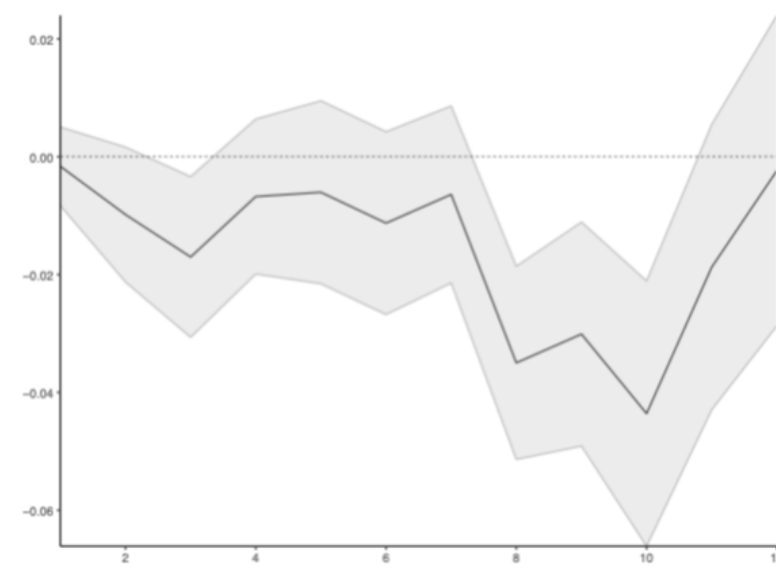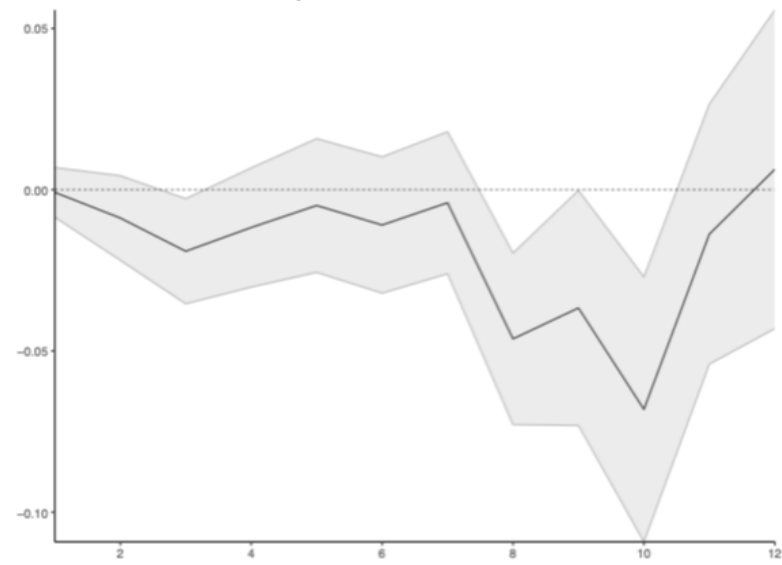

Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets). The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using a Newey-West correction for the standard errors.

Figure 2. Local Projection Estimates of Bank Capital Ratios in Advanced Economies Following a Positive Debt-to-GDP Shock
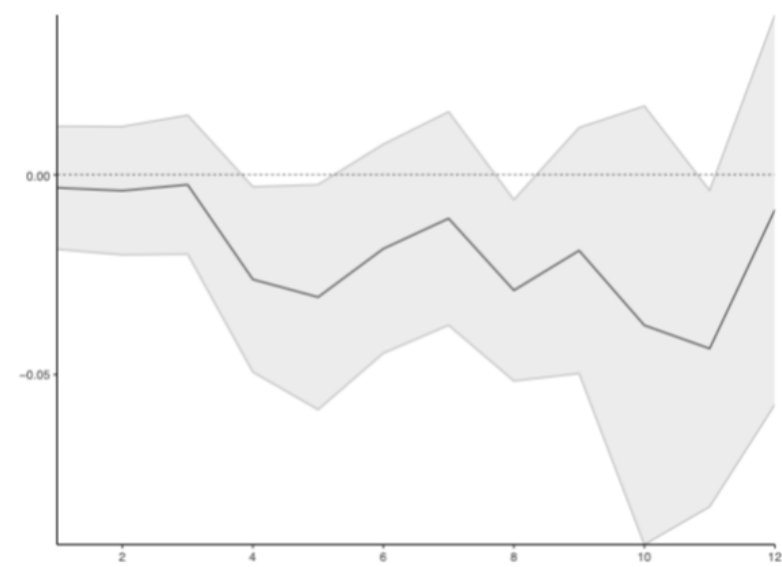
Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using a Newey-West correction for the standard errors.

Figure 3. Local Projection Estimates of Bank Capital Ratios in Non-advanced Economies Following a Positive Debt-to-GDP Shock

Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in non-advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using a Newey-West correction for the standard errors.

5.2. Conditioning on Regulatory Quality

Introducing Regulatory Quality as a conditioning variable shows that the transmission of fiscal shocks to bank capitalization depends strongly on the institutional environment. The linear specification reveals that higher public debt lowers bank capital in both advanced and non-advanced economies. Once Regulatory Quality is considered, however, the response changes in both sign and timing, confirming that institutional strength influences how fiscal stress is absorbed by the banking system.

