Central Bank Balance Sheets and Financial Crises: New Historical Evidence from Advanced and Emerging Economies since 1900

Pablo Aguilar Pérez[a,*] Eric Monnet[b,†]

[a] *CEPII*

[b] *Paris School of economics, EHESS & CEPII*

Abstract

This paper introduces a new annual historical database covering 132 central banks from their foundation to the present, providing the first systematic evidence on central bank balance sheets in emerging markets, in addition to the better-documented experience of advanced economies. The dataset is constructed from original annual reports and distinguishes between key central bank operations, including market-based asset purchases, liquidity provision (standing facility and lender of last resort), targeted lending, international reserves and direct government financing. This enables a detailed analysis of how central banks respond to financial crises across different institutional settings.

Using this novel dataset, we show that central bank responses to banking crises do not differ significantly between emerging and high-income economies. However, emerging markets experience more persistent economic downturns, primarily due to limited fiscal space that prevents counter-cyclical fiscal stimulus. In contrast, advanced economies benefit from a combined monetary and fiscal response. In twin crises, however, emerging markets face additional exchange-rate and inflation constraints, further limiting the response of both central bank balance sheets and fiscal policy.

Overall, our findings shift the focus from differences in monetary-policy reactions and lender-of-last-resort interventions to differences in policy space and policy mix. They suggest that the stronger macroeconomic effects of banking crises in emerging markets are driven less by weaker central banks than by broader fiscal and external constraints that limit stabilization capacity.

Keywords: central banks; central bank balance sheets; emerging countries; monetary policy; financial crises

JEL classification: E58; E42; N20; G01

[*] **Email adress:** pablo.aguilar-perez@cepii.fr

[†] **Email adress:** eric.monnet@psemail.eu

1 Introduction

Banking crises are among the most disruptive macroeconomic events, often associated with large and persistent output losses. A substantial literature has documented that these effects can be long-lasting, and in many cases permanent, particularly when crises interact with broader financial and external vulnerabilities Reinhart and Rogoff (2009); Bordo and Meissner (2016); Baron et al. (2021); Frydman and Xu (2023). At the same time, an influential body of work emphasizes the critical role of macroeconomic stabilization policies—especially monetary and fiscal interventions—in mitigating the real effects of financial crises (Romer and Romer, 2019; Laeven and Valencia, 2020; Ferguson et al., 2023; Metrick and Schmelzing, 2025). While this evidence is well established for high-income economies, much less is known about how stabilization policies operate in emerging markets, where institutional and macro-financial constraints may limit policymakers' ability to respond effectively. This gap is especially large for our knowledge of central banks: their operations and reactions during crises are much more well-known in advanced economies than elsewhere. Central banks do indeed tame the effect of banking crises in many ways, either by lending broadly to all banks (classic lender of last resort operations), by providing financial support to a small number of financial firms, or by purchasing assets to decrease interest rates and stimulate the economy.

This paper asks a simple but important question: do central banks react differently to banking crises in emerging markets, and can such differences explain the stronger and more persistent macroeconomic effects observed in these economies? A priori, there are strong reasons to expect weaker monetary responses in emerging markets. Central banks may be constrained by exchange-rate regimes and twin crises (Kaminsky and Reinhart, 1999), limited monetary-policy transmission due to underdeveloped financial markets (Brandao-Marques et al., 2021), or balance-sheet vulnerabilities arising from foreign-currency debt (De Leo et al., 2024). These constraints could reduce the effectiveness of monetary policy precisely when it is most needed.

To address this question, we build a new annual historical database covering 132 central banks from their foundation to the present, which allows us to track the evolution of central bank balance sheets over time and their response to financial crises. While a recent literature has exploited long-run balance-sheet data for advanced economies (Ferguson et al., 2023; Bazot et al., 2024), this paper is, to our knowledge, the first to assemble comparable historical evidence for emerging-market central banks.

Our new long-run statistics first reveal that the history of central banks in emerging markets differs markedly from that of the typical sample of high-income economies studied in the literature, which has focused on Western Europe, Japan, and North America. In the latter group of countries, surges in central bank balance sheets are associated with the World Wars and the post-2008 financial crisis. This pattern, however, does not hold for the majority of countries in the world. In emerging markets, central bank assets relative to GDP reached their peak during the crises of the 1980s and 1990s. The share of foreign reserves in these central banks' portfolios is much higher on average in the recent decades (because of the sticky preference for managed floats in emerging markets) but this was not the case earlier. Prior to the quantitative easing programs implemented in high-income economies during the 2010s, central bank assets relative to GDP were higher in non-high-income economies. Importantly, until the late 1990s, this pattern was not primarily driven by the accumulation of international reserves. The experience of the past two decades in Western Europe, North America, and Japan has thus generated a distorted perception of the relative importance of central bank operations across countries and over time.

Second, using this novel dataset in a cross-country empirical framework, we show that the conventional view about the weakness of central banks in emerging markets is only partially correct. In standard banking crises, central bank responses in emerging markets do not differ significantly from those in high-income economies. Despite similar monetary reactions, however, emerging markets experience more persistent downturns. We show that this asymmetry is closely linked to fiscal policy constraints: emerging markets are significantly less able to implement countercyclical fiscal policy, and this weaker fiscal response is strongly associated with slower recoveries. By contrast, high-income economies appear to benefit from a policy mix combining monetary and fiscal expansion, consistent with the idea that both tools are jointly necessary to mitigate the effects of financial crises.

The picture changes markedly in the case of twin crises, where banking crises coincide with exchange-rate turmoil. In these episodes, emerging markets face much tighter external and nominal constraints as they cannot maintain a credible peg. Sharp currency depreciations generate inflationary pressures and amplify foreign-currency balance-sheet mismatches, which, in turn, limit the scope for expansionary monetary policy and constrain central-bank balance-sheet interventions. As a result, emerging markets are effectively deprived of both fiscal and monetary stabilization tools. High-income economies, by contrast, appear better able to rely on central-bank balance-sheet policies even when fiscal space is limited, suggesting that policy credibility and monetary

sovereignty play a key role in crisis management under external stress. In these countries, fiscal orthodoxy during twin crises seems to be necessary to maintain a credible peg (and avoid serial devaluations) but it does not compromise the use of the central bank balance sheet to stope the banking crisis and stimulate the economy.

Our new dataset does not only enormously improve the coverage of central bank balance sheets compared to the previous literature. It allows us to go beyond aggregate measures of monetary policy and examine how central banks intervene during crises through the composition of their balance sheets. Constructing this database required collecting annual reports—often from archives and historical libraries—for each central bank since its creation. While many European central banks date back to the 19th century or earlier, most central banks in emerging and developing economies were established only in the interwar period or after World War II, often shortly after independence during decolonization. A key challenge was to harmonize balance-sheet items across institutions with very different accounting conventions and financial structures.

We address this by carefully distinguishing between different types of central bank assets that correspond to distinct policy tools and institutional environments. In particular, we separate market-based asset purchases (such as securities held outright, akin to quantitative easing), liquidity provision through regular lending facilities such as discount windows (used for lending of last resort to all banks during crises), targeted or emergency lending to specific institutions, and direct lending to governments. This distinction is crucial, as it captures differences not only in the intensity of central bank intervention but also in the nature of monetary policy implementation, which varies systematically with the level of financial development. It allows us to compare more precisely how central banks in advanced and emerging economies respond to crises, and to identify the constraints that shape their policy choices. We can also look at the reaction of foreign exchange reserves, although the reaction of the latter is often more difficult to interpret because of valuation effects.

Taken together, our findings contribute to the literature by shifting the focus from differences in monetary-policy reactions per se (and lender of last resort policy) to differences in policy space and policy mix. They suggest that the stronger macroeconomic effects of banking crises in emerging markets are not primarily driven by weaker central banks, but by broader constraints—especially fiscal and external—that limit the overall effectiveness of stabilization policy.

The paper contributes to the literature in three ways. First, it provides a new historical database on central bank balance sheets for a broad set of countries since 1900. Second, it documents long-

run divergences between high- and non-high-income central banks, with marked differences in reserve accumulation, domestic asset composition, and support to the public and quasi-public sector. Third, it links those divergences to crisis dynamics, macroeconomic fundamentals, and exchange-rate constraints in a unified empirical framework. More broadly, the paper argues that the central bank balance sheet is not merely an accounting object, but a window into how states manage crises under very different domestic and external constraints.

The remainder of the paper is organized as follows. Section 2 describes the data sources and the construction of central bank balance sheet variables, and documents the main historical trends in both aggregate size and portfolio composition across income groups. Section 3 turns to the determinants of balance sheet composition using panel regressions, focusing in particular on the share of international versus domestic assets and the share of special loans within the domestic portfolio. Having established systematic differences across income groups, Section 4 uses panel local projections to analyze the dynamic responses of both macroeconomic outcomes and central bank balance sheet variables to financial crises–focusing on banking and twin crises–thereby highlighting the constraints faced by different groups of countries and the interaction between fiscal capacity and balance sheet policy. Section 5 concludes.

2 Data and Stylized Facts

2.1 Data sources and sample

This paper relies on the Historical Central Bank Balance Sheet Database compiled by Aguilar Pérez et al. (2026). The dataset provides annual balance sheet information for a large set of central banks over the long run, with coverage starting in the early nineteenth century. Throughout the paper, the unit of observation is the central bank–year (identified by an ISO country code and year). Unless otherwise stated, the analysis considers the period 1900–2024. To assess the representativeness of the sample and facilitate the interpretation of cross-country aggregates, we complement the balance sheet dataset with macroeconomic indicators from the Global Macro Database (Müller et al., 2025). These additional data allow us to construct ratios–such as balance sheet components relative to nominal GDP–and to compute long-run macroeconomic variables used in the analysis.

Appendix Tables A.1–A.2 and Tables A.3–A.4 provide the detailed classification scheme and definitions of the balance sheet variables used in the empirical analysis, including the hierarchi-

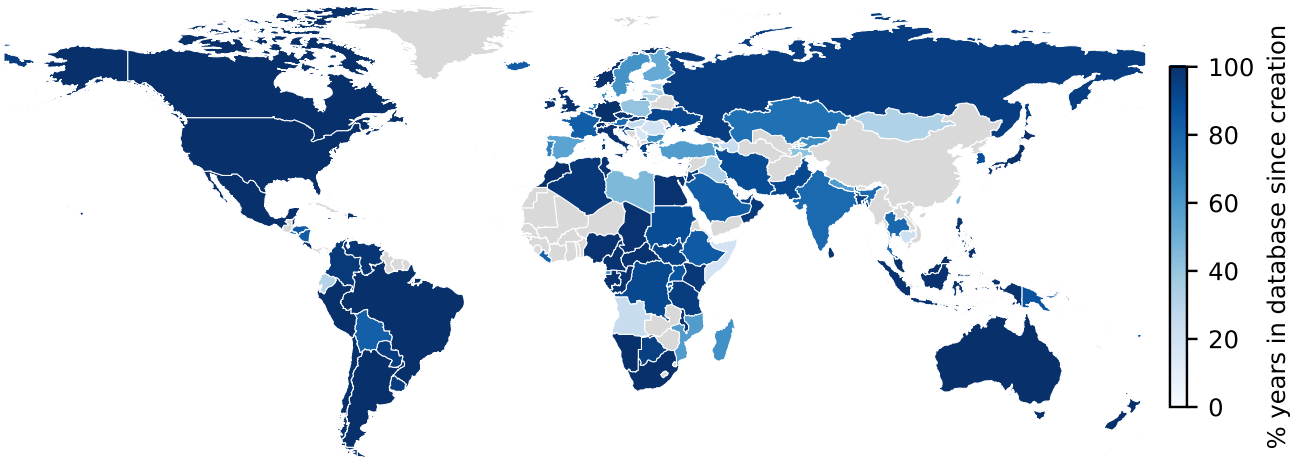
cal mapping between raw items and the portfolio aggregates. We also explain below the main categories of the asset side that will be used in this paper.

2.2 Coverage over time

Figure 1 illustrates the extensive historical scope of the database by comparing the share of year coverage in our database for central banks with at least one non-missing balance sheet observation for existing central banks since 1800. A remaining limitation of the database concerns the treatment of three monetary unions—the Eastern Caribbean Monetary Union (ECCU), the West African Economic and Monetary Union (UEMOA), and the Central African Economic and Monetary Community (CEMAC)–for which balance sheet information is typically reported only at the union level and not systematically disaggregated across member countries.[1]

[1]For the Central African monetary union (BEAC), however, we construct country-level series from the available aggregate balance sheet data. The reported values correspond to the balance sheet of the union as a whole–first under the Banque Centrale des États de l'Afrique Équatoriale et du Cameroun (from 1959) and subsequently under the Banque des États de l'Afrique Centrale (from 1973). To obtain country-level series, we allocate the aggregate BEAC balance sheet across member states using GDP weights. Specifically, we compute GDP-weighted shares for Cameroon, the Central African Republic, Chad, Gabon, and the Republic of the Congo, and from 1985 onward also Equatorial Guinea, and use these weights to construct country-level balance sheet series from the aggregate BEAC data. This approach partially alleviates the lack of country-level reporting for CEMAC, although the underlying balance sheet information remains derived from union-level accounts. By contrast, in the euro area national central banks continue to publish country-level balance sheets alongside the consolidated Eurosystem accounts.

Figure 1: World central bank coverage



Note: The maps shows the total share of available years of data per country to the creation year of the Central Bank, up until 2024. *Source*: Historical Central Bank Balance Sheet Database (Aguilar Pérez et al., 2026).

