Is the International Bank Lending Channel Driven by Ownership? Evidence from Local Banks and Foreign Subsidiaries

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Abstract

This paper examines whether bank ownership shapes the international transmission of monetary policy through the bank lending channel. Specifically, it investigates whether foreign subsidiaries respond differently from domestic banks to U.S. monetary policy shocks. Using a large bank-level dataset covering 2,039 institutions across 116 countries over the period 2001–2020, we combine detailed balance sheet information with an exogenous measure of U.S. monetary policy shocks. Our results indicate that foreign-owned banks seem to adjust their lending more strongly in response to U.S. monetary policy shocks than domestic banks. However, this effect is highly heterogeneous across banks and therefore not statistically significant. These findings hold regardless of whether lending persistence is explicitly modeled or not. Overall, the evidence downplays the role of internal capital markets in driving the international credit channel of monetary policy over yearly horizons. More broadly, results point suggest that foreign ownership appears to play a secondary role relative to broader balance sheet characteristics and exposure to global financial conditions.

Keywords: International bank lending channel; Monetary policy spillovers; Foreign bank ownership; Global financial cycle; Bank lending; Cross-border banking.

JEL Classification: F34; G21; E52; F42.

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Content

1. Introduction

Over the past few decades, the expansion of cross-border banking has reshaped how monetary policy is transmitted across countries. Changes in U.S. monetary policy now affect financial conditions well beyond domestic borders. A large body of work shows that globally active banks adjust their balance sheets in response to shifts in U.S. policy, transmitting these shocks to the economies in which they operate (Bruno and Shin, 2015; Cetorelli and Goldberg, 2011, 2012). This international bank lending channel has become a central piece of the broader "global financial cycle" view, where common factors, often tied to U.S. monetary conditions, drive credit dynamics across countries (Miranda-Agrippino and Rey, 2020).

Even so, banks do not all react in the same way. One question that remains somewhat unsettled is what explains these differences. A natural candidate is ownership. Foreign subsidiaries are part of multinational banking groups and are therefore linked to parent institutions through internal capital markets. These links can matter for how shocks are transmitted. When parent banks face funding pressures or changes in financial conditions at home, they may reallocate resources across their network, affecting lending in foreign affiliates (Cetorelli and Goldberg, 2012; De Haas and Van Lelyveld, 2010). At the same time, access to group-level funding may also allow subsidiaries to smooth local shocks, making them less dependent on host-country conditions (De Haas and Van Lelyveld, 2014). It is not obvious, ex-ante, which of these forces dominates.

At the same time, there are reasons to think that ownership might not be the main driver. A growing strand of the literature points instead to banks' balance sheet characteristics and funding structures. Banks that rely more heavily on cross-border or wholesale funding tend to be more exposed to global liquidity conditions, regardless of whether they are foreign-owned or domestic (Ongena et al., 2015; Baskaya et al., 2017). More recent work also highlights the role of geographic diversification and risk-taking behavior in shaping lending responses to external shocks (Doerr and Schaz, 2021; Dinger and Kaat, 2020). From this perspective, ownership may matter, but only as one element among several that determine how banks are connected to global financial markets.

One possible reason why ownership may not play role is related to how foreign subsidiaries are funded in practice. Once banks establish operations abroad, particularly in the case of large institutions, they often rely heavily on local funding sources, such as deposits collected in the host country. This reduces their dependence on internal capital markets and limits the extent to which shocks originating in the parent bank's home country are transmitted to their foreign affiliates. As a result, even though foreign ownership creates the potential for cross-border transmission, its actual importance may be attenuated when subsidiaries are largely funded locally.

In this paper, we revisit the role of ownership in the international transmission of monetary policy. We ask whether foreign subsidiaries respond differently from domestic banks to U.S. monetary policy shocks, and whether these differences are economically meaningful. To address this question, we use a large bank-level dataset covering 2,039 institutions across 116 countries over the period 2001–2020. The analysis combines detailed balance sheet information with an exogenous measure of U.S. monetary policy shocks based on Bu, Rogers, and Wu (2021), which allows us to trace how unexpected changes in U.S. policy affect lending abroad.

Our empirical approach starts from a standard two-way fixed effects framework, which controls for both bank-specific characteristics and common time effects. We then extend the analysis using dynamic panel methods to account for the persistence of lending and to address potential endogeneity concerns. This setup allows us to focus directly on the interaction between U.S. monetary shocks and foreign ownership, and to test whether banks linked to U.S. parent institutions adjust their lending differently from purely domestic banks. We also explore whether these effects become stronger during periods of global financial stress, when constraints on funding and balance sheets are more likely to bind.

The results suggest that ownership does not play a dominant role. In the baseline specifications, foreign subsidiaries appear to respond somewhat more strongly to U.S. monetary policy shocks; however, these estimates are not statistically different from those of the baseline category. This holds both in static and dynamic panel datasets. Differences across banks cannot b explained by ownership, which is in line with the idea that exposure to global funding conditions and balance sheet structures matter the most.

Our contribution is straightforward. First, we provide new cross-country evidence on the international bank lending channel using a broad sample that spans advanced, emerging, and low-income economies. Second, we take a closer look at the role of ownership, helping to clarify how important internal capital markets are in practice. Third, by comparing results across several empirical approaches, we show that accounting for persistence and heterogeneity in lending is important for identifying these effects.

These findings also carry policy implications. Since ownership does not play a statistically significant role in shaping the transmission of external shocks, concerns that foreign-owned banks systematically amplify the impact of global monetary conditions on domestic credit markets appear less warranted. If such an effect were present, domestic policymakers might face greater difficulty in insulating local credit conditions from global developments. Instead, the results suggest that focusing solely on ownership is too narrow; a more comprehensive understanding of banks' funding structures and their exposure to global financial markets is likely to be equally, if not more, important.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data. Section 4 outlines the empirical strategy. Section 5 presents the results. Section 6 concludes.

2. Literature Review

The global banking system plays a central role in the transmission of cross-border financial and monetary shocks. Changes in U.S. monetary policy may affect the leverage of internationally exposed banks and shape their lending decisions, thereby contributing to the expansion or contraction of credit supply in local economies (Bruno and Shin, 2015). While the existence of this international credit channel is well established in the literature (e.g., Ahrend and Goujard, 2015; Banti and Phylaktis, 2019; Girlado et al., 2025), a key unresolved question concerns the mechanisms underlying the transmission of such shocks. Further research is needed to establish whether bank ownership, distinguishing between foreign subsidiaries and purely domestic banks, fundamentally shapes how these shocks are absorbed and transmitted to the local real economy.

A dominant strand of the literature argues that foreign-owned banks behave differently from domestic institutions due to their deeper integration within internal capital markets of multinational banking groups. In this context, Cetorelli and Goldberg (2011, 2012) document how global banks actively reallocate liquidity across their international networks. They show that when parent institutions are hit by home-country liquidity shocks, they often withdraw funds from foreign affiliates to support domestic balance sheets, thereby transmitting shocks across borders.

Empirical evidence supports the view that international banks differ from domestic banks in the way they transmit financial conditions. Wu et al. (2011) find that foreign banks in emerging markets are less responsive to host-country monetary policy because they can draw on parent liquidity, yet they remain highly sensitive to shocks originating in their home countries. Similarly, De Haas and Van Lelyveld (2006, 2010, 2014) show that the internal capital markets of multinational banking groups can both stabilize and destabilize lending, depending on circumstances: parent banks may support subsidiaries during local crises, but may also force retrenchment when facing distress themselves. More recent evidence from Mexico indicates that foreign banks respond more strongly to both domestic and external shocks than domestic banks, suggesting greater volatility in their lending behavior (Cantú et al., 2022).