Figure 4 shows the results for the full sample. When regulatory quality is low, the initial response of bank capital is slightly negative but not significant. Beginning around year 4, the response becomes positive and remains statistically significant from years 5 to 9. This rise in capital is consistent with banks operating in weak regulatory environments where immediate loss recognition is limited. Banks may react to rising sovereign risk by building buffers gradually, either as a precaution or in response to implicit expectations that they will need to strengthen balance sheets in the face of mounting fiscal pressure. Under high regulatory quality the pattern reverses. Here, bank capital declines after the shock, and the decline is statistically significant between years 4 and 7. Stronger supervisory systems require banks to recognize sovereign-related losses earlier, producing a more front-loaded adjustment. After year 7 the response moves toward zero, indicating that the main phase of balance sheet correction takes place early in the projection window.

Figures 5 and 6 highlight that regulatory quality does not have the same influence in all countries. Its effects are most pronounced in advanced economies, where the divergence between low and high regulatory quality is wide and persistent. In Figure 5, advanced economies with low regulatory quality experience a large and statistically significant decline in capital. The response is negative and significant in years 2 and 3 and again from years 5 to 10, with losses that intensify over time. This sustained erosion reflects a situation in which sovereign risk accumulates within banks' portfolios and is not absorbed promptly through regulatory mechanisms. By contrast, advanced economies with high regulatory quality show an entirely different trajectory. The initial response is mild and not precisely estimated, but from year 6 onward the effect becomes positive and statistically significant. This pattern is consistent with the mechanism described earlier.: when regulatory quality is high, public debt shocks reduce bank capital in the short run, but in advanced economies this effect reverses, and capital rises in the medium term. Credible supervision and a more stable fiscal framework likely support this recovery.

Non advanced economies display a related but distinct pattern. In Figure 6, countries with low regulatory quality show a positive response of bank capital, with statistical significance between years 5 and 8. This increase aligns with the fact that banks in many non-advanced economies hold substantial domestic sovereign expo-

sures and may reinforce capital positions when fiscal conditions worsen. The positive response is therefore consistent with precautionary behavior in settings where banks are closely tied to the fiscal position of the state. When regulatory quality is high in non-advanced economies, the response turns negative and becomes statistically significant around years 4 and 5. The decline is more limited than in advanced economies, and the medium-term reversal observed in advanced countries with high regulatory quality is less evident here, which reflects differences in fiscal credibility and in the depth of financial markets.

Taking together, these results confirm that regulatory quality plays a central role in shaping the sovereign-bank interaction. In weak regulatory environments public debt shocks tend to raise bank capital, although in advanced economies this rise is temporary and eventually gives way to a decline. In strong regulatory environments public debt shocks tend to lower capital in the short run, but in advanced economies this decline later reverses and capital increases as the system adjusts. The effect of institutional quality is clearest in advanced economies but remains meaningful in non-advanced economies where structural characteristics and sovereign exposures shape the adjustment path. These findings demonstrate that the response of banks to fiscal stress cannot be understood without considering the institutional setting in which they operate.

The results reported here fit naturally with earlier research on how institutional arrangements shape banks' balance-sheet decisions. Work by Jokipii and Milne (2008) and Valencia and Bolaños (2018) shows that banks operating under stronger supervisory frameworks tend to rebuild capital more promptly, while those in weaker environments often move in a more procyclical direction. Our findings speak to the same underlying mechanism but in the context of fiscal rather than cyclical disturbances. The contrast between countries with strong and weak regulatory systems is particularly telling: when regulation is effective, the impact of a rise in public debt shows up quickly in bank capital, suggesting timely loss recognition and closer monitoring. Where regulation is weaker, the adjustment is slower and sometimes moves upward for a time, consistent with banks waiting longer to register sovereign-related losses or responding cautiously by raising buffers. This pattern matches the view, supported by Brei et al. (2016), that simple leverage-type measures are more revealing of underlying conditions than risk-weighted ratios when fiscal pressures begin to build.