2.3 Sample of countries

Table 1 summarizes the cross-country distribution of key central bank balance sheet components expressed as shares of nominal GDP over the 1900–2024 sample. The reported moments are computed across countries after first averaging variables over time at the country level. The table provides measures of central tendency and dispersion (number of non missing observations, mean, standard deviation, percentiles, and extreme values), thereby characterizing cross-country heterogeneity in the size and composition of central bank balance sheets. Detailed variable definitions and the underlying classification of assets, liabilities, and equity items are provided in the Appendix tables referenced above.

Further descriptive statistics split by income group classifications based on the World Bank are reported in Appendix Table A.7. The purpose of this split is to facilitate comparison with the high-income country sample used in Ferguson et al. (2023) (building on the historical macro-financial database of Jordà et al. (2017) (JST), which covers 17 advanced economies). Their sample corresponds to the following countries: United States, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. To ensure comparability while relying on a transparent and externally

defined criterion, we extend this definition using the World Bank income classification (available from 1986 onward). Specifically, we classify as high income those countries that remain in the World Bank high-income category for more than 15 years in the 1986-2025 classification. This classification results in a sample of 49 high-income countries and 85 non-high-income countries. Appendix A.5 and A.6 list the countries in each group, along with the first year they enter the sample.

Table 1: Central bank balance sheet descriptive statistics

	N	Mean	Std	Min	P25	P50	P75	Max
Metal holdings (Gold, silver and coins)	7744	1.41	3.21	0.00	0.07	0.41	1.41	28.29
Foreign exchange holdings (Deposits and securities)	7769	11.48	11.77	0.00	4.37	8.74	14.00	66.94
Participation in international organizations	7675	2.84	15.22	0.00	0.29	0.94	2.11	175.04
Discounts and advances	7811	1.69	2.12	0.00	0.32	1.09	2.32	13.74
Open market operations securities (Repo and Bills)	7422	2.11	3.92	0.00	0.12	0.86	2.29	34.85
Other government securities	6710	0.66	3.00	0.00	0.00	0.00	0.33	27.36
Direct loans to the public sector	7531	3.63	4.36	0.00	0.80	2.53	4.91	29.50
Special loans and targeted purchases	7673	0.76	1.18	0.00	0.05	0.36	1.02	8.83
Other assets	7607	1.11	1.94	-0.04	0.28	0.50	1.04	13.99
Total Assets	7811	28.25	24.48	3.31	16.36	22.93	31.42	231.50
Notes and coins in circulation	7811	7.35	5.65	0.00	4.45	5.94	9.20	47.37
Deposits of financial institutions	7791	6.45	10.31	0.00	2.19	4.14	6.69	98.90
Deposits of public sector	7761	3.34	4.53	0.00	1.13	2.09	3.42	26.54
Deposits of international organizations	7778	3.83	11.31	0.00	0.52	1.53	4.05	122.76
Open-market-operations liabilities	6682	1.54	2.67	0.00	0.03	0.29	1.82	16.64
Total liabilities	7811	25.83	23.57	2.61	13.77	20.66	31.10	229.05
Equity: Capital and reserves	7329	2.21	3.17	-6.69	0.85	1.42	2.63	26.59

Notes: The table reports descriptive statistics for central bank balance sheet items over the 1900–2024 sample having at least 2 countries per year of non-missing observations. All variables are expressed as shares of nominal GDP. N denotes the number of non-missing country-year observations for each variable. Means, standard deviations, and percentiles are computed across countries after first taking time averages at the country level.

2.4 Main operations of central banks

The main difficulty in constructing our dataset has been to interpret all balance sheet items and carefully standardize them across countries in order to obtain a sufficiently detailed and comparable dataset. We aimed to preserve as much detail as possible so as to reflect the diversity

and complexity of central bank operations, and thus go beyond simplified asset classifications that merely distinguish between international reserves and domestic assets, or between claims on the private sector and claims on the government.

In particular, we sought to distinguish between loans and asset purchases, between standing facility operations and open market operations, and between claims on government arising from secondary market purchases and those corresponding to direct lending. These distinctions are crucial for understanding how central banks implement monetary policy, finance (directly or indirectly) the government, and provide liquidity support during crises (Bindseil, 2014).

The full list of standardized categories is presented in the Appendix (Tables A.1 to A.4). For the purposes of this paper, we focus on the main domestic operations appearing on the asset side of central bank balance sheets. Our classification of foreign assets is relatively standard and follows that of the IMF. Foreign assets are marked to market, generating substantial valuation effects (due to changes in the prices of securities and exchange rate movements), whereas domestic assets are always recorded at book value.

We distinguish domestic assets into four main categories that reflect different types of central bank operations, each associated with specific policy objectives:

- **Loans.** This category includes all regular loans granted to financial institutions for liquidity management. The main instruments are discount loans (which dominated central bank balance sheets until the 1950s–1960s) and collateralized advances. These are typically short-term loans available under similar conditions to all financial institutions. They are commonly used when the money market is small or not well functioning. The central bank sets an interest rate at which banks can borrow. While most discount loans involve commercial paper, we also include the discounting of Treasury bills in this category, provided they correspond to loans to financial institutions (similar to collateralized advances backed by government securities) initiated at the request of these institutions, rather than direct lending to the government.

- **Special Loans.** These are loans (collateralized or not) granted to specific institutions. Historically, they encompass a wide variety of cases, but their distinguishing feature is that they are targeted at particular entities rather than offered uniformly to all institutions. Within this category, we identify important subcategories such as loans to the government (central or regional), asset purchases involving specific corporations (e.g., equity stakes in state-owned

financial or non-financial firms), and loans to corporations. Beyond government financing, these operations have typically served developmental or industrial policy objectives (e.g., promoting specific sectors or firms) or crisis management purposes (e.g., supporting distressed financial institutions). The boundary between these objectives is sometimes blurred, as crisis-related support may overlap with industrial policy goals.

- **Open Market Operations.** These consist of purchases of securities conducted primarily for monetary policy purposes, rather than for government financing or industrial policy. Unlike standing facilities, open market operations are initiated at the discretion of the central bank rather than in response to banks' requests for liquidity. Their implementation requires well-functioning and liquid money markets, as well as a sufficient supply of safe assets, which explains why they are a relatively recent feature in many central banking frameworks. In practice, distinguishing between open market operations conducted for monetary policy purposes and asset purchases intended to finance the government is not always straightforward, since both often involve government securities. In instances where we could not distinguish between the two, we created a category "other government securities" that reflects this ambiguity.

2.5 Stylized facts on central bank balance sheets

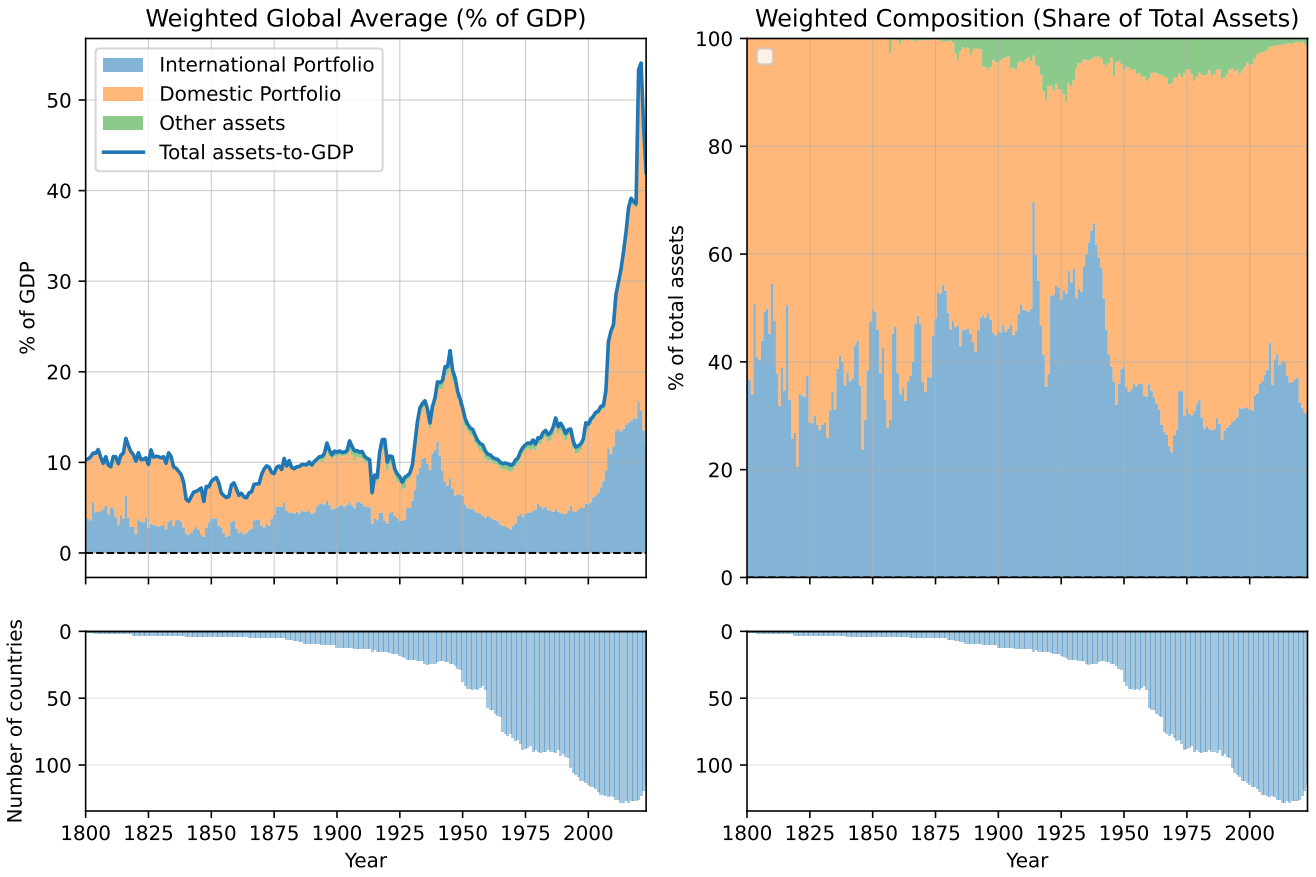
This subsection documents a set of stylized facts on the size, composition, and evolution of central bank balance sheets using the long-run cross-country data described above. Together, the figures highlight both common historical patterns and substantial heterogeneity in the way central banks conduct monetary policy and interact with the public sector.

The long-run expansion and changing composition of central bank assets. Figure 2 reports GDP-weighted averages of central bank assets-to-GDP ratios since the creation of central banks, decomposed by major asset categories. The left panel shows that central bank balance sheets have expanded markedly over the long run, with especially pronounced increases during the twentieth century and the post-war period. While early balance sheets were dominated by metallic reserves and foreign exchange holdings, domestic assets gradually became more important as monetary policy frameworks evolved and domestic financial markets developed.

The right panel of Figure 2 further decomposes this evolution by contrasting the international

and domestic components of central bank portfolios. A clear shift toward domestic assets emerges over time, reflecting the transition from specie-based and externally anchored monetary regimes toward modern systems centered on domestic liquidity provision, credit operations, and market-based monetary policy implementation. Nevertheless, the international portfolio—particularly foreign exchange reserves—remains quantitatively important, especially for emerging and developing economies.

Figure 2: Central bank balance sheet levels and composition, 1800–2024



Notes: The left panel displays average central bank assets as a share of GDP by asset category, weighted by each country's share of global GDP. The right panel presents the stacked composition of domestic and international portfolio holdings over time. *Source:* Historical Central Bank Balance Sheet Database (Aguilar Pérez et al., 2026).

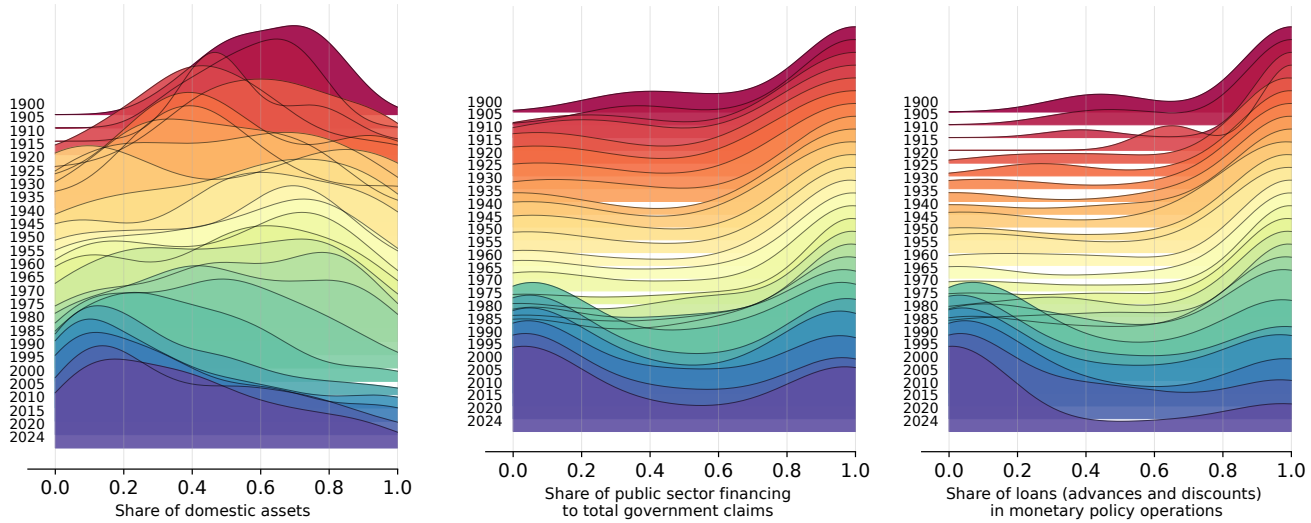
Cross-country heterogeneity in asset composition and public-sector exposure. Figure 3 explores cross-country distributions of key portfolio shares using ridgeline density plots. Panel (a) shows the distribution of the domestic portfolio share in total marketable securities. While the

median central bank increasingly relies on domestic assets over time, the distributions remain wide, underscoring persistent heterogeneity across countries. Some central banks continue to hold predominantly international portfolios, whereas others operate almost exclusively with domestic securities.

