Global Banks and the International Monetary and Financial System

A Minskyan approach

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__Nada más__
Con esta moneda
me voy a comprar
un ramo de cielo
y un metro de mar,
un pico de estrella,
un sol de verdad,
un kilo de viento,
y nada más.

María Elena Walsh
Tutú Marambá (1960),
Bs. As.: Ed. Sudamericana.

Acknowledgements

Any attempt to explain what brought me to the topic of global banking in a US-dollar-dominated world inevitably begins with Argentina and its recurring US-dollar shortages. I didn't choose to be born in the world's macroeconomic laboratory; I simply had the privilege. Intrigued by how other countries managed persistent external deficits, I began reading about policies for sustainable external borrowing. This led me to the topic of currency internationalisation and, ten years ago, to becoming fascinated by a report on the Brazilian case, and later by the papers of one of its authors. Not surprisingly, a year later, I read a post by Pablo Bortz suggesting two papers to understand countries' external vulnerabilities, one of which was authored by the report's author.

A few years later, Pablo, my MS supervisor by then, asked why I didn't do a PhD—and why not with that author. Not long after, I applied to just one PhD, ready to continue my non-academic career if that application failed. Yet here I am, grateful to my supervisor, Annina Kaltenbrunner, the author of that report and that paper. I cannot express my gratitude for her invaluable (and extensive) feedback, continuous guidance, and the many ways she supported me in finishing this thesis, contributing to policy-relevant research, and finding my place in academia. My bonanza didn't stop there. My supervisory team also included two exceptional scholars in the field. I thank Gary Dymski for his insights, critical feedback, encouragement, and support, and Bianca Orsi for her guidance and for showing me how essential Latin American insights are for understanding global finance. To Pablo Bortz, for encouraging me to pursue this PhD, and for years of readings, conversations, inspiration, and endorsement. To my examiners, Daniela Gabor, Bruno de Conti and Karsten Kohler, I thank you for your thoughtful engagement with my work and for providing a rewarding closure to this process.

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Abstract

This thesis examines the role of global banks in shaping the international monetary and financial system, conceptualising it as a network of interlocking balance sheets in which globally active banks issue US dollar liabilities that function as cross-border means of payment and settlement. The distribution of these liabilities is uneven and cyclical, reflecting institutional hierarchies and the evolving financial structure of global banks. The central question motivating the thesis is how this US dollar-dominated network generates and transmits global shocks and external vulnerability.

The first chapter explores theoretically how internationally accepted US dollars are created through global banks' credit operations, shaping countries' costs and ability to participate in cross-border transactions. It examines how global banks determine cross-country credit conditions, based on their pricing decisions and assessments of borrowers' creditworthiness. It argues that fluctuations in their desired balance sheet structures and expectations about borrowers' access to US dollars can act as sources of exogenous pressures on countries' balance of payments.

The second chapter provides empirical evidence that idiosyncratic shifts in global banks' leverage act as an independent driver of global liquidity. Using Granular Instrumental Variables and Instrumented Principal Component Analysis on 34 Global Systemically Important Banks, it constructs an instrument from size-weighted idiosyncratic shocks to leverage. Panel local projections for 74 economies show that positive leverage shocks appreciate exchange rates, boost inflows, and lower sovereign US dollar spreads, indicating that global banks are not only transmission channels but also generators of systemic shocks.

The third chapter examines how hierarchical funding fragilities create systemic risks to global financial stability. Through a balance-sheet framework of layered settlements that combines Minskyan and network perspectives, it shows how the structure and density of funding relations determine banks' hierarchical positions and risks. Network visualisations of cross-border funding, together with institutional analysis of infrastructures, business models, and regulation, reveal an asymmetric system in which US banks benefit from integrated onshore–offshore positions and privileged access to key infrastructures, while non-US banks rely more on wholesale, swap-based, and offshore funding.

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Introduction

The US dollar is the dominant currency in the international monetary and financial system (IMFS). Cross-border financial flows and positions denominated in US dollars are large, geographically dispersed, and connect multiple countries (Davies & Kent, 2020). This system involves a wide range of entities, regions outside the United States (US), and instruments (Aldasoro & Ehlers, 2018b). Within this structure, a small group of large, complex, and globally active banks occupies a central place (Cohen *et al.*, 2017). These global banks were at the centre of the Global Financial Crisis (GFC), with trans-Atlantic banking positions at the core of its origins (Tooze, 2018). In its aftermath, the literature has primarily focused on global banks as amplifiers of external shocks, particularly those originating in US monetary policy, rather than as independent sources of global risk. However, successive episodes of financial turmoil continue to show that stresses originating within the global banking system itself can disrupt US dollar funding markets worldwide. Both US and non-US global banks play central roles in this US dollar-based IMFS. According to data from the Bank for International Settlements (BIS), non-US banks held about $21 trillion each in US-dollar assets and liabilities by 2023, plus off-balance-sheet obligations estimated at twice that amount, surpassing the cross-border positions of US banks (Binder, 2024; McGuire *et al.*, 2024). At the same time, institutional arrangements and cross-country regulatory differences expose non-US banks' dollar operations to distinct funding risks and hierarchical positions in this global system. Yet, how these features jointly shape the availability of US dollar funding across countries, and the external vulnerabilities that follow from it, remains insufficiently understood.

How do global banks shape the availability and price of US dollar credit across countries, and how does this translate into external vulnerability? Can shocks that originate within global banks' own balance sheets act as independent drivers of global financial risk, rather than being merely channels for other shocks? Why do some global banks occupy higher positions in the hierarchical US dollar system than others, and how do institutional and network structures shape the related uneven funding risks they face?

This thesis addresses these questions by developing a conceptual framework to analyse how global banks issue internationally accepted US dollar liabilities and how their expectations, balance sheets, funding structures, and institutional linkages shape the creation and distribution of global liquidity. Empirically, it investigates whether shocks to global banks' balance sheets generate fluctuations in global liquidity and how their funding structures and operating infrastructures shape their systemic risk.

The remainder of this introduction is organised as follows. The next section situates the argument within the structure and recent evolution of global banking within the US dollar-based IMFS, which motivates the thesis. The following section reviews the primary theoretical and empirical literature exploring global shocks driven by financial institutions, as well as Post-Keynesian and Minskyan approaches to this issue. The subsequent sections set out the thesis objective, research questions, hypotheses, and methodology, summarising the main theoretical and empirical contributions of the thesis. Finally, the last section outlines the structure of the thesis.

1.1 A brief overview of global banking in the 21st century

The recent evolution of global banking motivates a closer examination of the structural features of the role that global banks play in the global US dollar system and of the theoretical frameworks that explain how they operate within it. Before the GFC, global banks' US-dollar-denominated assets and liabilities expanded rapidly, with non-US global banks' positions more than tripling after 2000 (McGuire & von Peter, 2012). Figure 1.1 illustrates this expansion of cross-border US-dollar balance sheets from different perspectives. It shows how, since the early 2000s, both US and non-US banks have accumulated significant US-dollar-denominated assets and liabilities across jurisdictions, particularly through offshore centres and the European banking system. The panels distinguish positions by reporting, parent, and counterparty country, highlighting how the global dollar system is structured through interconnected balance sheets.

The restricted access of non-US global banks to US deposit funding for international operations implies a structural dependence on wholesale markets to meet their US-dollar funding needs, including the issuance of commercial paper and certificates of deposit, the use of repo markets, and extensive reliance on funding from US money market funds (MMFs) (McGuire & von Peter, 2012). The drying up of these funding sources played a crucial role in the 2007–11 crisis, affecting not only the liquidity of non-US global banks

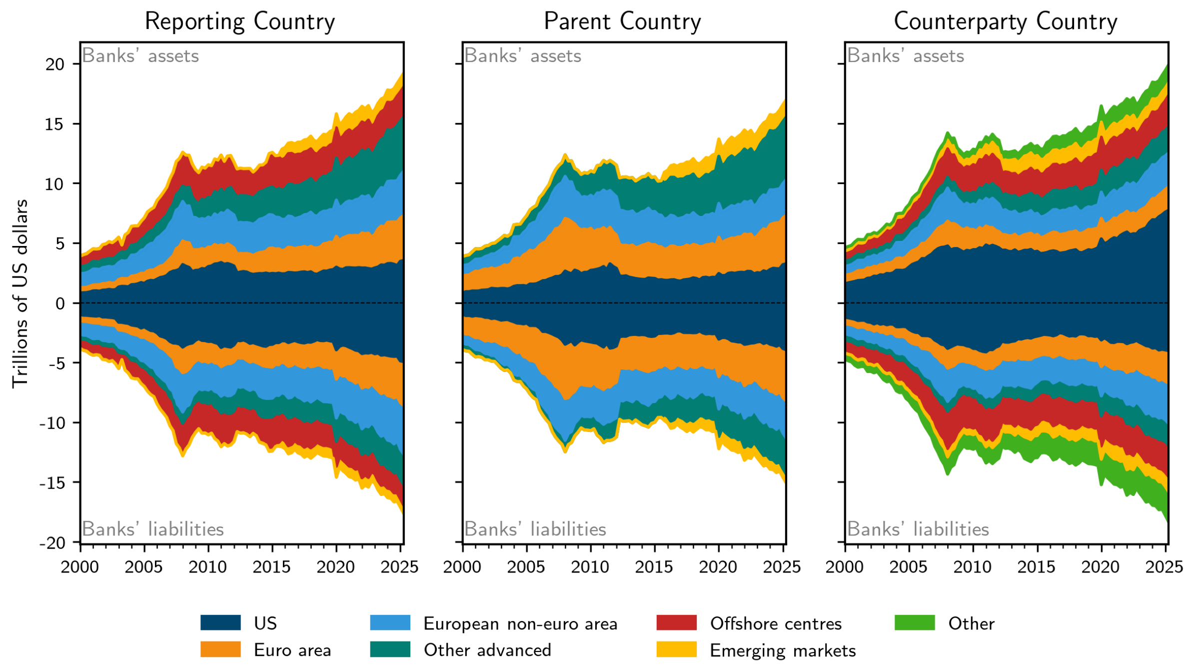

Figure 1.1: Cross-border US dollar positions of reporting banks by residency, nationality and country of counterparty. Source: BIS locational banking statistics. Note: US dollar-denominated assets (positive values) and liabilities (negative values) of banking systems listed in the legend booked in the Reporting Country, of banks headquartered in the Parent Countries, with counterparties in the Counterparty Countries. Country grouping: EU non-euro area: CH, DK, UK, SE, NO, IS; Euro area: AT, BE, CY, DE, ES, FI, FR, GR, IE, IT, LU, NL, PT, MT, SK, SI, EE, LV, LT; Other advanced economies: JP, AU, CA, SG, KR; Offshore centers: BS, HK, JE, KY, PA, TW, BM, GG, CW, IM, AN, MO, BH, MT; Emerging markets: BR, ID, MX, MY, TR, ZA, SA, CL, IN, PH, CN, RU.

but also their lending and solvency (European Systemic Risk Board, 2011). When market conditions deteriorated, maturity mismatches widened, and several non-US banks lost access to US dollar funding, forcing them into the foreign-exchange (FX) swap market and propagating stress across markets (Baba & Packer, 2009). A few years later, during the euro-area sovereign debt crisis, US MMFs sharply cut their exposures to European banks, triggering a contraction in US dollar credit and spillovers to other issuers (Ivashina *et al.*, 2015). US dollar shortages led to large fluctuations in borrowing costs in FX swap markets (Davies & Kent, 2020). Non-US banks transmitted these shocks through their internal capital markets: during the GFC, US branches channelled liquidity to their parent banks, while in 2011 they borrowed from their parents to cope with evaporating US dollar funding, both episodes reducing local lending (Aldasoro *et al.*, 2022a; Cetorelli & Goldberg, 2011, 2012; Correa *et al.*, 2016). The outbreak of the COVID-19 pandemic in early 2020 again tested these structures. As global investors and MMFs pulled back from short-term dollar markets, cross-currency bases widened sharply, and non-US banks came under renewed funding pressure (Eren *et al.*, 2020). These episodes exposed the structural dependence of global US dollar liquidity on short-term wholesale markets and the role of global banks as key transmission nodes.

Since the GFC, regulatory changes have sought to address some of these risks. The newly established Financial Stability Board proposed a series of policies to mitigate risks posed by global systemically important banks (G-SIBs), including capital surcharges and resolution plans. On the US side, MMF reforms in 2016 and evolving banks' risk management practices have reshaped the supply of dollar funding to non-US banks (Anderson *et al.*, 2021; Aldasoro *et al.*, 2021; Rime *et al.*, 2022; Cappiello *et al.*, 2021). Conversely, for US banks, tighter capital and liquidity rules as well as the 2018 tax code revision have curtailed their activity in key wholesale markets, including FX swaps and multinational bond issuance (Brophy *et al.*, 2019; Du *et al.*, 2018; Bonizzi & Kaltenbrunner, 2024). At the same time, in response to successive episodes of global financial stress, the Federal Reserve progressively established and expanded central bank liquidity swap lines to ease market pressures and support the US-dollar funding activities of key non-US global banks. These facilities were first introduced in December 2007, reactivated and extended during the euro-area crisis in 2010–2011, and later converted into standing arrangements with a core group of central banks, while remaining available as temporary emergency facilities for others[1] (Goldberg, 2022; McGuire & von Peter, 2012; Bahaj & Reis, 2022; Davies & Kent, 2020).

Yet structural fragilities persist. Many euro-area banks active in the US dollar markets continue to face structural funding gaps and rely on volatile short-term wholesale borrowing (European Banking Authority, 2025; Klaus & Mingarelli, 2024), leaving them exposed to rollover risk whenever markets tighten. Although activity has shifted away from Europe and into other regions, including emerging markets, this has not reduced systemic vulnerability. At the same time, non-bank financial institutions (NBFIs) have expanded rapidly and now account for a large share of global financial activities (Buch & Goldberg, 2025; Board, 2024). However, their growth remains structurally dependent on global banks. Since 2015, bank lending to NBFIs has grown at double-digit annual rates and now exceeds USD 1 trillion in the United States alone, with exposures heavily concentrated in the largest global banks (Davies & Kent, 2020). In this sense, the rise of NBFIs reflects a reorganisation with longer financial chains rather than a displacement of global banks from the core of the system (Aldasoro & Doerr, 2023; Aldasoro *et al.*, 2020b).

These developments show that global banks remain central to both the creation and the transmission of global liquidity, as well as its instability. Their balance sheet structures, funding choices, and hierarchical positions within the global dollar system are

[1] In 2020, the Fed further complemented this framework by creating the Foreign and International Monetary Authorities (FIMA) Repo Facility, which allows foreign central banks to obtain US-dollar liquidity by temporarily exchanging US Treasury securities for dollars

critical in determining how liquidity is generated and withdrawn. Despite this, theoretical work in economics has paid limited attention to what makes global banks distinct, how their operations relate to the international role of the US dollar, and how differences across banks shape systemic resilience. This motivates the thesis's focus on global banks' balance sheets and institutional configurations that shape their provision of cross-border credit.

1.2 Theoretical background

This section briefly reviews the recent international finance literature on the relationship between financial institutions and global financial conditions, alongside the Post-Keynesian and Minskyan perspectives. More detailed literature reviews are provided in Chapters 2, 3, and 4.

1.2.1 Global shocks, the US dollar, and financial institutions: recent research on international finance

The preceding discussion highlighted the central role of global banks in the international use of the US dollar, the evolution of their balance sheets, and their role in transmitting global shocks. A large body of research in international finance has sought to explain these issues through the lens of global financial integration and the dominance of US monetary and financial conditions. A major development in international finance has been the theoretical and especially empirical focus on co-movements across countries' financial markets, understood as the result of global shocks linked to the hegemonic role of the US dollar and US financial markets in the IMFS (Farhi & Maggiori, 2018; Gopinath & Stein, 2021; Gourinchas *et al.*, 2019). According to Kaminsky (2019), the cross-border financial flow cycles that culminated in the Global Financial Crisis stimulated a new area of research that extended the traditional push–pull framework (Calvo *et al.*, 1996). This literature identifies a global factor—the Global Financial Cycle—that drives co-movements in asset prices, cross-border financial flows, and credit growth across countries (Rey, 2013). Its main drivers are US monetary policy, global risk appetite, and the leverage of global banks. Empirical proxies such as the VIX and, more recently, the broad US-dollar exchange rate index (Forbes & Warnock, 2012; Miranda-Agrippino & Rey, 2022), capture the hegemonic position of the US dollar within the international monetary system (Davies & Kent, 2020; Gourinchas *et al.*, 2019).

This work links the dollar's dominance to a global transmission mechanism in which changes in US monetary policy and investor sentiment affect both sides of financial institutions' balance sheets, altering risk-taking and funding conditions worldwide (Passari

& Rey, 2015). This mechanism is closely related to the notion of global liquidity, defined by the BIS as "the ease of financing in global financial markets... an unobservable property of the financial system" that can only be inferred from a range of indicators (BIS, 2015, p. 20). In this view, global liquidity represents "the availability of funds for purchases of goods or assets from a global perspective" (Eickmeier *et al.*, 2014, p. 1), reflecting both the stance of US monetary policy and the capacity of private financial institutions to generate credit and leverage (Domanski *et al.*, 2011, p. 57).

The role of financial institutions in shaping the global financial cycle and global liquidity has been explored by both the theoretical and empirical literature. On the theoretical side, Rey (2013) formalises how these global financial conditions constrain national monetary autonomy under free capital mobility. In her framework, US monetary policy is transmitted through shifts in risk appetite and the balance sheets of large financial institutions, generating synchronised cycles in credit and cross-border flows even under floating exchange rates. Acalin (2023) extends this reasoning by showing that global banks' leverage both drives the global financial cycle and shapes global imbalances, as cross-border flows arise endogenously from balance-sheet expansion rather than from saving-investment gaps across countries.

Most of these models incorporate imperfections and segmentation in financial markets (Maggiori, 2022). By introducing financial frictions, this literature assigns a crucial role to intermediaries in determining cross-border flows and exchange rates. Gabaix & Maggiori (2015) and Itskhoki & Mukhin (2021) show that limits to arbitrage shape exchange rates, as intermediaries with constrained risk-bearing capacity demand excess returns to absorb international flows. In these models, intermediaries face either credit constraints (Gabaix & Maggiori, 2015) or mean-variance objectives (Itskhoki & Mukhin, 2021). Their capacity to absorb imbalances depends on regulation, incentives, and contractual restrictions such as Value-at-Risk limits (Adrian & Shin, 2014), position ceilings (Amador *et al.*, 2020; Fanelli & Straub, 2020), US interest rates (Ilzetzki & Jin, 2021), and the dollar exchange rate (Hofmann *et al.*, 2022). These constraints create feedback loops between exchange rate volatility and intermediation capacity, explaining deviations from uncovered interest parity (UIP) and covered interest parity (CIP) across currencies (Avdjiev *et al.*, 2019a; Cenedese *et al.*, 2021; Du *et al.*, 2018). Hence, balance sheet dynamics shape expected returns and contribute to the FX disconnect, that is, the weak link between exchange rates and macro fundamentals (Meese & Rogoff, 1983).

While this literature highlights how balance-sheet constraints shape global financial conditions in general, more recent work has focused explicitly on the currency dimension of these constraints, particularly on the US-dollar funding fragilities for non-US global banks. Bacchetta *et al.* (2025a) model how shocks to wholesale dollar borrowing and FX swap markets raise covered interest parity deviations, reduce bank net worth, and increase default probabilities. In their framework, swap lines and local-currency liquidity support can stabilise global banks' funding structures. In related work, Bacchetta *et al.* (2025b) show how offshore dollar funding shocks can appreciate the dollar through imperfect arbitrage in segmented funding markets, illustrating how global banks' balance sheets drive exchange rate movements. Ivashina *et al.* (2015) emphasise that when wholesale US dollar markets tighten, non-US banks contract US dollar lending disproportionately relative to local currency lending, linking CIP deviations directly to the currency composition of global credit. Lee (2024) show that non-US banks obtaining US-dollar funding synthetically via FX swaps with US banks face greater funding stress when US monetary tightening widens CIP deviations. Central bank swap lines can mitigate these spillovers by providing direct access to dollar liquidity. In this line, Bohórquez (2023) develop a model in which maturity mismatches in US dollar positions can lead to self-fulfilling US dollar liquidity crises, and where the Federal Reserve operates as an international lender of last resort through central bank swap lines. Eguren-Martin (2020) reinforce this view, showing how recurrent "dollar shortage" shocks tighten global banks' balance-sheet constraints and contract global lending, while swap lines can mitigate these dynamics and have become a central component of the global financial safety net.