Nonetheless, another body of work suggests that the distinction between foreign and domestic banks may be overstated. This alternative perspective emphasizes balance sheet characteristics and funding structures as the primary drivers of shock transmission. Ongena et al. (2015) show that during the global financial cri-

sis, both foreign banks and domestic banks reliant on international wholesale funding contracted credit to a similar extent, whereas domestically funded banks were comparatively insulated. This shifts the focus from ownership to funding conditions. The implication is that exposure to global financial markets, rather than ownership per se, determines a bank's vulnerability to external shocks. Consistent with this view, Baskaya et al. (2017) find that capital inflows stimulate lending more strongly through domestic banks with higher levels of external debt than through foreign banks, suggesting that domestic institutions can be equally integrated into global financial conditions.

A related explanation, consistent with this perspective, is that foreign subsidiaries may not be as dependent on parent funding as often assumed. In many cases, particularly for large and well-established institutions, lending activity is financed to a significant extent through local deposits raised in the host country. This reduces reliance on internal capital markets and limits the direct transmission of home-country shocks through ownership links. From this viewpoint, differences in lending behavior between foreign and domestic banks may reflect funding structures and market integration rather than ownership per se.

A related strand of the literature emphasizes the role of global financial conditions in shaping cross-border credit dynamics. Rey (2015) argues that financial globalization has given rise to a global financial cycle, characterized by strong co-movement in capital flows, asset prices, and credit growth across countries. This cycle is closely linked to monetary conditions in the United States and to fluctuations in global risk appetite. As a result, domestic financial conditions may be influenced by external factors even in economies with flexible exchange rates. From this perspective, international bank lending is not only a function of bank-specific characteristics, but also of exposure to common global forces that simultaneously affect financial intermediaries across countries.

Complementary evidence comes from the literature on international capital flows. Forbes and Warnock (2012) document large and recurrent "waves" of capital flows, surges, stops, flight, and retrenchment, that are primarily driven by global factors rather than domestic conditions. They show that changes in global risk are systematically associated with sharp movements in cross-border flows. These findings suggest that the transmission of financial shocks operates through broad international channels, affecting both foreign and domestic banks depending on their exposure to global funding conditions. This reinforces the idea that differences in lending behavior may reflect varying degrees of integration into global financial markets, rather than ownership alone.

Further contributions reinforce the importance of bank-specific characteristics over ownership. Doerr and Schaz (2021) show that geographic diversification plays a key stabilizing role during crises, with diversified

domestic banks exhibiting greater resilience than non-diversified foreign banks. Allen et al. (2017) find that the impact of ownership on lending in Central and Eastern Europe depends critically on the nature and origin of the crisis, highlighting the context-dependent nature of these effects. In addition, Dinger and Kaat (2020) demonstrate that cross-border capital flows affect both lending volumes and risk-taking across banks of different sizes and ownership structures, provided they have access to external funding.

A related strand of the literature emphasizes the role of creditor-country shocks and cross-border capital flows in shaping domestic credit conditions. Using cross-country data, Ahrend and Goujard (2015) show that shocks to creditor banks' balance sheets are an important driver of credit dynamics in recipient economies. Similarly, Baskaya et al. (2017) provide evidence that capital inflows can significantly expand domestic lending, particularly through banks with greater access to external funding. These findings highlight that international transmission operates not only through the organizational structure of banks, but also through their exposure to global financial conditions, suggesting that the distinction between foreign and domestic institutions may be less clear-cut than often assumed.

More recent contributions further stress the importance of bank-level heterogeneity in shaping the transmission of external shocks. Doerr and Schaz (2021) show that geographically diversified banks tend to be more resilient during periods of stress, pointing to diversification rather than ownership as a key determinant of lending stability. In a similar vein, Dinger and te Kaat (2020) find that cross-border capital flows affect both lending and risk-taking across banks with varying characteristics, provided they are sufficiently integrated into international financial markets. Taken together, this evidence suggests that exposure to global funding and portfolio diversification may play a more central role than ownership per se in determining how banks respond to external shocks.

3. Data

We use bank-level information from BankFocus. Our sample comprises 2,039 financial institutions across 116 countries (19 advanced economies, 79 emerging economies, and 18 low-income economies) over the period 2001–2020. The end year of the sample is determined by the availability of the U.S. monetary policy shock variable, constructed by Bu et al. (2021) and publicly available from the Federal Reserve Board up to the mentioned year.

Table 1 presents the summary statistics for the variables employed in our empirical analysis. The average bank size, represented by the natural log of total assets, is 13.9, with a relatively low standard deviation of 2.08,

suggesting a sample dominated by mid-to-large-sized international institutions. Profitability remains positive on average, with a mean Return on Assets (ROA) of 1.12%. Notably, the sample exhibits high levels of capitalization and liquidity for the sample analysed; the average Tier 1 Ratio stands at 20.38%, well above regulatory minimums, while liquid assets account for nearly 30% of total assets on average.

The sample also convers significant heterogeneity in terms of asset quality. Loan loss provisions show a mean of 6.07%, though the high standard deviation (7.71) reflects diverse risk profiles across banks and countries. Regarding our primary explanatory variables, the US monetary policy shock series is centered at zero, showing a range of movement between -0.42 and 0.16 percentage points, capturing both expansionary and contractionary policy shifts. Finally, the US Foreign Parent dummy reveals that approximately 2% of our bank-year observations correspond to institutions with a direct organizational link to a US-based ultimate owner[6].

Table 1. Descriptive Statistics of the Variables in Our Sample

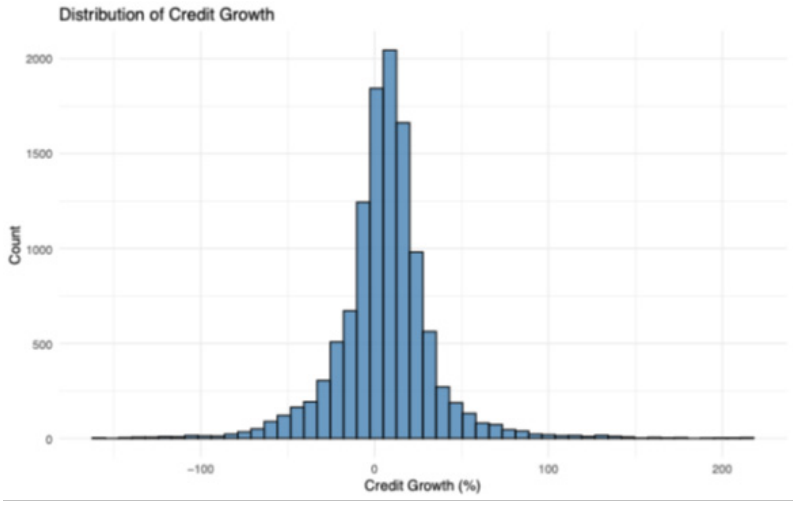
	Abbreviation	*Source*	*Mean*	*Median*	*Std.Dev*	*Max.*	*Min.*
Natural Log of Bank's Total Assets	total_assets	BankFocus	13.9	13.85	2.08	19	8.96
Return on Assets	roa	BankFocus	1.12	1.02	1.9	11.8	-11.5
Tier 1 Ratio	tier1_ratio	BankFocus	20.38	15.39	16.26	157	2.64
Liquidity Ratio	liq_assets_TA	BankFocus	29.23	25.01	18.86	92.3	0.67
Loan Loss Prov.	loan_lossR_GCLA	BankFocus	6.07	3.54	7.71	56.6	0
US Monetary Policy Shock	monetary_us_shock	Federal Reserve-BRW	0	0.03	0.1	0.16	-0.42
US Foreign Parent	is_us_uo	BankFocus	0.02	0	0.13	1	0

Note: The sample consists of bank-year observations excluding US-based operations from 2001 to 2020. All continuous bank-level variables have been trimmed at the 0.5% and 99.5% percentiles to mitigate the influence of extreme outliers and potential data entry errors.