The results also complement the literature on the sovereign–bank connection. Studies of the European sovereign debt crisis, such as De Grauwe (2012) and later theoretical work by Dell'Ariccia et al. (2018), argue that sovereign distress weakens banks through valuation effects, funding pressures, and the broader macroeconomic environment. More recent evidence from emerging markets, including Gómez-González et al. (2025), shows that these channels remain important today and are influenced by institutional quality. The evidence presented in this paper is consistent with these insights. Higher public debt tends to weaken bank capital on average, but the path of adjustment differs sharply across institutional settings. The slow and occasionally
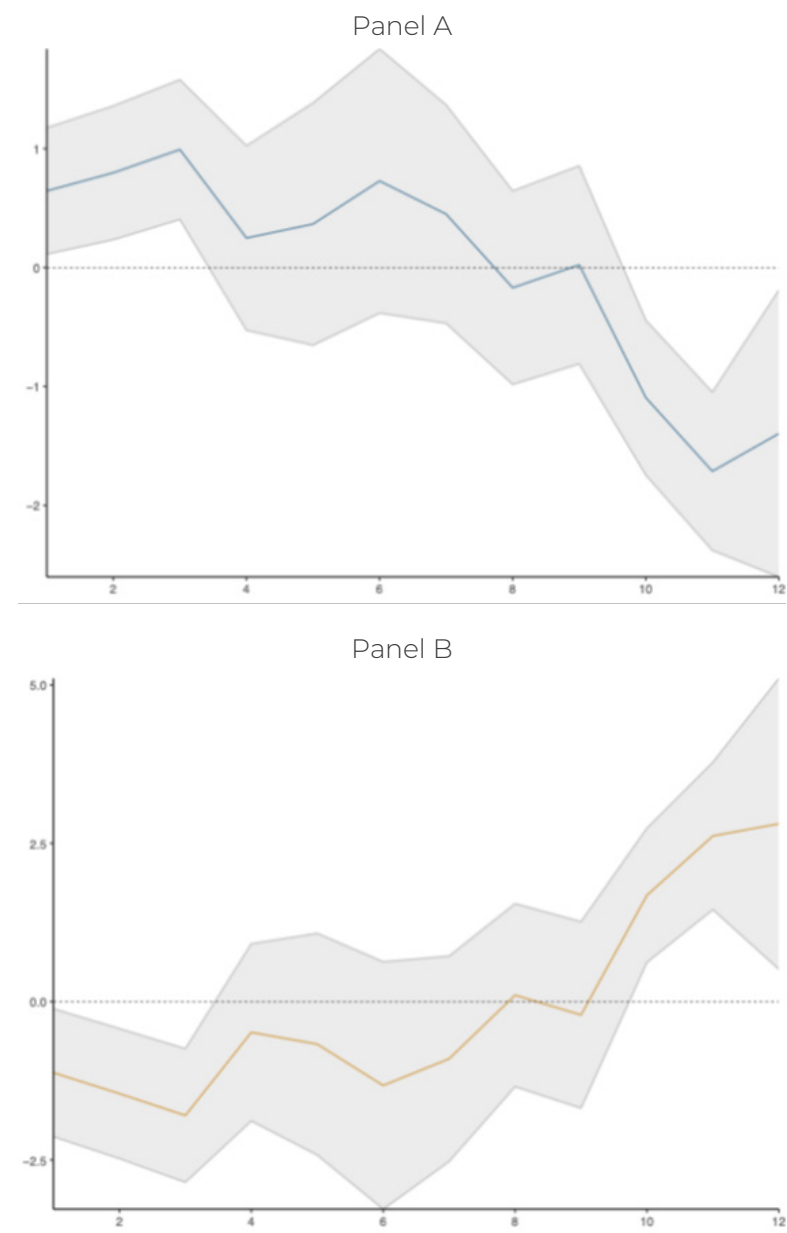
positive response in countries with weaker regulation is consistent with delayed balance-sheet recognition and with the fact that banks in these economies often hold a greater share of domestic sovereign debt. In advanced economies with stronger institutions, the initial decline in capital followed by a gradual recovery fits with closer supervisory scrutiny and more credible fiscal adjustment. These differences help explain why sovereign stress does not translate into banking fragility in a uniform way and highlight the role of institutions in shaping the adjustment process.

Figure 4. State-Dependent Local Projection Estimates of Bank Capital Ratios in the Full Sample Following a Positive Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable
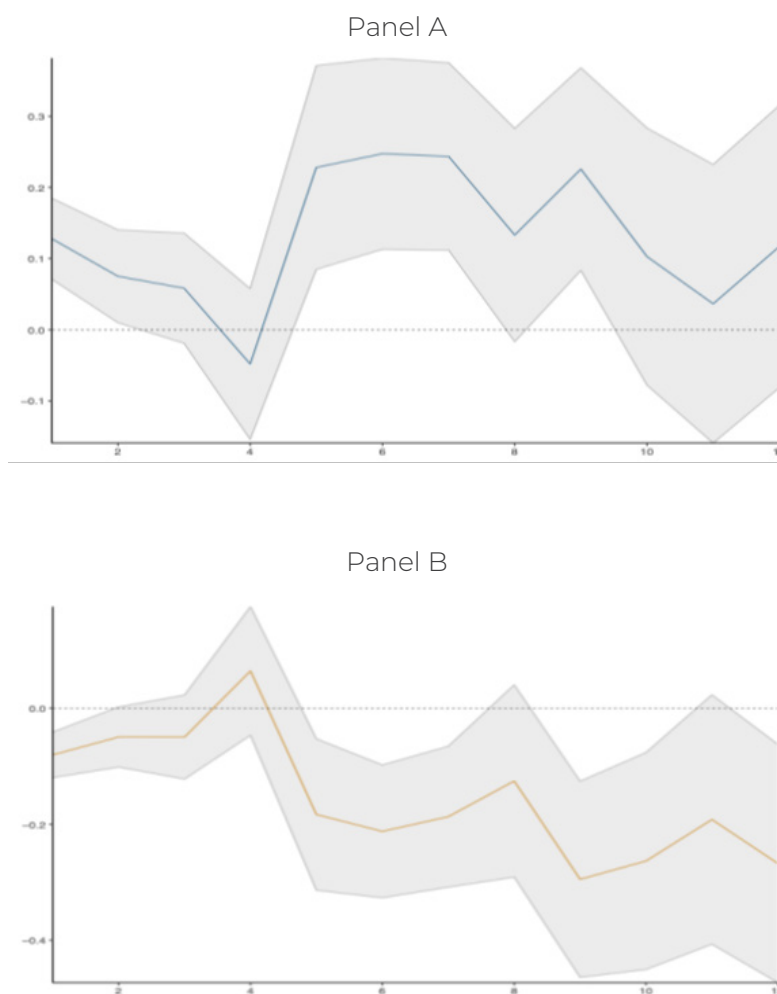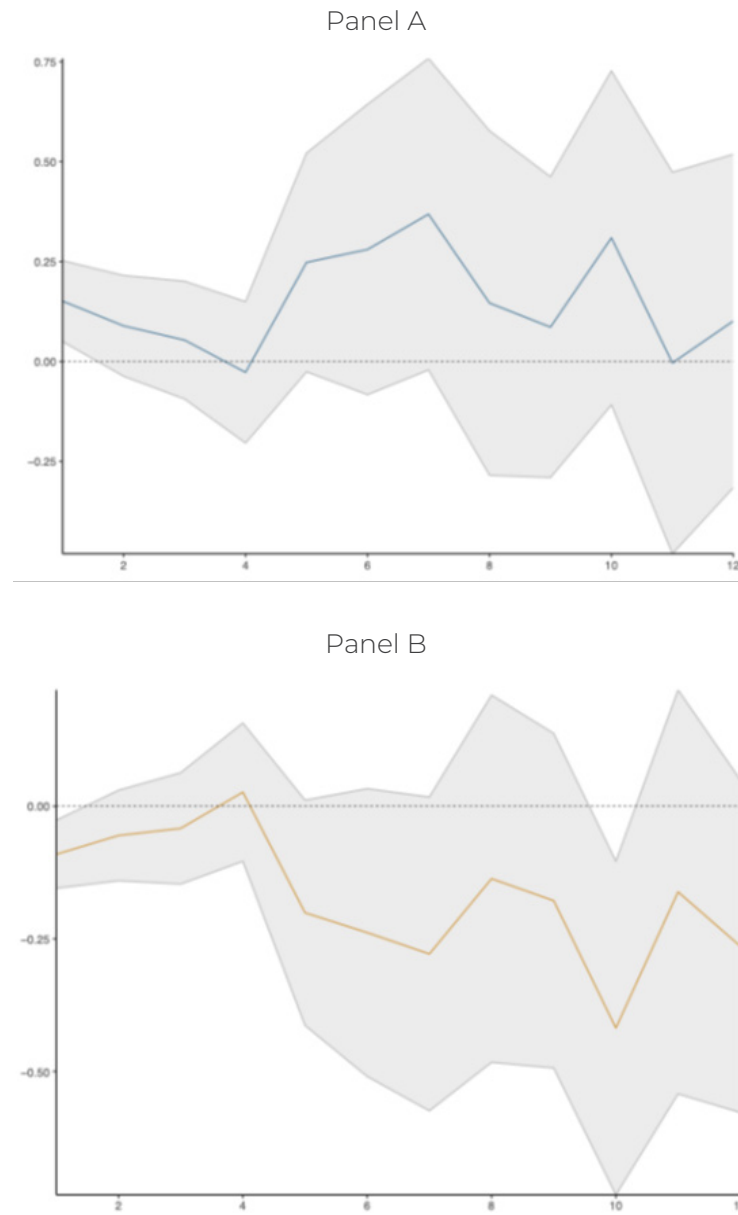
Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in our full sample of countries. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation uses a Newey-West standard error correction.