The empirical literature has examined how global banks' leverage amplifies global shocks, particularly those originating in US monetary policy. Bruno & Shin (2015b) show that global banks' leverage drives cross-border bank flows, supported by panel regression evidence. Bruno & Shin (2015a) find that looser US monetary policy leads US broker-dealers to increase leverage, which raises cross-border bank flows and depreciates the US dollar, while Cesa-Bianchi *et al.* (2018) and Cerutti *et al.* (2017) highlight similar effects across countries and the key role of non-US banks' leverage in driving global liquidity. A related strand of research links banks' leverage to asset prices and exchange rates, grounded in intermediary asset pricing and portfolio-balance models (Gabaix & Maggiori, 2015; He *et al.*, 2017; Obstfeld & Zhou, 2023). He *et al.* (2017) and Correa & DeMarco (2025) show that non-US dealers' leverage predicts exchange rate movements, while Adrian & Xie (2020) find that higher leverage raises demand for US-dollar assets and appreciates the dollar. Morelli *et al.* (2022) document that foreign-currency bonds held by distressed global banks suffered larger price contractions during the Lehman Brothers collapse. Together, these empirical studies show that global banks' leverage shapes cross-border flows, asset prices, and exchange rates. However, most of this literature focuses on global banks' balance sheets as transmission channels and amplifiers of global shocks rather than causal sources of shocks to global financial stability.

In sum, the theoretical literature highlights the central role of financial intermediaries in shaping international financial conditions. It has helped to reframe global liquidity as a balance-sheet phenomenon rather than as the simple outcome of countries' current accounts. Yet, except for Kumhof *et al.* (2020), it rarely distinguishes between banks and non-bank institutions. It continues to treat global banks as representative intermediaries rather than as differentiated institutions with distinct funding models, jurisdictions, and constraints. This thesis aims to close these gaps by providing a more consistent theoretical framework for analysing this phenomenon, enabling us to gain deeper insights into the structures and institutional configurations that underpin the US dollar-dominated global financial system. In parallel, the empirical literature shows that global banks are central to the transmission of US monetary and financial conditions, but largely views them as amplifiers rather than as institutions that cause fluctuations in global liquidity. This thesis aims to provide causal evidence that global banks are also sources of shocks to global financial conditions.

1.2.2 Why banks and global money are different: insights from post-Keynesian theory

In contrast, the post-Keynesian literature highlights that, because banks' liabilities are accepted as means of payment and settlement, banks are qualitatively different from other financial institutions (Davidson, 1988; Dow, 1997; Lavoie, 2022; Palley, 1996; Rochon, 1999). In this framework, the money supply is endogenously created through lending, as loans simultaneously generate deposits. Banks are therefore central to productive activity, as they create new purchasing power. As a result, the banking system plays a decisive role in shaping credit conditions (Lavoie, 2022; Bonizzi & Kaltenbrunner, 2020). Building on this view, post-Keynesian authors emphasise that credit conditions emerge from banks' assessments of creditworthiness under uncertainty (Rochon, 2006; Hawkins, 2002; Wolfson, 1996) and from their own preferences regarding balance-sheet structures and profitability (Cardim De Carvalho, 2015; Chick & Dow, 2002; Dafermos, 2012; Dymski, 1992; Godley & Lavoie, 2006a; Le Heron & Mouakil, 2008; Nikolaidi, 2014; Wray, 1992b).

The application of the endogenous money theory to the open economy has focused on the effects of net cross-border financial flows on the stock of domestic money and the ability of the central bank to set interest rates (Angrick, 2018a; Bozhinovska, 2015; Gerioni *et al.*, 2023; Lavoie, 2021). However, these analyses generally treat cross-border flows as exogenous shocks to domestic money creation rather than as the result of banks' own international operations. Only a few authors have applied the endogenous money theory to study not the effects of cross-border flows, but their creation. Among these, Rossi (2007) and Kohler (2022) explore international payments and cross-border flows from an endogenous money perspective. For Kohler (2022), in line with Harvey (2019), cross-border bank credit creation is endogenous and demand-driven, explained by desired trade balances. While this insight links money creation to real activity, it does not address the institutional and currency-specific features of global credit creation, particularly the dominant role of the US dollar, nor how global banks set cross-border credit conditions, and their implications for global liquidity. Tropeano (2025a), with greater attention to the currency dimension, shows that the global dollar system can create assets and liabilities independently of saving or current account positions through banks' balance-sheet operations. However, this analysis does not examine how global banks drive cross-border credit conditions, nor how hierarchical structures shape the setting of those conditions.

In turn, Dow (1999) and, in more detail, Hawkins (2003) highlight the US dollar's role and international banks' liquidity preferences in shaping countries' participation in cross-border transactions. In line with this thesis, Hawkins (2003) connects international banks' balance sheet decisions (and their drivers) with the balance-of-payments constraint, which is a key long-term limitation on growth for some post-Keynesians (Thirlwall, 1979; Vernengo & Pérez Caldentey, 2020). Building on Sheila Dow's work on centre-periphery structures of financial development and banks' behaviour (1988, see also Cerpa Vielma 2022; Cerpa Vielma & Dymski 2022), Hawkins (2003) underscores that international banks' liquidity preferences and currency choices asymmetrically influence countries' external financing conditions. Nevertheless, these authors do not examine in detail the financial structures and financial relationships that shape global banks' behaviour, nor do they empirically explore how these structures affect global financial conditions.

Foreign credit constraints are the foundation of the balance-of-payments constraint, representing a key long-term constraint for post-Keynesians. Thirlwall (1979, p. 45) defines it as the growth of exports relative to import elasticity, limiting countries' capacity to import essential goods once external borrowing possibilities are exhausted (Vernengo & Pérez Caldentey, 2020). "Thirlwall's Law" has since been extended to include cross-border financial flows and debt sustainability explicitly (Bhering *et al.*, 2019; Moreno-Brid, 2003; Setterfield, 2012). Yet, its connection to the balance sheets, risk perceptions, and funding conditions of international financial institutions remains insufficiently explored.

Other post-Keynesian strands, such as the international currency hierarchy literature, have highlighted the role of global financial institutions and the US dollar in determining global financial conditions (Bonizzi & Kaltenbrunner, 2021; De Conti *et al.*, 2013; Macalos, 2021). This literature explains vulnerabilities through currencies' liquidity premia (Bonizzi & Kaltenbrunner, 2021), shaped by internationalisation (Orsi *et al.*, 2025), liquidity preferences (De Conti *et al.*, 2013; Kaltenbrunner, 2015), and global financial institutions' balance sheets (Ramos, 2019). Recent work highlights non-bank institutions (Bonizzi & Kaltenbrunner, 2020). Yet this literature pays limited attention to the financial hierarchies among institutions, and especially banks, that shape global credit conditions.

Although post-Keynesian authors emphasise that "existing monetary systems – including the international dollar system – are based on bank money (or credit money)" (Bibow, 2024, p. 569), the specific role of banks in international finance remains underexplored. As Bouguelli (2025) notes, "post-Keynesians have not paid much attention to the international activity of banks" (p. 2), and only a few contributions have briefly examined how non-US banks create US dollars outside the United States (Lavoie, 1988; Nersisyan & Dantas, 2017; Robinson, 1979).

Related IPE and Critical Macro-Finance (CMF) research has also examined the international monetary hierarchy (Murau *et al.*, 2022). Early work focused on state-issued currencies and their international roles (Cohen, 1971; Helleiner & Kirshner, 2009; Strange, 1971), while later studies analysed how private institutions create and distribute US-dollar liquidity offshore within geopolitically shaped hierarchies (Murau, 2018; Murau *et al.*, 2022, 2020; Murau & van't Klooster, 2023). Yet this literature broadly explored the hierarchy through policy and governance, paying less attention to the actual network structures that constitute the IMFS. In turn, network approaches map cross-border finance as hierarchical creditor–debtor linkages (Oatley *et al.*, 2013; Winecoff, 2015), but often treat these ties as homogeneous, abstracting from the institutional characteristics that sustain them (Haberly & Wójcik, 2022).

In summary, despite extensive post-Keynesian work on endogenous money and monetary hierarchies, as well as the renewed attention in IPE and CMF to offshore dollar creation, little research has analysed how global banks' balance-sheet structures and funding relations underpin the creation of international US-dollar liquidity. This thesis builds on the post-Keynesian insight that money is endogenously created and extends it to the global level, analysing how the liabilities of global banks—particularly those denominated in US dollars—function as global money within a hierarchical international system.

1.2.3 Mr. Minsky and the Minskyans on global finance: a suggested interpretation

This thesis fills these gaps by adopting a Minskyan approach, extending both Hyman Minsky's work, particularly his limited writings on international finance, as well as the work of other Minskyan authors. Within post-Keynesian economics, the Minskyan strand highlights how the interlocking balance-sheet structures of different units and institutional features of monetary and financial systems shape capitalist dynamics.

Minsky viewed the modern capitalist economy as a Keynesian "monetary economy of production", organised through a network of interconnected balance sheets and corresponding cash flows across economic units (Bonizzi & Kaltenbrunner, 2019). This balance sheet perspective implies, as Bonizzi & Kaltenbrunner (2021) argue, that "every asset acquisition decision is always taken in conjunction with a particular liability structure" (p. 48). The assets and liabilities of hierarchically placed financial institutions are mutually constituted, and the 'moneyness' of each liability depends on its position within a tiered structure of settlement (Bonizzi, 2017; Bonizzi & Kaltenbrunner, 2019, 2020). The CMF literature extends Minsky's balance sheet perspective to contemporary financial practices (Dutta *et al.*, 2020). It analyses how the hierarchical and evolving nature of balance sheet linkages underpins the endogenous creation of fragility, driven by the continual search for new ways to monetise credit (Dutta *et al.*, 2020; Gabor, 2020). Yet, as Bonizzi & Kaltenbrunner (2020, p. 81) note, in abstracting from the origins of the endogenous money tradition, CMF sometimes risks overlooking its broader insights into macroeconomic dynamics and the specific role of bank credit.

For Minsky, the balance-sheet network is hierarchical, with each layer corresponding to a different type of institution. In this regard, Minsky (1986d), argues that the distinctions between financial institutions—their liability structures and the extent to which their liabilities are accepted as money—are "more reflective of the legal environment and institutional history than of the economic function" they perform (p. 249)[2]. Nevertheless, he emphasises that "as banking is presently organized, there is one set of banks—the commercial banks—that remain of special importance because of their aggregate size and because their liabilities constitute a large part of the money supply" (p. 250). As a result, "banks whose liabilities are money are unlike money lenders whose financing activities are restricted to the contents of their strongbox" (p. 251). In this way, Minsky emphasises the special role of banks in money creation in our current legal and institutional structures.

This hierarchy of money implies that in an economy, there are "special money instruments for different purposes" (Minsky, 1986d, p. 255). In this way, Gabor (2020) describes the hierarchical relationship between central banks and banks: "central bank liabilities (reserves) – the strongest promises to pay in local currency – have historically been issued to a subset of financial institutions: commercial banks. These in turn issue private settlement money (bank deposits), traditionally second in the hierarchy of monetary liabilities because of the social contract between banks and the state" (Gabor, 2020, p. 49). Going further, Murau & Pforr (2020) indicates that central bank reserves (and notes) also promise payment in the unit of account, which, in the absence of an empirical form, means they promise to pay themselves. Thus, "money is nothing but a balance sheet item

[2]The thesis does not examine the origins of the institutional structure but how global banks operate within it, following Minsky (1989), "[w]e don't endeavour to explain how or where this structure arose: genesis is not our problem. The evolution of the structure of financial interrelation and the interactions among units in an economy with a complex financial structure is our concern" (p. 63).

issued as the liability of a (hierarchically higher) institution, which functions as an asset for another (hierarchically lower) institution" (Murau & Pforr, 2020, p. 56).

This creates a hierarchy of institutions and forms of money: non-bank money consists of bank liabilities, while banks' money consists of central bank liabilities. Net settlement at each level requires money from a higher level or credit from that level to defer settlement. While this hierarchy of money is present in the post-Keynesian and CMF literature, the hierarchies among different banks have received less attention. For Minsky, institutional and market developments also shape hierarchies between different banks. Exploring the US domestic system, Minsky (1994) describes how the National Banking Act defined a geographical and functional hierarchical network of correspondent banks that persisted even after the Act was no longer in place. In turn, these "(h)ierarchical banking relations can be a source of weakness for the financial system", since they create spillover effects during financial instability (Minsky, 1975, p. 11). This perspective on layered relations provides the foundation for understanding financial hierarchies among banks, and, as developed in this chapter, among global banks.

In Minsky's view, the structure of financial institutions is not neutral for the real economy. As he argues in Minsky (1989), "the significance of the financial structure—i.e., the impact of the particular set of financial institutions and financial relations that exist upon the behaviour of the economy" is central to understanding macroeconomic developments (p. 49). "(U)nderstanding the behaviour and evolution of financial practices and structures" is essential, since "precise propositions about the behaviour of the economy are conditional upon institutions and usages, particularly the monetary institutions" (ibid.). In this context, "the portfolio preferences of banking and financial institutions determine capitalization rates for different types of capital assets and financing terms for various types of investments" (Minsky, 1986d, p. 255).

Minskyan authors have mainly focused on extending and applying the Financial Instability Hypothesis in both theoretical (many of them formal) and empirical models, primarily in the corporate and, more recently, the household sectors, with less attention to institution-driven financial cycles. Many of these models examine the evolution of corporate leverage and asset prices (Nikolaidi & Stockhammer, 2017), while the institutional dynamics of banks and other financial intermediaries often remain in the background. The few exceptions in which banks play a major role focus on the endogenous propagation of financial cycles (Dymski, 1992; Nikolaidi, 2014; Ryoo, 2013). Yet, in line with Minsky's original emphasis on the institutional structure of finance, it is equally important to examine how financial institutions can generate exogenous shocks to economic activity—an aspect crucial for understanding their role in financial stability and for providing causal evidence of their macroeconomic effects. This thesis contributes to this objective.

Alongside these contributions, authors have also extended the Minskyan approach to the open economy. A first generation focused on cross-border financial flows (Arestis & Glickman, 2002; Frenkel & Rapetti, 2009; Kregel, 1998a). These authors emphasised financial liberalisation as the source of the boom in financial inflows, which generated a boom in asset prices and built up the financial fragility that triggered the crisis. As Bonizzi & Kaltenbrunner (2021) point out, this strand focuses on domestic economic policy as the source of cyclical external crises rather than global factors. Similarly, Kohler (2021) reviews post-Keynesian models of external financial cycles and shows that none explicitly model a global financial cycle. After the GFC, Minskyan authors shifted their attention from endogenous external debt dynamics to the gross cross-border flows driven by the portfolio choices of international financial institutions (Bonizzi & Kaltenbrunner, 2019, 2024; De Conti *et al.*, 2013; Kaltenbrunner & Painceira, 2015; Ramos, 2019). In this literature, the expectations and preferences of global investors interact with speculative exchange rate expectations and growing financial exposures, creating global liquidity cycles driven by global factors rather than the dynamics of borrower economies. These authors present an alternative perspective on currency hierarchy and the international liquidity premium of currencies, highlighting the importance of financial structures and interlocking balance sheets, rather than the properties of currencies as an international asset class. Using Minsky's (1976) understanding of an asset's liquidity as determined by a debtor's ability to meet outstanding obligations with that asset, they argue that the international liquidity of a currency is explained by the ability to convert it into the currency in which external obligations are settled (Kaltenbrunner, 2015; Löscher & Kaltenbrunner, 2022). In turn, the already mentioned CMF and related IPE literature place greater emphasis on the (geo)political forces that shape the hierarchies of offshore US dollar creation (Binder, 2024; Murau, 2018; Murau *et al.*, 2022, 2020; Murau & van't Klooster, 2023).

Surprisingly, this literature rarely references Minsky's own views on the IMFS. While Minsky's writings on international finance are limited—mainly addressing balance-of-payments taxonomies and the sustainability of the US external balance—several overlooked works contain rich descriptions of the IMFS that anticipate many of the conceptual contributions later developed by Minskyan authors and BIS economists (Shin, 2017; Avdjiev *et al.*, 2016).

Minsky recognised the international role of the US dollar and of global banks, applying his balance-sheet network perspective to the IMFS. First, he notes that "a reserve currency or an international money is necessary for the effective functioning of today's complex international trading, investing, and financing economy. Furthermore, the dollar is the reserve currency and it is assumed that there is no real alternative to using the dollar as the reserve currency in the visible future" (Minsky, 1978, p. 2). In turn, these “international dollars are created by the banking process” (Minsky, 1979, p. 17).

Applying his hierarchical network perspective to global finance, he indicated that the international role of the US dollar and its implications for the United States arise from a collective web of financial relationships: “the dollar, as the preeminent reserve currency, is the unit of denomination of a vast array of international financial contracts. These contracts determine a matrix of commitments to pay dollars that involves a multitude of central banks, governments, business organizations, and persons. This in effect makes the United States the banker for the world economy” (Minsky, 1978, p. 3). Similarly, Minsky (1986a) also observed that “(t)here is a vast international network of dollar-denominated debt which leads to large cash flows to United States entities and to the non-U.S. banks and nationals that own dollar-denominated assets. This structure makes the United States analogous to a bank and the rest of the world analogous to depositors and borrowers” (p. 7). In this way, unlike most post-Keynesian literature, Minsky goes beyond the “triple coincidence” view, which assumes that the decision-making, monetary, and economic areas are one and the same (Avdjiev *et al.*, 2016). This thesis follows Minsky by focusing on globally active banks issuing US-dollar-denominated liabilities across jurisdictions, used for cross-border payments and settlement.

Minsky (1986c) noted that in this international network, non-US banks can also issue US-dollar deposits. Connecting financial relationships, the US dollars and non-US banks, he indicates that “international financial linkages largely, but not exclusively, take the form of dollar-denominated indebtedness. This is so even if the loans are on the books of non-United States financial institutions and if the borrowers from, lenders to, or depositors in the institutions are not United States entities” (Minsky, 1986a, p. 7). However, for him, these institutions remained in a lower hierarchical position than US banks: “(t)o a depositor in such an offshore bank the dollars on deposit in, say, a ‘German’-based bank is as much a dollar as any deposit in a New York office of a U.S. chartered bank. Thus the German chartered bank must earn dollar income and hold dollar assets. In particular, it must hold assets [or new funding] that give it a quick command of dollars in New York” (p. 8. Added parenthesis). As later described by Aldasoro *et al.* (2024), the offshore US dollar system is organised around the continuous settlement of interbank liabilities linking onshore and offshore banks. When funding pressures emerge, differences between offshore and onshore rates are absorbed through additional interbank borrowing and credit, with FX swaps functioning as the main instrument for managing these funding mismatches. In line with BIS research, Minsky viewed US-dollar shortages not only as a country problem (Despres *et al.*, 1966; Kindleberger, 1966), but as a specific type of funding risk faced by non-US banks (McGuire & von Peter, 2012). This thesis extends these insights by presenting a hierarchical structure of international settlement across global banks.