Figure 1 shows the distribution of bank-level credit growth in our sample. The distribution is centered around zero and displays a roughly bell-shaped pattern, although with noticeable dispersion and some fat tails. This suggests that while most banks experience moderate changes in lending, there are episodes of both sharp contractions and rapid expansions.

[6] The minimum percentage of control along the ownership chain from a subject company to its Ultimate Owner must be 50.01%. A company is classified as an Ultimate Owner if it has no identified shareholders or if the ownership shares of its shareholders are unknown.

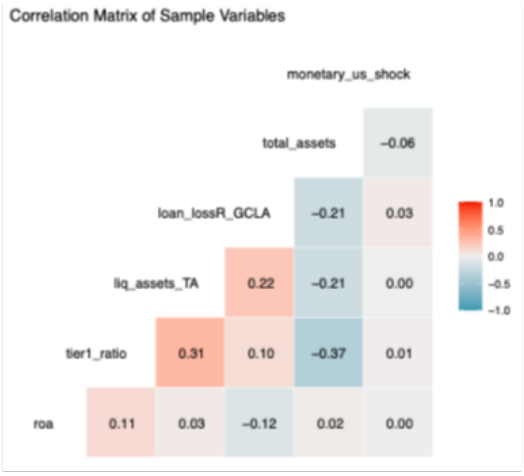
Figure 1. Distribution of Bank Credit Growth



Note: Distribution of credit bank growth. Variables defined in Table 1.

Figure 2 presents the pairwise correlations among the main variables used in the analysis. Overall, the correlations are relatively modest, suggesting that multicollinearity is unlikely to be a major concern. As expected, bank size and liquidity exhibit some positive association, while higher loan loss provisions are negatively correlated with key balance sheet indicators. Importantly, the U.S. monetary policy shock variable shows only weak correlations with bank-level characteristics, supporting its interpretation as an exogenous source of variation in our empirical framework.

Figure 1. Distribution of Bank Credit Growth



Note: Variables defined in Table 1.

4. Methodology

We investigate the transmission of US monetary policy shocks to international bank lending through the internal capital market channel. To ensure the robustness of our findings, we compare our main results with a variety of econometric approaches that addresses potential issues of endogeneity, persistence in lending behavior, and the influence of extreme observations.

Our baseline empirical strategy utilizes a Two-Way Fixed Effects (TWFE) panel model. This specification allows us to control for unobserved time-invariant bank characteristics and global macro-financial shocks. The baseline equation is defined as:

$$Credit\ Growth_{i,j,t} = \alpha_i + \delta_t + \beta_1 X_{i,t} + +\beta_2 \left(Parent_{i,j} \times Shock_{US,t}\right) + \epsilon_{i,j,t}, \quad (1)$$

Where, $Credit\ Growth_{i,j,t}$ is the log change in Gross Loans and Advanced Claims (GLAC) for bank i in country j at time t. α_i and δ_t are bank and year fixed effects, respectively. $X_{i,t}$ is a vector of bank-level controls, including Total Assets (log), Return on Assets (ROA), Tier 1 Capital Ratio, Liquidity Ratio, and Loan Loss Provisions. $Parent_{i,j} \times Shock_{US,t}$ is our main interaction term between a dummy for US-owned foreign subsidiaries and the Bu, Rogers, and Wu (2021) US monetary policy shock series.

As a robustness for our main results, we postulate a series of variations from this main model. For instance, we use winsorization, rather than trimming, as an alternative way to ensure that our results are not driven by data entry errors or extreme events (such as large-scale mergers). We apply winsorization where we cap continuous variables at percentiles 0.5% and 99.5%, replacing extreme values with the boundary values. This ensures that the OLS estimator, which is sensitive to squared residuals, provides a consistent reflection of the typical bank in the sample.

We also perform a dynamic panel analysis for considering the persistence of bank lending, which could in principle have an impact in our treatment of interest. To account for this, we extend our model into a dynamic framework by including the lagged dependent variable in the main regression. To resolve the Nickell Bias that arises in these cases, even when our sample spans almost 20 years, we employ two advanced estimators: Dynamic GMM (Arellano & Bond, 1991) and System GMM (Blundell and Bond, 1998).

The former method transforms the model into first differences to remove bank-level fixed effects and uses lagged levels of the dependent variable as instruments to address the correlation between the lagged dependent variable and the transformed error term. In our context, the Difference GMM estimator (Arellano & Bond,

1991) is more appropriate than the System GMM approach (Blundell and Bond, 1998) due to the structure of our data. While System GMM can offer efficiency gains by utilizing levels as instruments, it relies on a steady-state stationarity assumption, namely, that the bank-specific fixed effects are uncorrelated with the first differences of the variables. Given the two-decade span of our data and the high persistence of bank balance sheet components like total assets and Tier 1 ratios, this assumption is likely violated. Nevertheless, we also report results for a System GMM.

Finally, we examine whether the transmission channel is amplified during periods of global financial instability following previous insights in the literature. We identify global crisis years in our sample (2008, 2009, and 2020) and introduce a triple interaction term to our model $\beta_3\left(Parent_{i,j} \times Shock_{US,t} \times Crisis_t\right)$. This allows us to isolate whether the internal capital market channel functions differently when global liquidity constraints are binding, compared to "normal" economic periods.

5. Results

This section presents the empirical results on the transmission of U.S. monetary policy shocks to bank lending, with a focus on whether foreign ownership shapes this process. We begin with the baseline estimates and then turn to a set of robustness checks that address outliers, persistence in lending, and crisis periods.

5.1. Baseline results

Table 2 reports the results from the baseline two-way fixed effects specification. The coefficients on the control variables are broadly in line with standard expectations. Larger banks exhibit faster credit growth, consistent with the idea that scale and funding access support lending expansion. Quantitatively, the estimated coefficient on bank size is sizeable: a one-unit increase in log assets is associated with an increase in lending growth on the order of 6 percentage points. While this magnitude should be interpreted with caution given the specification, it highlights the importance of scale in shaping credit dynamics.

Liquidity and loan loss provisions enter with negative and statistically significant coefficients. The magnitude is economically meaningful. For instance, a 10-percentage point increase in the liquidity ratio is associated with roughly a 2.6 percentage point decline in lending growth, suggesting that banks holding larger liquidity buffers expand credit more conservatively. Similarly, a 1 percentage point increase in loan loss provisions is associated with a reduction in lending growth of about 0.5 percentage points, pointing to the importance of asset quality in constraining credit supply.

Turning to the variable of interest, the interaction between U.S. monetary policy shocks and foreign ownership is positive but not statistically significant. The point estimate implies that a 10-basis point U.S. monetary policy shock is associated with an additional increase in lending growth of roughly 0.57 percentage points for foreign subsidiaries relative to domestic banks. This is not negligible in economic terms, but the lack of statistical precision suggests substantial heterogeneity across banks. As such, the baseline results provide only tentative evidence of an ownership-based transmission channel.

Table 2. TWFE Main Model

	Estimate	*Std.Error*	*t Statistic*	*P. Value*
Log of Total Assets	6.42	1.55	4.14	0.00
Return on Assets	0.69	0.37	1.87	0.06
Tier 1 Ratio	0.07	0.06	1.14	0.25
Liquidity Ratio	-0.26	0.05	-5.83	0.00
Loan Loss Prov.	-0.46	0.10	-4.61	0.00
Foreign Monetary Shock: Foreign Parent	57.21	36.41	1.57	0.12
Adj. R2	0.22			

Note: The main model is a Two-Way Fixed Effects (TWFE) OLS regression with Bank and Year fixed effects. Bank size (Total Assets) shows a strong positive correlation with credit growth. Conversely, Liquidity and Loan Loss Provisions show a significant negative relationship, suggesting that highly liquid banks or those with higher risk allocations expand credit more slowly. The Interaction Term (Shock × Foreign Parent) is positive but fails to reach statistical significance ($p = 0.12$), indicating that in the raw data, the internal capital market channel is present but noisy. Variables have been trimmed at 0.5 and 99.5 percentiles (see Appendix B for an alternative robustness check).