Figure 5. State-Dependent Local Projection Estimates of Bank Capital Ratios in Advanced Economies Following a Positive Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable

Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation uses a Newey-West standard error correction.

Figure 6. State-Dependent Local Projection Estimates of Bank Capital Ratios in Non-advanced Economies Following a Positive Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable

Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation uses a Newey-West standard error correction.

5.3. Robustness and econometric considerations

For robustness, we re-estimate the local projection models shown above using System GMM. This approach addresses potential endogeneity arising from the joint evolution of bank capital and public debt and the persistence that characterizes both variables. The GMM estimates, shown in Appendix Figures A1 through A6, provide an additional layer of evidence on the dynamics identified earlier.

The linear GMM results in Figures A1 to A3 point in the same direction as the baseline estimates but display weaker statistical precision. Across the full sample and the two country groups, the response of bank capital to a debt shock is generally negative over the medium term, but the confidence bands are wide and significance is limited. This pattern is familiar in applications of System GMM to highly persistent variables. When instruments are drawn from lagged values of series that evolve slowly over time, it is difficult to construct strong instruments, and standard errors increase accordingly. As a result, the linear GMM responses should be viewed as confirmation of the qualitative direction of the effect, rather than as precise estimates of its magnitude or timing.

The state-dependent GMM results in Figures A4 to A6 provide a much clearer picture. Once Regulatory Quality is allowed to shape the adjustment path, the impulse responses closely reproduce the nonlinear patterns obtained in the main text. In the full sample, the response under low regulatory quality again shows a medium-term rise in capital after the debt shock, while high regulatory quality produces an early decline that levels off as the horizon widens. These differences are visible and economically meaningful, even though the confidence bands are wider than under OLS.

The distinction becomes sharper when advanced and non-advanced economies are considered separately. For advanced economies (Figure A5), the GMM estimates reaffirm that weak regulatory environments leave banks exposed to persistent balance sheet deterioration following increases in public debt. The decline in capital is long lasting and economically large. In contrast, when regulatory quality is high, the short-run decline eventually gives way to a gradual recovery, a pattern consistent with earlier recognition of losses and with supervisory intervention that prevents the accumulation of sovereign risk on bank balance sheets. This medium-term reversal is exactly what the main text documents and is again present in the GMM estimates.

For non-advanced economies (Figure A6), the GMM results again align with the earlier findings. Under low regulatory quality, capital tends to rise in the medium term, reflecting the behavior of banks that hold substantial shares of domestic sovereign debt and reinforce their buffers when fiscal risks intensify. Under high regulatory quality, the response turns negative in the middle of the horizon, consistent with stricter supervisory

standards that require more rapid adjustment. Although financial structures and market depth differ across non-advanced economies, the GMM responses confirm that the direction and timing of the adjustment continue to depend on the institutional environment.

Taken together, the GMM estimates reinforce the central message of the paper. While the linear results become less precise when estimated with GMM, the nonlinear patterns that condition on Regulatory Quality remain visible, economically meaningful, and consistent across methods. This stability suggests that the mechanism documented in the main text is not sensitive to the estimation approach. Institutional quality shapes how banks absorb fiscal shocks: weak supervision allows adjustment to be postponed, while strong supervision brings losses forward and supports a more orderly balance sheet correction. The fact that this structure appears clearly in both sets of estimates strengthens the credibility of the main empirical findings.