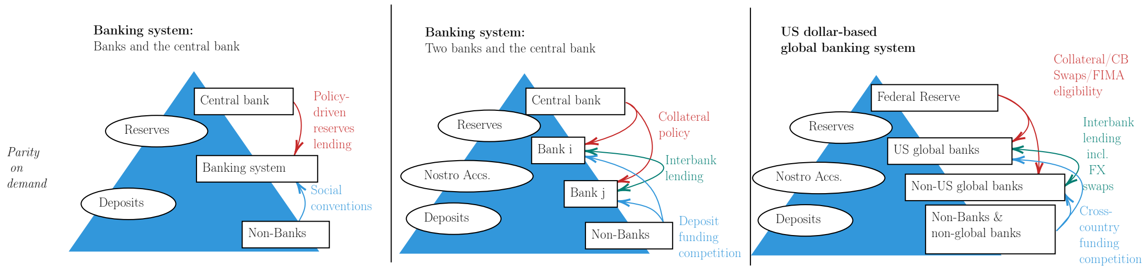

Figure 1.2: Hierarchy of money with multiple banks. Source: own elaboration.

Figure 1.2 illustrates this perspective by extending the hierarchy of money framework to multiple layers of banking. The first panel illustrates the traditional domestic hierarchy, in which banks are special because social conventions and state backing make their liabilities widely accepted as money. Central bank reserves serve as banks' money. In contrast, bank deposits serve as money for non-banks, forming two interconnected funding relationships: non-banks hold deposits, and banks obtain reserves from the central bank through credit. The second panel introduces multiple banks within this hierarchy, emphasising that banking systems are themselves stratified. Minsky (1975, 1994) highlight that banks compete for deposit funding, lend to each other, and rely on central bank credit when interbank funding becomes costly or unavailable. However, access to central bank lending is itself hierarchical: only some banks hold eligible collateral or satisfy regulatory and institutional conditions to borrow directly from the central bank, while others must rely on interbank markets or more expensive funding sources. Through correspondent relationships, the liabilities of some banks—recorded as nostro accounts by others—function as money within the interbank system, extending the hierarchy horizontally as well as vertically. The third panel generalises this framework to the US dollar-based global banking system. It shows how both US and non-US global banks are embedded in a multi-tiered structure in which access to US dollar funding depends on institutional position. Such access varies according to each global bank's characteristics and jurisdictional links: some have direct access to the Federal Reserve, others rely indirectly through central bank swap lines, while many depend on credit from US banks—including via FX swaps—or on offshore funding. This configuration illustrates the hierarchical organisation of global banking and anticipates the analysis developed later in this section and in Chapter 4.

These fragilities reveal a structural need for global money, captured by Minsky's "survival constraint", where both banks and countries must maintain positive cash-flow positions to meet payment obligations. At the international level, the balance of payments operates as this survival constraint, requiring continual settlement in global money (Mehrling, 2022, 2023). The importance of access to US dollars through balance-of-payments flows was repeatedly highlighted by Minsky, who explicitly linked this to both the external-debt dynamics emphasised by the first generation of open-economy Minskyan models (Arestis & Glickman, 2002; Frenkel & Rapetti, 2009; Kregel, 1998a), and the expectations and assessments of international investors stressed by the second generation (Bonizzi & Kaltenbrunner, 2019, 2024; De Conti *et al.*, 2013; Kaltenbrunner & Painceira, 2015; Ramos, 2019). He argued that international credit relations ultimately depend on expectations of future dollar earnings: "International investments and loans depend upon the perceived prospects of payments, which means that they reflect expectations of future dollar earnings. The ability to borrow dollars depends upon the belief that the dollars will be repaid; i.e., the borrower will earn dollars." (Minsky, 1984, p. 21).

Minsky further developed this reasoning into a balance-sheet view of international indebtedness, highlighting that all external liabilities must be validated by cash flows in foreign currency: "Every liability (. . .) must be supported by cash flows (. . .) The same requirement that cash flows support asset values holds for international indebtedness, the only difference being that the supporting cash flows may be derived from income denominated in one currency while the payments are denominated in another. The peso-denominated income of a Mexican entity may need to be exchanged into dollars for a commitment to be validated. The terms upon which dollars are available for pesos then determines whether commitments can be fulfilled. The availability of foreign currency depends upon the balance of payments of the country and the character of national assets that can be sold or pledged to foreigners." (Minsky, 1986c, p. 5).

In this sense, Minsky repeatedly emphasised that expectations about a country's external position underpin the extension of international credit: "For international financing, current lending reflects expectations of favourable balance-of-payments conditions for the borrowing country." (Minsky, 1986a, p. 11). Creditworthiness, therefore, depends not only on domestic income generation but also on the ability to convert local-currency earnings into dollars: "(I)n terms of validating external debts denominated in dollars it is not enough for debtor units to have a large cash flow in the domestic currency; they must also be able to transform the domestic-currency cash flow into dollars" (Minsky, 1986a, p. 13). As he further explained, "(t)he cash flow commitments by such debtors to banks can be fulfilled only if their 'profits' and 'taxes' in the local currency can be transformed into dollars at favourable terms (. . .) These units need to earn a sufficient income in their domestic currency and they need to be able to exchange these profits for dollars at an exchange rate that is consistent with the profitability of their business." (Minsky, 1984, p. 20, 22).

Accordingly, Minsky concluded that international lending depends on the expected capacity of deficit countries to generate foreign exchange surpluses over time: "If bankers are financing balance-of-payments deficits they must be concerned about the ability of the deficit countries to generate a sufficiently favourable merchandise balance to at least service the growing outstanding debts." (Minsky, 1979, p. 22). Similarly, "(A) debtor ... has to be in 'surplus', if not now then expected over some relevant horizon, for payment commitments on debt are to be fulfilled (...) Ultimately, the availability of dollars to validate debt depends upon the balance of trade (...) not necessarily now but expected over a reasonable future is the basis of a debtor country's viability." (Minsky, 1986a, p. 13).

Finally, usually associated with Kindleberger (1984), Minsky also highlighted the importance of an international lender of last resort, but focusing again on the role of non-US banks as part of the global US-dollar system. For him, the growth of offshore US-dollar banking placed large portions of dollar-denominated activity beyond the reach of regulatory oversight, raising unresolved questions about who acts as lender of last resort in times of stress (Minsky, 1979, 1986c): "access to the Federal Reserve is restricted to member banks or U.S.-chartered banks. (...) Dollars to meet withdrawals will be available either from a bank's own resources (securities that are marketable for dollars in New York are part of every international bank's position) or from the home Central Bank. A Central Bank's ability to provide dollars depends upon its dollar balances and arrangements with the Federal Reserve for swaps of its domestic currency for dollars. The Federal Reserve exercises its responsibilities for resolving any international rollover or flight problem by keeping orderly conditions in the United States money market and by providing dollars to domestic banks and to foreign central banks by way of discount, swap or similar arrangements" (Minsky, 1986a, pp. 8-9).

1.3 Thesis objectives, Research Questions, Hypotheses, and Methodology

The objective of this thesis is to explain how global banks shape the structure and dynamics of the international monetary and financial system through the creation, distribution, and settlement of US dollar liabilities. It conceptualises this system as a hierarchical network of interlocking balance sheets in which a small group of globally active banks issue liabilities that function as the main cross-border means of payment—global money. By analysing both the mechanisms of global money creation and the institutional arrangements that sustain its circulation and settlement, the thesis identifies how global banks' expectations, desired balance-sheet structures, and funding networks shape and reproduce the hierarchical and cyclical features of the US dollar–based international monetary and financial system. Overall, the thesis shows how global banks act as issuers of global money, sources of systemic shocks, and nodes in hierarchical settlement networks, arguing that financial asymmetries cannot be understood through national policies or macroeconomic fundamentals alone but through the ways global banks issue, price, and settle US dollar liabilities.

The thesis addresses the following research questions:

RQ1 How do global banks drive cross-country US dollar credit conditions, and what are the implications for countries' balance of payments?

RQ2 Do exogenous shocks to global banks' balance sheets act as independent drivers of global liquidity, beyond common global factors such as US monetary policy?

RQ3 How is the hierarchy of global banking structured, and what institutional and network characteristics explain the uneven funding risks global banks face?

From these questions, three hypotheses are formulated:

H1 The dynamics of the balance of payments can be understood through the flows of US dollars created by global banks, and fluctuations in their balance sheet preferences and creditworthiness assessments create external pressures for countries' balance of payments.

H2 Higher global banks' leverage causally affects global liquidity conditions, leading to exchange rate appreciations, increases in cross-border inflows, and temporary reductions in sovereign spreads across different countries.

H3 The global banking system is hierarchical: while both US and non-US global banks issue US dollar liabilities, the credit relationships of each bank in funding networks and access to US infrastructures determine their funding fragilities and position in the hierarchical network.

The central hypothesis is that fluctuations in global banks' assessments and balance-sheet preferences—particularly their desired leverage—affect the cross-border pricing and allocation of US dollar credit. These fluctuations act as exogenous sources of pressure on the balance of payments of different countries, mediated by institutional features such as network centrality, regulatory access, and liquidity backstops.

To test these hypotheses, this thesis develops a framework for analysing hierarchical settlement systems using balance sheet linkages, which it then investigates from multiple angles using different methods. Empirically, it estimates the causal effects of global banks' leverage shocks on global liquidity and maps the network structure of US dollar funding in global banking.

The methodology integrates theory, empirics, and institutional analysis. In Chapter 2, a theoretical framework extends Post-Keynesian endogenous money theory to the global level, formalising how banks' balance sheets and expectations determine cross-country credit conditions. In Chapter 3, an econometric strategy combines a granular instrumental variables approach and instrumented principal component analysis in a novel way to isolate granular shocks to banks' leverage, which are used as instruments in panel local projections of global liquidity indicators.

In Chapter 4, an institutional and network approach maps the structure of the US dollar-based global banking system using bilateral data and network visualisations.

By combining these approaches, the thesis develops an integrated framework to understand how global banks create, transmit, and mediate the cyclical and hierarchical features of the international monetary and financial system.

1.4 Thesis structure and contributions

This thesis is organised into three chapters, in addition to this introduction and a concluding chapter. As a cumulative thesis, each chapter is a standalone paper that makes an independent contribution to the literature, collectively advancing the theoretical and empirical understanding of global finance.

Chapter 2 develops a framework to understand how global banks drive US dollar credit conditions and global liquidity. It advances a Minskyan theory of the creation of global money, understood as the internationally accepted instrument for cross-border payments. It argues that a small group of large financial institutions whose US dollar liabilities are internationally accepted—global banks—endogenously create this money through their credit operations. By setting the credit conditions for the creation of such liabilities, these banks—located mainly in developed countries—shape countries' costs and ability to engage in cross-border transactions. These conditions depend on two factors: banks' general pricing decisions, determined by their desired balance sheet structures shaped by their liquidity and risk preferences; and their assessments of borrowers' creditworthiness, based on expectations of future access to US dollars. Fluctuations in these factors generate external pressures on countries' balance of payments worldwide[3]. This highlights the systemic role of global banks: by setting the credit conditions for access to US dollars, they not only determine global liquidity dynamics but also reflect and reproduce the hierarchical structure of the international monetary system. In this way, the chapter contributes to different strands of post-Keynesian literature by explicitly linking balance-of-payments constraints to the balance sheets and expectations of international financial institutions that endogenously create global money, thereby shaping the hierarchical position of borrower countries in the IMFS.

[3]The macroeconomic implications of global banks' cross-border flows do not end there. Global banks can affect domestic financial conditions through other channels not explored in this thesis (Gabor, 2015).

Empirically, Chapter 3 contributes to the literature on the global financial cycle, and, in particular, to the research on the impact of global banks' leverage on cross-border bank flows, exchange rates, and asset prices. It provides empirical evidence that shifts in global banks' leverage act as independent sources of global liquidity shocks. In line with the theoretical framework, this chapter focuses on 34 Global Systemically Important Banks, which account for the lion's share of all cross-jurisdictional bank liabilities. Using a Granular Instrumental Variables (GIV) approach that exploits the concentration among these institutions, it constructs an instrument from the size-weighted sum of idiosyncratic leverage shocks. These shocks are isolated via Instrumented Principal Component Analysis (IPCA), which accounts for heterogeneous and time-varying exposures to global factors. Panel local projections for 74 advanced and emerging economies show that positive leverage shocks ease global liquidity by appreciating exchange rates, boosting cross-border inflows, and reducing sovereign dollar spreads. This shows that global banks are not only transmission channels of other global factors, such as shifts in US monetary policy or credit demand, but also independent sources of systemic shocks: changes in their expectations and desired balance sheet structures can alter global liquidity conditions and drive the global financial cycle.

Chapter 4 extends this theoretical framework by examining the hierarchical funding fragilities in global banking. While Chapter 2 explores how a small group of financial institutions determines the US dollar credit conditions that shape countries' ability to participate in cross-border transactions beyond their existing holdings of US dollars, Chapter 4 starts from the premise that countries already hold these US dollar liabilities and use them to make international payments, which global banks must then settle. Building on this starting point, the chapter develops a balance-sheet framework of layered international settlements to show how the structure of funding relationships determines banks' hierarchical positions and funding risks, thereby revealing systemic vulnerabilities that affect global liquidity worldwide. It extends the Minskyan perspective—which highlights that monetary systems are organised in tiers of liabilities requiring settlement at higher levels—by introducing a network approach. This approach shows how the density and interconnectedness of global banks' funding relationships determine their ability to settle liabilities and, consequently, their position in the global funding and financial hierarchy. At the lowest level of the settlement hierarchy, a global bank with a larger client network can settle payments internally on its own balance sheet; if net withdrawals occur, interbank credit among global banks enables deferred settlement at the next level; and at the highest level, direct or indirect access to the Federal Reserve's emergency lending allows for final settlement. Empirically, Chapter 4 complements this analysis with network visualisations of cross-border funding relationships and institutional analysis of infrastructures, business models, and regulation, revealing a highly asymmetric global funding network. US banks benefit from integrated onshore–offshore positions and central roles in infrastructures, while the international operations of a few non-US banks rely on branches' wholesale funding, FX swaps from US banks, and offshore liabilities. This shows that global banking hierarchies are shaped by patterns of daily operations, financial ties, and institutional arrangements developed over time, rather than by size or policy alone.

Chapter 5 concludes. It summarises the main theoretical and empirical findings, outlines their implications for the understanding of global liquidity and financial stability, and identifies directions for future research.

2

Global money and the balance of payments: How do global banks drive cross-country US dollar credit conditions?

2.1 Introduction

The US dollar is the most widely used cross-border means of payment. Cross-border US dollars largely take the form of deposit liabilities issued by a small group of globally active financial institutions. Countries require access to these US dollar deposits to pay for most balance of payments-related transactions, and restricted access can affect their growth and development possibilities (Vernengo & Pérez Caldentey, 2020). However, theoretical frameworks explaining how US dollar credit is created and distributed across borders remain incomplete. What are the relevant drivers of credit conditions for these transactions? Are certain institutions particularly relevant? What shapes the differential credit conditions between borrowers from different countries?

The centrality of the US dollar in the International Monetary System (IMS) and the role of financial institutions in cross-border financing have gained attention in recent literature (Maggiori, 2022; Miranda-Agrippino & Rey, 2022; Obstfeld & Zhou, 2023). Nonetheless, most of this work treats financial institutions as generic intermediaries, without distinguishing between banks and non-bank financial institutions. A few exceptions consider how banks create cross-border payment instruments (Borio & Disyatat, 2015), but do not explore the IMS asymmetries—where most transactions occur in one currency, and access is unequal across countries.

Post-Keynesians and other critical scholars have long emphasised the role of banks in creating money and purchasing power endogenously through credit (Dow, 1997; Lavoie, 2022; Mehrling, 2012; Minsky, 1986d; Sissoko, 2024). In this view, while central banks set the base rate and credit flows depend on borrower initiative, banks still shape lending spreads and credit restrictions (Wolfson, 1996)[1]. Nevertheless, so far, most open economy applications have focused on the effects of net cross-border flows on the stock of domestic money, and the ability of the central bank to set interest rates (Angrick, 2018a; Bozhinovska, 2015; Gerioni *et al.*, 2023; Lavoie, 2021). Only a few authors have presented applications of the endogenous money theory to study, not the effects of cross-border flows, but their creation. Among these, Rossi (2007) and Kohler (2022) explore international payments and cross-border flows from an endogenous money perspective. For Kohler (2022), in line with Harvey (2019), cross-border bank credit creation is endogenous and demand-driven, explained by desired trade balances and, for Kohler, also by the demand for external credit when relatively cheaper than domestic funding. Dow (1999) and, in more detail, Hawkins (2003) highlight the US dollar's role and the liquidity preference of international banks in shaping countries' participation in cross-border transactions[2]. Moreover, as Bouguelli (2025, p. 2) indicates, "post-Keynesians have not paid much attention to the international activity of banks".

Building upon this literature, this chapter explores theoretically how the worldwide accepted instrument for cross-border payments —global money— is created through the credit operations of globally active banks, and how these institutions determine the relevant credit conditions for cross-border real and financial transactions[3]. For this, it follows a Minskyan perspective, which understands the countries' balance of payments as a matter of global money inflows and outflows. In turn, these "international dollars are created by the banking process" (Minsky, 1979, p. 17), by both US and non-US international banks (Minsky, 1986a). By situating the balance sheet, expectations, and preferences of the global money issuers—global banks—at the analytical core, this chapter studies their role in shaping the US dollar credit conditions, which ultimately influence the countries' costs and ability to participate in cross-border transactions. Particularly, it explores how global banks determine these conditions based on two main factors[4]. First, their general

[1]These also include the size and maturity of the loan, requested collateral, guarantees, covenants, etc.

[2]Other post-Keynesian strands, such as the international currency hierarchy literature, have highlighted the role of global financial institutions and the US dollar in determining global financial conditions (Bonizzi & Kaltenbrunner, 2021; De Conti *et al.*, 2013; Macalos, 2021). However, the special role of banks in the creation of monies with different positions in the hierarchy is underexplored in this literature (Deos & Gerioni, 2022).

[3]In line with Keynes (1914, p. 49), here we consider that "there are two separate problems, namely, due provision for the internal currency and due provision for external payments, of which the second is in general the crucial one".

[4]Rochon (2006, p. 177) indicates that "a post-Keynesian theory of bank lending must focus simultaneously on the creditworthiness of borrowers, that is the 'financial profile' of borrowers (. . .), as well as the behavior of banks, who are responsible for defining and redefining the conventions used to establish the

pricing decisions, which depend on their desired balance sheet structures. Second, their assessments of the borrowers' creditworthiness, which are based on their expectations regarding borrowers' future access to US dollars. Fluctuations of these factors can act as exogenous sources of pressure for the balance of payments of countries across the world.

For simplicity, this chapter assumes global banks lend directly to diverse end-borrowers worldwide. Explicitly considering longer financial chains through other financial institutions does not alter the core implications. As the ultimate issuers of cross-border means of payment, global banks remain central to US dollar credit conditions, shaping both borrowing costs and investment returns for other financial institutions. Furthermore, even if other cross-border investors conduct the creditworthiness assessments of final borrowers, these assessments still fundamentally depend on a country's ability to access the global money issued by these global banks.

The rest of the chapter is structured as follows. Section 2.2 examines the role of banks in driving credit conditions from an endogenous money perspective. Section 2.3 expands this framework to a global level, analysing how global banks drive US dollar credit conditions when they try to shape their balance sheet structures and through their countries' creditworthiness assessments. Finally, Section 2.4 concludes.

2.2 An endogenous money perspective on bank-driven credit conditions

This section examines the role of banks in driving credit conditions from an endogenous money perspective, focusing on two key aspects. First, banks change their credit conditions when they try to shape their balance sheet structures. Second, banks assess the creditworthiness of each borrower according to their current credit standards, setting borrower-specific credit conditions. Therefore, variations in both the banks' balance sheets and their creditworthiness assessments can create fluctuations in credit conditions, both across and within borrowers.