5.2. Accounting for persistence in lending

Tables 3 turn to dynamic specifications, which account for the persistence of lending behavior. The results confirm that credit growth is highly persistent. In Table 3 (Difference GMM), the coefficient on lagged lending is around 0.22, indicating that roughly one-fifth of current lending growth carries over from the previous period.

Once persistence is accounted for, the magnitude of the ownership interaction becomes larger, but continues to be statistically insignificant due to heterogeneity. In Table 3, the coefficient implies that a 10-basis point U.S. monetary policy shock is associated with an additional 0.75 percentage point increase in lending growth for foreign subsidiaries relative to domestic banks. Similar results are obtained using a System GMM approach (see Appendix B).

Table 3. TWFE Dynamic Model - DGMM

	Estimate	*Std.Error*	*z Statistic*	*P. Value*
Lag Credit Growth	0.22	0.03	8.48	0.00
Log of Total Assets	42.19	6.14	6.87	0.00
Return on Assets	-0.18	0.45	-0.41	0.68
Tier 1 Ratio	0.09	0.17	0.50	0.61
Liquidity Ratio	-0.82	0.09	-8.89	0.00
Loan Loss Prov.	-0.27	0.19	-1.44	0.15
Foreign Monetary Shock: Foreign Parent	74.52	55.88	1.33	0.18
Sargan Test	191.96	P. Value	0.12	

Note: Two-step Difference GMM (Arellano-Bond) using lagged levels as instruments for the differenced equations.

5.3. Crisis periods

Table 4 explores whether the transmission mechanism is amplified during periods of global financial stress. The interaction between U.S. monetary shocks and foreign ownership remains positive but statistically insignificant, with an implied magnitude of around 0.27 percentage points for a 10-basis point shock. The triple interaction term, capturing crisis periods, suggests a larger potential effect, approximately 0.79 percentage points for a 10-basis point shock, but is imprecisely estimated. While the point estimates are consistent with an amplification mechanism during crises, the lack of statistical significance makes it difficult to draw firm conclusions. One possible interpretation is that crisis effects are heterogeneous across banks and countries, leading to offsetting dynamics in the aggregate. This would be consistent with existing evidence showing that the role of multinational banks during crises depends on both parent and host country conditions (Cetorelli and Goldberg, 2011).

Table 4. TWFE with Crises

	Estimate	*Std.Error*	*z Statistic*	*P. Value*
Log of Total Assets	6.42	1.55	4.14	0.00
Return on Assets	0.69	0.37	1.87	0.06
Tier 1 Ratio	0.07	0.06	1.15	0.25
Liquidity Ratio	-0.26	0.05	-5.83	0.00
Loan Loss Prov.	-0.46	0.10	-4.61	0.00
Foreign Monetary Shock: Foreign Parent	26.73	43.20	0.62	0.54
Crisis::Foreign Monetary Shock::Foreign Parent	79.17	87.30	0.91	0.36
Adj. R2	0.22			

Note: TWFE OLS including an interaction for global financial crisis years (2008, 2009, 2020).

Taken together, the results suggest that the economic magnitude of the ownership channel may not be trivial but is highly heterogeneous around the world making the effect negligible in the aggregate analysis. This is in line with a broader literature showing that exposure to global financial conditions depends not on ownership, but on funding structures and balance sheet characteristics (Baskaya et al., 2017; Dinger and Kaat, 2020). In that sense, ownership may matter in specific context, but it is not a main determinant of how banks transmit external shocks.

Overall, the findings suggest that internal capital markets may play a role in amplifying the international transmission of monetary policy, but that this effect operates alongside other channels. A more complete understanding of global financial transmission therefore requires looking beyond ownership and considering the broader set of factors that shape banks' exposure to global conditions.

One possible explanation for the insignificant role of ownership in our results is that foreign subsidiaries are not solely dependent on funding from their parent institutions. In practice, once foreign banks establish operations in a host country, particularly in the case of large institutions, they tend to rely heavily on local funding sources, such as deposits collected in the host market. This reduces their dependence on internal capital markets and, in turn, their exposure to shocks originating in the parent bank's home country. As a result, even though foreign ownership creates the potential for cross-border transmission, its quantitative importance may be limited when subsidiaries are largely funded locally. This mechanism helps explain why differences between foreign and domestic banks are not always pronounced in the data.

Another interpretation of the lack of statistical significance is that the effect of ownership varies substantially across banks and environments. While some foreign subsidiaries may rely heavily on internal capital markets and respond strongly to parent-country shocks, others operate largely on a stand-alone basis and are primarily funded through local deposits. This cross-bank heterogeneity implies that positive and negative responses may offset each other in aggregate, making it difficult to identify a consistent average effect. In this sense, the absence of statistical significance should not be interpreted as evidence that ownership never matters, but rather that its relevance depends on specific institutional and financial characteristics that are not fully captured in a reduced-form framework.

6. Conclusions

This paper examines whether ownership matters for how banks transmit U.S. monetary policy shocks across countries. In particular, it asks whether foreign subsidiaries, linked to parent banks through internal capital markets, adjust their lending differently from purely domestic banks when global financial conditions shift. To address this question, we use a large bank-level dataset covering more than one hundred countries over two decades, combined with an exogenous measure of U.S. monetary policy shocks.

The results suggest that, while ownership may play a role within specific multinational banking groups, its aggregate impact is not clear-cut. In the baseline estimates, foreign subsidiaries tend to respond somewhat more strongly to U.S. monetary policy shocks; however, these differences are not statistically significant. This conclusion remains unchanged when accounting for persistence in lending. Although the estimated magnitudes are not negligible and point to a potential amplification of external shocks through foreign-owned banks, substantial heterogeneity prevents us from identifying a robust effect. Overall, the findings are consistent across model specifications in indicating that ownership does not exert a statistically significant influence on the transmission of U.S. monetary policy shocks.

This picture is perhaps not surprising. While multinational banks can reallocate funds across borders, they are also heterogeneous institutions, operating under different constraints and exposures. The findings suggest that ownership may capture part of this story in specific settings, but not all of it. Other factors, such as how banks are funded or how exposed they are to global markets, likely matter just as much. In that sense, the distinction between foreign and domestic banks may be less sharp than it first appears.

One possible explanation for this pattern is that foreign subsidiaries are not fully reliant on funding from their parent institutions. In many cases, especially for large banks, lending activity in host countries is largely financed through local deposits. This reduces dependence on internal capital markets and limits the transmission of shocks originating in the parent bank's home country. As a result, the effect of ownership, while present, may be more limited than suggested by models that emphasize cross-border funding alone.

From a policy perspective, the results point in two directions. On the one hand, foreign-owned banks can act as a channel through which external monetary conditions affect local credit, which may limit the ability of domestic policymakers to fully insulate their economies. On the other hand, focusing only on ownership would miss an important part of the picture. A broader view that considers banks' balance sheets and their links to international funding markets is likely to be more useful.

There are also some clear limitations. The analysis is based on bank-level balance sheet data and a reduced-form empirical framework, which means that the underlying mechanisms cannot be fully disentangled. In addition, the results point to considerable variation across banks and countries, which is only partially explored here. It would be useful to understand better how institutional settings, regulatory frameworks, or differences in financial development shape these effects. More granular data, for instance at the loan level, could also help shed light on how these adjustments take place in practice.

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Appendix

A. Robustness to outliers (alternative specification)

Table A1 examines the robustness of the results to extreme observations by using winsorized data instead of simply removing the largest and smallest values. The coefficients on the control variables remain stable, reinforcing the baseline findings. The magnitude of the liquidity and loan loss provision effects is very similar, suggesting that the relationship between risk, balance sheet composition, and lending is not driven by outliers.