6. Conclusions

This paper studies how banks' capital ratios respond to government debt-to-GDP shocks, drawing on evidence from a broad group of advanced and non-advanced economies. On average, an increase in public debt is followed by a decline in the ratio of equity to total assets. This pattern is consistent with the channels through which fiscal pressures affect banks: valuation losses on sovereign portfolios, changes in the scale and composition of assets, and the weakening of macroeconomic conditions that accompanies rising sovereign risk. Yet the aggregate response conceals substantial heterogeneity. Once regulatory quality is allowed to condition the dynamic adjustment, capital ratios display a clear state-dependent pattern. Banks operating in weaker regulatory environments incorporate the effects of fiscal stress slowly and may even show increases in capital ratios in the medium term. By contrast, banks in jurisdictions with stronger supervisory frameworks recognize losses earlier, experience an immediate decline in capital, and—within advanced economies—rebuild capital as conditions stabilize.

These findings underscore the central role of institutional quality in shaping the transmission of fiscal shocks to the banking sector. Strong supervisory systems allow losses associated with sovereign exposures to be recognized in a timely manner, reducing the likelihood that vulnerabilities accumulate unchecked. In weaker regulatory environments, the initial behavior of capital may provide an incomplete picture of bank resilience, as delayed loss recognition and concentrated sovereign exposures can mask underlying fragilities for an extended period.

The results also highlight the importance of the capital measure used in policy analysis and surveillance. Because domestic sovereign securities often carry a zero-risk weight, risk-weighted capital ratios can remain largely unchanged during episodes of fiscal deterioration. In contrast, the capital-to-assets ratio responds directly to valuation changes and balance-sheet adjustments and therefore offers a more transparent indicator of the pressures generated by government debt. It also avoids the comparability issues that arise from differences in supervisory discretion and internal modeling practices across countries.

Differences between advanced and non-advanced economies point to additional policy considerations. Banks in emerging and developing economies typically hold a larger share of domestic sovereign debt and operate in institutional environments where supervisory capacity is more limited. Credible fiscal frameworks and improvements in oversight are therefore crucial for containing potential feedback between sovereign and banking sector risks. In advanced economies, where supervisory intervention is timelier, ensuring that banks rebuild capital once conditions improve is important for avoiding prolonged balance-sheet constraints and supporting the recovery of credit supply.

Several directions for future research emerge from these findings. One concerns the portfolio adjustments that accompany fiscal shocks. Examining how banks alter the maturity structure and risk profile of their sovereign holdings would deepen the understanding of balance-sheet mechanisms driving the state dependence identified here. Another concerns the growing role of non-bank intermediaries in sovereign debt markets; little is known about whether their balance-sheet responses differ from those of banks or whether similar institutional patterns arise. Distinguishing between temporary and persistent fiscal shocks may also shed light on whether banks react differently to cyclical deficits than to structural fiscal imbalances. Finally, more granular supervisory data would allow researchers to investigate how regulatory interventions affect the timing of loss recognition and the pace at which capital adjusts, offering further insight into the institutional channels highlighted by the empirical results.

References

Adämmer, P. (2019). lpirfs: An R package to estimate impulse response functions by local projections. The R Journal (2019) 11:2, pages 421-438.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. Journal of econometrics, 68(1), 29-51.

Auerbach, A. J., & Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. American Economic Journal: Economic Policy, 4(2), 1-27

Auerbach, A. J., & Gorodnichenko, Y. (2013). Output spillovers from fiscal policy. American Economic Review, 103(3), 141-146

Avezum, L., Oliveira, V., & Serra, D. (2024). Assessment of the effectiveness of the macroprudential measures implemented in the context of the Covid-19 pandemic. International Review of Economics & Finance, 93, 1542–1555

Benbouzid, N., Kumar, A., Mallick, S. K., Sousa, R. M., & Stojanovic, A. (2022). Bank credit risk and macro-prudential policies: Role of counter-cyclical capital buffer. Journal of Financial Stability, 63, 101084

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. Journal of econometrics, 87(1), 115-143

Brei, M., Gambacorta, L., & Meeks, R. (2016). The cyclicality of banks' capital buffers. Journal of Financial Stability, 24, 22–30

Carvallo, O., Kasman, A., & Kontbay-Busun, S. (2015). The Latin American bank capital buffers and business cycle: Are they pro-cyclical?. Journal of International Financial Markets Institutions & Money, 36, 148–160

De Grauwe, P. (2012). The governance of a fragile Eurozone. Australian Economic Review, 45(3), 255-268

Deghi, A., Fendoglu, M. S., Iyer, T., Tabarraei, H., Tabarraei, M. H. R., Xu, Y., & Yenice, M. (2022). The sovereign-bank nexus in emerging markets in the wake of the COVID-19 pandemic. International Monetary Fund

Dell'Ariccia, M. G., Ferreira, C., Jenkinson, N., Laeven, M. L., Martin, A., Minoiu, M. C., & Popov, A. (2018). Managing the sovereign-bank nexus

Farhi, E., & Tirole, J. (2018). Deadly embrace: Sovereign and financial balance sheets doom loops. The Review of Economic Studies, 85(3), 1781-1823

Gambacorta, L., & Karmakar, S. (2018). Leverage and risk-weighted capital requirements. 56th issue (December 2018) of the International Journal of Central Banking

Gomez-Gonzalez, J. E., Uribe, J. M., Valencia, O. M., & Kim, B. (2025). Doom loops in Latin America. Emerging Markets Review, 101334

Gómez-Puig, M., & Sosvilla Rivero, S. (2024). The diabolic loop between sovereign and banking risk in the euro area. IREA–Working Papers, 2024, IR24/06

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical is-sues1. Hague Journal on the Rule of Law, 3(2), 220-246.