Panel (b) focuses on public-sector financing, defined as the share of direct government loans and special domestic operations in total government-related claims. The distributions reveal that direct central bank involvement in government financing has been widespread historically, particularly in earlier periods, but has become more heterogeneous in the post-war era. In some countries, public-sector financing remains a central feature of the balance sheet, while in others it has been largely replaced by market-based operations or constrained by institutional reforms.

Panel (c) contrasts traditional central bank lending (advances and discounts) with open market operations. The gradual shift away from loan-based monetary policy toward market-based instruments is visible in the downward movement of the distribution over time. Nonetheless, traditional lending facilities continue to play a non-negligible role in many countries, especially during episodes of financial stress or in less developed financial systems.

Figure 3: Distributions of central bank portfolio composition and public-sector financing (1900–2024)



(a) Domestic portfolio share of assets

(b) Public-sector financing share in total government-related claims

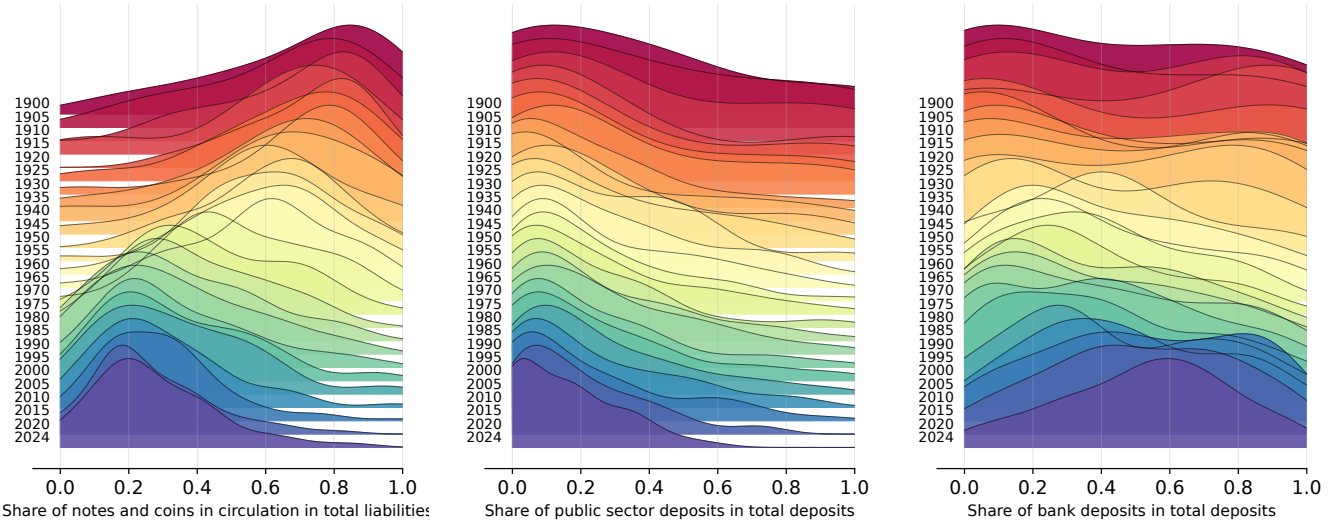
(c) Traditional loans vs OmO

Note: Panel (a) shows the cross-country distribution of the domestic portfolio share, defined as Domestic Assets /(Domestic Assets + International Assets), plotted every five years. Panel (b) shows the cross-country distribution of the public-sector financing share, defined as (Direct loans to the public sector + Special domestic operations) / (Direct loans to the public sector + Special domestic operations + Open market operations (repo and bills) + Other government securities). Panel (c) shows the cross-country distribution of the traditional Central Bank Loans (Advances + Discounts) over all monetary policy operations (Loans + Open market operations (repo and bills) plotted every five years. *Source*: Historical Central Bank Balance Sheet Database.

Liability-side transformations. Figure 4 documents the evolution of central bank liabilities. Panel (a) shows a long-run decline in the share of notes and coins in circulation relative to total liabilities, reflecting the rise of deposit-based monetary systems and the growing importance of non-currency liabilities. Despite this secular trend, currency remains quantitatively significant in many countries, particularly in earlier decades and in cash-intensive economies.

Panels (b) and (c) focus on the composition of deposits held at the central bank. Public sector deposits exhibit substantial cross-country and time variation, often reflecting fiscal arrangements, treasury cash management practices, and institutional design. Deposits of financial institutions, by contrast, become increasingly dominant over time, consistent with the growing role of reserve requirements, settlement balances, and liquidity management frameworks in modern monetary policy.

Figure 4: Distributions of central bank liability composition (1900–2024)



(a) Notes and coins in circulation as a share of total liabilities

(b) Public sector deposits as a share of total deposits

(c) Financial institutions deposits as a share of total deposits

Note: This figure shows the cross-country distributions of central bank liability components, plotted every five years. Panel (a) reports the share of notes and coins in circulation relative to total central bank liabilities. Panel (b) reports the share of public sector deposits in total deposits held at the central bank. Panel (c) reports the share of deposits of financial institutions in total deposits. All distributions are computed across countries for each year. *Source*: Historical Central Bank Balance Sheet Database.

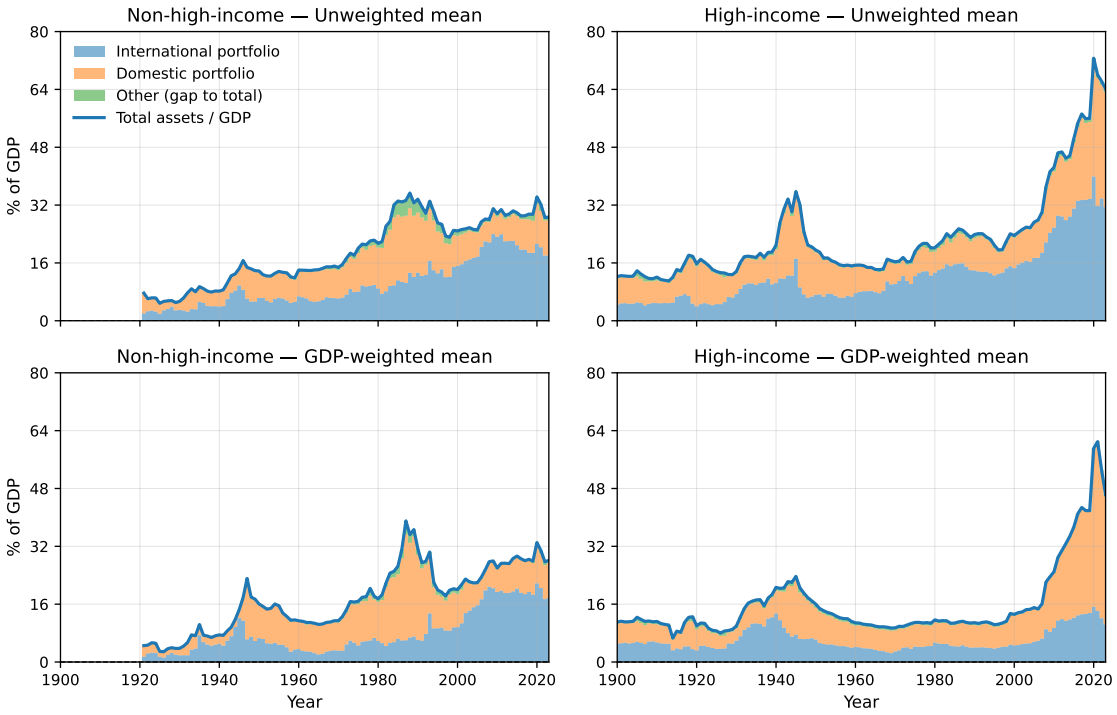
Differences between high-income and non-high income economies Figure 5 highlights substantial cross-group differences in both the level and the composition of central bank balance sheets. Across all panels, high-income economies exhibit persistently higher central bank assets-to-GDP ratios than non-high-income economies, with the gap widening markedly from the late twentieth century onward and becoming especially pronounced after the Global Financial Crisis. This divergence is consistent with the stronger reliance of advanced-economy central banks on large-scale balance sheet policies in the post-2008 period.

The decomposition by asset categories further reveals that these differences are not only quantitative but also compositional. In high-income countries, the long-run expansion is driven predominantly by domestic assets, reflecting the growing role of domestic securities holdings and liquidity provision operations as monetary policy frameworks shifted toward interest-rate targeting and, later, unconventional policies. By contrast, non-high-income countries display a comparatively larger role for international portfolios over much of the sample, consistent with the importance of foreign assets and reserve accumulation in monetary and external-stability strategies. While

domestic assets increase in non-high-income economies as well, their rise is more gradual and the overall balance-sheet expansion remains smaller.

A key additional insight relative to global averages comes from comparing unweighted and GDP-weighted means within each income group. The unweighted series capture the "typical" country experience and display smoother, more gradual changes. In contrast, GDP-weighted averages place greater emphasis on large economies, revealing sharper swings and a more pronounced post-2008 expansion, particularly among high-income countries, indicating that the global balance-sheet surge is disproportionately driven by a subset of systemically large central banks. For non high-income economies, the decomposition also reveals a distinct historical pattern: balance-sheet size peaks in the 1980s, after which average assets-to-GDP ratios flatten or decline before rising again more moderately in recent decades. Overall, the figure shows that the long-run shift from international toward domestic assets documented in the global aggregates masks important heterogeneity across income groups.

Figure 5: Large differences in size and composition by income levels, 1900–2024



Notes: The figure reports weighted and unweighted average central bank assets-to-GDP ratios for high-income and non-high-income countries. Income groups are defined using the World Bank classification: countries are classified as high income if they remain in the World Bank high-income category throughout the available classification period. Weighted averages use GDP weights (in U.S. dollars), while unweighted averages assign equal weight to each country. *Sources:* Historical Central Bank Balance Sheet Database; Global Macro Database.

3 Macroeconomic determinants of the composition of central bank balance sheets

Having documented the long-run shift in the composition of central bank balance sheets and the sharp difference between the history of central banks in advanced (high-income) economies and in other countries, we next examine the macroeconomic and institutional correlates of this evolution. The objective at this stage is descriptive and structural rather than causal: we seek to identify the main drivers associated with cross-country and over-time variation in portfolio composition.

To assess the analysis, we estimate panel fixed-effects models of the form :

$$y_{i,t} = \alpha_i + \gamma_t + \beta' X_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $y_{i,t}$ denotes a balance sheet share in country i at time t, α_i are country fixed effects and γ_t are year fixed effects. The vector $X_{i,t}$ includes a rich set of macroeconomic fundamentals and institutional variables commonly associated with reserve accumulation, exchange rate management, fiscal-monetary interactions, and central bank design.

Macroeconomic controls comprise log real GDP per capita, exports-to-GDP, current account-to-GDP, government debt-to-GDP, and log CPI, all drawn from the Global Macro Database (Müller et al., 2025) and the log real effective exchange rate (REER) computed from the TRADHIST database (Fouquin and Hugot, 2016). These variables proxy for income level and development, trade exposure, external imbalances, and domestic price stability. Exchange rate regime classifications (Fine classification) and anchor currency indicators–capturing whether a country pegs to the USD, GBP, or FRF–are taken from Ilzetzki et al. (2022) and reflect the external monetary anchor and exchange rate policy framework. Financial openness is measured using the extended Chinn-Ito index following Chinn and Ito (2008), with pre-1970 extensions based on Quinn and Toyoda (2008), capturing the degree of capital account liberalization. Finally, institutional features of central bank governance are proxied by the CBIE index from Romelli (2022), which measures institutional and political aspects of central bank independence. Standard errors are double-clustered at the country and year levels.

While the full-sample regression provides a benchmark relationship between fundamentals and portfolio shares, the stylized facts suggest that structural differences between high- and non-high-income economies may be substantial. To allow for fully heterogeneous slopes, we therefore estimate the model separately within each income group:

$$y_{i,t}^{(g)} = \alpha_i^{(g)} + \gamma_t^{(g)} + \beta^{(g)\prime} X_{i,t}^{(g)} + \varepsilon_{i,t}^{(g)}, \qquad g \in \text{High income}, \text{Non-high income}. \tag{2}$$

Estimating the specification by subsample allows the entire coefficient vector to differ across development levels, rather than imposing common slopes. This approach provides a transparent comparison of the structural drivers of balance sheet composition between advanced and developing economies and helps assess whether the mechanisms highlighted in the aggregate analysis operate differently across income groups.

The first dependent variable is the share of international assets in total central bank assets. Table 2 reports the corresponding estimates.

In the full sample, several robust relationships emerge. The coefficient on the current account-

to-GDP ratio is positive and significant, indicating that improvements in the current account are associated with a higher reserve share. One possible interpretation is that such improvements partly reflect earlier exchange rate depreciations, which tend to coincide with reserve accumulation. Government debt-to-GDP displays a negative and statistically significant coefficient, suggesting that higher public indebtedness is linked to a reallocation toward domestic assets. This may reflect stronger fiscal–monetary interactions or an increased demand for domestic sovereign securities. Inflation (measured as log CPI) is positively and significantly associated with the international share, consistent with the view that macroeconomic instability raises precautionary demand for foreign assets. Finally, exchange rate regime rigidity is negatively and significantly related to the international share, implying that less flexible regimes are associated with larger reserve holdings.