2.2.1 Banks' balance sheet structures and interest rate spreads

Even when the creation of money through banks' credit is driven by the creditworthy demand and initiative of borrowers, the banks' considerations about their desired balance sheet structures and profitability remain pivotal in determining credit conditions in post-Keynesian models (Chick & Dow, 2002; Dymski, 1992; Godley & Lavoie, 2006a; Le Heron & Mouakil, 2008). In most of these models, banks accommodate the creditworthy demand

creditworthiness of would-be borrowers".

and portfolio choice of other sectors, being mainly price-makers (Sawyer, 2017). However, banks still try to shape their balance sheet structures, usually through two different channels: by increasing credit restrictions, modelled as a share of rejected notional credit demand (Dafermos, 2012; Nikolaidi, 2014), or through changes in their interest rate spreads (Godley & Lavoie, 2006a,b)[5]. Following the second option, it is possible to express the banks' price setting as a function of their targeted balance sheet structure and profitability (Dvoskin & Feldman, 2021)[6]. In line with post-Keynesian authors (Godley & Lavoie, 2006a; Minsky, 1986d; Wray, 1992b), this chapter focuses on two key ratios: a leverage ratio and a liquidity ratio, which have both been associated with risk and liquidity preferences (Hawkins, 2003).

Equation 2.1 presents this pricing equation, where banks set their rates to target a Return on Equity equal to a targeted excess profitability r^T over the base rate i_{cb}[7]. For this, they set their funding rates on liabilities L (time deposits and other) as the base rate minus a mark-down μ, and their lending rate on assets A as the base rate plus a mark-up $\sigma_{b,t}$:

$$r^T + i_{cb} = \frac{A\,(i_{cb}+\sigma_{b,t}) - L\,(i_{cb} - \mu)}{E} \tag{2.1}$$

We assume that banks set the mark-down μ to influence their clients' portfolio choice and shape their liquidity ratio (liquid assets over liquid liabilities)[8], $\phi_{b,t} = A^{liq}_{b,t}/L^{liq}_{b,t}$. In this way, if banks aim to increase this liquidity ratio (in line with the targeted ratio, $\phi^T_{b,t}$), they will reduce the mark-down and increase their funding rates: $\partial\mu/\partial\phi < 0$. Finally, defining the leverage ratio as $\lambda_{b,t} = A_{b,t}/E_{b,t}$, and using the accounting identity $A_{b,t} = L_{b,t} + E_{b,t}$, it is possible to express the general mark-up as a function of the targeted profitability and the balance sheet structure[9]:

$$\sigma_{b,t} = \frac{r^T_{b,t} - (\lambda_{b,t} - 1) * \mu_{b,t}\,(\phi)}{\lambda_{b,t}} \tag{2.2}$$

Desired balance sheets also change over time because of many factors, including

[5] In the models of Godley & Lavoie (2006b), interest rate spreads change slowly with the gap between the endogenous observed balance sheet ratios, and the exogenous targeted ratios.

[6] A similar pricing equation, but with optimizing banks, can be found in Abadi *et al.* (2023).

[7] "In a world with explicit bank owners and compulsory capital adequacy ratios, banks need to make a definite amount of profits. They first need to cover the dividend payments, which their household shareholders view as desirable; secondly, they need to augment their own funds in line with the BIS rules on capital adequacy ratios" (Godley & Lavoie, 2006b, p. 9).

[8] "When banks have an insufficient amount of bills relative to their liquidity preference, they increase the interest rates on deposits, and so induce households to trade their Treasury bills for bank deposits (mostly time deposits)" (Godley & Lavoie, 2006b, p. 5).

[9] Operational costs and competition will affect this mark-up (Seccareccia, 1996).

changes in the banks' liquidity and risk preferences (Cerpa Vielma, 2022; Rochon, 1999)[10]. These, in turn, are tied to their subjective expectations and confidence regarding different types of risks related to their asset and liability positions (Dow & Dow, 1989; Lavoie, 1996b)[11]. Although conceptually distinct, for the sake of parsimony, we summarise these behavioural factors in a composite parameter $\theta_{b,t}$, representing the banks' desired margin of safety (Nikolaidi, 2014). Therefore, we assume that a higher $\theta_{b,t}$ is associated with a lower λ and a higher $\phi_{b,t}$ ($\lambda^T_{b,t} = \lambda^T(\overset{-}{\theta_{b,t}}), \phi^T_{b,t} = \phi^T(\overset{+}{\theta_{b,t}})$). In this way, Equation 2.2 highlights how changes in banks' desired balance sheet structures and profitability can create bank-driven shocks to credit conditions. An increase in the desired profitability, a decrease in the desired leverage, an increase in the desired liquidity ratio, or an increase in their liquidity preference and/or risk aversion, driving the last two, will imply a higher spread[12]:

$$\frac{\partial \sigma_{b,t}}{\partial \lambda_{b,t}} < 0, \quad \frac{\partial \sigma_{b,t}}{\partial \; r^T_{b,t}} > 0, \quad \frac{\partial \sigma_{b,t}}{\partial \phi_{b,t}} > 0, \quad \frac{\partial \sigma_{b,t}}{\partial \theta_{b,t}} > 0$$

Further details of these derivations, as well as those appearing later in the chapter, are provided in Appendix A. In a more complex model, both the observed and the desired balance sheet structure of banks could be endogenised, in line with the approach of Nikolaidi (2014) and Dafermos (2018). Moreover, there is a myriad of other possible actions that banks can take to shape their desired balance sheets, such as reducing their dividend or buybacks, issuing new equities (Lavoie, 2019)[13], as well as reducing their position in tradable assets and wholesale funding[14]. However, this simple framework highlights the intrinsic connection between banks' desired balance sheet structures and the credit conditions they set.

2.2.2 Creditworthiness assessment and borrower-specific credit conditions

The second major source of bank-driven credit fluctuations is changes in global banks' assessments of borrowers' creditworthiness. Based on these assessments, banks determine the terms of credit. It is important to distinguish between credit conditions and credit

[10] They can change with regulation (Tymoigne, 2010).

[11] Banks' liquidity preference can change both "endogenously" with the macro environment and general expectations across banks or "exogenously" due to individual bankers' subjective considerations, animal spirits and disposition towards uncertainty (Dequech, 1999; Dow & Dow, 2011; Rochon, 2006).

[12] Differently from many post-Keynesian models, where the deterioration of firms' ratios deteriorates financial conditions, here the focus is on changes in the banks' desired ratios.

[13] However, these operations might not fulfil the objective in the short run or during turmoil periods. As Borio & Zhu (2012) indicate, banks show reluctance to issue new equity or cut dividends during financial turmoil, because it is perceived as a sign of weakness.

[14] Indirectly, selling assets can affect financial conditions through asset prices, and with them, the available collateral of some borrowers, reducing their creditworthiness (Ramskogler, 2011).

standards/criteria. Creditworthiness criteria refer to the bank's internal guidelines for new loans and refinancing approvals, set prior to negotiations—e.g., preferred sectors, regions, collateral, or financial performance. In contrast, credit conditions are the agreed terms applied to a specific loan, negotiated between the bank and the borrower (Burlon *et al.*, 2019).

Given the creditworthiness criteria, it is in the assessment process that borrower-specific credit conditions are shaped. These depend on banks' current knowledge and expectations about both idiosyncratic risks—linked to borrower characteristics—and common risks—related to the macroeconomic environment—under uncertainty (Hawkins, 2002, 2003; Rochon, 2006). Bankers must judge repayment likelihood amid uncertainty, guided by conventions with varying confidence levels (Wolfson, 1996). [15]. To do so, they apply techniques and heuristics to classify borrowers into risk categories (Lavoie, 2022). Based on these ratings and internal criteria, they then set credit conditions—or deny the loan altogether.

Wolfson (1996) develops a simple model showing how credit assessment shapes borrower-specific credit conditions, focusing on two key measures: interest rate spreads and credit restrictions. Considering separately the general and borrower-specific components of this spread, the lending rate $i_{b,t}^{j}$ for borrower j depends on the base rate i_{cb}, the bank's general mark-up $\sigma_{b,t}$, and the borrower-specific spread $\rho_{b,t}^{j}$:

$$i_{b,t}^{j} = i_{cb,t} + \sigma_{b,t} + \rho_{b,t}^{j} \tag{2.3}$$

The borrower-specific spread is typically associated with a risk premium "imposed by banks to cover default risks" (Lavoie, 2022, p. 2022)[16]. In this way, a higher risk premium is associated with characteristics that deteriorate the robustness of the borrower's creditworthiness (Rochon, 2006; Wray, 1992a), such as higher levels of indebtedness, in line with Kalecki's principle of increasing risk (Sawyer, 2001). For Wolfson (1996), this risk premium depends on two factors. First, it depends negatively on the banks' confidence in their expectations about borrowers' future cash flows $E_{b,t}\left[CF_{T}^{j}\right]$, which in turn depend on different borrowers' characteristics. Second, given their assessment of the borrowers'

[15]In this way, credit conditions for particular borrowers are not necessarily only an outcome of asymmetric information, or asymmetric risk aversions between borrowers and bankers, but, in a world of fundamental uncertainty, of asymmetric expectations between them (Wolfson, 1996).

[16]For many post-Keynesians, risk premia are associated with cardinal probabilities, while liquidity premia with liquidity preference, which depends on the confidence uncertainty about those expectations (Cardim De Carvalho, 2015). However, Dow (2019) indicates that degrees of confidence allow to talk about degrees of uncertainty. In that sense, here is not possible to talk about probabilities with absolute confidence, since most of the sources of global money are contingent on an infinite possibility of social interactions (Dymski, 2013). Therefore, this "credit risk [is understood] as a special case of a broad-ranging liquidity risk" (Bianco & Sardoni, 2018, p. 175. Added parentheses).

risk profile, it depends positively on the banks' risk aversion and liquidity preference $\theta_{b,t}$ (Dow, 1996a; Lavoie, 2022)[17].

$$\rho_{b,t}^{j} = \rho\left(E_{b,t}\left[CF_{T}^{j}\right], \theta_{b,t}\right) \tag{2.4}$$

In turn, credit restrictions can be derived using a similar decision rule to Wolfson (1996) and Hyun (2023). Given the notional credit demand $C^{D,j}$ of the borrower j, and the lending rate $i_{b,t}^{j}$, the bank accepts the requested loan if its expectations about the borrower's future free cash flow $E_{b,t}\left[CF_{T}^{j}\right]$ cover the service of the loan (principal and interest payments). In line with Hyun (2023), we express the relationship as a minimum free cash flows to debt service ratio δ^{min}, including both the principal and the interest payments[18], which represents the current banks' creditworthiness criteria:

$$\delta^{min}\left(\theta_{b,t}\right) \leq \frac{E_{b,t}\left[CF_{T}^{j}\right]}{\left(1+i_{b,t}^{j}\right)C^{D,j}} \tag{2.5}$$

We assume that δ^{min} represents the banks' creditworthiness standards, which also depend on $\theta_{b,t}$. Creditworthiness criteria vary across time with the perceived uncertainty about the future macroeconomic conditions and banks' preferences (Minsky, 1980; Rochon, 2006). In that sense, higher banks' risk aversion and/or liquidity preference will tighten credit standards, and in this particular model, the minimum required free cash flows to debt service ratio. Based on this inequality, the credit restrictions, as a share between zero and one of the notional credit demand, can be expressed as:

$$cr_{t}^{j} = 1 - \frac{E_{b,t}\left[CF_{T}^{j}\right]}{\delta^{min}\left(\theta_{b,t}\right)\left(1+i_{b,t}^{j}\right)C^{D,j}}, \; where \; cr_{t}^{j} \in [0,1] \tag{2.6}$$

Where the effective credit demand is equal to the non-restricted notional credit demand $C^{ED,j} = C^{D,j}\left(1-cr_{t}^{j}\right)$. This condition introduces a slight asymmetry between risk premia and credit constraints as determinants of effective credit. While risk premia directly impact notional credit demand through the cost of borrowing (given the slope of notional credit demand), credit constraints affect realised credit only if the restrictions are binding. In such a scenario, a deterioration of banks' expectations and confidence regarding the borrower's future access to liquidity (profitability, liquid assets, etc.)[19],

[17] "There is a range within which banks have the discretion to set the rate" (Rochon, 1999, p. 285).

[18] Wolfson only includes interest rate payments, while Hyun also makes explicit the role of the loan's tenor. For Wolfson, the state of confidence has to be "higher" than the bankers' risk aversion. Here we assume that risk aversion changes the value of δ^{min}

[19] Effective credit demand may also decline due to worsening borrower expectations and reduced notional demand, without an increase in credit restrictions. Credit and "expectations are bounded by what is considered to be reasonable/ normal by the most pessimistic economic sector" (Tymoigne, 2006a, p. 5).

combined with higher interest rates[20] and stricter creditworthiness criteria, implies that a lower proportion of the notional credit demand will be accepted by banks:

$$\frac{\partial cr^j_{b,t}}{\partial E_{b,t}\left[CF^j_T\right]} < 0, \quad \frac{\partial cr^j_{b,t}}{\partial i^j_{b,t}} > 0, \quad \frac{\partial cr^j_{b,t}}{\partial \delta^{min}\left(\theta_{b,t}\right)} > 0$$

Given the components and determinants of the lending rate, this also implies that the factors that increase the lending rate might also increase the credit restrictions:

$$\frac{\partial cr^j_{b,t}}{\partial \lambda} < 0, \quad \frac{\partial cr^j_{b,t}}{\partial\ r} > 0, \quad \frac{\partial cr^j_{b,t}}{\partial \phi} > 0, \quad \frac{\partial cr^j_{b,t}}{\partial i_{CB}} > 0, \quad \frac{\partial cr^j_{b,t}}{\partial \rho^j_{b,t}} > 0$$

Since both the risk premium and the credit restrictions have common determinants (the expectations about the borrower and banks' liquidity preference and risk aversion), and the latter also depends on the former, credit conditions generally move together across time. As Wolfson (1996) highlights, they are usually affected by the business cycle and the observed and desired financial structures of borrowers and banks, which can change with each other endogenously. Because of this, the effective credit available can be highly volatile and cyclical, especially for borrowers considered less creditworthy. Consequently, fluctuations in these aspects can create exogenous fluctuations in credit accessibility from a borrower's perspective, regardless of the borrower's notional demand.

2.3 A global money framework: global banks as drivers of balance of payments conditions

The previous section explored how banks can drive credit conditions in a domestic economy, where their deposits are accepted as a means of payment and settlement. How does this change at the global level, where just one currency is used for most cross-border payments? What are the relevant credit conditions for these cross-border transactions? Are banks from all nationalities equally important in driving those? This section extends the previous framework to a global level, emphasizing two facts about our current International Monetary System: the US dollar is the most widely used cross-border means of payment and settlement—hereafter referred to, for simplicity, as global money—, and most of these cross-border US dollars are deposit liabilities of a reduced group of globally active financial

Here we focus on what happens when banks' expectations are the lower bound: $E_{b,t}\left[CF^j_T\right] < E_j\left[CF^j_T\right]$.

[20] Interest rate changes may lead firms to adjust prices, making expected cash flows endogenous (Dvoskin & Feldman, 2021). Yet, financing costs can hurt smaller firms with limited pricing power and, at the macro level, reduce real wages and expected expenditure, lowering expected cash flows.

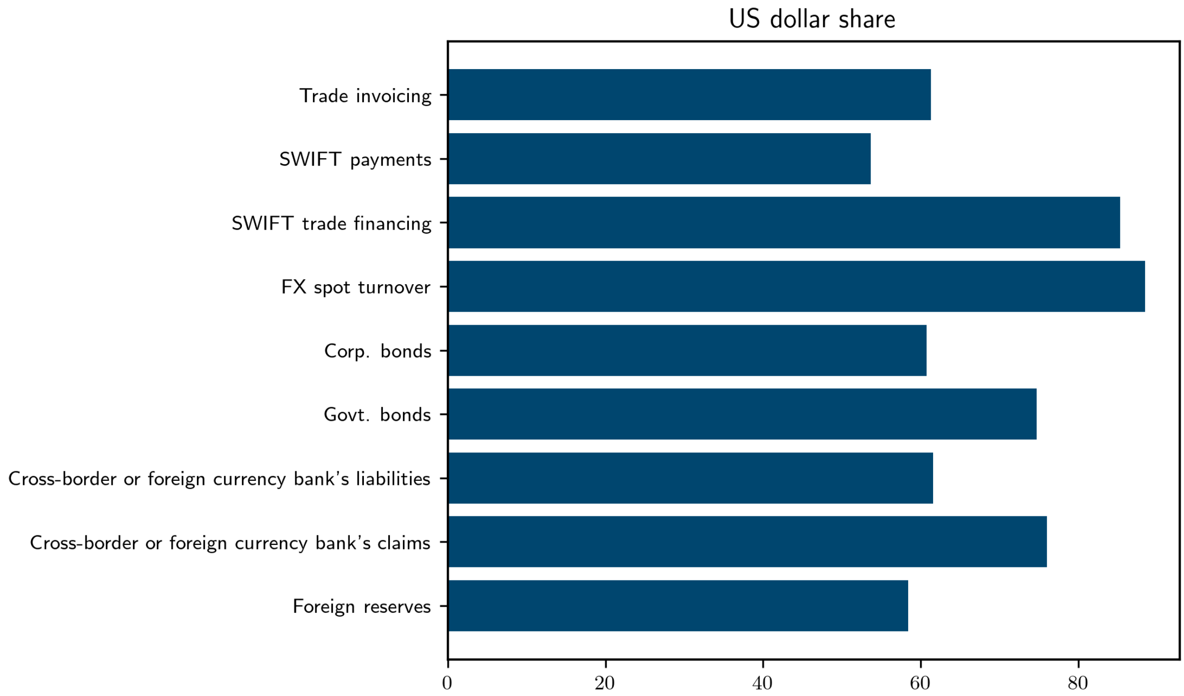

Figure 2.1: Global role of the US dollar. Shares (%). Source: own elaboration based on Federal Reserve notes, BIS, SWIFT, Maggiori *et al.* (2020)and Coppola *et al.* (2021). Latest data available.

institutions — hereafter global banks[21]—. These two facts are explored in this section before extending creditworthiness assessments to a cross-border context and analysing their implications.

2.3.1 Global money and the balance of payments survival constraint

Figure 2.1 shows the share of the US dollar in different cross-border related transactions and instruments. In all these usages, the US dollar represents the lion's share[22]. This implies that countries require access to US dollars to participate in most cross-border transactions.

In a world where cross-border transactions require global money, most gross flows in the balance of payments are global money flows by definition. Using Minsky's (1986c,1986d) balance of payments characterization and cash flow typology, we can express the global money flows of any particular borrower-country, highlighting the role of previous

[21]While similar to Global systemically important banks classification by the Financial Stability Board, this chapter focuses on banks central to the international US dollar system, not necessarily all G-SIBs.

[22]Second, while the Euro is included as an international currency in these indicators, its global use is more limited. The framework can accommodate multiple "global monies", especially since many key banks in cross-border Euro payments also operate in the offshore US dollar system.

commitments of both interest and principal payments[23]:

$$0 = \underbrace{X_t - M_t}_{\substack{\textit{trade}\\\textit{flows}}} + \underbrace{(p^A_{t-1} + i^A_{t-1})A_{t-1} - (p^L_{t-1} + i^L_{t-1})L_{t-1}}_{\substack{\textit{portfolio}\\\textit{service flows}}} + \underbrace{\Delta L_t}_{\substack{\textit{new}\\\textit{external}\\\textit{liabilities}}} - \underbrace{\Delta A_t}_{\substack{\textit{new}\\\textit{external}\\\textit{assets}}} \tag{2.7}$$

A country requires global money for gross cross-border payments, both real and financial. These include imports M, the service of external liabilities $\left(p^L_{t-1} + i^L_{t-1}\right) L_{t-1}$ (which includes the remuneration i^L_{t-1} and the amortization of these liabilities p^L_{t-1}) and the accumulation of new external assets ΔA[24]. The sources to acquire it are restricted to the country's exports X, the liquidation ∇A and amortization and return $\left(p^A_{t-1} + i^A_{t-1}\right) A_{t-1}$ of their previously accumulated external assets and their additional external borrowing possibilities ΔL (Terzi, 2006)[25]. This highlights the multiple sources of external vulnerability, related not only to trade deficits and external debt commitments, but also to surges in gross outflows and sudden stops in gross inflows (Cavallo *et al.*, 2015). This aligns with the literature emphasising the importance of the financial account for financial stability (Borio & Disyatat, 2015; Kregel, 1998b; Pantelopoulos, 2024). This structural need for global money can be emphasised with the Minskyan concept of "survival constraint", where a unit "in order to survive, must satisfy the condition that the initial cash plus the receipts minus the costs payable to that date are greater than zero" (Minsky, 1954, p. 96). In this line, "the balance of payments is the international analogue of the survival constraint, requiring settlement in international money" (Mehrling, 2023, p. 3), and countries need to match daily global money expenditures and global money inflows to meet their external payment obligations (Angrick, 2018b). From this perspective, this balance of payments is not only a long-term constraint on growth, but it is also a short-term "matter of clearing and settlement" (Mehrling, 2022, p. 144).[26]. Since only a handful of instruments are accepted as global money, both external credit relationships and the cross-border transactions they allow strongly depend on the conditions set by the issuers of these instruments. Because of this, it is important to explore, firstly, how global money is created and which are the key institutions in play. And secondly, to discuss the factors that determine these credit operations, ultimately influencing the ability of different countries to participate in cross-border transactions.