Jokipii, T., & Milne, A. (2008). The cyclical behaviour of European bank capital buffers. Journal of Banking & Finance, 32(8), 1440-1451

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. American economic review, 95(1), 161-182

Jordà, Ò., Schularick, M., & Taylor, A. M. (2020). The effects of quasi-random monetary experiments. Journal of Monetary Economics, 112, 22-40

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: the causes of banking and balance-of-payments problems. American economic review, 89(3), 473-500

Lang, J. H., & Menno, D. (2025). The state-dependent impact of changes in bank capital requirements. Journal of Banking & Finance, 176, 107439

Neef, H. O. D. D., Schandlbauer, A., & Wittig, C. (2023). Countercyclical capital buffers and credit supply: Evidence from the COVID-19 crisis. Journal of Banking & Finance, 154, 106930

Newey, W. K., & West, K. D. (1987). Hypothesis testing with efficient method of moments estimation. International Eco-nomic Review, 777-787

Reinhart, C. M., & Rogoff, K. S. (2011). From financial crash to debt crisis. American economic review, 101(5), 1676-1706

Sivec, V., & Volk, M. (2023). Empirical Evidence on the Effectiveness of Capital Buffer Release. International Journal of Central Banking, 19(3), 139–173

Valencia, O. C., & Bolaños, A. O. (2018). Bank capital buffers around the world: Cyclical patterns and the effect of market power. Journal of Financial Stability, 38, 119–131
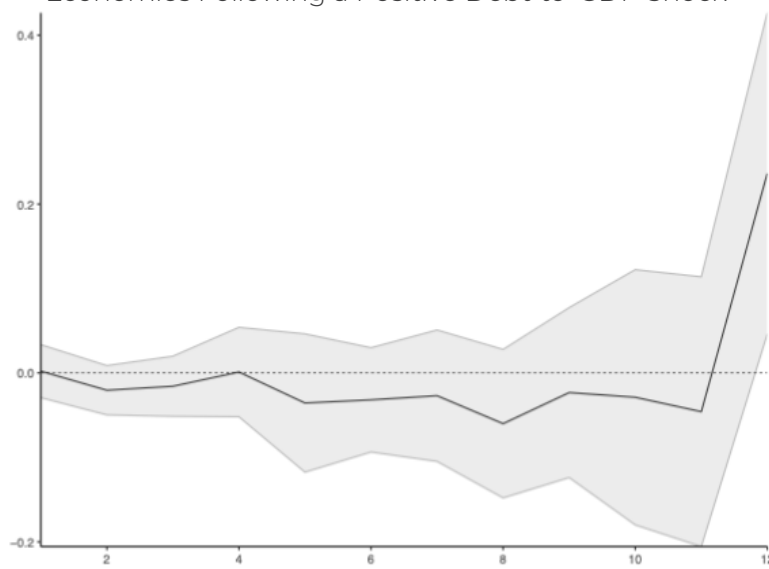
Appendix

Figure A1. Local Projection Estimates of Bank Capital Ratios Following a Positive Debt-to-GDP Shock (Full Sample)
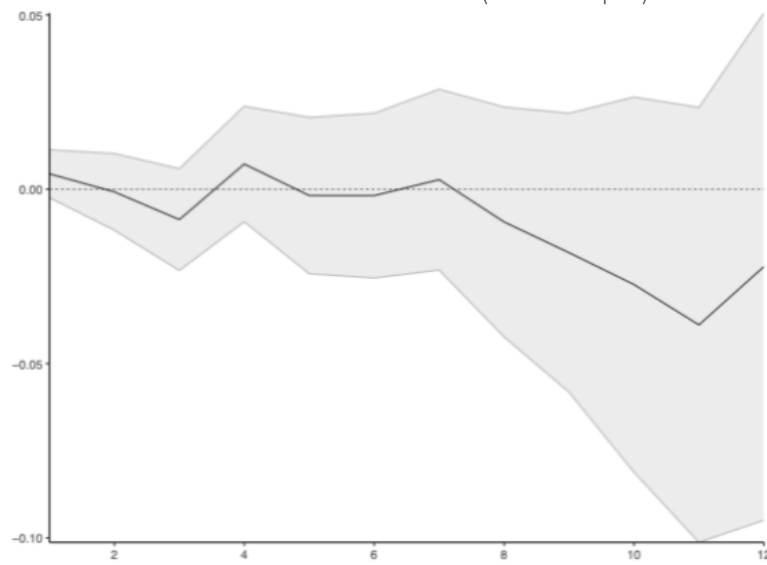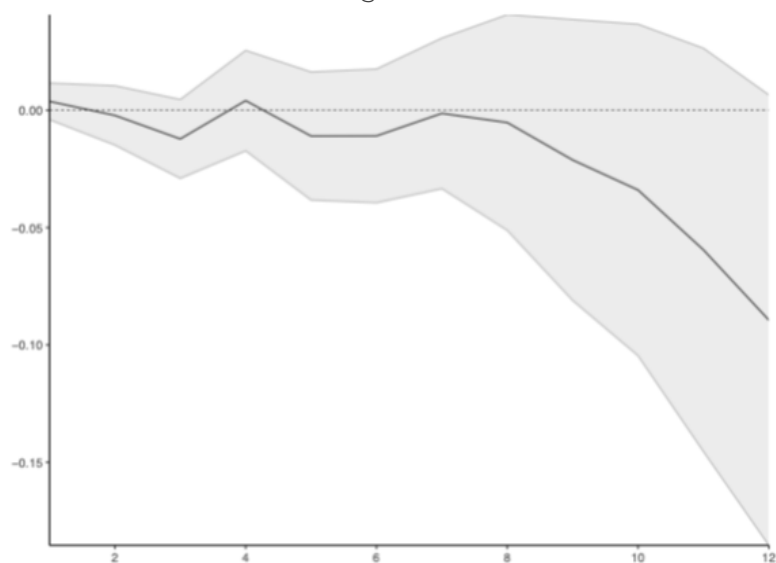

Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets). The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using System GMM.