These average relationships, however, mask substantial heterogeneity across income groups. Once the sample is split, differences emerge with respect to exchange rates and inflation. Inflation is positively and significantly associated with international asset shares only in high-income countries. This likely reflects the greater prevalence of flexible exchange rate regimes in these economies: higher inflation is more readily associated with currency depreciation, which mechanically increases the value–and thus the share–of foreign-currency assets through valuation effects. By contrast, the real effective exchange rate (REER) is a significant determinant only in the lower-income subsample. In these economies, exchange rate movements tend to be more tightly managed, and depreciations are often associated with active foreign exchange interventions.

Balance sheet composition reflects both exchange rate considerations and public sector constraints across all country groups, with government debt-to-GDP emerging as a consistently significant determinant. Higher levels of public indebtedness are associated with a greater absorption of domestic assets by central banks, indicating a shift in portfolio composition toward domestic securities as fiscal pressures intensify. This pattern is evident in both high- and non–high-income economies, although its implications are particularly pronounced where fiscal space is more limited. A descriptive example is Japan, where the share of domestic assets on the central bank balance sheet increased from 85.5% in 1990 to 93.4% in 2023. Over the same period, central bank domestic assets rose sharply–from around 13% to 48% of total outstanding public debt–alongside a sustained increase in the public debt-to-GDP ratio, which exceeded 250% in 2023. This evolution illustrates how rising sovereign indebtedness can lead central banks to play an increasingly prominent role in absorbing domestic government securities. Exchange rate arrangements also play a central and highly robust role. Less flexible regimes are associated with larger reserve holdings, consistent with

the need to sustain exchange rate commitments through reserve accumulation.

These findings point to substantial cross-country heterogeneity in the drivers of international reserve holdings, while also revealing a set of common underlying factors. In high-income economies, reserve allocation is more closely associated with inflation dynamics and external balances, consistent with the role of exchange rate flexibility and valuation effects in shaping central bank balance sheets. By contrast, in non–high-income economies, exchange rate movements–captured by the REER–play a more direct role, reflecting more active foreign exchange management and intervention-driven reserve accumulation. Across both groups, however, public debt and exchange rate arrangements emerge as the most important and consistently significant determinants of portfolio composition.

Table 2: International portfolio share: $\frac{\text{International portfolio}}{\text{Domestic + International portfolio}}$

	Full sample		Low income		High income	
	(1)	(2)	(3)	(4)	(5)	(6)
log GDP per capita	12.0***	3.32	16.1***	0.977	-0.910	1.25
	(4.30)	(6.43)	(4.87)	(4.72)	(10.1)	(17.9)
Gov Spending / GDP	0.020	0.004	0.024	-0.022	0.209	0.213
	(0.030)	(0.043)	(0.035)	(0.033)	(0.220)	(0.323)
Current account / GDP	0.150**	0.104*	0.121	0.103*	0.258	0.239
	(0.061)	(0.057)	(0.108)	(0.058)	(0.157)	(0.174)
log REER	-1.86	-2.51	-2.54	-3.17**	-2.69	-1.21
	(1.61)	(1.54)	(1.62)	(1.45)	(3.80)	(4.77)
Gov. debt / GDP	-0.170***	-0.188***	-0.111**	-0.116**	-0.179***	-0.176**
	(0.033)	(0.033)	(0.048)	(0.046)	(0.055)	(0.066)
log CPI	2.01***	1.02*	1.18*	-0.148	5.75*	6.19*
	(0.702)	(0.600)	(0.590)	(0.379)	(3.11)	(3.57)
ER arrangement	-2.03***	-2.17***	-1.53***	-1.71***	-1.92***	-2.07***
	(0.329)	(0.328)	(0.302)	(0.311)	(0.347)	(0.393)
KA openness (extended)	1.28	0.476	2.27*	0.234	3.42*	3.33
	(1.18)	(1.20)	(1.34)	(1.54)	(1.93)	(2.25)
CBIE index	13.0	-10.7	57.8***	10.4	-14.4	-15.8
	(11.1)	(11.2)	(17.7)	(16.1)	(13.9)	(17.6)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Observations	4,078	4,078	2,164	2,164	1,914	1,914
R^2	0.63	0.67	0.63	0.72	0.68	0.69

Notes: Country and year fixed effects included as indicated. Standard errors are double-clustered at the country and year levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample: 1950–2024. The dependent variable is the share of international assets in total (domestic + international) central bank assets, constructed from the Historical Central Bank Balance Sheet Database. Macroeconomic controls (log real GDP per capita, government spending-to-GDP, current account-to-GDP, log REER, government debt-to-GDP, log CPI) are from the Global Macro Database (Müller et al., 2025). Exchange rate arrangement (Fine classification) from Ilzetzki et al. (2022). Financial openness (KA openness, extended) follows Chinn and Ito (2008) and is extended backward using Quinn and Toyoda (2008). The CBIE index is from Romelli (2022).

Turning to the composition of domestic assets, Table 3 reports estimates for the share of special lending within the domestic portfolio.[2] In contrast to the international portfolio regressions,

[2]Special loans include direct loans to the government, targeted asset purchases, and lending to specific corporations, as detailed in the previous section.

the full-sample results point to fewer robust determinants. Capital account openness stands out as one of the two significant variables, although this result is entirely driven by high-income economies. In these countries, greater financial openness facilitates access to external financing for both governments and the private sector, reducing the need for central banks to engage in domestic credit intermediation through targeted or non-standard lending instruments. By contrast, openness does not appear to play a meaningful role in shaping special lending in lower-income economies.

Government spending relative to GDP emerges as the most consistently significant factor across specifications. The estimated coefficients indicate a negative relationship between public spending and the share of special loans, suggesting a substitution pattern: when fiscal policy is less expansionary, central banks tend to increase their use of special lending, and vice versa. This finding speaks directly to the role of central banks in providing implicit fiscal support. At the same time, government debt-to-GDP is positively and significantly associated with special lending only in high-income countries. This suggests that as debt levels rise, central banks in these economies absorb a larger share of domestic government liabilities, but without a commensurate increase in public spending.

The determinants of special lending differ markedly across subsamples. In lower-income economies, macroeconomic conditions play a central role. Stronger growth is associated with a lower reliance on special lending, consistent with reduced need for policy intervention in more favorable economic environments. A higher current account surplus is linked to an increase in special lending, possibly reflecting the availability of external buffers (increased reserves) that allow central banks to extend credit domestically. In contrast, higher inflation is associated with a reduction in special lending, which may reflect tighter policy constraints: in economies with less flexible exchange rate regimes, expanding quasi-fiscal operations in an inflationary environment could exacerbate macroeconomic instability.

In high-income economies, institutional and financial factors dominate. Greater central bank independence and higher capital account openness are both associated with a lower share of special lending, consistent with a more market-oriented policy framework and a reduced role for quasi-fiscal interventions. Inflation, however, enters with a positive coefficient, indicating that central banks tend to expand special lending when inflation rises, possibly to offset tighter financial conditions or higher borrowing costs. In addition, less flexible exchange rate arrangements are associated with a higher share of special lending, consistent with the constraints highlighted by the trilemma (Obstfeld et al., 2005), whereby limited exchange rate flexibility may require greater reliance on

balance sheet policies.

These results highlight the extent to which the composition of central bank balance sheets responds to different sets of constraints across countries. In high-income economies, institutional features–such as central bank independence, financial openness, and exchange rate regimes–play a central role in shaping policy choices. In contrast, in lower-income economies, balance sheet composition is more closely tied to macroeconomic conditions, including growth, external balances, and inflation dynamics. This divergence highlights the differing policy environments faced by central banks and raises important questions about the scope for intervention and the effective policy space available, particularly during periods of economic stress.

Table 3: Special loans share: $\frac{\text{Special loans}}{\text{Domestic portfolio}}$

	Full sample		Low income		High income	
	(1)	(2)	(3)	(4)	(5)	(6)
log GDP per capita	-10.9*	-10.8	-18.1***	-14.3**	-6.42	-2.23
	(5.55)	(7.03)	(6.47)	(7.04)	(10.4)	(14.5)
Gov Spending / GDP	-0.155***	-0.176**	-0.173***	-0.139**	-0.562*	-0.710**
	(0.054)	(0.070)	(0.061)	(0.069)	(0.308)	(0.323)
Current account / GDP	0.112	0.120	0.346***	0.305**	-0.306	-0.370*
	(0.091)	(0.092)	(0.126)	(0.122)	(0.202)	(0.201)
log REER	-1.52	-0.810	-0.291	1.68	-9.73	-10.1
	(2.28)	(2.46)	(2.02)	(2.00)	(7.11)	(7.78)
Gov. debt / GDP	0.044	0.048	-0.031	-0.067	0.144*	0.178**
	(0.054)	(0.059)	(0.060)	(0.057)	(0.079)	(0.086)
log CPI	-1.26	-1.22	-1.57*	-1.91**	5.71	10.1**
	(0.766)	(0.837)	(0.870)	(0.928)	(4.26)	(4.92)
ER arrangement	-0.602	-0.652	0.418	0.494	-1.16**	-1.36**
	(0.445)	(0.447)	(0.486)	(0.572)	(0.559)	(0.633)
KA openness (extended)	-3.41**	-3.77**	-1.67	-2.12	-4.80*	-5.21*
	(1.67)	(1.73)	(2.21)	(2.45)	(2.77)	(2.76)
CBIE index	-27.9*	-22.7	2.18	4.03	-53.7**	-44.1*
	(16.2)	(16.4)	(24.9)	(28.2)	(22.9)	(24.8)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Observations	4,076	4,076	2,170	2,170	1,906	1,906
R^2	0.59	0.60	0.55	0.57	0.55	0.57

Notes: Country and year fixed effects included as indicated. Standard errors are double-clustered at the country and year levels. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Sample: 1950–2024. The dependent variable is the share of special lending within domestic portfolio assets, defined as the sum of (i) direct loans to government and public entities, (ii) special direct loans to private or quasi-public entities, and (iii) targeted private asset purchases, divided by total domestic portfolio assets. Macroeconomic controls are from the Global Macro Database (Müller et al., 2025). Exchange rate regime, financial openness, and the CBIE index are defined as in Table 2.

4 Central Bank Balance Sheet Responses to Financial crises

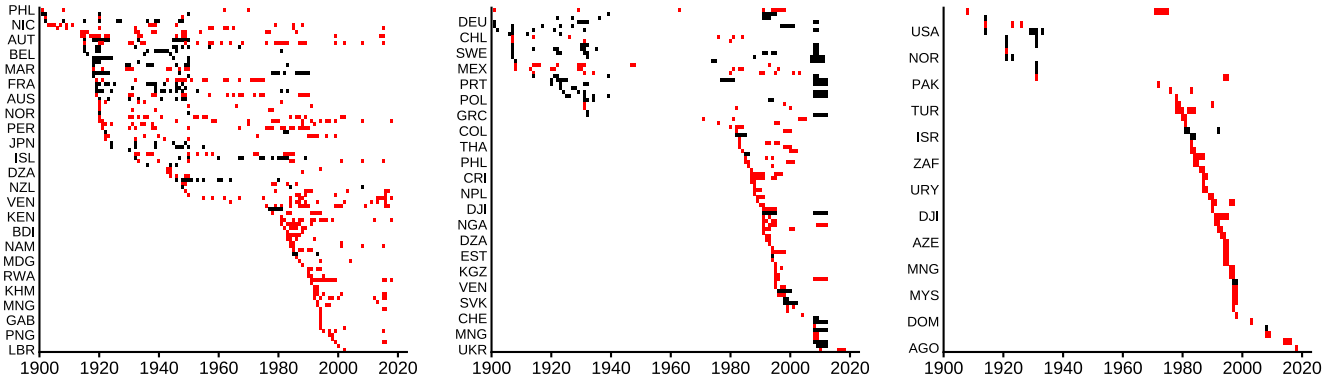
To study how central bank balance sheets evolve around episodes of financial stress, we merge our balance-sheet panel with standard crisis chronologies covering the full 1900–2024 period. For the post-1950 era, we rely on the dataset constructed by Nguyen et al. (2022), while for the pre-1950 period we use the historical crisis database of Reinhart et al. (2016). Combining the two sources allows us to obtain a consistent long-run coverage of currency and banking crises across a large set of countries.

We construct three country–year indicators: (i) currency crises, (ii) banking crises, and (iii) twin crises (banking crises occurring jointly with balance-of-payments crises). To ease interpretation and clearly distinguish mechanisms, we exclude country–years in which currency and banking crises occur simultaneously from the standalone currency and standalone banking crisis dummies; such observations are instead captured exclusively by the twin-crisis indicator. This separation allows us to isolate pure currency events, pure banking events, and systemic episodes involving both dimensions of financial stress.

Historically, currency crises are substantially more frequent than banking crises, especially in the early and mid-twentieth century, underscoring the central role of exchange-rate instability in the international monetary system. Financial crises exhibit clear temporal clustering, most prominently during the interwar period and again following the collapse of the Bretton Woods system in the early 1970s. By contrast, the Bretton Woods era itself is characterized by comparatively low financial instability, consistent with the combination of fixed exchange rates, capital controls, and tighter financial regulation. Banking crises, while less common in raw frequency than currency crises, tend to concentrate in major global stress episodes and often coincide with broader macro-financial disruptions.