The interaction term between U.S. monetary shocks and foreign ownership remains positive but becomes smaller. The implied magnitude suggests that a 10-basis point shock is associated with an additional lending response of about 0.34 percentage points for foreign subsidiaries, again economically meaningful but not precisely estimated. Overall, these results indicate that while the baseline magnitude is not driven by extreme observations, the ownership effect remains difficult to pin down in static models.

Table A1. TWFE Model (Winzored)

	Estimate	*Std.Error*	*t Statistic*	*P. Value*
Log of Total Assets	9.00	2.29	3.93	0.00
Return on Assets	0.27	0.34	0.78	0.43
Tier 1 Ratio	0.00	0.07	-0.02	0.98
Liquidity Ratio	-0.27	0.06	-4.84	0.00
Loan Loss Prov.	-0.70	0.14	-5.12	0.00
Foreign Monetary Shock: Foreign Parent	34.31	31.43	1.09	0.28
Adj. R2	0.18			

Note: TWFE OLS regression on data winsorized at the 1% and 99% levels.

B. Lending persistence (alternative specification)

In Table B1 we specify a different model for estimation of the system's dynamics: System GMM. These new results yield a somewhat smaller magnitude than the baseline dynamic results in the text, with an implied effect of approximately 0.50 percentage points for a 10-basis point shock. However, concerns about instrument validity limit the reliability of these estimates.

Table B1. TWFE Dynamic Model - SGMM

	Estimate	*Std.Error*	*z Statistic*	*P. Value*
Lag Credit Growth	0.29	0.03	10.54	0.00
Log of Total Assets	-1.14	0.28	-4.06	0.00
Return on Assets	1.74	0.43	4.08	0.00
Tier 1 Ratio	-0.08	0.04	-1.73	0.08
Liquidity Ratio	-0.27	0.03	-9.51	0.00
Loan Loss Prov.	-0.41	0.05	-8.38	0.00
Foreign Monetary Shock: Foreign Parent	50.06	43.43	1.15	0.25
Sargan Test	63.59	P. Value	0.00	

Note: System GMM (Blundell- Bond) using lagged levels as instruments for the differenced equations. To prevent instrument proliferation, the instrument matrix is collapsed, and the lag range for the GMM-style instruments is restricted to (t-2) to (t-4). The Sargan test reports the p-value for the null hypothesis of instrument validity (over-identifying restrictions). AR(1) and AR(2) are Arellano-Bond tests for first and second-order serial correlation in the first-differenced residuals, where the null hypothesis is no autocorrelation. Standard errors are robust and clustered at the bank level.

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:

$$CapitalRatio_{i,t+h} = \alpha_{i,h} + Debt_{c,t}\beta_{1,h} + Growth_{c,t}\beta_{2,h} + Inf_{c,t}\beta_{3,h} + ROE_{i,t}\gamma_{1,h} + Res_{i,t}\gamma_{2,h} + Size_{i,t}\gamma_{3,h} + NPL_{i,t}\gamma_{4,h} + \varepsilon_{i,t+h},\ h = 0,1,\dots,H-1. \quad (1)$$

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 difference 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 differences (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 different 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:

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

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

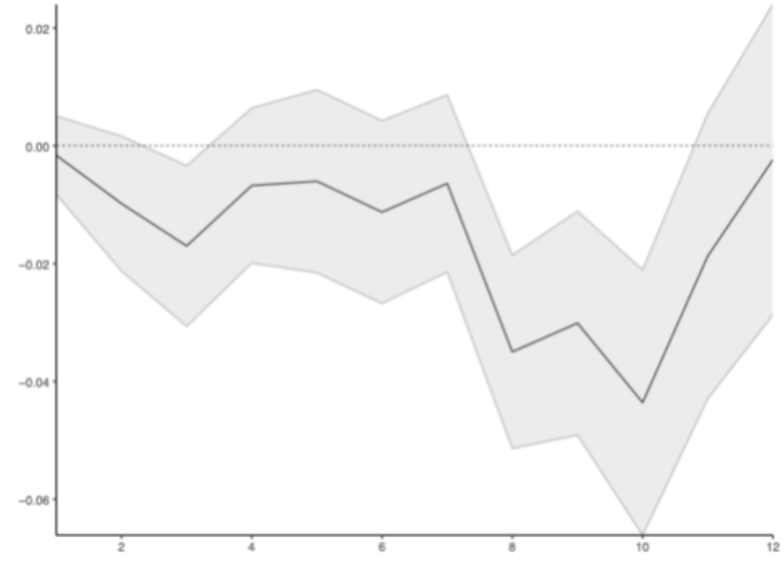
We begin by examining the average response of bank capital ratios to an increase in the public debt to GDP ratio, without yet accounting for differences in institutional quality. Figure 1 shows that the capital to assets ratio declines immediately after the shock, although the response becomes statistically 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.

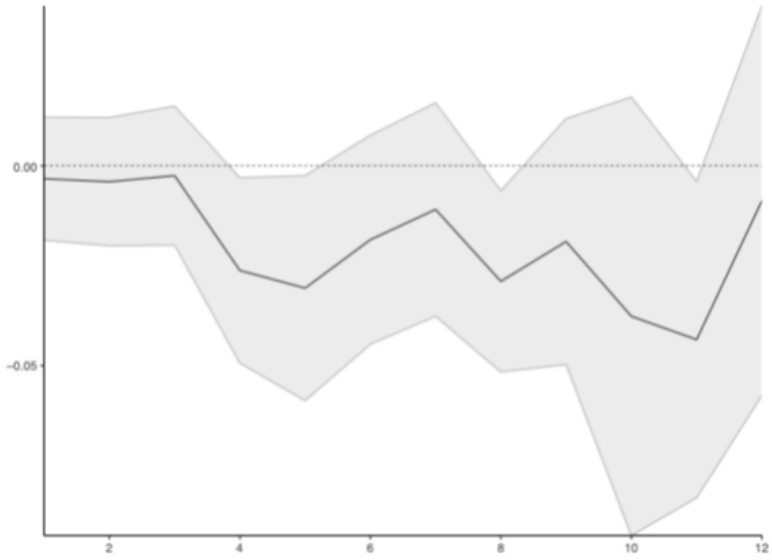
Summing-up, the linear results indicate that increases in public debt reduce bank capitalization in an economically meaningful and statistically significant way. The fact that significance appears both in the short run and again in the medium term suggests that fiscal shocks affect banks through more 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)



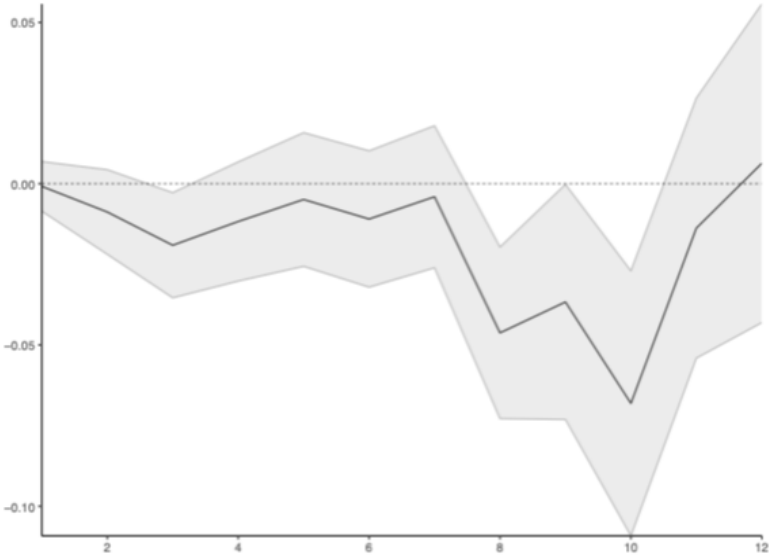
Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets). The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using a Newey-West correction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