[23]As Kohler (2022) points out, financial flows are not truly gross in the balance of payments accounts. There, the new negative and positive inflows/outflows, as well as principal payments, are netted in the net acquisition of financial assets and net incurrence of liabilities for each item.

[24]The stock of foreign assets and liabilities also shifts with capital gains from asset prices and exchange rates. We could restate the equation in terms of changes in the International Investment Position, incorporating capital gains in the i^A and i^L, without affecting the current analysis.

[25]For countries, these operations can be decentralized—some units issue external liabilities, while others acquire global money to finance imports or accumulate external assets.

[26]Importantly, stable international demand for the external liabilities of countries issuing internationally accepted US dollars eases this constraint. This is especially true for the United States, where the global acceptance of its currency means the "external constraint does not bite" (Costabile, 2013, p. 191).

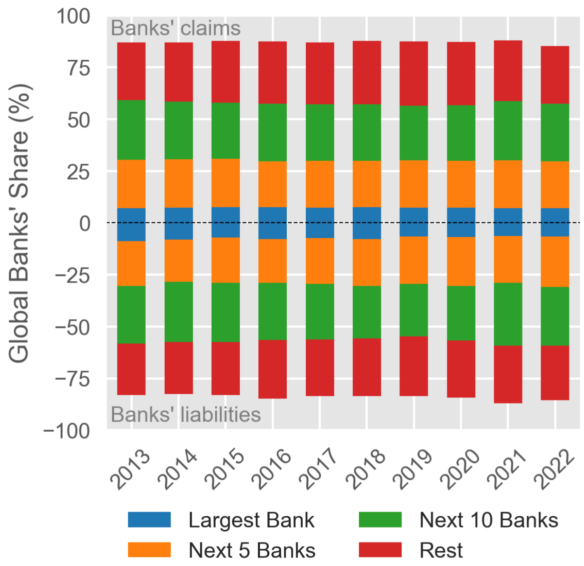

Figure 2.2: Share of the 25 global banks on cross-jurisdictional (XJ) bank positions. Source: own elaboration based on the Global Systemically Important Banks (G-SIB) data from the Basel Committee on Banking Supervision and the consolidated banking statistics from the Bank for International Settlements. Note: selection of 25 G-SIB with more than 1,5% average participation on the total cross-jurisdictional claims and liabilities between 2013 and 2022.

2.3.2 Global banks as global money issuers

As in most domestic economies, global money mainly comprises bank deposits (Rossi, 2007), most of them denominated in US dollars (Bertaut *et al.*, 2021). In that sense, these "international dollars are created by the banking process" (Minsky, 1979, p. 17)[27]. Therefore, the global money supply is endogenous since it is mainly created as US dollar deposits by banks when they create loans in response to creditworthy demand. However, if domestic regulations allow it, any bank from any country can issue deposits denominated in US dollars [28], the problem is, paraphrasing Minsky (1986d, p. 228), to get these deposits accepted as a means of cross-border payment and settlement[29]. While non-US banks held $21 trillion each in US dollar assets and liabilities by 2023—plus off-balance sheet obligations estimated at twice that—most of these positions were concentrated in a few advanced economies (Binder, 2024; McGuire *et al.*, 2024). Moreover, as Figure 2.2 illustrates, a small group of global banks represents the lion's share of all cross-jurisdictional bank positions reported to the Bank for International Settlements.

[27]If the global bank and borrower are in different countries, the operation generates gross cross-border inflows and outflows for both. Yet, nothing physically "flows" between countries—only a new set of claims is recorded, expanding both balance sheets (Kohler, 2022).

[28]"Banks can run a book in any unit — dollars, marks, cigarettes or fur-pelts" (Minsky, 1986a, p. 9).

[29]US dollar deposits issued by local banks might be accepted domestically, but not abroad. If the domestic units want to make a cross-border payment, the country will still require US dollar deposits with a global bank.

This chapter argues that only the US dollar liabilities of these few global banks—headquartered in a handful of countries—are widely accepted as global money, a privilege not shared by banks from most countries. This acceptability is manifested in their hierarchical position within the network of correspondent banking relationships (Dörry *et al.*, 2018; Rossi, 2007)[30]. In this network, only a few domestic banks maintain direct bilateral accounts with each other, but most have such arrangements with global banks (Arauz, 2021; Pantelopoulos, 2022). When cross-border payments between two units (or their banks) are made, global banks facilitate these payments by recording changes in the ownership of their liabilities (Arauz, 2021; Bindseil & Pantelopoulos, 2023). Thus, this role and observed concentration from Figure 2.2 are not merely a reflection of these banks' size, but also of the differential acceptability of their liabilities. While the reasons behind this acceptability are beyond the scope of the chapter, its implications are central. First, if the liabilities of only a few banks are generally accepted as global money—while others are not—then access to those liabilities becomes essential for participating in cross-border transactions. Second, this acceptability gives these institutions—and the credit conditions they set—a central role: they define the terms under which countries (or units) lacking sufficient global money can obtain it to make cross-border payments[31].

Global banks behave differently from domestically oriented local banks because of their global reach and complexity, which expose them to a broader range of risks. First, as Acalin (2023) shows, the largest global banks exhibit both higher average leverage and greater leverage volatility over time compared to other large banks. As discussed in Section 2.2.1, this can lead to fluctuations in US dollar credit conditions. Second, and relatedly, global banks include both US and non-US institutions (Aldasoro *et al.*, 2024; Binder, 2024; Murau *et al.*, 2020). However, non-US global banks may not benefit from US deposit insurance, direct access to the Federal Reserve's balance sheet, or stable US-based deposit funding. This makes them reliant on balances and credit lines from US global banks—or on Federal Reserve swap lines with their local central banks—for dollar liquidity (Dafermos *et al.*, 2022; Mehrling, 2015; Minsky, 1986a)[32]. Thus, the US

[30]"Almost all of the world's banks with international businesses have accounts at these megabanks" (Arauz, 2021, p. 231).

[31]Similarly, Binder (2024) argues that since both US and non-US global banks can create US dollars, they play a key role in deciding who gets access to global money and under which conditions. Global Banks can affect domestic financial conditions by other channels not explored in this chapter (Gabor, 2015).

[32]Kumhof *et al.* (2020, p. 8) indicate that "dollar credit can also be created by non-US banks, as long as they have adequate access to correspondent banking arrangements or central bank swap lines with the reserve currency economy". Similarly, He & McCauley (2012, p. 7) point out that "offshore markets in a currency can flourish if offshore financial institutions are able to maintain and to access freely clearing balances in the currency with onshore banks". This was also acknowledged by Minsky (1986b, p. 8): "To a depositor in such an offshore bank the dollars on deposit in, say a 'German' based bank is as much a dollar as any deposit in a New York office of a U.S. charted bank. Thus the German charted bank must earn dollar income and hold dollar assets. In particular it must hold assets that give it a quick command of dollars in New York". Consequently, there is a continuous and time-varying hierarchy of

dollar-based international payment system operates as a three-tier banking system (Lavoie, 1992), requiring distinct settlement layers and interconnected infrastructures (Faudot, 2018).

As a result, the relevant base rate for cross-border US dollar credit includes various Federal Reserve policy rates i_{US}, including the rate for the central banks' swaps. As well, the general interest rate spread σ_{GB} is shaped by the balance sheet conditions of both US and non-US global banks, particularly their leverage and liquidity ratios λ_{GB}, ϕ_{GB}:

$$i_{GB,t} = i_{US,t} + \sigma_{GB,t}\left(\lambda_{GB}, \phi_{GB}\right) \tag{2.8}$$

Still, as with individual borrowers, their lending rate is not uniform across countries. The next section examines how global banks influence country-specific US dollar credit conditions.

2.3.3 Creditworthiness assessments and the balance of payments

As mentioned earlier, creditworthiness assessments reflect both borrower-specific and macroeconomic factors. In cross-border financing, however, they include an additional layer: the borrower-country's ability to access global money to meet future debt payments. While this may involve borrower-specific aspects (e.g. if the borrower is an exporter or holds US dollars[33]), it is primarily based on expectations about the distinct flows within the country's balance of payments, which global banks use to set country-specific credit conditions.

The connection between the cross-border creditworthiness assessments and the accessibility to US dollars through the balance of payments flows was repeatedly highlighted by Minsky:

> "International investments and loans depend upon the perceived prospects of payments, which mean that they reflect expectations of future dollar earnings. The ability to borrow dollars depends upon the belief that the dollars will be repaid; i.e., the borrower will earn dollars." (Minsky, 1984, p. 21)

> "Every liability (...) must be supported by cash flows (...) The same requirement that cash flows support asset values holds for international indebtedness,

global banks, based on the cross-border acceptability of these institutions' deposits, their access to credit from US banks, as well as their regulatory environment and their proximity to the lending from the Federal Reserve (Murau *et al.*, 2022; Saeidinezhad, 2022).

[33] The balance of payments at the country level remains important in this assessment even for exporters. For instance, Local regulation might force these to sell the earned US dollars in the domestic exchange market.

the only difference being that the supporting cash flows may be derived from income denominated in one currency while the payments are denominated in another. The peso-denominated income of a Mexican entity may need to be exchanged into dollars for a commitment to be validated. The terms upon which dollars are available for pesos then determines whether commitments can be fulfilled. The availability of foreign currency depends upon the balance of payments of the country and the character of national assets that can be sold or pledged to foreigners" (Minsky, 1986c, p. 5)

"For international financing, current lending reflects expectations of favorable balance of payment conditions for the borrowing country" (Minsky, 1986a, p. 11)

In this way, servicing most external liabilities depends on future access to US dollars. As a result, global banks assess a borrower's ability to obtain US dollars and under what conditions. This expected access, in turn, depends on anticipated flows in the balance of payments[34]. While global banks and other cross-border investors can observe recent trends in a country's external accounts, future behaviour remains uncertain. So how do global banks make such assessments under uncertainty?

Similar to the process described by Harvey (2009) and Kaltenbrunner (2011) for FX investors—and consistent with Section 2.2—global banks form expectations about a country's cross-border payment capacity based on conventions and shifting confidence in those conventions, categorising countries into risk groups[35]. As with individual borrowers, cross-border creditworthiness assessments are shaped by both global (common across countries) and domestic (idiosyncratic) factors (Hawkins, 2003). In line with the decision rule outlined in Section 2.2, global banks will lend to a borrower-country if they expect that the country's future access to US dollars will exceed its external debt service obligations—interest and principal—by at least a minimum external debt service coverage ratio δ_{Ext}^{min}:

[34] If the country observes a surplus in other currencies, it will still have to be converted into US dollars, affecting the exchange rate given the accessibility conditions to US dollars and the demand for such currency (Toporowski, 2013).

[35] Similarly, Basel Committee on Banking Supervision (1982, p. 2) highlights that in the banks' assessment of country risk "(s)ince the key question is whether there will be impediments to the repayment of external indebtedness, the size, nature and maturity pattern of a country's current external indebtedness are particularly significant (. . .) The analyst will nonetheless wish to project a path for countries' external debt and to forecast their ability to service and repay, which means looking at the outlook for official reserves and other balance-of-payments items, terms of trade, exchange rates, inflation, the country's record in servicing and repaying external debt and other relevant factors. Given the complexities, it is no surprise that banks, particularly large banks with diversified portfolios, recognise that forecasting risks over the life of a bank's credit exposure entails a substantial measure of judgement".

$$\delta_{Ext}^{min} \leq \frac{X_{k,t+1} - M_{k,t+1} + \left(p_{k,t}^{A} + i_{k,t}^{A}\right) A_{k,t} - \left(p_{k,t}^{L} + i_{k,t}^{L}\right) L_{k,t} - \Delta A_{k,t+1} + \Delta L_{k,t+1}}{\left(1 + i_t^{US} + \sigma_t + \rho_t^k\right)\left(1 - cr_t^k\right) C_t^{D,k}} \tag{2.9}$$

Importantly, $\Delta L_{k,t+1}$ excludes the new external credit under assessment ($(1 - cr_t^k)C_t^{D,k}$). Summarising the expected US dollar cash flows of the country as $E_t\left[BoP_T^k\right]$, Equation 2.9 can be rearranged to emphasise the drivers of US dollar credit conditions for the country k:

$$\underbrace{E_t[BoP_{t+1}^k]}_{\substack{\text{Expected}\\ \text{access to USD}}} \cdot \underbrace{1/\delta_{Ext}^{\min}(\theta_{b,t})}_{\substack{\text{Credit–}\\ \text{worthiness}\\ \text{criteria}}} \geq \underbrace{(i_t^{US} + \sigma_t)}_{\substack{\text{General lending}\\ \text{rate}}} \underbrace{(1 + \rho_t^k)(1 - cr_t^k)}_{\substack{\text{Country } k\\ \text{credit conditions}}} \underbrace{C_t^{D,k}}_{\substack{\text{credit}\\ \text{demand}}} \tag{2.10}$$

The left side of the inequality in Equation 2.10 represents the expectations of global banks (and their confidence in these expectations) about the future access to US dollars of the country k, adjusted by their creditworthiness criteria, which depends on their risk aversion and liquidity preference (Hawkins, 2003). The right side of the inequality represents the US dollar commitments associated with current general US dollar lending rates, the country's notional credit demand, and particular credit conditions. This includes a country-specific risk premium $\rho_t^k = \rho(E_t[BoP_{t+1}^k], \theta_{b,t})$, which depends again on the global banks' risk aversion and liquidity preference, as well as the country's characteristics shaping its creditworthiness. For instance, a country with high volatility or negative trends in trade and income balances as well as in cross-border inflows and outflows will be less creditworthy in the eyes of global banks (Kregel, 2004).

It is important to highlight that $E_t\left[BoP_{t+1}^k\right]$ will also affect the expected depreciation of the local currency versus the US dollar and vice versa. Lower expected US dollar access will imply depreciation pressures in the exchange rate market. In turn, a higher exchange rate will imply that the borrower's income and holdings of local currency (and local currency assets) will buy a smaller quantity of US dollars, perhaps not enough to service the external liability[36]. Moreover, the borrower's local currency income can be negatively affected by the contractionary effects of the depreciation. Something similar happens when the external liabilities are denominated in local currency. If global banks do not want to maintain their position in the borrower country's liabilities (or buy exports

[36]Similarly, "(i)n terms of validating external debts denominated in dollars it is not enough for debtor units to have a large cash flow in the domestic currency; they must also be able to transform the domestic currency cash flow into dollars" (Minsky, 1986a, p. 13). In the same line "(t)he cash flow commitments by such debtors to banks can be fulfilled only if their "profits" and "taxes" in the local currency can be transformed into dollars at favorable terms (. . .) These units need earn a sufficient income in their domestic currency and they need to be able to exchange these profits for dollars at an exchange rate that is consistent with the profitability of their business" (Minsky, 1984, p. 20,22)

from this country), they will exchange them in the exchange rate market, demanding US dollars. Therefore, external liabilities in local currency do not completely eliminate the depreciation pressures on the balance of payments coming from the service of these liabilities (Dvoskin & Landau, 2023). However, local currency liabilities can reduce the country's external vulnerabilities. Since they move the currency risk from the balance sheet of the borrowers to the lenders, they can reduce the contractionary effect of the depreciation. Still, the lending behaviour of foreign units bearing the currency risk might be procyclical (Hofmann *et al.*, 2020; Kaltenbrunner & Painceira, 2015), since there is an "additional layer of uncertainty" (Dow, 1999, p. 162).

2.3.4 Global banks' US dollar credit conditions and balance of payments' vulnerabilities and constraints

Two important implications can be derived from the forward-looking assessment based on the balance of payments presented in Equation 2.10, both long emphasised by the Latin American structuralists and other literature. The first implication is that these credit conditions are a source of external vulnerabilities since they are strongly dependent on different external factors (Kohler, 2021; Ocampo, 2016)[37]. These credit conditions are vulnerable to changes in expectations and perceived uncertainty, as well as highly dependent on external factors that drive exports, other inflows, etc. Since all the sources of US dollars are related to international transactions, they are affected by global factors. These include changes in global activity affecting the price and volume of the trade flows and other global financial factors, such as the monetary policy of the Federal Reserve. Importantly, changes in global banks' liquidity preference and balance sheets can affect these US dollar credit conditions, as highlighted in the work of Dow (1999) and Hawkins (2003). Figure 2.3 summarises the drivers of an individual country's US dollar credit conditions. Given the country-level external credit demand—which the figure depicts as downward-sloping with respect to the interest rate[38], credit restrictions and interest rates depend on the global banks' expectations about the country's balance of payments, the US base rate, the global banks' desired balance sheet structures, as well as their liquidity preference and risk aversion[39]. The effective credit demand is convex because of

[37]This also relates to the local pull factors versus global push division classification in the literature on the drivers of cross-border flows (Calvo *et al.*, 1996, 1993; Koepke, 2019), and most recent literature on the global financial cycle (Aldasoro *et al.*, 2023a; Bortz *et al.*, 2022; Kaminsky, 2019; Miranda-Agrippino & Rey, 2022; Rey, 2013; Vernengo, 2023b). Particularly, to the empirical research on the effects of global banks' leverage on cross-border flows (Bruno & Shin, 2015a,b; Cesa-Bianchi *et al.*, 2018).

[38]At the country level, external credit demand—like that of individual borrowers—can be interest rate insensitive or even upward sloping. Higher US dollar rates may lead some units to demand more, prompting others to increase credit demand as well, or to cover rising interest payments on past liabilities (Minsky, 1986a).

[39]Unlike the adverse selection literature in international finance—where external loan supply takes a backward-bending form (Folkerts-Landau, 1985)—here, credit restrictions appear as borrower-specific

the effect of higher interest rates on the country's creditworthiness for a given expected US dollar access (Hyun, 2023). Cross-border credit dynamics are thus shaped by shifts in these determinants. First, a tightening of global banks' balance sheets—via lower target leverage λ or higher target liquidity ϕ—raises the required mark-up σ_{GB}, shifting the horizontal supply curve (i_{GB}) upward. If this interest rate rises sufficiently, credit restrictions begin to bind for some countries as the debt service costs breach the established creditworthiness threshold. Second, if creditworthiness standards themselves tighten, the gap between notional credit demand (C^D) and effective credit demand (C^{ED}) widens. This rotates the effective credit demand curve to the left, reducing the accessible volume of cross-border credit even if interest rates remain unchanged (if these rates are high enough). Finally, if expectations regarding a borrower's future access to US dollars deteriorate, both the country risk premium ρ and the gap between notional and effective credit demand simultaneously increases.