Figure 6 provides a visual overview of the crisis sample from 1900 to 2024. Each row corresponds to a country (not all countries are labeled for readability), and each column to a year. Coloured cells indicate crisis years (black for high-income countries, red for lower income countries), while blank cells correspond either to non-crisis years or to missing observations, depending on data availability. The heatmaps highlight both the historical clustering of crises in specific periods and the pronounced heterogeneity across countries in terms of crisis frequency, duration, and type.

Figure 6: Financial crises across countries (1900–2024)



(a) Currency crises (b) Banking crises (c) Twin crises

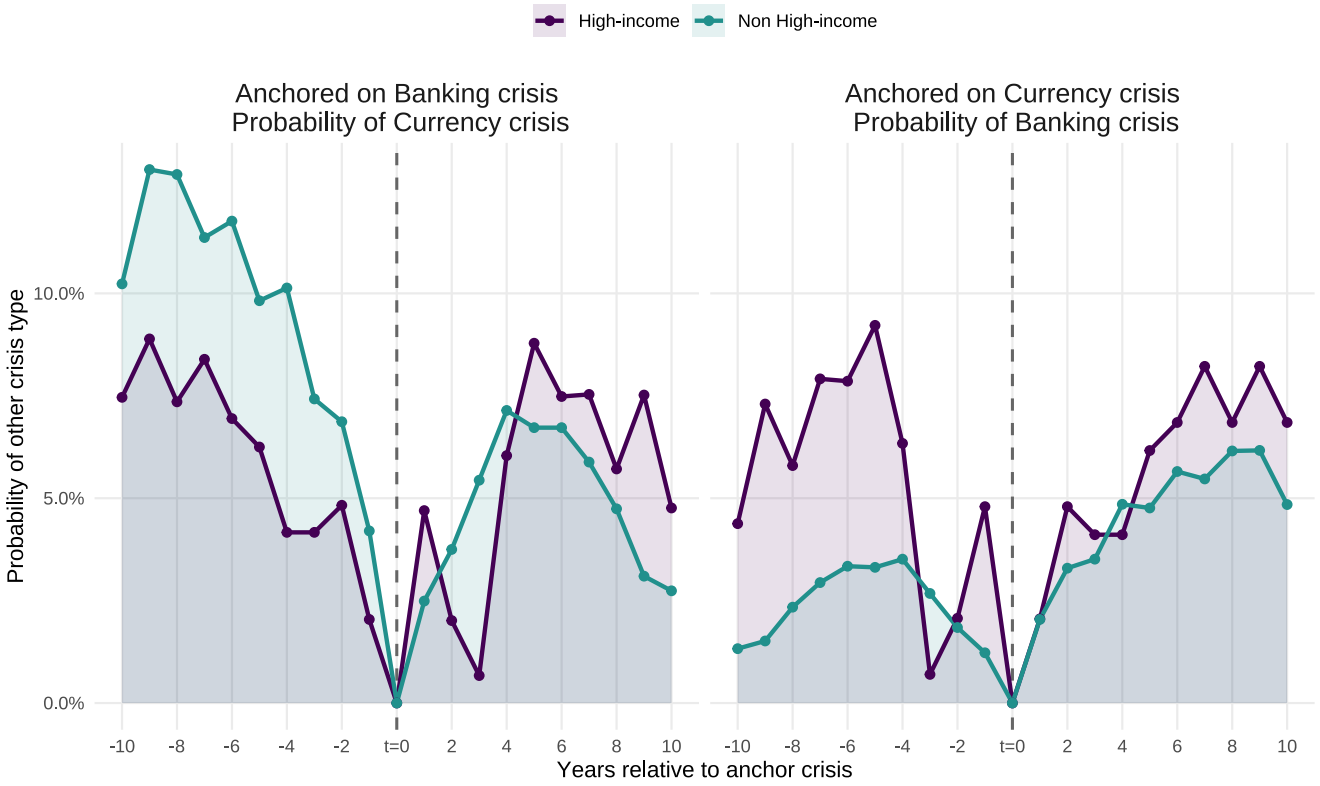
Note: Each panel reports a country–year crisis grid. Rows correspond to countries and columns to years. Black shade rows correspond to high-income countries while red shade rows correspond to non high-income countries. A shaded cell indicates that a crisis occurs in that country-year; unshaded cells correspond to non-crisis years (or missing values when coverage is unavailable). Countries are ordered by the first year with non-missing crisis information to improve readability. *Source*: Crisis dummies from Nguyen et al. (2022) for the post 1950 crises and Reinhart et al. (2016) for the pre-1950 events.

Figure 7 examines the temporal relationship between banking and currency crises using an event-study framework. It reports the probability of experiencing a crisis of the other type within a ± 10-year window around a crisis event at $t = 0$, estimated separately for high-income and non–high-income countries. The patterns reveal substantial differences across income groups.

In non–high-income economies, currency crises tend to precede banking crises. The left panel shows that the probability of a currency crisis rises markedly in the years leading up to a banking crisis, peaking between $t = -6$ and $t = -4$. This pattern suggests that exchange-rate pressures and external imbalances often act as leading indicators of subsequent banking distress, consistent with mechanisms whereby currency depreciations weaken balance sheets through foreign-currency exposures. This finding contrasts with (Nguyen et al., 2022), who document that banking crises tend to coincide with or precede currency crises.

By contrast, no similarly pronounced lead–lag relationship emerges for high-income countries. The probability of a banking crisis around currency crises is more muted and broadly symmetric over time, with only a modest increase prior to $t = 0$ (around $t = -6$). If anything, the sequencing in advanced economies is more consistent with the view that banking distress precedes or coincides with currency pressures.

Figure 7: Probability of banking and currency crises around crisis events



Note: The figure reports event-study probabilities of experiencing a crisis of the other type in a window from $t-10$ to $t+10$, conditional on a crisis at $t=0$. The left panel is anchored on banking crises and shows the probability of currency crises, while the right panel is anchored on currency crises and shows the probability of banking crises. Estimates are reported separately for high-income and non–high-income countries. High-income classification follows the World Bank definition (from 1986 onward). *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016).

Figure 8 highlights marked differences in the use of special lending across income groups and over time. For high-income economies, special loans remain relatively moderate as a share of GDP throughout most of the sample, with temporary spikes during the two World Wars, the Global Financial Crisis and the COVID-19 pandemic. Crisis clustering is visible in the shaded bars, but the response in special lending appears contained and short-lived.

By contrast, non-high-income economies exhibit both higher levels and greater volatility in special loans relative to GDP. Peaks in special lending often coincide with periods of intense financial stress, particularly during the interwar years and from the 1980s onward, when currency and banking crises become more frequent. The co-movement between crisis incidence and special

lending is more pronounced in this group, suggesting a stronger reliance on central bank balance sheet interventions during episodes of financial instability.

Figure 8: Special loans to GDP by income group, 1900–2024



Note: The solid line reports the GDP-weighted mean of special loans as a share of GDP (in percent) for each income group. Weights correspond to countries' nominal GDP in USD. Shaded bars indicate the number of currency crises (blue), banking crises (red) and twin crises (purple) in each year within the corresponding income group (right axis). The high-income group comprises countries classified as high income by the World Bank from 1986 onward. *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016); central bank balance sheet data from Aguilar Pérez et al. (2026).

In the empirical analysis that follows, we focus primarily on banking crises and twin crises, as these episodes are more informative about the constraints faced by central banks and the trade-offs embedded in balance sheet reactions. By construction, currency crises are largely driven by sharp depreciations–either through devaluations in less flexible regimes or through freely floating episodes following the abandonment of pegs. As such, they do not necessarily impose the same degree of policy tension. Exchange rate adjustments are, in many cases, the outcome of a mechanical or policy-driven realignment, and are typically accompanied by predictable macro-financial dynamics, including higher inflation and valuation-driven increases in the domestic-currency value of foreign reserves. These features imply that currency crises, taken in isolation, are less informative about the active use of central bank balance sheets under constraint.

By contrast, banking crises and twin crises involve more complex and binding trade-offs. Episodes of banking distress are characterized by substantial losses in the financial sector (Bordo and Meissner, 2016), raising the question of how these losses are absorbed—either through fiscal backstops or through direct central bank intervention. Twin crises, in particular, combine external pressures with domestic financial instability, further tightening policy constraints (Kaminsky and Reinhart, 1999). In such contexts, central banks may be required to expand liquidity provision, engage in quasi-fiscal operations, or to reduce their reserves to defend their pegs. Focusing on these episodes therefore allows us to better capture the conditions under which central bank balance sheets become active policy tools, and to disentangle the relative roles of fiscal capacity, financial structure, and institutional constraints in shaping their response.

4.1 Specifications: Panel Local Projections

We estimate dynamic responses using local projections (LP) following the methodology developed by Jordà (2005); Jordà and Taylor (2025). The LP approach provides a flexible and transparent framework to derive impulse response functions without imposing the dynamic restrictions inherent in vector autoregressive (VAR) models. Rather than recovering impulse responses from a single estimated system, the LP method directly estimates the response of a variable at each horizon through a sequence of regressions.

The LP framework is particularly well suited to our setting for several reasons. First, it allows for straightforward estimation and structural interpretation, as emphasized by Stock and Watson (2018). Second, while LP and VAR approaches are theoretically equivalent under correct

specification (Plagborg-Møller and Wolf, 2021; Olea et al., 2025), LPs are less sensitive to model misspecification. This robustness is especially valuable in macroeconomic applications, where low-order autoregressive representations may be difficult to specify accurately (Marcellino et al., 2006). Third, LP inference remains reliable in the presence of highly persistent data and when estimating impulse responses over longer horizons (Montiel Olea and Plagborg-Møller, 2021). These features are particularly relevant given the persistence of macroeconomic aggregates and balance sheet variables in our panel.

Accordingly, for each horizon $h = 0, 1, \ldots, H$, we estimate the following two-way fixed effects panel specification:

$$y_{i,t+h} = \alpha_i + \gamma_t + \beta_h \mathit{Crisis}_{i,t} + \sum_{s=l}^{h} \Phi_h y_{i,t-s} + \sum_{s=l}^{h} \Theta_h Z_{i,t-s} + \varepsilon_{i,t+h}, \tag{3}$$

where i indexes countries and t denotes years. The dependent variable $y_{i,t+h}$ represents outcome v at horizon h. The variable $\mathit{Crisis}_{i,t}$ is an indicator equal to one in the onset year of a currency, banking, or twin crisis, and zero otherwise. The coefficient β_h therefore traces the dynamic response of outcome v at horizon h to a crisis shock at time t.

The specification includes country fixed effects α_i, which absorb time-invariant heterogeneity across countries, and time fixed effects γ_t, which control for global shocks common to all countries. We include two lags of the dependent variable to account for persistence. The vector $Z_{i,t}$ contains additional macroeconomic controls—specifically the current account-to-GDP ratio and government debt-to-GDP ratio—each included with two lags in all specifications. Standard errors are computed using Newey–West corrections to account for serial correlation. This framework enables us to trace the medium-run effects of financial crises on macroeconomic outcomes and central bank balance sheet dynamics while maintaining robustness to dynamic misspecification and persistence in the data.

We estimate dynamic responses to crisis onsets using two-way fixed effects panel local projections as in Equation (3). We report impulse responses for horizons $h = 0, \ldots, H$ with Newey–West standard errors (two lags) and confidence bands as indicated in the figure notes. Throughout, crisis onsets follow Nguyen et al. (2022); Reinhart et al. (2016), while central bank balance sheet variables come from Aguilar Pérez et al. (2026). The empirical objective is twofold: (i) to characterize macroeconomic adjustment following currency, banking, and twin crises; and (ii) to quantify how central banks alter the size and composition of their balance sheets in response to these events.

4.2 Results: All economies

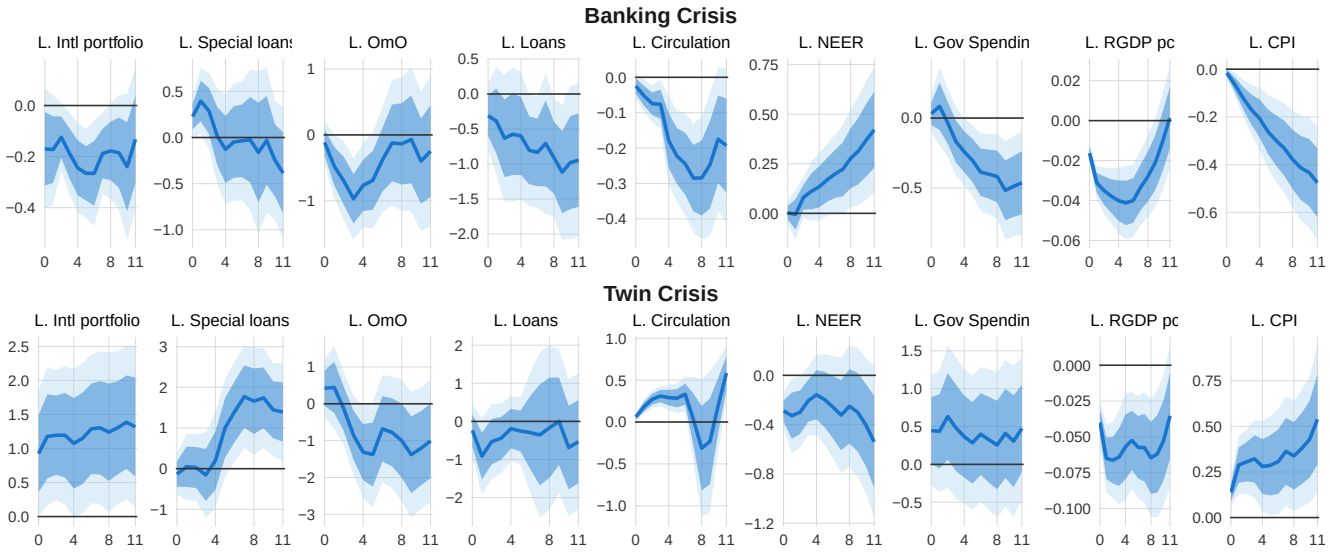
Figure 9 reports the baseline local projection estimates following the onset of banking and twin crises. The dependent variables include the logarithm of central bank balance sheet components–international reserves, special loans, open market operations (OMO), loans (discounts and advances), and currency in circulation–as well as key macroeconomic indicators: the nominal effective exchange rate (NEER), government spending, real GDP per capita, and the consumer price index.