Figure A2. Local Projection Estimates of Bank Capital Ratios in Advanced Economies Following a Positive Debt-to-GDP Shock
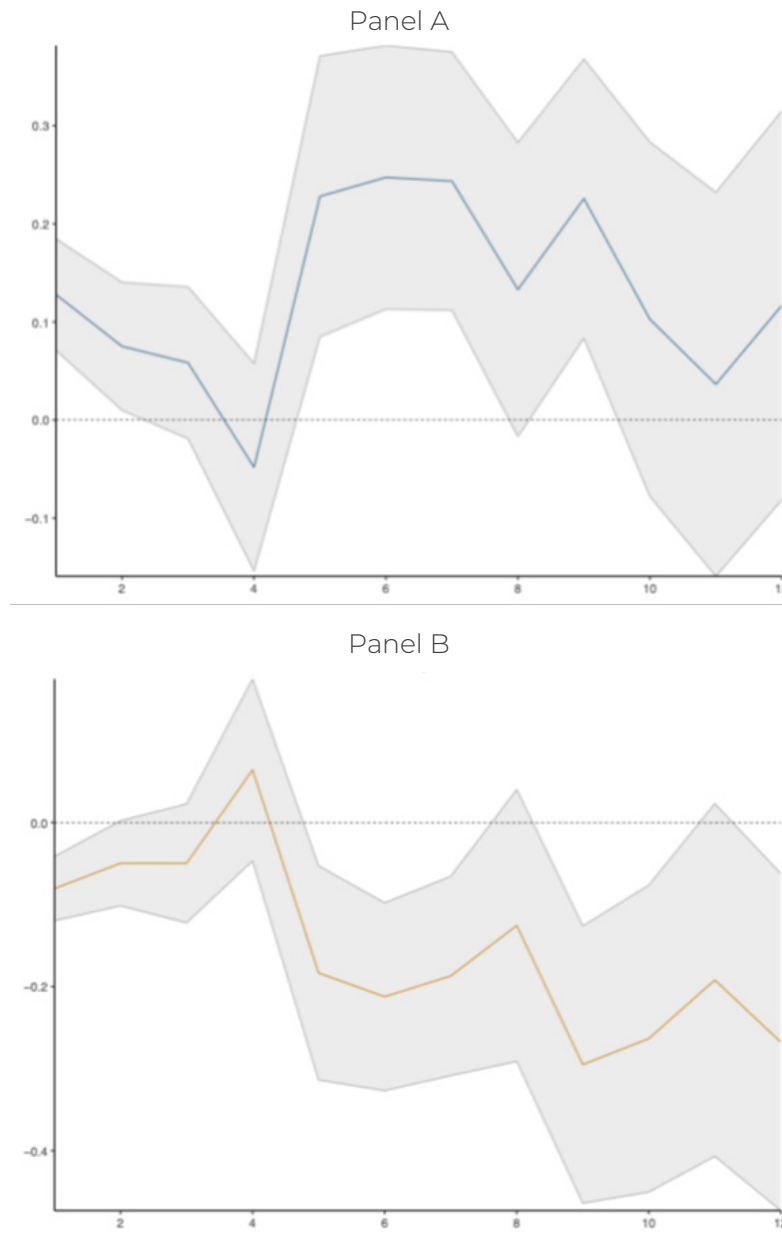

Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using System GMM.