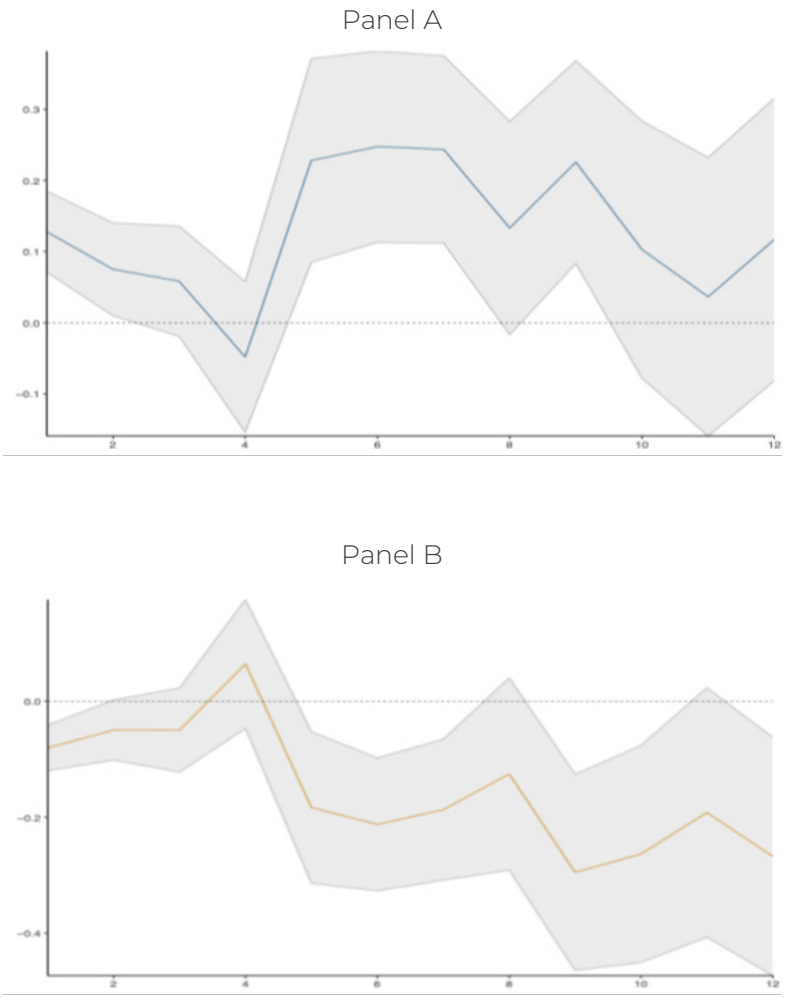
Taking together, these results confirm that regulatory quality plays a central role in shaping the sovereign-bank interaction. In weak regulatory environments public debt shocks tend to raise bank capital, although in advanced economies this rise is temporary and eventually gives way to a decline. In 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

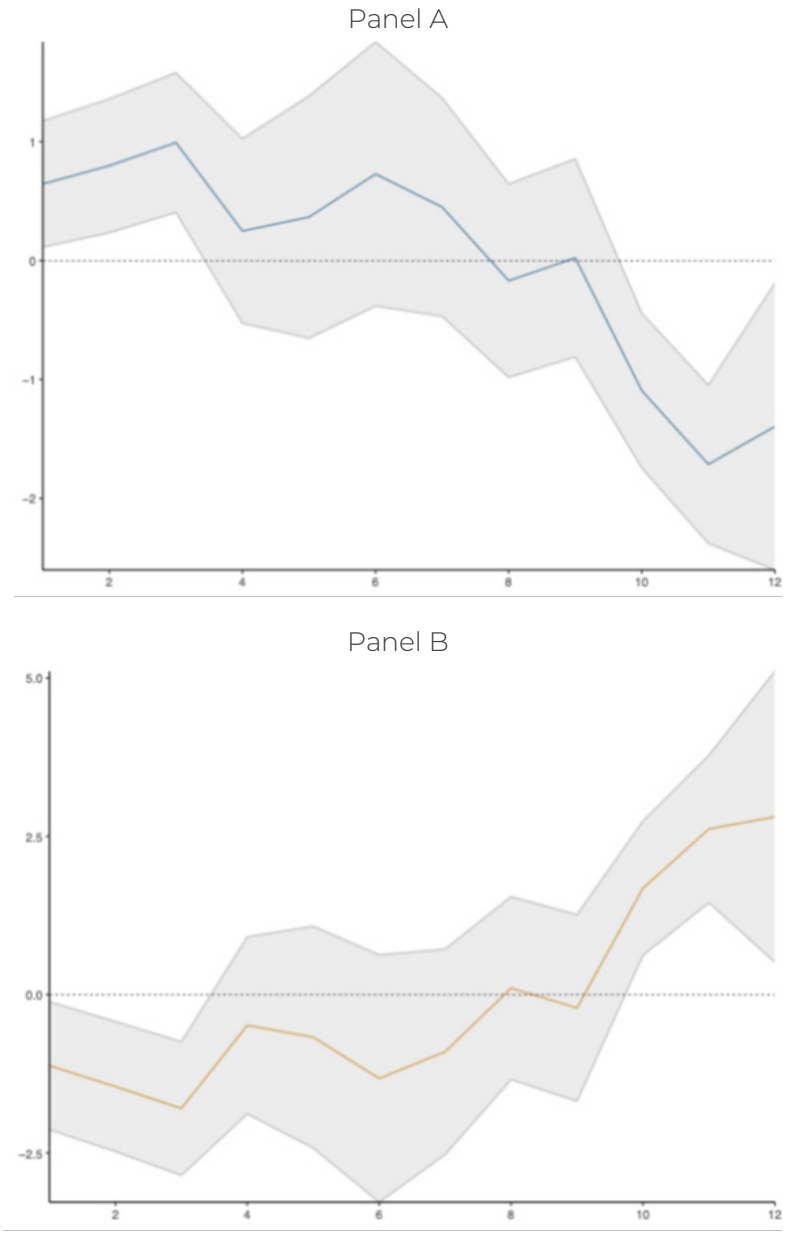
positive response in countries with weaker regulation is consistent with delayed balance-sheet recognition and with the fact that banks in these economies often hold a greater share of domestic sovereign debt. In advanced economies with stronger institutions, the initial decline in capital followed by 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



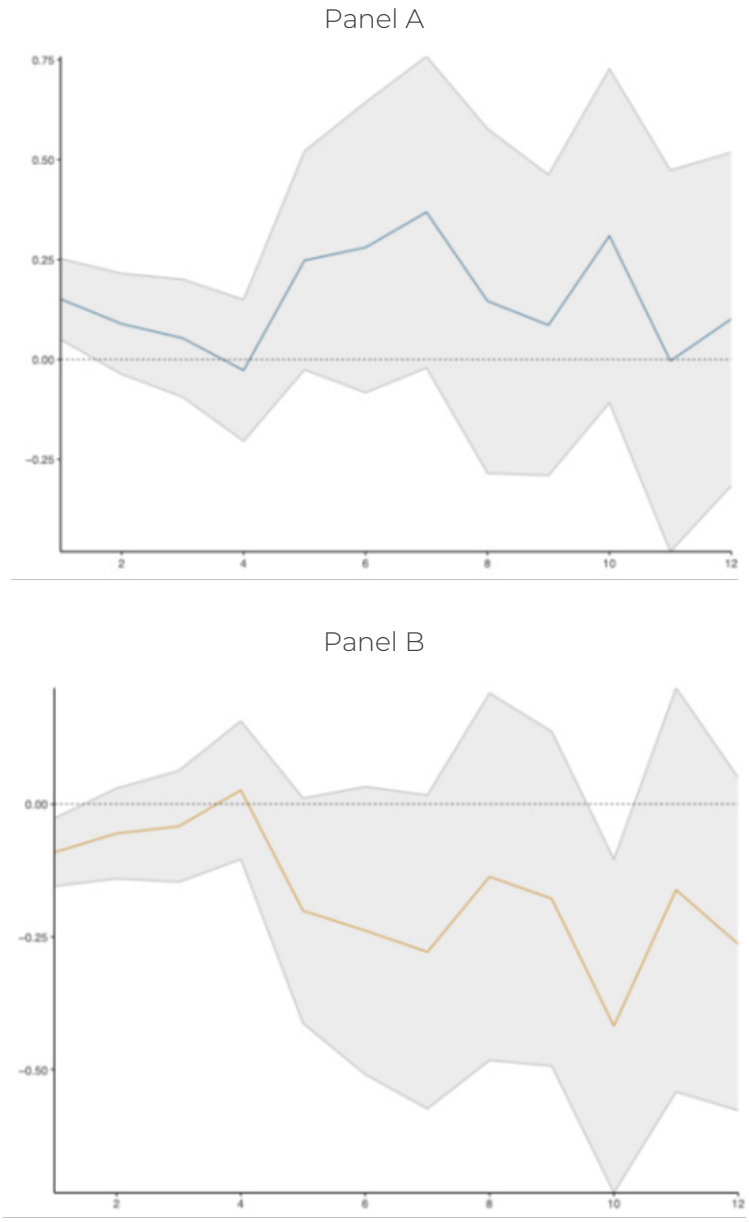
Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in our full sample of countries. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality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