Three main results emerge. First, both types of crises are associated with large and persistent output losses. Real GDP per capita declines sharply on impact and recovers only gradually over time. The cumulative contraction is economically meaningful, reaching around 4 percent following banking crises and close to 7 percent in the case of twin crises.

Second, exchange rate dynamics play a central role in shaping crisis transmission. During banking crises, the exchange rate tends to appreciate, due in part to the deflationary effects on the banking sector and aggregate demand. This occurs despite a decline in international reserves, suggesting that countries–particularly those with less flexible exchange rate regimes–attempt to defend the peg. In contrast, twin crises are characterized by a marked depreciation of the NEER. This depreciation mechanically increases the value of foreign reserves through valuation effects, thereby raising the international portfolio share and, in turn, constraining the scope for further balance sheet expansion.

Third, the macro-financial profiles of banking and twin crises, and the associated central bank responses, differ markedly. Banking crises are deflationary over medium horizons, with sustained declines in the price level, and are associated with an overall contraction in central bank balance sheets. While central banks provide short-term support (through special loans), these episodes are typically accompanied by tighter fiscal policies aimed at preserving exchange rate stability. By contrast, twin crises — where exchange rate depreciation relaxes external constraints - are associated with a significant expansion in special lending. In these cases, central banks step in to absorb financial sector losses that governments are unable to fully internalize. However, as shown in Section 3, the nature and intensity of these responses vary significantly across income groups and institutional settings, highlighting the importance of accounting for heterogeneity in central banks' responses.

Figure 9: Local projections and financial crises: Benchmark effects



Note: Panel local projection impulse responses estimated on the 1900–2024 sample with two-way fixed effects. The figure reports point estimates together with confidence bands as indicated. Inference is based on Newey–West standard errors with two lags. *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016); central bank balance sheet data from Aguilar Pérez et al. (2026).

4.3 Results: Separating between income groups

To assess heterogeneity, Figure 10 repeats the analysis separately for high-income and non-high-income economies. The split is based on World Bank income classifications and yields a high-income group of 49 countries.[3] The resulting impulse responses differ sharply across the two groups.

In banking crises, high-income economies combine exchange rate flexibility with an active policy mix. The nominal exchange rate tends to depreciate, while both special lending (in the first years) and government spending (more persistently) increase. This joint monetary–fiscal expansion is associated with a faster recovery, despite a stronger initial decline in output. By contrast, non–high-income economies display a markedly different pattern. The nominal effective exchange rate typically appreciates, reflecting efforts to defend fixed or tightly managed exchange rate regimes. This defense comes at the cost of significant reserve losses and is accompanied by more restrictive fiscal policy, which declines substantially over the following decade. In this context,

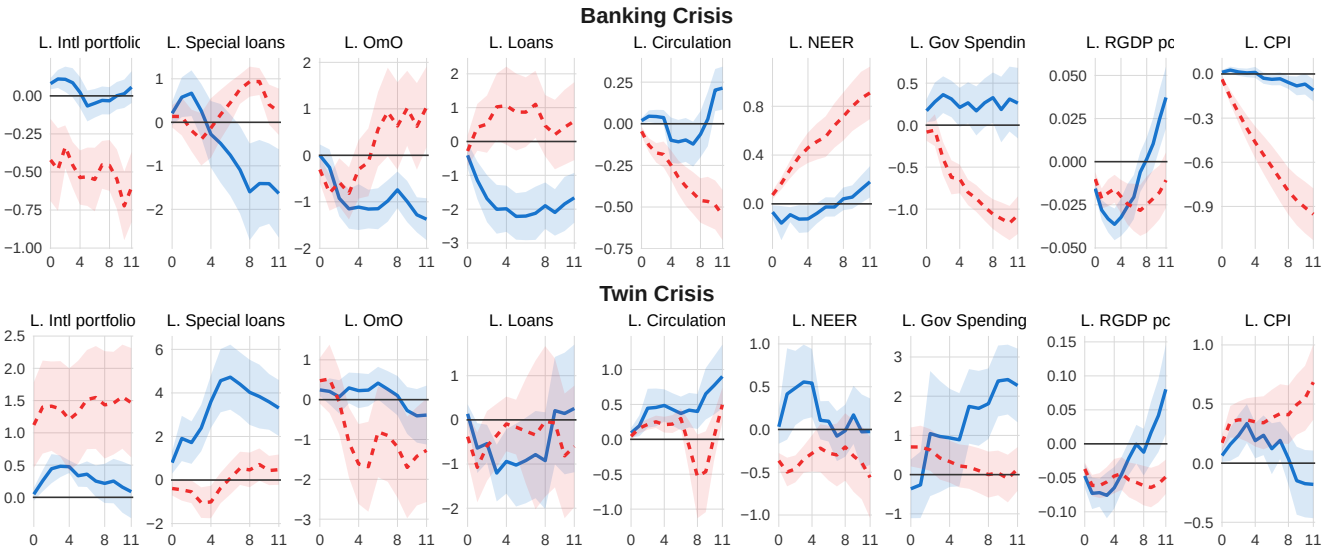
[3]Because World Bank classifications begin in 1986, we construct a time-invariant high-income indicator by selecting economies that are consistently classified as high income over the available World Bank window (>15 years of High Income) and then applying this partition over the full historical sample.

central banks step in through an increase in special loans, effectively substituting for limited fiscal space. Importantly, while the expansion of central bank balance sheets is broadly comparable across income groups in standard banking crises, the overall policy mix differs: emerging markets are significantly less able to deploy countercyclical fiscal policy, and this weaker fiscal response is closely associated with more persistent downturns.

The contrast becomes even sharper in twin crises. In non–high-income economies, the collapse of the exchange rate regime provide an immediate relaxation of the peg constraint and leads to sharp depreciations. However, this adjustment comes with tighter external and nominal constraints: depreciations fuel inflationary pressures and exacerbate foreign-currency balance sheet mismatches, which in turn limit the scope for expansionary monetary policy. They ultimately lead to a very strong constraint on macroeconomic policies in order to retain the credibility of the new peg. As a result, both fiscal and monetary stabilization tools are constrained, and loss absorption shifts primarily toward the government, albeit in a limited way.

In high-income countries, by contrast, adjustment relies more heavily on central bank intervention, with a pronounced expansion in special lending. Even with twin crises, these countries enjoy greater credibility in international financial markets, so that a currency crisis does not lead to serial devaluations and inflation. However, maintaining the credibility of the peg still requires fiscal orthodoxy. Even when fiscal policy remains relatively restrained to preserve credibility, central banks nevertheless retain the ability to deploy their balance sheets aggressively to stabilize the financial system. This combination of monetary capacity and policy credibility helps sustain a stronger recovery, highlighting the role of monetary sovereignty in shaping crisis outcomes under external stress. Figure A.1 confirms our results when controlling for the CPI, showing that the fiscal and special loans effects hold when taking into effect price level differences.

Figure 10: Local projections and financial crises: heterogeneity by income group



Note: Panel local projection impulse responses estimated separately for high-income and non-high-income economies (World Bank classification-based split; 49 high-income countries). Two-way fixed effects; Newey–West standard errors with two lags; confidence bands as indicated. *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016); central bank balance sheet data from Aguilar Pérez et al. (2026).

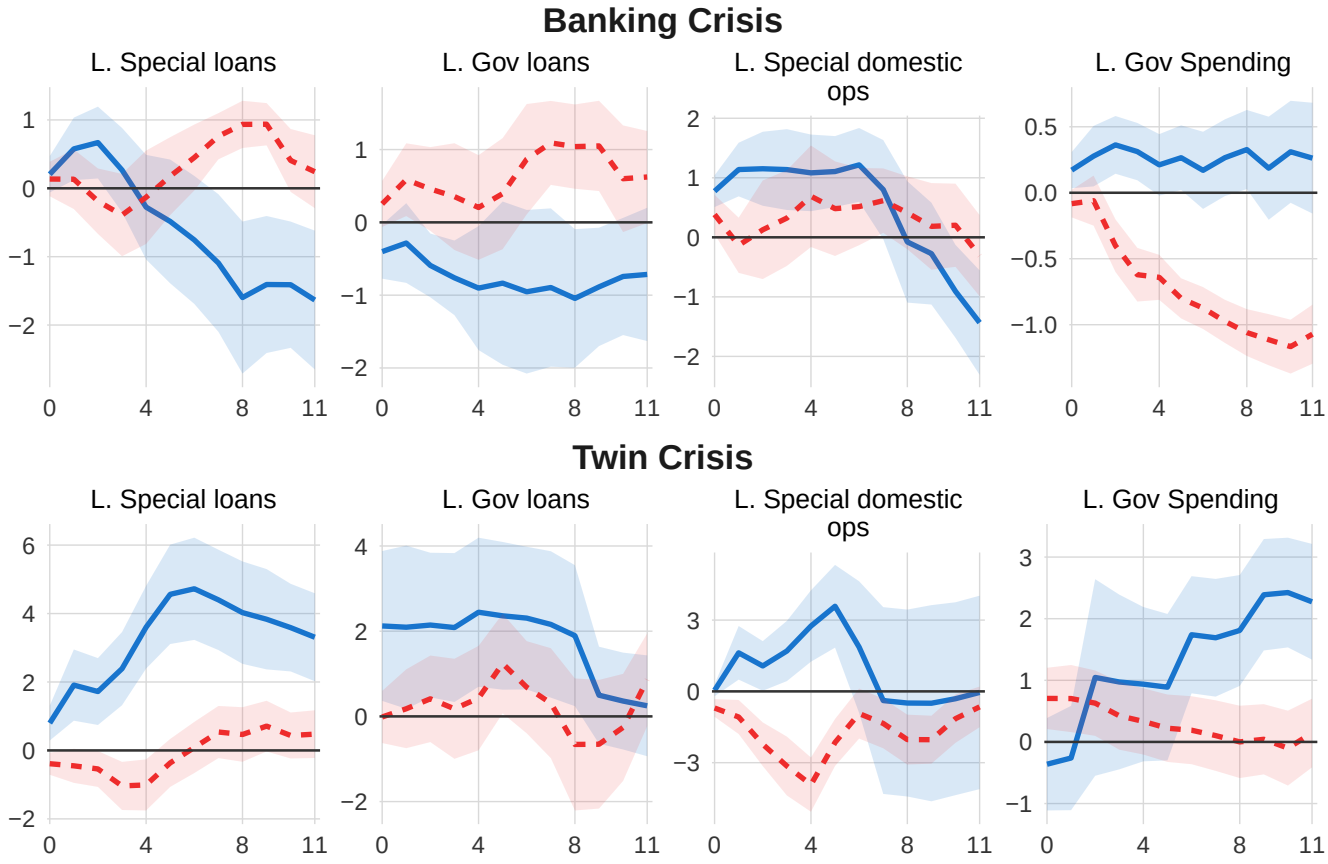
To better understand the mechanisms underlying these patterns, Figure 11 further decomposes special lending into its two main components: direct lending to the government and special domestic operations, which include targeted private asset purchases, bank recapitalizations, and emergency lending to private institutions. This decomposition reveals a particularly stark form of heterogeneity across income groups.

In high-income economies, the expansion of special loans during crises is driven primarily by special domestic operations. This indicates that central banks play a direct and active role in stabilizing the financial system by absorbing private sector losses, both in banking and twin crises. These interventions are consistent with a lender-of-last-resort and market-maker-of-last-resort function, allowing central banks to support distressed financial institutions and restore market functioning. The role of the central bank as a crisis manager is therefore especially clear in this group, with balance sheet policies directly targeting financial sector vulnerabilities.

By contrast, in non–high-income economies, the increase in special loans is largely accounted for by direct lending to the government. This suggests that central bank interventions are primarily aimed at supporting fiscal capacity rather than directly stabilizing the private financial sector.

Targeted interventions toward banks and financial institutions remain limited, particularly in twin crises where external and nominal constraints are most binding. In these episodes, central banks appear unable to effectively perform lender-of-last-resort functions at scale, reflecting tighter constraints on their balance sheets. Overall, this decomposition highlights that, while the aggregate expansion of special lending may appear similar across groups, its underlying composition—and thus its economic role—differs fundamentally, pointing to important limits on central bank crisis management in emerging and developing economies.

Figure 11: Local projections and financial crises: special loans heterogeneity by income group



Note: Panel local projection impulse responses estimated separately for high-income and non-high-income economies (World Bank classification-based split; 49 high-income countries). Two-way fixed effects; Newey–West standard errors with two lags; confidence bands as indicated. *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016); central bank balance sheet data from Aguilar Pérez et al. (2026).