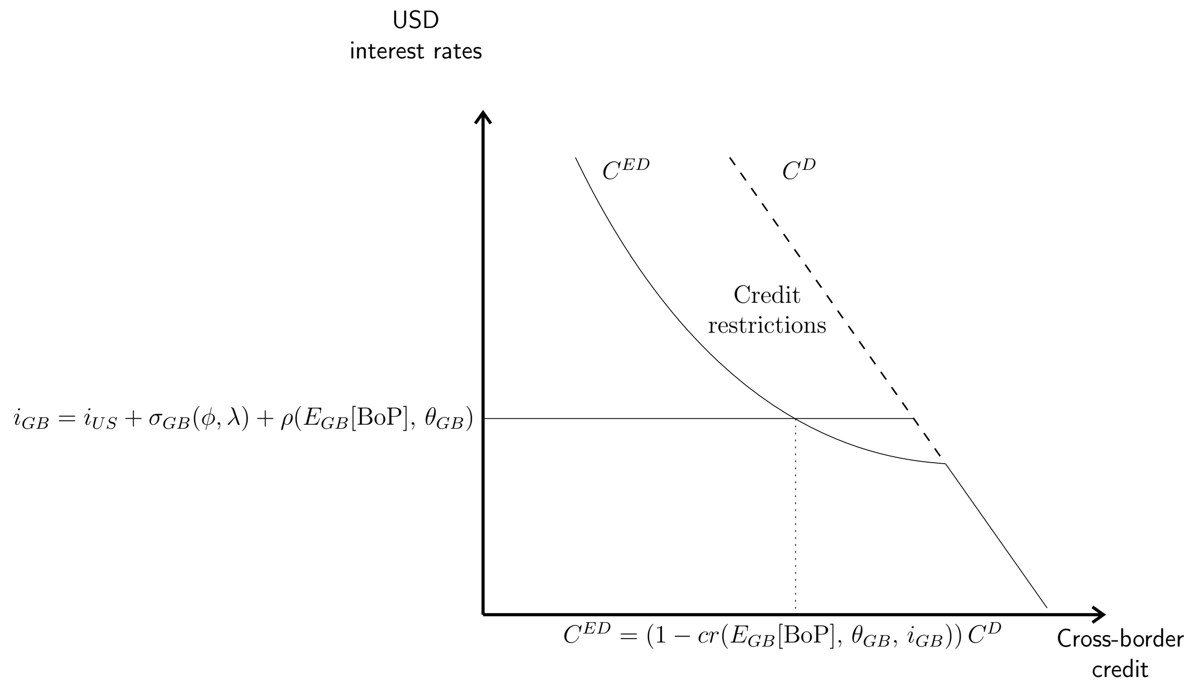

Figure 2.3: US dollar credit conditions.

The second implication is that, if expectations about the future of an economy are not shared with the global banks for a given lending rate, that economy will face tight credit restrictions and even become unable to access any external credit (Botta, 2021; Serrano & Summa, 2015)[40]. As Hawkins (2003, p. 136) indicates, a "country operating at the limit of its balance of payments is seen in the same light as an individual who is unable to exploit her creditworthiness further". In this way, this framework makes

effective credit demand, which remains linked to notional credit demand.

[40]Paraphrasing Keynes (1930, vol. I, p. 212), there is apt to be an unsatisfied fringe of the borrower-countries.

compatible an endogenous supply of US dollars at the global level, but "exogenously limited from the perspective" of an individual country (Oberholzer, 2023, p. 170). This will restrict their capacity to fund trade imbalances, accumulate external assets, and service external liabilities. While this creditworthiness assessment can change with global banks' expectations, confidence, and conventions, there are long-lasting conventions grounded on the country's economic, financial, and institutional structure, which are central to the stability of external funding (Vernengo, 2023a). If these structures also imply an inelastic minimum demand of US dollars for different levels of activity, the maximum external credit available is a balance-of-payments constraint on output (Bhering *et al.*, 2019; Setterfield, 2012; Thirlwall, 1979; Vernengo & Pérez Caldentey, 2020)[41]. In this way, these creditworthiness assessments can shape the balance-of-payments constraints. While there are many recent extensions of the balance-of-payments constraints models to include financial factors (Bhering *et al.*, 2019; McGuire & von Peter, 2012; Mason, 2014; Moreno-Brid *et al.*, 2023; Moreno-Brid, 2003; Morlin, 2022; Pérez Caldentey, 2023; Pérez Caldentey & Vernengo, 2024), the present framework explicitly relates these to the balance sheets and expectations of international financial institutions[42].

Since the presented creditworthiness assessments affect both credit restrictions and risk premia, they create different tolerable indebtedness levels for each country (Bortz, 2021). Different from Bhering *et al.* (2019), where a fixed maximum ratio exists between external liabilities and exports, this framework allows that ratio to vary by country, given a minimum debt service coverage ratio[43]. Including future borrowing possibilities as a future source of US dollars helps explain why advanced economies—deeply integrated into the IMS—can sustain external borrowing, while exports remain crucial for countries not deemed creditworthy. As Kregel (2004) notes, some countries benefit from strong investor

[41]The structuralist literature and others have challenged the idea that changes in relative prices and exchange rates alone can secure external balance and full employment through higher exports and import substitution (Vernengo & Pérez Caldentey, 2020). Sylla (2024) distinguishes between dependence on foreign real resources and international payment issues. A few countries can purchase foreign goods in their own currency with limited exchange rate effects, but most cannot (Ehnts & Randall Wray, 2024). For these, the balance-of-payments constraint is a real resource constraint—reflecting limited capacity to meet domestic demand with local resources and technology—financially expressed as a lack of foreign finance (Vernengo, 2006).

[42]Recent post-Keynesian adaptations of the Mundell-Fleming framework introduce a vertical balance of payments curve in the domestic interest rate-output space (Dvoskin *et al.*, 2024; Marins, 2023; Serrano & Summa, 2015). This framework could be extended to a two-country post-Keynesian Mundell-Fleming model, where higher US dollar rates tighten balance-of-payments constraints.

[43]Many authors have highlighted the role of exports and trade surpluses as sources of non-debt-generating US dollars (d'Arista, 2004), and the connection between the riskiness of external debt and the dynamics of the borrowers' exports (Cesaratto, 2020, p. 123). Minsky also indicates: "If bankers are financing balance of payment deficits they must be concerned about the ability of the deficit countries to generate a sufficiently favourable merchandise balance to at least service the growing outstanding debts" (Minsky, 1979, p. 22). Similarly, "(A) debtor ... has to be in 'surplus', if not now then expected over some relevant horizon, for payment commitments on debt are to be fulfilled (...) Ultimately, the availability of dollars to validate debt depends upon the balance of trade (...) not necessarily now but expected over a reasonable future is the basis of a debtor country's viability" (Minsky, 1986a, p. 13).

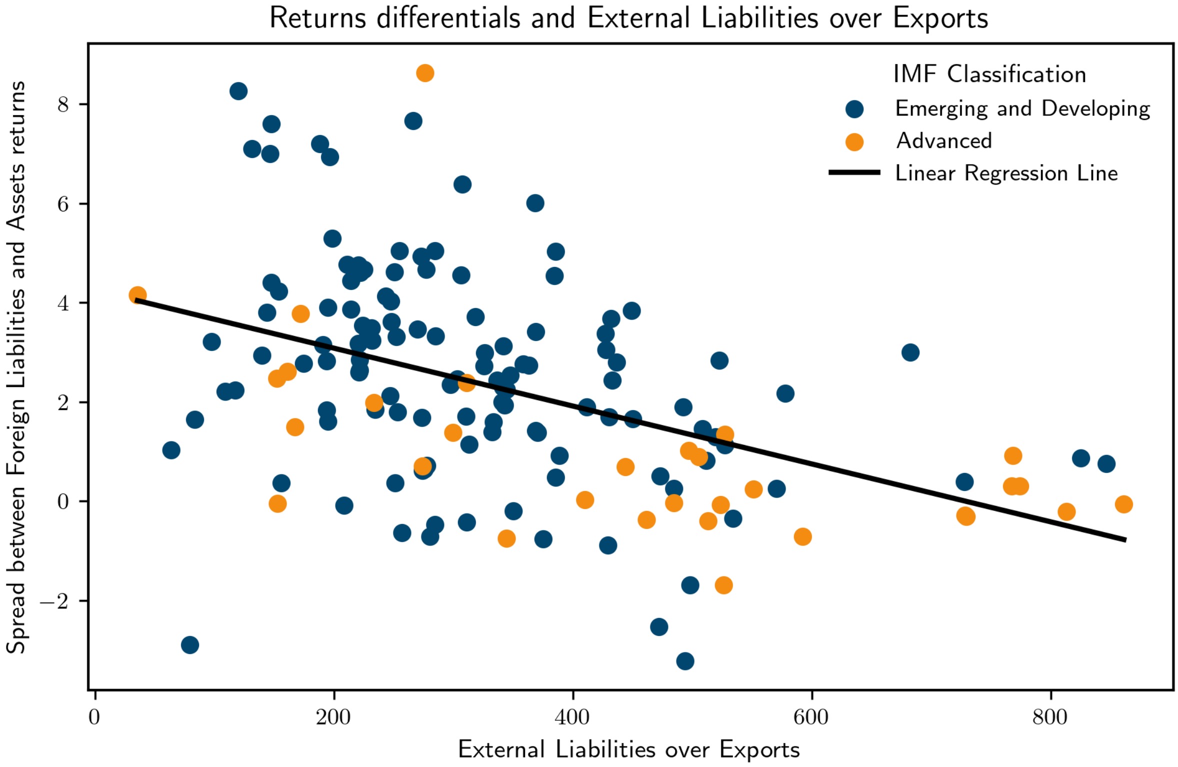

Figure 2.4: External liabilities over annual exports and spread between the implicit return on external liabilities and external assets. Source: own elaboration based on IMF data and Lane & Milesi-Ferretti (2018). Note: implicit returns are calculated as in yields in Curcuru *et al.* (2013), without including capital gains. Average values between 2000 and 2022. Excludes outliers.

confidence, with lenders expecting debt service not only from future export earnings but also from continued access to external credit. This confidence allows such countries to maintain low risk premia and high external debt levels, as shown in Figure 2.3. Although the maximum debt tolerance and associated risk premia are not directly observable, similar patterns can be seen by comparing the spread between returns on external liabilities and assets with the ratio of external liabilities to exports, as in Figure 2.4.

Finally, if credit demand is normalised across countries, credit constraints and risk premia determine each country's position in what Hawkins (2003) calls "the spectrum of international provision", with exceptionally creditworthy countries in the top, and excluded ones in the bottom. Figure 2.5 shows this relationship. In the diagram, the horizontal lines labelled 1, 2, and 3 represent the specific US dollar credit supply conditions faced by borrowers at descending levels of the hierarchy. Line 1 corresponds to a borrower positioned near the top, enjoying high confidence from global banks and thus facing a minimal risk premium ρ^1. In contrast, Lines 2 and 3 illustrate the conditions for borrowers situated progressively lower in the hierarchy; these agents are perceived as riskier and are consequently burdened with higher risk premia and higher credit restrictions given their notional credit demand. This aligns with the post-Keynesian literature on the currency hierarchy, which emphasises the liquidity of different currencies — the ease of converting local currency into US dollars without loss—, and their ability to fulfil money's functions internationally (Bonizzi & Kaltenbrunner, 2020, 2021; Fritz *et al.*, 2018). According to Orsi *et al.* (2020, p. 23) "the determinants of the liquidity premium [and the positions in the hierarchy] are rather mixed in the literature" (added parenthesis), but exchange rate stability, current account dynamics, and external debt are commonly highlighted. Specifically, Kaltenbrunner (2011) argues that the liquidity premium depends on market participants' preferences and their views on a country's ability to meet external obligations. In sum, this literature roots the liquidity premium in expected external performance and investor preferences, in line with the framework presented here—though this framework broadens the focus to all external liabilities and highlights the role of global banks.

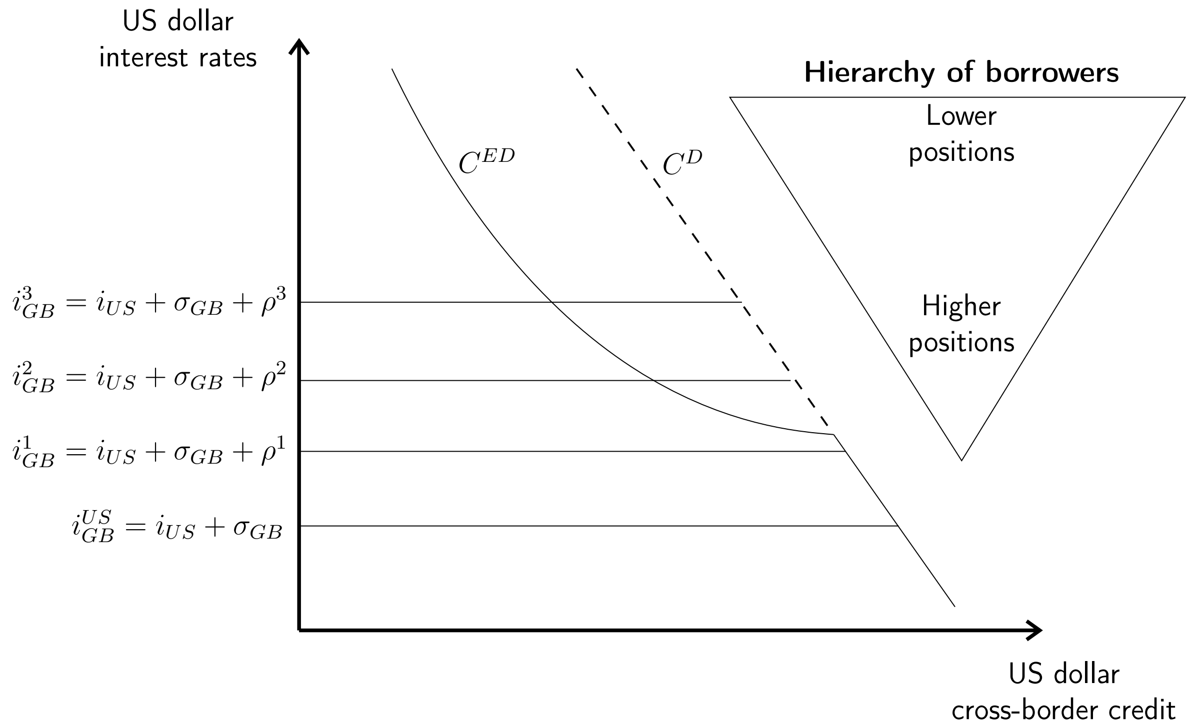

Figure 2.5: Credit restraints, risk premia, and the hierarchy of borrowers. Source: own elaboration.

2.4 Conclusions

Drawing on the post-Keynesian endogenous money theory and the Minskyan tradition, this chapter develops a simple framework to understand the role of global banks in shaping the US dollar credit conditions that drive countries' external funding and ability to participate in cross-border transactions.

Cross-border credit is fundamentally demand-driven, but whether that demand is judged creditworthy and on what terms depends on global banks' evolving considerations. In this way, two global bank-related factors shape these credit conditions: their balance sheet dynamics and their assessment of countries' external creditworthiness. The latter is based on expectations about a country's future access to global money—via trade surpluses, foreign assets, or borrowing potential. These expectations, however, are not static, shifting over the cycle, with both domestic and global developments. Notably, changes in creditworthiness assessments can restrict access to external credit even without any alteration in the borrower's underlying economic fundamentals. Furthermore, global banks constantly adjust credit conditions to manage their balance sheet structures, influenced by liquidity preferences, regulations, and macro conditions in advanced economies. These dynamics can create external pressure on countries' balance of payments, triggering financial stress even if their economic conditions remain stable.

Global banks are not neutral intermediaries, but creators of international purchasing power that countries need to engage in cross-border transactions. While borrower economies can implement policies to improve their balance of payments and creditworthiness, local factors are just a part of the story. The expectations of these institutions can shift quickly due to global factors unrelated to the borrower's idiosyncrasies. Moreover, various external factors can affect the balance sheets and preferences of these key institutions.

Importantly, with the rising role of Non-Bank Financial Institutions (NBFIs) in international finance (Aldasoro & Ehlers, 2018b; Goldberg, 2022), one might question the theoretical and empirical relevance of the framework. While NBFIs are important drivers of financial and economic conditions, the endogenous money perspective highlights the hierarchical and distinct role of banks as issuers of money (Bouguelli, 2020; Michell, 2024; Sissoko, 2024). In this sense, global banks—as issuers of global money—remain central to US dollar conditions, even in a world where NBFIs account for much of the cross-border flows. This is because NBFIs must first borrow from global banks or collect US dollar deposits created by them (Davidson, 1978)[44]. This includes non-US NBFIs borrowing US dollars via FX swaps to invest abroad and hedge local currency liabilities (McGuire *et al.*, 2021). Thus, global banks set both borrowing conditions and the returns on competing investments for NBFIs[45]. The framework can be extended to include NBFIs, with global banks remaining key to US dollar credit conditions (Section 2.3.2), while their assessments of leveraged NBFIs, and the NBFIs' assessments of final borrower countries, also become relevant (Section 2.3.3).

[44]Or less commonly, a non-global US bank.

[45]The NBFI categorisation might be too broad to include the different activities in a simple but useful theoretical framework.

3

Granular shocks to global banks' leverage and global liquidity: a causal analysis

3.1 Introduction

Global banks play a crucial role in shaping global liquidity conditions, influencing cross-border financial flows, exchange rates, and funding costs in international money markets (Bruno & Shin, 2015b). Global liquidity, defined as the ease of financing across international markets, is central to financial stability because it affects asset prices, foreign credit conditions, and the global transmission of monetary policy (Cohen *et al.*, 2017). The relationship between global liquidity and global banks is well-documented. Research highlights how their leverage can propagate financial shocks worldwide, with disruptions in the balance sheets of these institutions having far-reaching effects on countries' financial conditions (Cetorelli & Goldberg, 2011; Devereux & Yetman, 2010; Kalemli-Özcan *et al.*, 2013). Both policymakers and academics have increasingly emphasised the importance of understanding these mechanisms, particularly as global banks play a critical role in the international financial system. However, the literature has largely focused on global banks as amplifiers of external shocks, particularly those originating in monetary policy, rather than as independent sources of global liquidity fluctuations. This chapter aims to fill this gap by empirically examining how idiosyncratic shocks to the leverage of global banks affect cross-border financial conditions, utilising a novel identification strategy.

This chapter provides new causal evidence that exogenous shocks to the leverage of global banks drive global liquidity, utilising a novel identification strategy. The importance of this and other global factors in shaping cross-border financial conditions has been emphasised in a large literature (Calvo *et al.*, 1993, 1996; Kaminsky, 2019; Engel & Wu, 2024). Framed in terms of the global financial cycle, more recent studies document strong co-movement in asset prices, cross-border financial flows, and credit growth across countries (Rey, 2013; Miranda-Agrippino & Rey, 2022; Scheubel *et al.*, 2024). This cycle is primarily driven by US monetary policy, global uncertainty, and the leverage of global banks (Kaminsky, 2019). While many studies have established causal effects of monetary policy shocks, global banks' leverage has mainly been examined as a transmission channel, particularly as a key determinant of the strength of the risk-taking channel of monetary policy (Avdjiev & Serena, 2025; Lee *et al.*, 2022; Avdjiev *et al.*, 2018; Dell'Ariccia *et al.*, 2014)[1]. To fill this gap, this chapter contributes to this growing literature by providing novel causal evidence of global banks' leverage as a source of exogenous shocks to global liquidity conditions. To this end, an instrumental variable for the aggregate leverage of global banks is constructed, using bank-level data and the high concentration within the global banking sector, following the granular instrumental variable approach of Gabaix & Koijen (2024). The results show that higher global banks' leverage shocks significantly appreciate exchange rates against the dollar, reduce US dollar-denominated bond spreads, and increase gross cross-border inflows.

Chapter 2 developed a theoretical framework in which the worldwide accepted instrument for cross-border payments—global money—is created through the credit operations of globally active banks. From a Minskyan perspective, it interprets countries' balance of payments as flows of global money, where "international dollars are created by the banking process" (Minsky, 1979, p. 17) by both US and non-US international banks (Minsky, 1986a). By situating the balance sheets, expectations, and preferences of these global money issuers at the analytical core, the framework highlights their central role in determining cross-border credit conditions and shows how these depend on their desired leverage. Building on these theoretical insights, a stylised model of global liquidity is developed that formalises how fluctuations in global banks' leverage act as exogenous pressures on global liquidity worldwide and provides the basis for the empirical analysis that follows.