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



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.

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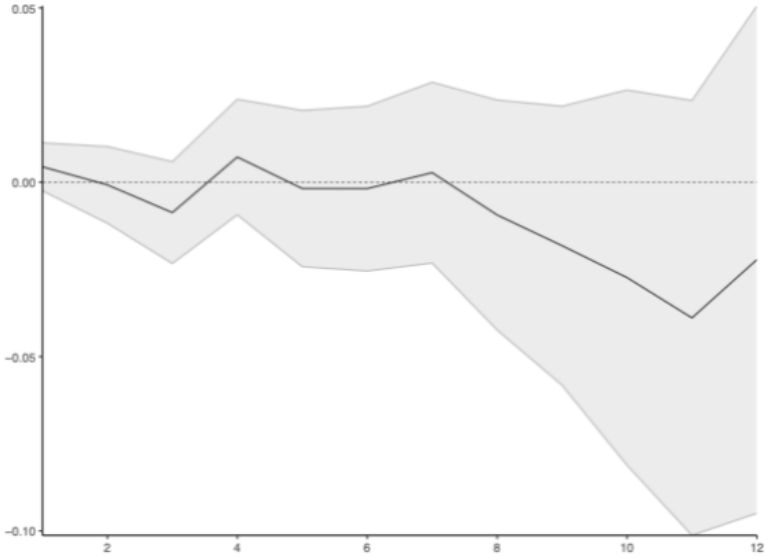
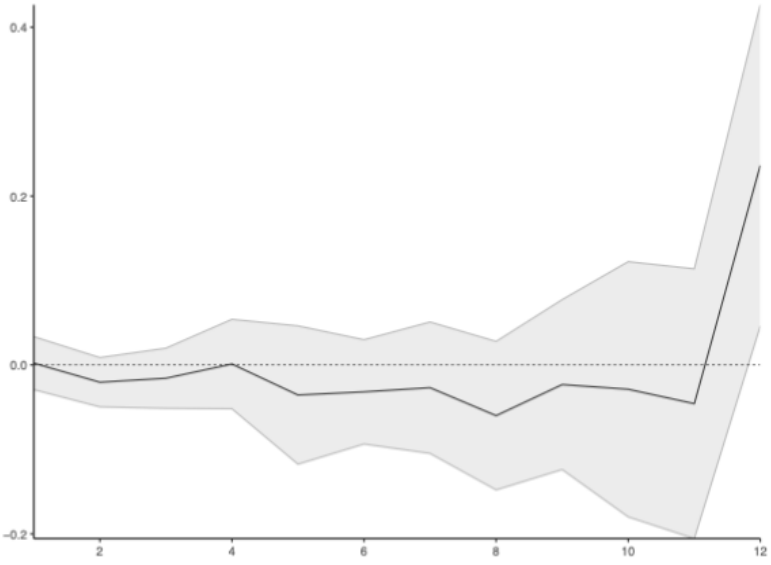
Appendix

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



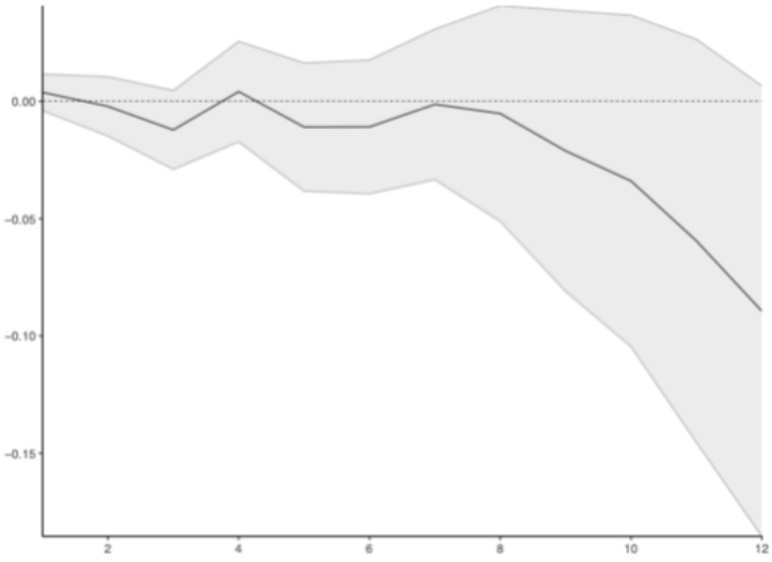
Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets). The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using System GMM.

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



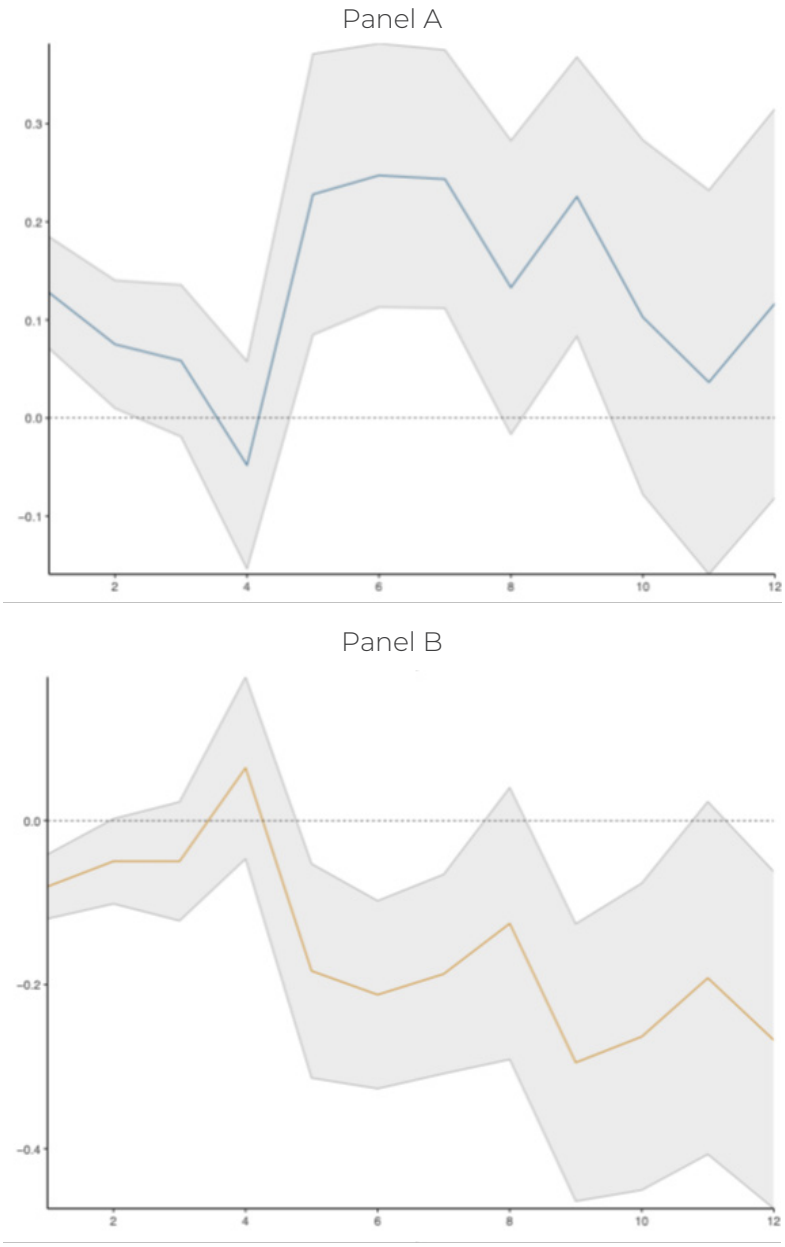
Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using System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