5 Conclusion

This paper has examined how central banks respond to financial crises when their balance sheets are shaped not only by domestic financial conditions, but also by external constraints, exchange-rate arrangements, and institutional features. Using a new historical database covering 132 central banks since 1900, we document long-run differences in the size and composition of central bank assets, identify the macroeconomic determinants of portfolio allocation, and trace the dynamic responses of both macroeconomic outcomes and balance sheet components to banking and twin crises.

The results help clarify the question raised in the introduction: whether differences in central bank behavior can explain the more severe and persistent effects of financial crises in emerging markets. The answer is not that central banks in these economies intervene less. In standard banking crises, their balance sheet responses are broadly comparable–if anything, more active–than those observed in high-income countries. Yet downturns remain more persistent. The key difference lies in the policy environment. Emerging markets face tighter fiscal constraints and are less able to implement countercyclical fiscal policy, which reduces the effectiveness of monetary interventions. Furthermore, balance sheet expansions are usually targeted to increasing the financing of the government, rather than lending to financial institutions. By contrast, high-income economies rely on a joint expansion of monetary and fiscal policy, which helps sustain a faster recovery.

In twin crises, these differences become more pronounced. Lower income economies are subject to tighter external and nominal constraints, as exchange rate depreciations generate inflationary pressures and exacerbate foreign-currency balance sheet mismatches. These dynamics restrict the scope for central bank intervention and reduce the effectiveness of both monetary and fiscal policy. High-income economies, by contrast, retain greater room to maneuver. Even when fiscal policy remains relatively cautious, central banks can expand their balance sheets and intervene directly to stabilize the financial system, supporting a stronger recovery.

The analysis also shows that central bank balance sheets in emerging and developing economies cannot be interpreted solely as domestic stabilization tools. They also reflect the need to manage external pressures, with a persistent tension between exchange-rate stability, reserve adequacy, and domestic financial support. This tension is particularly visible in less flexible exchange rate regimes, where central banks must defend the currency while responding to banking sector stress. In more flexible regimes, exchange rate movements absorb part of the adjustment, allowing central

banks to focus more directly on financial stabilization.

Looking at the composition of balance sheets is essential to understand these mechanisms. While aggregate expansions may appear similar across countries, the underlying instruments differ. In high-income economies, central banks intervene primarily through targeted support to the financial sector, including asset purchases, recapitalization measures, and emergency lending. In emerging markets, a larger share of interventions takes the form of support to the sovereign, reflecting limited fiscal space and tighter external constraints. This difference in composition helps explain why similar balance sheet expansions can lead to very different macroeconomic outcomes.

These findings suggest that crisis dynamics cannot be understood by focusing on monetary policy in isolation. The effectiveness of central bank actions depends on the interaction between fiscal capacity, external constraints, and institutional credibility. The central bank balance sheet is therefore not only a policy instrument, but also a reflection of the broader constraints faced by policymakers during crises.

References

Aguilar Pérez, P., Chenard, A., Monnet, E., and Morvillier, F. (2026). Central banks historical balance sheets : a new database. *Forthcoming in 2026*.

Baron, M., Verner, E., and Xiong, W. (2021). Banking crises without panics. *The Quarterly Journal of Economics*, 136(1):51–113.

Bazot, G., Monnet, E., and Morys, M. (2024). Central banks and the absorption of international shocks (1891-2019). Technical report. Working Paper.

Bindseil, U. (2014). *Monetary Policy Operations and the Financial System*. Oxford University Press.

Bordo, M. D. and Meissner, C. M. (2016). Fiscal and financial crises. In *Handbook of macroeconomics*, volume 2, pages 355–412. Elsevier.

Brandao-Marques, L., Harjes, T., Sahay, R., Xue, Y., and Gelos, G. (2021). Monetary policy transmission in emerging markets and developing economies. *CEPR Discussion Papers*.

Chinn, M. D. and Ito, H. (2008). A new measure of financial openness. *Journal of comparative policy analysis*, 10(3):309–322.

De Leo, P., Gopinath, G., and Kalemli-Ozcan, S. (2024). Monetary policy and the short-rate disconnect in emerging economies.

Ferguson, N., Kornejew, M., Schmelzing, P., and Schularick, M. (2023). The safety net: Central bank balance sheets and financial crises. *CEPR Discussion Paper*, 17858.

Fouquin, M. and Hugot, J. (2016). Two centuries of bilateral trade and gravity data: 1827-2014. *Vniversitas Económica*, pages 1–39.

Frydman, C. and Xu, C. (2023). Banking crises in historical perspective. *Annual Review of Financial Economics*, 15(1):265–290.

Ilzetzki, E., Reinhart, C. M., and Rogoff, K. S. (2022). Rethinking exchange rate regimes. In *Handbook of international economics*, volume 6, pages 91–145. Elsevier.

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

Jordà, Ò., Schularick, M., and Taylor, A. M. (2017). Macrofinancial history and the new business cycle facts. *NBER macroeconomics annual*, 31(1):213–263.

Jordà, Ò. and Taylor, A. M. (2025). Local projections. *Journal of Economic Literature*, 63(1):59–110.

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

Laeven, L. and Valencia, F. (2020). Systemic banking crises database ii. *IMF Economic Review*, 68(2):307–361.

Marcellino, M., Stock, J. H., and Watson, M. W. (2006). A comparison of direct and iterated multistep AR methods for forecasting macroeconomic time series. *Journal of Econometrics*, 135(1-2):499–526.

Metrick, A. and Schmelzing, P. (2025). Banking-crisis interventions across time and space. *The Review of Financial Studies*, page hhaf071.

Montiel Olea, J. L. and Plagborg-Møller, M. (2021). Local Projection Inference Is Simpler and More Robust Than You Think. *Econometrica*, 89(4):1789–1823.

Müller, K., Xu, C., Lehbib, M., and Chen, Z. (2025). The global macro database: A new international macroeconomic dataset. Technical report, National Bureau of Economic Research.

Nguyen, T. C., Castro, V., and Wood, J. (2022). A new comprehensive database of financial crises: Identification, frequency, and duration. *Economic Modelling*, 108:105770.

Obstfeld, M., Shambaugh, J. C., and Taylor, A. M. (2005). The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility. *Review of economics and statistics*, 87(3):423–438.

Olea, J. L. M., Plagborg-Møller, M., Qian, E., and Wolf, C. K. (2025). Local projections or vars? a primer for macroeconomists. Technical report, National Bureau of Economic Research.

Plagborg-Møller, M. and Wolf, C. K. (2021). Local Projections and VARs Estimate the Same Impulse Responses. *Econometrica*, 89(2):955–980.

Quinn, D. P. and Toyoda, A. M. (2008). Does capital account liberalization lead to growth? *The Review of Financial Studies*, 21(3):1403–1449.

Reinhart, C. M., Reinhart, V., and Trebesch, C. (2016). Global cycles: Capital flows, commodities, and sovereign defaults, 1815–2015. *American Economic Review*, 106(5):574–580.

Reinhart, C. M. and Rogoff, K. S. (2009). *This time is different: Eight centuries of financial folly*. princeton university press.

Romelli, D. (2022). The political economy of reforms in central bank design: evidence from a new dataset. *Economic Policy*, 37(112):641–688.

Romer, C. D. and Romer, D. H. (2019). Fiscal space and the aftermath of financial crises: How it matters and why. *Brookings Papers on Economic Activity*, (1 (Spring)):239–331.

Stock, J. H. and Watson, M. W. (2018). Identification and Estimation of Dynamic Causal Effects in Macroeconomics Using External Instruments. *The Economic Journal*, 128(610):917–948.

Appendices

Appendix A - Data and sample

Table A.1: Central bank balance sheet classification: Assets (International portfolio)

Category name	**Description**
1 International portfolio	
1.1 Metallic reserves	
1.1.1 Gold	Gold held, whether abroad (e.g., at the Fed) or domestically. Includes all forms of gold (bullion, unrefined gold, gold coins). Excludes the "Gold tranche with the IMF," which is classified under participation in international institutions (IMF assets).
1.1.2 Other metallic reserves	Valuable metals other than pure gold. Examples include silver bullion; old coins held for historical or collector value; fractional or subsidiary coins; coins out of circulation to be melted.
1.2 Foreign exchange reserves	Deposits and securities when the distinction cannot be made. Examples: foreign exchange holdings; convertible foreign exchange; foreign bills and balances with correspondents abroad; approved foreign exchange.
1.2.1 Deposits	Foreign currencies held in deposit form. Examples: deposits at foreign banks; foreign deposits; cash in foreign banks; demand deposits abroad; Nostro accounts; claims on foreign commercial banks.
1.2.2 Securities	Securities denominated in foreign currency held as reserves (including World Bank RAMP holdings). Examples: U.S. Treasury bonds; foreign bonds and equities; Treasury bills; foreign-currency repo collateral; fixed-income securities.
1.3 Special international loans	Loans and financial assistance granted to foreign countries, bilaterally or via multilateral initiatives. Examples: clearing agreements; IMF-coordinated crisis assistance; swap lines.
1.4 Participation in international institutions	
1.4.1 Assets held at the IMF	All assets held at the IMF. Examples: quota subscriptions, SDR holdings, reserve positions.
1.4.2 Participation in other supranational institutions	Participations in institutions above the national level. Examples: World Bank, Arab Monetary Fund, BIS, SWIFT.
1.5 Other international reserves	Other foreign-currency assets not classified above. Examples: derivative assets in foreign currency; FX revaluation accounts; cash collateral paid.

Table A.2: Central bank balance sheet classification: Assets (Domestic portfolio and other assets)

Category name	Description
2 Domestic portfolio	
2.1 Monetary policy operations	
2.1.1 Loans	Categories where discount and advances are provided together. Includes rediscount facilities and collateralized lending.
2.1.1.1 Discount loans	Bills rediscounted by the central bank for domestic commercial banks. The central bank owns the asset. Includes sector-specific rediscounting (exports, agriculture, industry).
2.1.1.2 Advances and collateralised lending	Short-term advances to domestic commercial banks, typically collateralised. Includes marginal lending facilities and ECB LTROs.
2.1.2 Domestic securities	Domestic securities not classified as development-related equity investments.
2.1.2.1 Open market operations	
2.1.2.1.1 Bills held	Securities purchased on secondary markets for liquidity provision. Includes Treasury bills and QE/LSAP holdings acquired for monetary policy purposes.
2.1.2.1.2 Repurchase agreements	Securities acquired via repo or reverse-repo operations with domestic banks. Includes fine-tuning and structural operations.
2.1.2.2 Government securities	Domestic government securities whose acquisition mode or purpose is unspecified. Typically non-marketable or held to maturity; residual category.
2.2 Special loans	
2.2.1 Direct loans to the government and other public administrations	Direct financing of government entities without constraints on fund use. Includes primary-market purchases of government bonds unrelated to liquidity provision.
2.2.2 Special domestic operations	
2.2.2.1 Special direct loans	Loans with specific policy objectives or usage constraints. Examples: exporter loans; sectoral credit; ELA; loans to development banks.
2.2.2.2 Targeted asset purchases	Assets held for purposes other than liquidity management. Includes equity stakes, regulatory participations, and bankruptcy-prevention measures.
2.3 Assets managed on behalf of others	Funds transiting through the central bank but managed separately. Examples: deposit insurance funds; sovereign wealth funds; earmarked government programs.
2.4 Other domestic assets	Other unclassified domestic-currency assets. Examples: central bank real estate; pension assets; cash holdings; equipment; intangible assets.
3 Other assets	Other unclassified assets. Examples: sundry assets; unpaid interest; miscellaneous receivables.

Table A.3: Central bank balance sheet classification: Liabilities (Circulation and Deposits)

Category name	**Description**
4 Circulation	Notes and coins in circulation.
5 Deposits	
5.1 Deposits of private financial institutions (residents)	Deposits by domestic commercial banks and other resident financial institutions (e.g., insurance companies). Examples: bank accounts; mandatory reserve deposits; commercial bank deposits.
5.1.1 Deposits of private financial institutions in local currency (residents)	Deposits of resident financial institutions denominated in domestic currency.
5.1.2 Deposits of private financial institutions in foreign currency (residents)	Deposits of resident financial institutions denominated in foreign currency.
5.2 Deposits of private non-financial institutions (residents)	Deposits by resident private institutions other than financial institutions.
5.3 Deposits of the government and other public administrations	Government deposits, including deposits by non-government public administrations. Examples: public entity deposits; government department accounts.
5.4 Deposits of private non-residents	Deposits of non-residents other than international organizations. Examples: deposits related to loans contracted with foreign private banks.
5.5 Deposits of international organizations	
5.5.1 Deposits due to the IMF	Liabilities connected to the IMF. Examples: IMF reserve positions; temporary IMF financial assistance; SDR allocation liabilities.
5.5.2 Deposits due to other supranational institutions	Deposits stemming from supranational institutions other than the IMF, mostly linked to loans or foreign financial assistance. Examples: World Bank; public development banks (ADB, KfW); foreign central banks; UN programs; USAID; foreign government agencies.
5.6 Deposits managed on behalf of others	Deposits managed by the central bank on behalf of third parties; matches "assets managed on behalf of others" on the assets side. Examples: sovereign wealth funds; earmarked public funds.
5.7 Other deposits	Other unclassified deposits.