Global liquidity cannot be measured directly, but its footprints can be traced through proxy measures (Cohen *et al.*, 2017). Following previous literature (Bruno & Shin, 2015a,b; Morelli *et al.*, 2022; Banti *et al.*, 2012), the analysis uses exchange rates, US dollar government bond spreads, and gross cross-border inflows at the country level for 74 advanced and emerging market countries between 2000-Q1 and 2022-Q4. Larger gross cross-border flows, appreciating exchange rates against the US dollar, and compressed US dollar spreads signal easier cross-border financial conditions and an expansion of

[1]More generally, there is an extensive literature exploring the role of global banks in the transmission of international shocks (Adams-Kane *et al.*, 2015; Cetorelli & Goldberg, 2011, 2012)

global liquidity. By using country-level variables instead of global measures, the results show that the outcomes are not driven by advanced economies with large exposures to cross-border flows. In turn, while heterogeneous, the effects are economically significant for both advanced and emerging economies. To measure global banks' leverage, the chapter uses bank-level data for 34 institutions classified as Global Systemically Important Banks (G-SIBs) by the Basel Committee on Banking Supervision (BCBS) between 2013 and 2023. These institutions' global systemic relevance is determined by their size, interconnectedness, and cross-jurisdictional activity, among other factors (Laeven *et al.*, 2016; McLemore *et al.*, 2022; Egger *et al.*, 2023). They comprise the lion's share of the global banking system. While some authors have relied on aggregated measures of leverage (Bruno & Shin, 2015b; Cesa-Bianchi *et al.*, 2018; Cerutti *et al.*, 2017), using bank-level data highlights the systemic relevance of individual institutions in driving global shocks and enables the identification strategy to exploit idiosyncratic shocks to these institutions.

The key challenge when studying the effect of global banks' leverage on global liquidity is endogeneity. Fluctuations in exchange rates and asset prices can have valuation effects on global banks' portfolios (Pedrono, 2022). Similarly, during periods of higher credit demand, banks expand both assets and liabilities, as well as their loan loss provisions (Kohler, 2022; Fontaine *et al.*, 2023; Huizinga & Laeven, 2019). Both factors can affect leverage ratios. In turn, changes in global liquidity can affect global banks' risk perceptions and appetite, changing their desired leverage (Bruno & Shin, 2015b; Cohen *et al.*, 2017). Finally, other confounding factors driving global banks' leverage associated with global financial and economic conditions include cross-border flows, exchange rates, and asset prices (Mandalinci & Mumtaz, 2019; Koepke, 2019; Engel & Wu, 2024). For instance, changes in US monetary policy can drive the correlation between global liquidity and global banks' leverage (Miranda-Agrippino & Rey, 2020)[2]. Because of this, measures of global banks' leverage correlated with other confounding factors can deliver biased estimates of their effects on global liquidity.

To address this bias, the empirical strategy consists of three steps. First, to identify exogenous variation in leverage, idiosyncratic shocks to global banks' leverage are estimated, isolating them from the common factors that affect all global banks, both observable and unobservable. Idiosyncratic shocks are orthogonal to the global financial cycle, and macroeconomic drivers of cross-border flows, exchange rates and bond spreads. Most papers use Principal Component Analysis (PCA) for this purpose. In the context of this chapter, while PCA accounts for heterogeneous exposures to common factors across

[2]For instance, Kalemli-Özcan (2019) highlights that the Federal funds rate affects the risk tolerance of global investors. Similarly, Lee & Bowdler (2020), using US monetary policy shocks identified based on narrative sources, find that global banks reduce leverage faster and more strongly after a monetary tightening, negatively affecting cross-border banking flows.

banks, it assumes that these exposures are static over time. This is a threat to identification since global banks react differently to macroeconomic developments depending on the structure of their balance sheets, performance, and regulatory constraints. For example, changes in the US Federal Reserve policy rate might affect banks differently depending on their holdings of marketable securities, or current levels of leverage (Dell'Ariccia *et al.*, 2014). In that scenario, PCA may not fully remove the influence of common shocks from the estimated idiosyncratic components. To address this concern and better isolate idiosyncratic shocks, accounting for bank-specific and time-varying exposures, the chapter applies the Instrumented Principal Component Analysis (IPCA) from Kelly *et al.* (2019, 2020). This method allows for both observable and unobservable common factors and estimates time-varying, bank-level exposures as functions of each bank's observed characteristics, such as liquidity ratios, profitability, and risk measures. Accounting for these characteristics allows for the capture of balance sheet developments, including those that may tighten or ease Basel III or domestic regulatory requirements, such as the risk-weighted capital ratio or the leverage ratio.

In the second step, a valid and optimal instrument for aggregate global banks' leverage is constructed using the asset size-weighted sums of these idiosyncratic shocks, using the Granular Instrumental Variables (GIV) approach of Gabaix & Koijen (2024). Given the high concentration in global banking, idiosyncratic shocks to individual institutions affect aggregate outcomes, making it possible to use them as valid instruments to investigate their causal effects on global liquidity. The relevance of aggregating idiosyncratic shocks using size-weighted averages lies in the granular structure of the global banking sector, where, even within a handful of G-SIBs, a small number of large institutions account for a disproportionate share of total assets. Thus, idiosyncratic shocks to large banks do not average out, but instead have significant effects on aggregate outcomes. The GIV strategy exploits this feature, treating variation in leverage that originates from individual banks, but orthogonal to common shocks, as an instrument for aggregate leverage. This approach is appropriate in this context because it directly targets the endogenous component of leverage that is entangled with global financial conditions, isolating exogenous variation arising from micro-level dynamics that plausibly satisfy the exclusion restriction. While Gabaix & Koijen (2024) suggest using IPCA to construct a GIV with loadings dependent on characteristics, to my knowledge, this is the first work to empirically apply IPCA for GIV construction, relaxing time-invariant loading assumptions.

In the last step, the estimated instrument is used to study the dynamic causal effects of global banks' leverage on global liquidity through panel local projections (Jordà, 2005, 2023). This method is particularly well-suited to estimating impulse responses in a flexible, semi-parametric framework that avoids imposing strong assumptions on the underlying data-generating process. It allows me to trace the full temporal pattern of global liquidity responses to identify leverage shocks over multiple horizons.

I find that idiosyncratic shocks to global banks' leverage have statistically and economically significant effects on all three indicators of global liquidity. Positive shocks to global banks' leverage are associated with looser global liquidity conditions, temporarily reducing dollar spreads, increasing cross-border inflows, and appreciating exchange rates versus the US dollar. The effects are significant even when controlling for a broad set of global and local factors. These include domestic macro-financial conditions, capital controls, and financial development, as well as global risk, US monetary policy, and the global business cycle, variables that the literature has identified as key drivers of the global liquidity measures (Koepke, 2019; Engel & Wu, 2024). For instance, the global financial cycle measure of Miranda-Agrippino & Rey (2022) is strongly correlated with cross-border flows and asset prices, and global banks' leverage, underscoring the importance of controlling for such confounding forces to isolate the independent effect of leverage shocks. The results confirm the systemic relevance of the G-SIBs, highlighting their role as sources, and not only as amplifiers or transmission channels, of global shocks.

Additionally, the findings are consistent with the crucial role of global banks' leverage as a key driver of the global financial cycle (Rey, 2013). Moreover, the observed loosening effect of shocks on global liquidity supports theories in which the leverage of financial institutions is the primary state variable driving financial conditions (Adrian *et al.*, 2016). As highlighted by Adrian *et al.* (2016) and Fontaine *et al.* (2023), macro-finance models offer conflicting predictions regarding the relationship between financial institutions' leverage and financial conditions. While some frameworks emphasise that increased equity among financial institutions leads to more relaxed financial conditions, others underscore the role of procyclical leverage as the critical determinant shaping risk-taking behaviour and asset prices (Cohen *et al.*, 2017). The findings presented in this paper align with the latter category of models. The literature has emphasised the role of global banks' direct lending to their subsidiaries, branches, and other domestic banks in transmitting international shocks (De Haas & Van Lelyveld, 2014; Claessens & Van Horen, 2014)[3], focusing on the effects of leverage on cross-border bank flows (Bruno & Shin, 2015b). Departing from this focus, the results of this chapter show significant effects of leverage on total cross-border flows. This aligns with the perspective of Correa *et al.* (2020), who argue that global banks drive the financing "that supports the leverage of other financial institutions and determines asset prices" (p. 9), implying that global banks can influence both the asset and liability sides of cross-border investors' balance sheets, thereby shaping their behaviour. While these other investors can also be sources or amplifiers of shocks, exploring their effects is beyond the scope of this work.

[3]See Avdjiev *et al.* (2019b) for a different perspective.

The findings are highly relevant to policymakers, confirming the importance of global banks' leverage for international financial stability, especially in the current regulatory and market environment. By identifying the causal role of leverage adjustments among G-SIBs as drivers of global liquidity, the chapter provides insights into the transmission channels through which banking sector dynamics generate cross-border spillovers. This understanding is critical for designing effective regulatory frameworks that mitigate adverse externalities, stabilise cross-border flows, and support exchange rate stability, particularly in emerging markets exposed to shifts in global financial conditions.

The results are robust across alternative GIV specifications, measures, and subsamples. Robustness checks assess the stability of the findings by constructing alternative GIVs, including specifications with static loadings on common factors, mean asset shares as weights, separate instruments for US and non-US global banks' granular shocks, and the inclusion of leads of the instrument. In addition, the baseline results are compared with regressions based on alternative raw measures of global banks' leverage used in the literature. An exchange rate market pressure index is also employed as a dependent variable to examine the effect of leverage shocks on exchange rate dynamics, accounting for both policy interest rate changes and official foreign exchange interventions. Finally, the validity of the results is examined by estimating the model separately for advanced and emerging economies, and for the period following the Global Financial Crisis and preceding the COVID-19 shock.

The remainder of this chapter is organised as follows. Section 3.2 reviews the related empirical literature. Section 3.3 presents a simple model to motivate the empirical strategy. Section 3.4 describes the bank-level and macroeconomic data used in the empirical model. Section 3.5 outlines the methodology for estimating the GIV and the panel local projections. Section 3.6 presents the main findings, followed by robustness exercises in Section 3.7. Finally, Section 3.8 concludes.

3.2 Related empirical literature

This chapter contributes to several strands of literature. A central focus of this literature has been the impact of global banks' leverage on cross-border bank flows. Bruno & Shin (2015b) present a framework where global banks' leverage drives cross-border bank flows, supported by panel regression findings. Bruno & Shin (2015a) use a VAR model to show that US broker-dealers increase leverage when US monetary policy is loose, which increases cross-border bank flows, and depreciates the US dollar. Cesa-Bianchi *et al.* (2018) implement a panel VAR model with multiple countries, finding similar results, while Cerutti *et al.* (2017) highlight the role of non-US banks' leverage in driving global liquidity. This chapter departs from these authors, identifying the effects of global banks' leverage on total gross inflows, rather than focusing solely on bank flows. The empirical literature on the effects of global banks' leverage on asset prices and exchange rates is also growing, motivated by recent theoretical contributions in the fields of intermediary asset pricing and the renewed portfolio-balance approach (Gabaix & Maggiori, 2015; He *et al.*, 2017; Obstfeld & Zhou, 2023). Adrian *et al.* (2011) use financial institutions' aggregated data to explain excess returns in foreign exchange rate markets[4]. He *et al.* (2017) use the leverage of primary dealer counterparties of the New York Federal Reserve to explain cross-sectional variation in expected returns, including exchange rates, sovereign bonds, and credit default swaps. Correa & DeMarco (2025) find that non-US dealers' leverage has predictive power for exchange rates, while the effects for US dealers are insignificant. Adrian & Xie (2020) explore the causal effects of non-US banks' demand for US dollars on the US dollar exchange rate, finding that higher leverage increases demand for US dollar assets, appreciating the US dollar. Studying how global banks' capital affects the transmission of global shocks, Morelli *et al.* (2022) find that foreign currency sovereign and corporate bonds held by distressed global banks experienced larger price contractions around the Lehman Brothers bankruptcy. This contributes to both strands of literature by providing causal evidence of the effects of global banks' leverage on gross inflows, exchange rates, and foreign currency spreads.

This chapter also contributes to the literature using the Granular Instrumental Variables approach pioneered by Gabaix & Koijen (2024) with a novel empirical application of the IPCA method for the construction of the granular instrument. There is a growing literature applying GIV to study shocks from global banks and other financial institutions. Camanho *et al.* (2022) use a GIV based on idiosyncratic shocks from large funds to estimate the causal effect of equity flows on exchange rates. Aldasoro *et al.* (2023b) study the causal impact of cross-border banking flows on emerging economies using panel local projections. Becker *et al.* (2023) explore how US and foreign banks' US dollar syndicated lending affects the US dollar exchange rate, constructing a GIV based on shocks to the bank flows. They find stronger effects when US broker-dealers' leverage is low. Bippus *et al.* (2023) use cross-border position data of UK-resident banks to construct a GIV, finding significant effects of idiosyncratic demand flows on the exchange rate. They find that lower capital ratios increase the size of these effects. This chapter contributes to this literature by exploring the effects of idiosyncratic shocks to banks' leverage. In this line, the paper most closely related to this chapter is Acalin (2023), which studies the relationship between global banks' leverage and net cross-border flows, constructing a GIV based on the leverage of global banks. Unlike Acalin (2023), this chapter extends the analysis to exchange rates, emerging market bond spreads, and gross cross-border inflows,

[4]Cesa-Bianchi *et al.* (2019b) find that other measures of risk appetite, such as credit conditions surveys, have also predictive power over exchange rate excess returns.

capturing how global banks' leverage drives global liquidity.

3.3 A simple model of global banks and global liquidity

This section presents a simple model that summarises the key theoretical mechanisms to be tested empirically in this chapter. The model builds on the framework developed in Chapter 2 and related contributions such as Aldasoro *et al.* (2023b); Bruno & Shin (2015b); Gabaix & Maggiori (2015).

Global banks manage their balance sheets by targeting specific ratios that reflect both regulatory constraints and internal risk management objectives. Here, the focus is on the leverage ratio, defined as $\psi = \frac{A_{GB}}{E_{GB}}$, where A denotes assets, L liabilities, and E equity. Assets include loans not only to borrower economies, but also to diverse financial and non-financial firms that also invest in the borrower economies. This implies that the credit conditions set by global banks also affect non-bank cross-border flows[5]. These borrower economies hold deposits with global banks, creating a two-way balance-sheet relationship. Following Godley & Lavoie (2006a), global banks accommodate their balance-sheet composition to the portfolio decisions of non-banks, but set the pricing of their assets and liabilities relative to the policy rate.

In line with Chapter 2, global banks determine the lending rate by applying a mark-up, or spread, σ, over the base rate i_{US} set by the Federal Reserve, and set their funding rate by applying a markdown μ (assumed fixed here). Banks choose the spread σ to achieve a return on equity (ROE) equal to the base rate plus a target excess return r:

$$r + i_{US} = \frac{A_{GB}(i_{US} + \sigma) - L_{GB}(i_{US} - \mu)}{E_{GB}} = \psi\sigma - (\psi - 1)\mu - i_{US}. \tag{3.1}$$

From this condition, the lending rate spread can be expressed as a function of leverage and desired profitability:

$$\sigma(\psi) = \frac{r - (\psi - 1) \cdot \mu}{\psi}.$$

This implies that the spread is inversely related to leverage, $\frac{\partial \sigma}{\partial \psi} < 0$. Desired leverage is, in turn, constrained by banks' risk management preferences, which define a

[5]Moreover, if these credit conditions affect asset prices, they can affect the inflows from non-leveraged investors (e.g., asset managers), prompting fire sales.

value-at-risk (VaR) limit:

$$VaR = \omega \cdot \varphi \cdot A_{GB} < E_{GB},$$

where φ represents the perceived level of uncertainty or market risk and ω captures effective risk aversion determined by liquidity preferences and internal risk management practices. In this way, the model presents a setting that is both similar to the traditional macro-finance literature, but that captures the Minskyan dynamics of the global banks' margin of safety (Nikolaidi, 2014). Substituting assets and equity in terms of leverage yields:

$$\omega \cdot \varphi \cdot \psi < 1,$$

so the maximum leverage consistent with the risk constraint is:

$$\psi = \frac{1}{\omega \cdot \varphi}.$$

Global banks, therefore, target this maximum leverage to minimise lending spreads while achieving their desired profitability, thereby improving their competitive position. In sum, global banks, given their desired margins of safety and expected levels of different risks, adjust their desired leverage (summarising their financial structures) and define their mark-ups over the policy rate. Then, they provide all the credit demanded by borrower economies and other cross-border investors.

Exchange rate levels and volatility can both reflect and influence the perceived creditworthiness of external borrowers (and the cross-border investors that lend to them and borrow from global banks)[6]. This perception has a subjective component, $\varphi_{b,0}$, idiosyncratic to each global bank b, and an endogenous component that depends on the nominal exchange rate e. Similar specifications can be found in Bruno & Shin (2015a) and Gabaix & Maggiori (2015). The exposure of each bank to this risk factor is mediated by two parameters: φ_1, common to all banks, and $\lambda_{b,t}$, a time-varying term capturing differences in banks' balance-sheet composition, liquidity, and profitability. Leverage can then be expressed as:

$$\psi = \frac{1}{\omega \cdot (\varphi_{b,0} + \varphi_1 \lambda_{b,t} e)}.$$

This highlights the endogenous relationship between global banks' leverage and broader measures of global liquidity. To illustrate how changes in leverage transmit to external financing conditions, the model focuses on three variables that capture countries' ease and cost of accessing foreign currency: cross-border inflows from global banks and

[6] Gabaix & Maggiori (2015) link volatility to the binding risk constraints of financiers, whereas Bruno & Shin (2015b) use a structural model to show how nominal exchange rate levels determine the credit risk of local borrowers.

other international investors, the exchange rate, and the US dollar risk premium. For a representative domestic economy, these relationships can be expressed as:

$$FL = f\left(i - i_{US} - \Delta e^e - \sigma(\psi) - \rho\right), \tag{3.2}$$

$$e = \chi - \gamma FL, \tag{3.3}$$

$$\rho = \rho\left(\frac{L(1 + i_{US} + \sigma(\psi) + \rho)}{\overline{X}} - \delta^{Max}\right), \tag{3.4}$$

$$L = L_{-1} + FL, \tag{3.5}$$

where FL denotes cross-border inflows, i and i_{US} are the domestic and US policy rates, Δe^e is the expected depreciation rate, σ is the lending spread, and ρ is the country risk premium. Both policy rates are exogenous in the model.

The exchange rate depends on the demand and supply of US dollars in the FX market, where χ represents a fixed demand for foreign assets net of the current account balance, L denotes foreign liabilities, X exports, and δ^{Max} is the benchmark for creditworthiness based on the ratio of foreign liabilities to exports (Moreno-Brid *et al.*, 2023; Morlin, 2022). Ignoring capital gains, the stock of foreign liabilities evolves with cross-border inflows.

For simplicity, FL represents both the final borrowers' demand for external borrowing and the cross-border investors' demand for the borrower-economy liabilities. Including foreign-currency lending to final borrowers does not change the model's implications. The model abstracts from quantity-based credit restrictions for simplicity.

This simple model captures the main effects of global banks' leverage on global liquidity. Higher leverage increases inflows due to improved relative returns and external creditworthiness of final borrowers: $\frac{\partial FL}{\partial \psi} > 0$. Increased leverage, by boosting inflows, causes an appreciation of the domestic currency relative to the US dollar: $\frac{\partial e}{\partial \psi} < 0$. Finally, higher leverage reduces the risk premium in the short term since it reduces the interest payments: $\frac{\partial \rho_{st}}{\partial \psi} < 0$. However, the effect is smaller in the medium term because the increase in the stock of foreign liabilities deteriorates the debt service ratio: $\frac{\partial \rho_{mt}}{\partial \psi} \approx 0$. Further details of these derivations, as well as those appearing later in the chapter, are provided in Appendix B.