Figure A3. Local Projection Estimates of Bank Capital Ratios in Non-advanced Economies Following a Positive Debt-to-GDP Shock
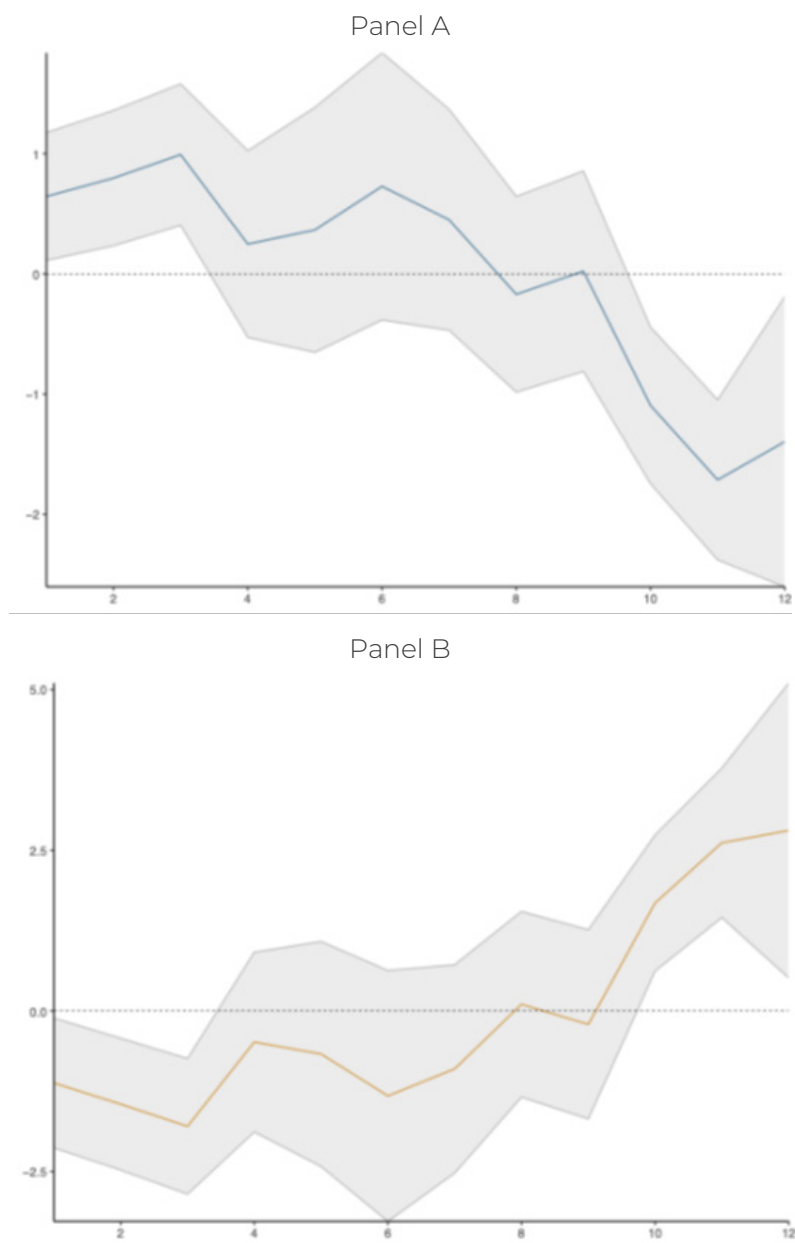

Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in non-advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using System GMM.

Figure A4. State-Dependent Local Projection Estimates of Bank Capital Ratios in Our Full Sample of Countries Following a Positive Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable
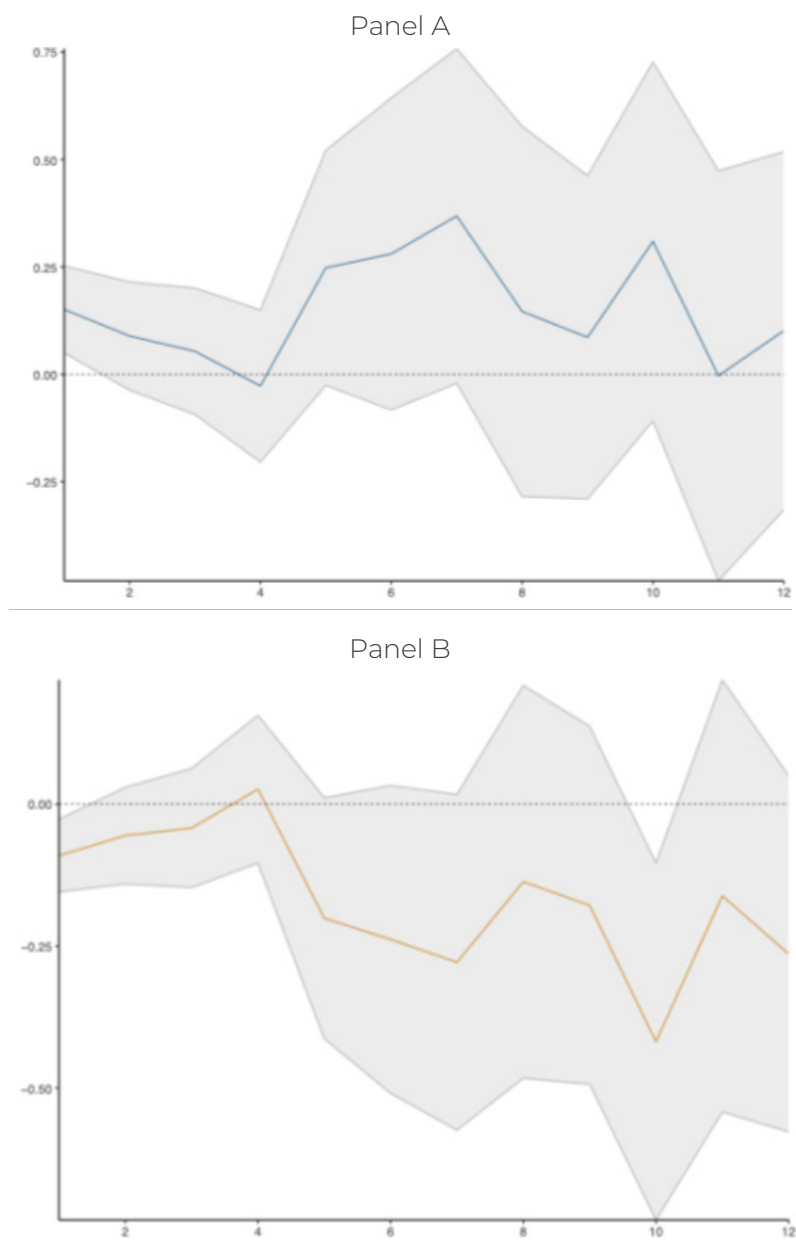
Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation is performed using System GMM.

Figure A5. State-Dependent Local Projection Estimates of Bank Capital Ratios in Advanced Economies Following a Positive Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable

Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation is performed using System GMM.

Figure A6. State-Dependent Local Projection of Bank Capital Ratios in Non-advanced Economies Following a Shock Debt-to-GDP Shock, with Regulatory Quality as the Switching Variable

Panel A

Panel B

Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in non-advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the switching variable, and the estimation is performed using System GMM.