Table A.4: Central bank balance sheet classification: Liabilities (OMO, Equity, and Other Liabilities)

Category name	**Description**
6 Open market operation liabilities	
6.1 Bills issued	
6.1.1 Bills issued held by financial institutions	Bills issued by the central bank and purchased by domestic commercial banks, often serving as an alternative to deposits and closely linked to monetary policy. Examples: certificates of deposit; central bank bills; Bank of Indonesia certificates.
6.1.2 Other bills issued (held by non-financial institutions)	Bills issued by the central bank and purchased by institutions other than domestic commercial banks, primarily to increase central bank liabilities.
6.2 Reverse repo bills	Reverse repurchase operations on the liability side, contracted with commercial banks. Examples: securities sold under repurchase agreements.
7 Equity	
7.1 Capital	Capital, paid-up capital, and initial capital.
7.2 Reserves and provisions	Central bank reserves, provisions, and accumulated results, including both profits and losses. Examples: general reserve fund; special reserves; pension fund; retained earnings; stabilization reserves; accumulated losses; profit or loss for the year.
8 Other liabilities	Other unclassified liabilities. Examples: trade and other payables; miscellaneous accounts; sundry liabilities.

Table A.5: Countries in the sample with high-income status

Country	Start sample	Region	Country	Start sample	Region	Country	Start sample	Region
Hong Kong SAR China	1936	Eastern Asia	Finland	1914	Northern Europe	Bahrain	1966	Western Asia
Japan	1900	Eastern Asia	Iceland	1947	Northern Europe	Cyprus	1965	Western Asia
South Korea	1959	Eastern Asia	Ireland	1943	Northern Europe	Israel	1954	Western Asia
Taiwan	1974	Eastern Asia	Norway	1900	Northern Europe	Kuwait	1971	Western Asia
Czechia	1994	Eastern Europe	Sweden	1900	Northern Europe	Oman	1972	Western Asia
Hungary	1998	Eastern Europe	United Kingdom	1900	Northern Europe	Qatar	1966	Western Asia
Poland	1993	Eastern Europe	Australia	1950	Oceania	Saudi Arabia	1961	Western Asia
Slovakia	1993	Eastern Europe	New Zealand	1932	Oceania	United Arab Emirates	1974	Western Asia
Bahamas	1974	Latin America and the Caribbean	Brunei	2011	South-eastern Asia	Austria	1946	Western Europe
Barbados	1973	Latin America and the Caribbean	Singapore	1971	South-eastern Asia	Belgium	1900	Western Europe
Cayman Islands	1997	Latin America and the Caribbean	Croatia	1993	Southern Europe	France	1900	Western Europe
Curaçao	1997	Latin America and the Caribbean	Greece	1928	Southern Europe	Germany	1951	Western Europe
Trinidad & Tobago	1970	Latin America and the Caribbean	Italy	1900	Southern Europe	Luxembourg	1997	Western Europe
Canada	1935	North America	Malta	1968	Southern Europe	Netherlands	1900	Western Europe
United States	1914	North America	Portugal	1900	Southern Europe	Switzerland	1907	Western Europe
Denmark	1900	Northern Europe	Slovenia	1991	Southern Europe			
Estonia	1992	Northern Europe	Spain	1900	Southern Europe			

Notes: This table lists the countries in the sample classified as high-income according to the World Bank. A country is considered high-income if it is classified as such for at least 15 years over the 1986–2024 period. For each country, the table reports the first year with a non-missing observation for total central bank assets and its geographical region.

Table A.6: Countries in the sample with non-high-income status

Country	Start sample	Region	Country	Start sample	Region	Country	Start sample	Region
Kazakhstan	1999	Central Asia	Libya	1957	Northern Africa	Comoros	2004	Sub-Saharan Africa
Kyrgyzstan	2003	Central Asia	Morocco	1935	Northern Africa	Congo - Brazzaville	1960	Sub-Saharan Africa
Tajikistan	2010	Central Asia	Sudan	1960	Northern Africa	Congo - Kinshasa	1966	Sub-Saharan Africa
Mongolia	1991	Eastern Asia	Tunisia	1959	Northern Africa	Djibouti	2012	Sub-Saharan Africa
Bulgaria	1900	Eastern Europe	Latvia	1991	Northern Europe	Equatorial Guinea	1985	Sub-Saharan Africa
Romania	1997	Eastern Europe	Lithuania	1994	Northern Europe	Ethiopia	1963	Sub-Saharan Africa
Russia	1992	Eastern Europe	Fiji	1989	Oceania	Gabon	1960	Sub-Saharan Africa
Ukraine	1994	Eastern Europe	Papua New Guinea	1979	Oceania	Kenya	1967	Sub-Saharan Africa
Argentina	1935	Latin America and the Caribbean	Cambodia	1955	South-eastern Asia	Liberia	2009	Sub-Saharan Africa
Belize	1977	Latin America and the Caribbean	Indonesia	1951	South-eastern Asia	Madagascar	1993	Sub-Saharan Africa
Bolivia	1963	Latin America and the Caribbean	Malaysia	1959	South-eastern Asia	Malawi	1965	Sub-Saharan Africa
Brazil	1965	Latin America and the Caribbean	Philippines	1949	South-eastern Asia	Mozambique	1994	Sub-Saharan Africa
Chile	1926	Latin America and the Caribbean	Thailand	1951	South-eastern Asia	Namibia	1990	Sub-Saharan Africa
Colombia	1927	Latin America and the Caribbean	Bangladesh	1975	Southern Asia	Nigeria	1960	Sub-Saharan Africa
Costa Rica	1950	Latin America and the Caribbean	India	1936	Southern Asia	Rwanda	1966	Sub-Saharan Africa
Dominican Republic	1947	Latin America and the Caribbean	Iran	1960	Southern Asia	Somalia	2013	Sub-Saharan Africa
Ecuador	1952	Latin America and the Caribbean	Maldives	1986	Southern Asia	South Africa	1921	Sub-Saharan Africa
El Salvador	1961	Latin America and the Caribbean	Nepal	1973	Southern Asia	South Sudan	2011	Sub-Saharan Africa
Honduras	1950	Latin America and the Caribbean	Pakistan	1949	Southern Asia	Tanzania	1967	Sub-Saharan Africa
Jamaica	1970	Latin America and the Caribbean	Sri Lanka	1951	Southern Asia	Uganda	1966	Sub-Saharan Africa
Mexico	1925	Latin America and the Caribbean	Serbia	2001	Southern Europe	Armenia	1997	Western Asia
Nicaragua	1991	Latin America and the Caribbean	Angola	2000	Sub-Saharan Africa	Azerbaijan	1998	Western Asia
Paraguay	1952	Latin America and the Caribbean	Botswana	1976	Sub-Saharan Africa	Iraq	1933	Western Asia
Peru	1922	Latin America and the Caribbean	Burundi	1964	Sub-Saharan Africa	Jordan	1951	Western Asia
Uruguay	1969	Latin America and the Caribbean	Cameroon	1960	Sub-Saharan Africa	Lebanon	1966	Western Asia
Venezuela	1940	Latin America and the Caribbean	Cape Verde	1997	Sub-Saharan Africa	Palestinian Territories	1995	Western Asia
Algeria	1964	Northern Africa	Central African Republic	1960	Sub-Saharan Africa	Turkey	1932	Western Asia
Egypt	1946	Northern Africa	Chad	1960	Sub-Saharan Africa			

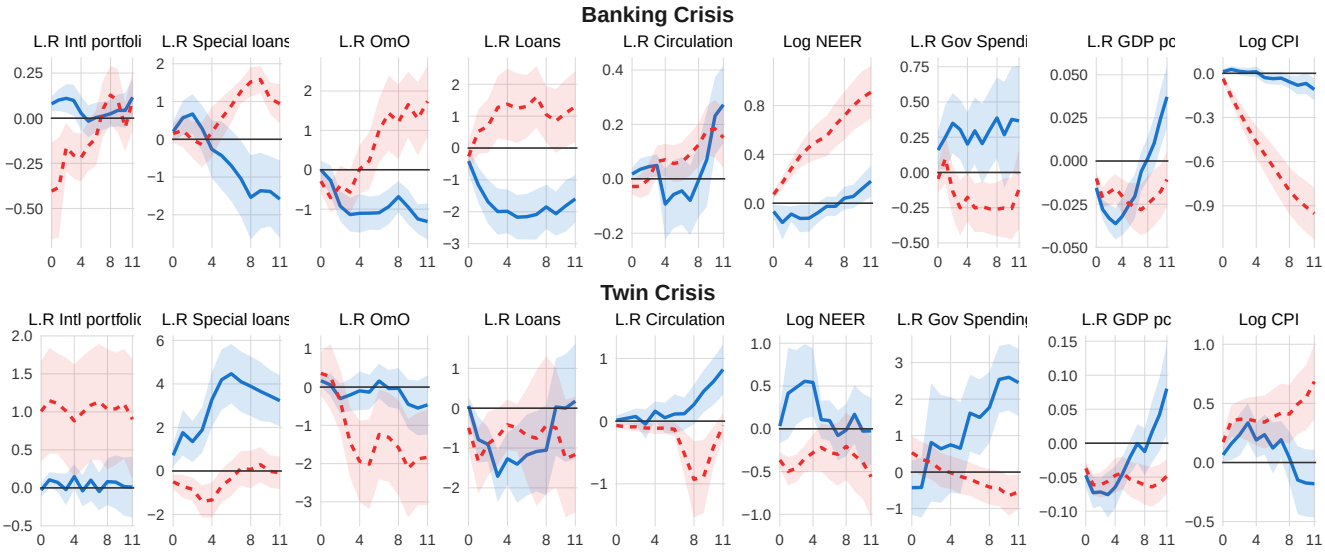
Notes: This table lists the countries in the sample classified as non-high-income according to the World Bank. Countries are defined as non-high-income if they are not classified as high-income for at least 15 years over the 1986–2024 period. For each country, the table reports the first year with a non-missing observation for total central bank assets and its geographical region.

Table A.7: Central bank balance sheet descriptive statistics by income group

	High income								Non-high income							
	N	Mean	Std	Min	P25	P50	P75	Max	N	Mean	Std	Min	P25	P50	P75	Max
Metal holdings (Gold, silver and coins)	3500	1.72	3.00	0.00	0.12	0.52	1.68	15.45	4244	1.23	3.33	0.00	0.06	0.27	1.09	28.29
Foreign exchange holdings (Deposits and securities)	3500	12.04	13.51	0.00	2.58	8.09	14.79	53.75	4269	11.15	10.68	0.00	4.98	8.90	13.66	66.94
Participation in international organizations	3454	5.10	24.86	0.00	0.03	0.73	2.27	175.04	4221	1.50	1.81	0.00	0.50	1.01	2.04	12.66
Discounts and advances	3542	2.18	2.95	0.00	0.19	1.17	2.56	13.74	4269	1.40	1.37	0.00	0.36	1.05	2.00	5.96
Open market operations securities (Repo and Bills)	3307	3.59	5.49	0.00	0.70	2.18	4.21	34.85	4115	1.26	2.30	0.00	0.07	0.40	1.60	15.12
Other government securities	2978	0.62	0.90	0.00	0.00	0.32	0.88	3.78	3732	0.68	3.67	0.00	0.00	0.00	0.00	27.36
Direct loans to the public sector	3282	1.99	2.19	0.00	0.23	1.10	3.06	8.25	4249	4.56	4.98	0.00	1.64	2.85	6.04	29.50
Special loans and targeted purchases	3433	0.48	0.78	0.00	0.00	0.12	0.43	2.83	4240	0.93	1.34	0.00	0.14	0.61	1.12	8.83
Other assets	3406	0.95	1.28	0.00	0.21	0.54	1.18	6.52	4201	1.20	2.23	-0.04	0.30	0.48	0.89	13.99
Total Assets	3542	32.26	33.68	3.31	17.62	24.36	34.29	231.50	4269	25.88	16.67	6.34	15.83	21.36	30.34	110.76
Notes and coins in circulation	3542	7.53	4.65	2.36	4.68	6.27	9.41	30.62	4269	7.23	6.19	0.00	4.22	5.45	8.76	47.37
Deposits of financial institutions	3532	8.50	14.32	0.00	2.95	4.75	7.94	98.90	4259	5.24	6.77	0.00	1.90	3.65	5.92	55.67
Deposits of public sector	3502	3.09	4.74	0.05	0.71	1.78	3.13	25.88	4259	3.49	4.42	0.00	1.31	2.16	3.69	26.54
Deposits of international organizations	3509	4.30	17.45	0.00	0.23	0.83	3.02	122.76	4269	3.55	5.08	0.00	0.77	1.83	4.62	39.85
Open-market-operations liabilities	2972	1.57	3.10	0.00	0.01	0.29	1.70	16.64	3710	1.53	2.43	0.00	0.04	0.33	1.87	9.75
Total liabilities	3542	29.14	32.85	2.61	14.72	21.37	33.91	229.05	4269	23.87	15.65	5.77	13.54	19.90	28.47	107.50
Equity: Capital and reserves	3487	2.46	2.95	-0.49	1.01	1.74	2.65	14.92	3842	2.07	3.30	-6.69	0.77	1.28	2.50	26.59

Notes: The table reports descriptive statistics for central bank balance sheet items over the 1900–2024 sample. All variables are expressed as shares of nominal GDP. N denotes the number of non-missing country-year observations for each variable. Means, standard deviations, and percentiles are computed across countries after first taking time averages at the country level. Statistics are reported separately for high-income and non-high-income countries based on the World Bank classification.

Figure A.1: Local projections and financial crises in real terms: heterogeneity by income group



Note: Panel local projection impulse responses estimated separately for high-income and non-high-income economies (World Bank classification-based split; 49 high-income countries). The series are natural logarithms and divided by CPI to get real terms. Two-way fixed effects; Newey–West standard errors with two lags; confidence bands as indicated. *Sources*: Crisis data from Nguyen et al. (2022); Reinhart et al. (2016); central bank balance sheet data from Aguilar Pérez et al. (2026).