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



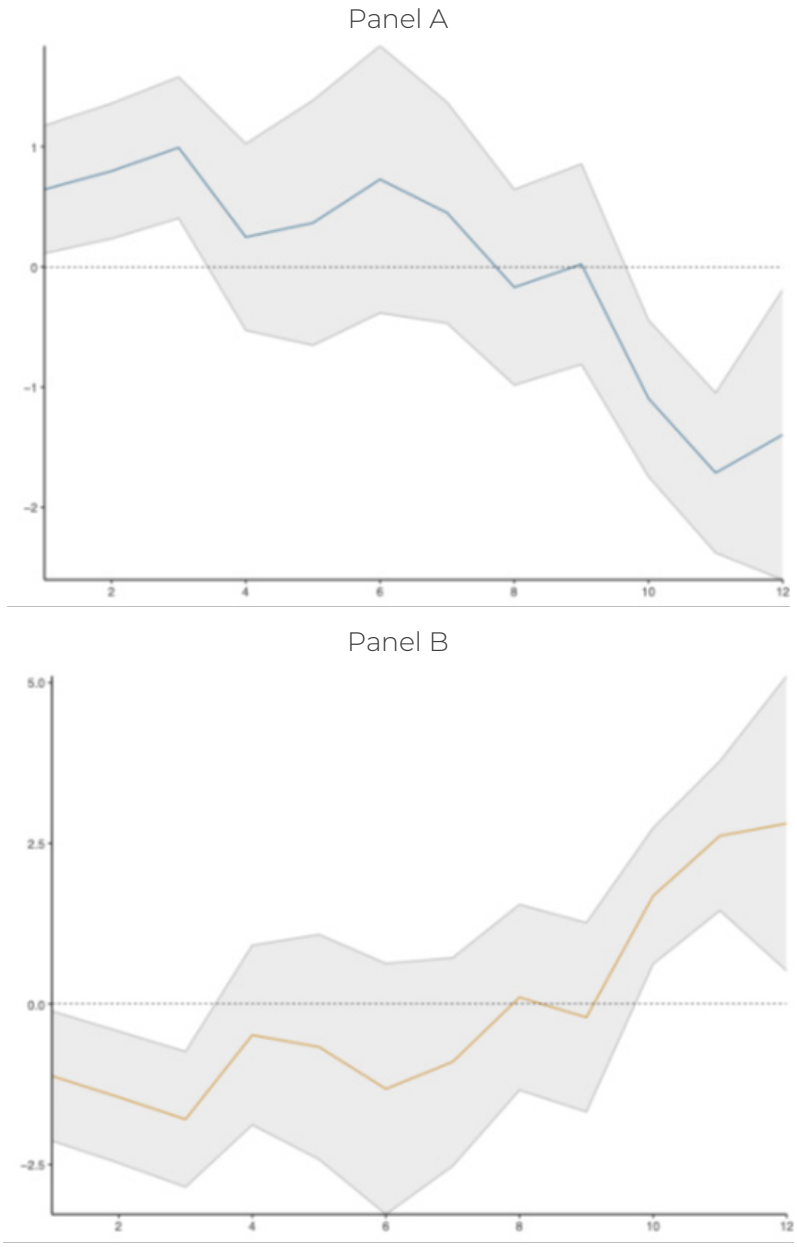
Note: This figure shows the effect of a shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in non-advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, and the estimation is performed using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



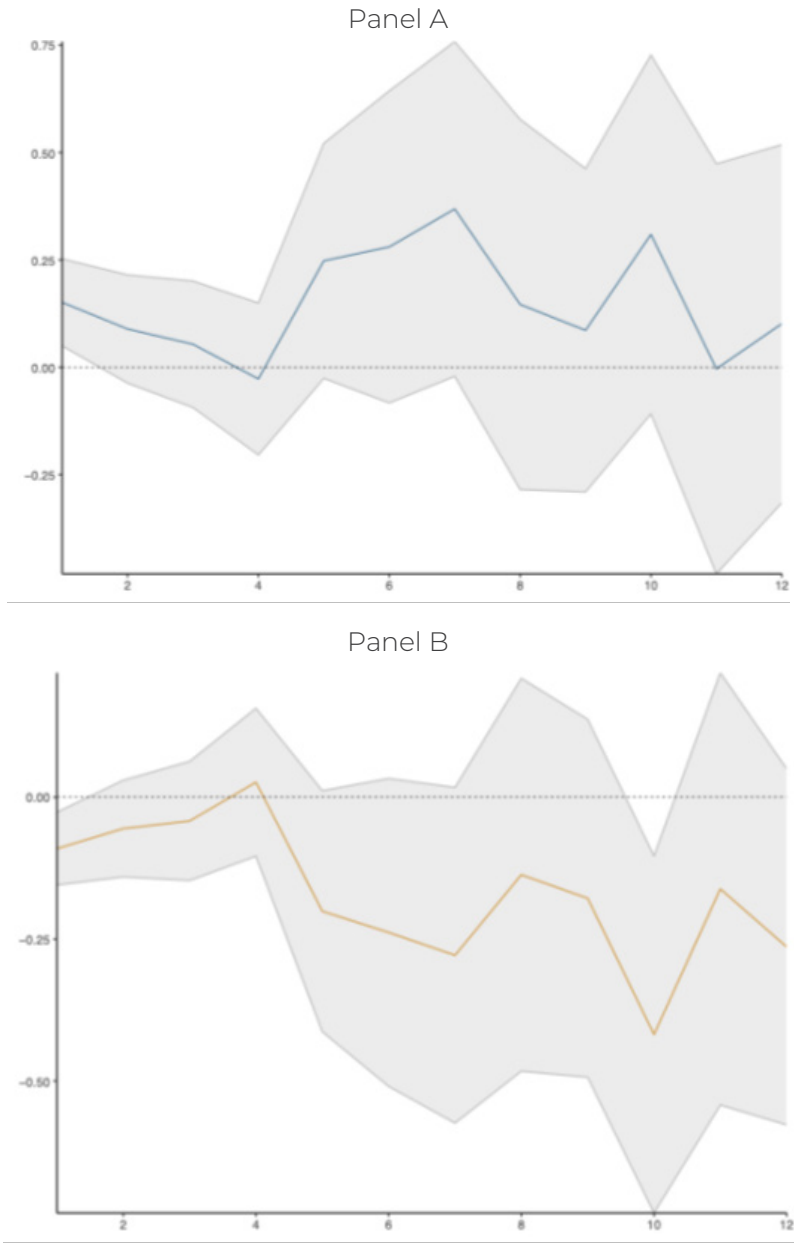
Note: This figure shows the effect of a state-dependent shock to the government debt-to-GDP ratio on banks' capital ratios (equity over total assets) in advanced economies. The dynamic responses are estimated using a panel local projections model with individual fixed effects, regulatory quality as the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



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



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.

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