In summary, this is the testable hypothesis of the chapter: Higher global banks' leverage has a positive causal effect on global liquidity conditions (exchange rate appreciations, larger gross inflows, and temporarily lower USD interest rate spreads).

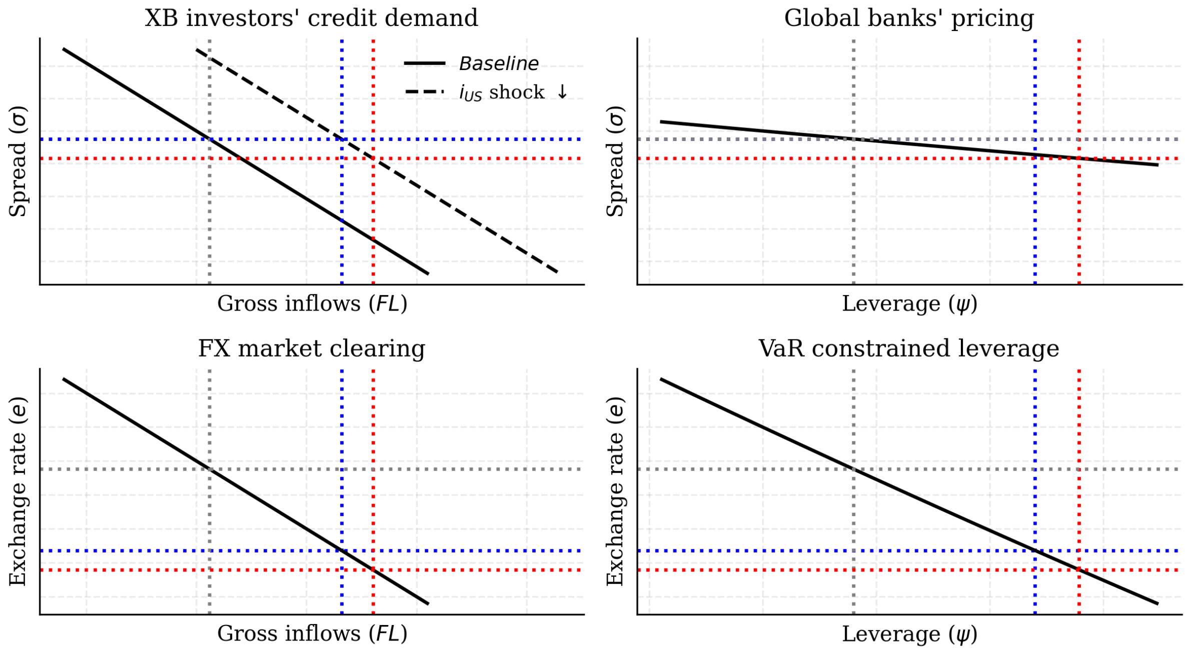

Figure 3.1: Effect of a reduction in the US monetary policy rate

However, estimating this effect is challenging, as the level of risk perceived by global banks changes with global liquidity. The following simulation illustrates how confounders can create biases in this estimation. Figure 3.1, plots how an initial equilibrium (grey lines) is affected by a reduction in the monetary policy rate from the United States. The blue lines indicate the initial direct effect, increasing cross-border flows, and credit demand. The larger inflows appreciate the exchange rate of the borrower economies versus the United States. The depreciation of the US dollar improves economic and financial conditions across the world, reducing the risk perceived by global banks in the balance sheets of their borrowers. This reduces the Value-at-Risk constraints, allowing higher leverage, which in turn allows for relaxing global banks' credit conditions, here exemplified by the lending spread. Finally, this improves global liquidity even further, reinforcing the effect of monetary policy. The red line shows the final equilibrium given the feedback effect from global banks.

Higher targeted leverage allows global banks to offer lower lending rates, which boosts credit demand. This raises gross inflows, appreciates the exchange rate, and temporarily compresses the country risk premium. However, because perceived risk co-moves with the exchange rates and the demand for credit, leverage both drives and responds to global liquidity. For instance, if we run a regression between the exchange rate and the global banks' leverage without any further controls, we will be capturing the variation explained by the effect of the policy shock and feedback effect in both variables (from the grey equilibrium to the red one), instead of only the effect of latter (from the blue equilibrium to the red one). We could include the US monetary policy as a control in the regression; however, not only can some global banks react differently to this shock than others ($\lambda_{b=1} \neq \lambda_{b=2}$), but the same bank can react differently across time depending on its current exposure to the shock ($\lambda_{b=1,t} \neq \lambda_{b=1,t+1}$).

Therefore, estimating the causal effect of leverage requires an instrument that isolates changes in leverage unrelated to concurrent shifts in global liquidity. The next section describes the empirical strategy to capture bank-level idiosyncratic shocks. While at quarterly frequencies it is hard to find the origin of these shocks, these can be associated with exogenous changes in the risk-aversion or risk perceptions of global banks.

3.4 Data

The sample consists of bank-level data from 34 G-SIBs headquartered in 12 countries and country-level data from 74 advanced and emerging market economies. The sample covers quarterly data from Q1-2000 to Q4-2022.

3.4.1 Global banks' data

The sample of global banks consists of 34 institutions classified as G-SIBs by the Basel Committee on Banking Supervision (BCBS) at least once between 2013 and 2023[7]. The BCBS's assessment methodology for G-SIBs is based on different scores, which are calculated by comparing various indicators — such as size, interconnectedness, and cross-jurisdictional activity — against corresponding denominators that represent the totals in the sample of reporting banks[8]. These banks are, by definition, globally active and large institutions[9].

A strong granular instrument requires a high degree of concentration in the global banking system (Gabaix & Koijen, 2024). This concentration can be observed at the banking system (Aldasoro & Ehlers, 2019; Avdjiev *et al.*, 2021), and the bank levels (Ioannou *et al.*, 2019; Schoenmaker, 2017), as also shown in Table 3.1. This concentration has remained significant in recent years. Between 2016 and 2023, these 34 banks accounted for 61% of total claims and 65% of total cross-jurisdictional claims reported in the consolidated banking statistics of the Bank for International Settlements.

[7] The BCBS's sample of G-SIBs starts in 2013. However, Alessandri *et al.* (2015) develop a methodology to identify G-SIBs, and apply it for the years between 2007 and 2012, finding that the top G-SIBs show a relatively high degree of stability over time.

[8] In turn, the sample of reporting banks is defined by the leverage ratio exposure measure. All banks exceeding 200 billion euros, or that have been classified as a G-SIB in the previous year, are required to report the indicators to their national supervisory authorities

[9] As Gabaix & Koijen (2024) indicate, it is possible to construct GIVs using a subset of the top entities. In this line, Acalin (2023) selects 23 banks based on their average asset size. In turn, the sample is based on the banks' systemic importance as defined by the BCBS.

Importantly, the concentration remains high within the sample. The 10 largest banks alone explained 35% of total claims and 32% of total cross-jurisdictional claims. Similarly, the sample's asset share Excess Herfindahl — a standard measure of concentration — is 10%. These metrics support the application of the GIV methodology to this set of banks.

Based on this sample, quarterly bank-level financial accounts from Fitch Connect are used. In line with He *et al.* (2017) and Coimbra & Rey (2024), the analysis relies on consolidated balance sheet data (at the holding company level). The use of holding-level data is not only driven by the limited cross-country coverage of branches and subsidiaries. As He *et al.* (2017) argue, using holding-company balance sheets acknowledges the role of internal capital markets in the mitigation and contagion of shocks across the different businesses of the holding company, thereby reflecting decisions taken at the holding level that affect branches and subsidiaries worldwide (d'Avino & Shabani, 2025; Berrospide *et al.*, 2016). This is particularly important in the case of global banks, as they operate across different types of financial markets and geographical locations, as it enables shocks to be analysed as global rather than as domestic shocks tied to individual branches or subsidiaries. In cases where multiple types of statements for each bank are available, the selection criteria of Raddatz *et al.* (2024) are followed[10]. Following Acalin (2023), missing values are linearly interpolated for a given quarter, and bank-quarter observations with negative equity and leverage higher than 100 are removed. The sample consists of 3,010 bank-quarter observations. Total assets are calculated in US dollars using end-of-quarter exchange rates to compute banks' quarterly asset shares. Leverage is calculated as the ratio of assets over book equity, in line with Adrian *et al.* (2016), who find that this measure better captures how financial institutions affect financial conditions.

Table 3.1 lists the 34 G-SIBs, headquartered in 12 countries (Canada, China, Finland, France, Germany, Italy, Japan, the Netherlands, Spain, Switzerland, the United Kingdom and the United States).

The bank characteristics used in Section 3.5.1 are grounded in the literature on bank capital structure (Antoniou *et al.*, 2008; Gropp & Heider, 2010; Lee *et al.*, 2017). These include measures of profitability (dividend payout ratio, net interest margin, non-interest expense over total operating income), risk (loan loss provisions over gross loans, net charge-offs over average gross loans, non-performing loans over gross loans and risk-weighted assets over total assets), liquidity (liquid assets over wholesale liabilities) and size (the logarithm of total assets). These also include the lagged value of the bank

[10] Raddatz *et al.* (2024) keep only financial statements based first on quality type (with the order of priority: restated, original, preliminary, partial), audited/qualified categories (audited-unqualified, audited-qualified, and audited-unqualified), and accounting standards (international financial reporting standards, international accounting standards, local generally accepted accounting principles, US GAAP, regulatory).

	Name	Country	XJ claims share	Asset share	Leverage	Leverage (std)
1	HSBC	GB	5.45	1.20	24.32	7.43
2	BNP Paribas	FR	4.07	2.99	26.52	5.30
3	Santander	ES	3.69	1.97	16.55	2.34
4	Citigroup	US	3.09	2.36	12.56	3.29
5	Deutsche Bank	DE	2.89	2.03	31.96	10.61
6	Barclays	GB	2.80	1.88	25.92	6.53
7	MUFG	JP	2.65	3.15	22.73	6.57
8	ING Bank	NL	2.65	1.23	27.76	7.65
9	JP Morgan	US	2.47	3.39	13.50	2.64
10	Standard Chartered	GB	1.96	0.85	16.44	2.08
11	UBS	CH	1.91	1.23	28.72	12.55
12	Société Générale	FR	1.82	1.87	27.60	4.70
13	Credit Suisse	CH	1.79	1.00	22.93	6.16
14	Unicredit	IT	1.77	1.18	15.93	1.69
15	Bank of China	CN	1.64	3.74	14.86	1.75
16	Toronto Dominion	CA	1.61	1.25	19.53	3.26
17	Crédit Agricole	FR	1.61	2.67	20.52	3.11
18	SMFG	JP	1.59	2.04	24.49	10.06
19	RBC	CA	1.56	1.23	20.84	2.40
20	Goldman Sachs	US	1.49	1.25	16.05	4.19
21	Mizuho	JP	1.48	2.10	34.32	16.90
22	Nordea	FI	1.42	0.83	21.78	2.54
23	Bank of America	US	1.41	2.92	11.28	1.52
24	BBVA	ES	1.35	0.95	16.22	3.25
25	RBS	GB	1.24	0.74	29.73	5.99
26	Morgan Stanley	US	1.15	1.10	18.42	7.58
27	ICBC	CN	0.82	5.02	15.77	3.60
28	BPCE	FR	0.81	1.79	20.69	4.10
29	Wells Fargo	US	0.49	2.18	11.01	1.34
30	China Construction	CN	0.35	4.25	15.05	3.28
31	BNY Mellon	US	0.34	0.46	9.76	1.52
32	BoComm	CN	0.32	1.65	19.35	11.79
33	State Street	US	0.30	0.31	13.70	2.79
34	Agricultural Bank	CN	0.21	4.12	22.37	13.03

Table 3.1: List of 34 G-SIBs in the sample. Note: Cross-jurisdictional (XJ) claims share and Asset share calculated with BIS data between 2013 and 2023. Mean and standard deviation of leverage calculated with 2000-2022 data.

leverage and a dummy for changes in the accounting standards.

3.4.2 Aggregate data

Dependent variables. The main dependent variables used as measures of global liquidity include the nominal exchange rate of each country versus the US dollar (where a higher value indicates a more depreciated local currency) for 65 economies, the Emerging Market Bond Index (EMBI) spread for 36 emerging economies and gross cross-border inflows for 74 economies. The data for exchange rates, and cross-border inflows come from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). These include foreign direct investment inflows, portfolio investment inflows (which include bonds and equity), and other investment inflows (mostly bank instruments, such as loans and deposits). This implies that the empirical model captures not only the effect of global banks' leverage on their own lending to the countries in the sample, but also on cross-border flows originating from other banks and from financial and non-financial investors. The EMBI spreads are published by JP Morgan and collected from Datastream. This index represents the weighted averages of yield spreads of bonds denominated in US dollars over US government debt securities at the same maturities. Country-level summary statistics are included in Table B.1 of the Appendix B.

Local controls. To account for specific economic conditions in each country, quarterly data on real GDP growth, inflation rates, interest rates for deposits, and domestic credit growth from the IFS-IMF dataset are included. The exchange rate regime classification from Ilzetzki *et al.* (2022) and the measure of countries' capital inflow restrictions from Fernández *et al.* (2016) are also included. Following Okot *et al.* (2022), the financial development index from the IMF is included.

Global controls. To control for other global financial factors impacting global liquidity, the CBOE volatility index (VIX) and the effective federal funds rate, both obtained from the Federal Reserve Economic Data, are included. To control for global factors related to the global business cycle, the US and global (excluding the US) real gross domestic product (GDP) growth rates from the database of Global Economic Indicators of the Federal Reserve Bank of Dallas are included (Grossman *et al.*, 2014). Global variables are included both as controls in the panel local projections regression and as observable common factors in the IPCA estimation of Section 3.5.1.

3.5 Econometric methodology

This section presents the econometric methodology to estimate the causal effect of global banks' leverage on global liquidity. Expressed in simple terms, as in Aldasoro *et al.*

(2023b), the main objective is to identify the coefficient β^y:

$$\begin{aligned} y_t &= \beta^y L_t + \epsilon_t^y \\ L_t &= \sum_b s_b l_{b,t} \end{aligned} \tag{3.6}$$

Where y_t is a measure of global liquidity and L_t is the global banks' leverage. The latter is constructed as the weighted average of the leverage $l_{b,t}$ of each bank b, using asset shares s_b as weights. The key challenge in this estimation is the potential endogeneity of global banks' leverage to the global liquidity measures and other confounding factors. This would imply that L_t and ϵ_t^y are correlated, leading to a potential estimation bias in β^y.

To address this potential endogeneity, and identify the causal effect of global banks' leverage on global liquidity, I use a GIV approach, developed by Gabaix & Koijen (2024). This methodology exploits the granularity of data to construct an instrument based on the size-weighted sum of idiosyncratic shocks in markets where participant sizes are heterogeneous. Importantly, this approach requires correctly separating idiosyncratic shocks from changes in leverage driven by global liquidity and other common factors across global banks. This includes considering how global banks react differently to these common factors, depending on their current risk exposures and performance. For instance, Damar *et al.* (2013) find that the procyclicality of bank leverage depends on both the liquidity conditions in wholesale funding markets and the degree of banks' reliance on that type of funding. To capture these idiosyncratic shocks considering time-varying exposures to common factors, I implement an IPCA (Kelly *et al.*, 2019, 2020). This method jointly estimates unobserved latent factors and the bank's time-varying exposures to both these factors and other observable common factors, using bank characteristics.

The estimation proceeds in three steps. First, I estimate the G-SIB level idiosyncratic shocks to leverage using IPCA. Second, I construct the GIV as the weighted average of the bank-level idiosyncratic shocks. Finally, I use this instrument to estimate the causal effect of global banks' leverage on exchange rates, cross-border flows, and EMBI spreads through a panel local projections framework.

3.5.1 Estimates of bank-level leverage shocks using Instrumented Principal Component Analysis

Suppose that the leverage of each bank depends on a set of bank-specific characteristics $X_{b,t}$ (including a constant), a set of common factors η_t, and bank-level idiosyncratic shocks

$u_{b,t}$:

$$l_{b,t} = \underbrace{\alpha_{b,t}}_{X_{b,t-1}\Gamma_\alpha + u_{\alpha,b,t-1}} + \underbrace{\lambda_{b,t}}_{X_{b,t-1}\Gamma_\lambda + u_{\lambda,b,t-1}} \eta_t + u^*_{b,t} \tag{3.7}$$

The common factors η_t can include both observable η^o_t and unobservable latent factors η^l_t. Since $X_{b,t}$ includes a constant, the dynamic factor loadings $\lambda_{b,t}$ include both time-varying loadings that depend on the bank's characteristics and fixed loadings through time. Finally, the set of coefficients Γ_α and Γ_λ define the mapping from the bank characteristics to the observable and unobservable common factors.

The empirical estimation of equation 3.7 is challenging since both loadings and latent factors are unobservable. To address this, I implement the IPCA method from Kelly *et al.* (2019, 2020). This method efficiently and consistently estimates unobserved latent factors and the bank's exposures to these factors using observable bank characteristics as instrumental variables. Additionally, this method allows the inclusion of pre-specified observable factors. If bank characteristics determine how leverage reacts to common shocks, this relationship will appear in the estimated loadings of the factors on the characteristics Γ_λ. Otherwise, if the characteristics affect banks' leverage directly, this will be attributed to the intercept Γ_α. The IPCA method not only allows estimation of the bank-specific time-varying coefficients $\alpha_{b,t}$ and $\lambda_{b,t}$, but also a pre-specified number of latent common factors η^l_t.

Following Kelly *et al.* (2019), I run the empirical counterpart of equation 3.7:

$$l_{b,t} = X_{b,t-1}\Gamma_\alpha + X_{b,t-1}\Gamma_\lambda \eta_t + u_{b,t} \tag{3.8}$$

Where the residuals $u_{b,t}$ are a composite error composed by $u_{b,t} = u^*_{b,t} + u_{\alpha,b,t-1} + u_{\lambda,b,t-1}\eta_t$, with $u_{\alpha,b,t-1}$ and $u_{\lambda,b,t-1}$ being errors in the estimations of the true factor model parameters. In the context of the GIV estimation, the composite error recovered with the IPCA, $u_{b,t}$, is an idiosyncratic shock. This is the case, first, because $u_{\alpha,b,t-1}$ is a shock to the leverage of the bank b, not common to other banks. Second, as Gabaix & Koijen (2024) highlight, $u_{b,t}$ is still an idiosyncratic shock even if there are unexpected changes in the loadings (the leverage of a global bank changes more than expected in response to a common shock $u_{\lambda,b,t-1}\eta_t$)[11]. Therefore, $u_{b,t}$ can be used to construct a granular instrument.

The banks' characteristics and the observable common factors used in this step are described in Section 3.4. Following Aldasoro *et al.* (2023b), three latent factors are included. Figure B.1 shows the estimated loadings of the factors on the characteristics, and Figure B.2 shows the estimated latent factors. Only the residuals and the latent

[11] This is also true if the volatility of idiosyncratic shocks to leverage depends on the common shocks (Gabaix & Koijen, 2024): $u_{b,t} = \sigma_t v_{b,t}$, where σ_t and (η_t, ε_t) are correlated, but $v_{b,t}$ is independent of $\sigma_t(\eta_t, \varepsilon_t)$.

factors from this regression are used in the following steps. In line with Holm-Hadulla & Thürwächter (2024), the degree of idiosyncrasy of the shocks is further assessed by estimating the correlation of $u_{b,t}$ across banks. The median value of the coefficients is 0.0007, indicating no systematic relationship between banks' shocks.

3.5.2 Constructing the granular instrumental variable

For the aggregation of the bank-level idiosyncratic shock, lagged banks' asset shares are used as weights s_b. By weight-averaging these shocks, the instrument reacts more strongly to idiosyncratic shocks to larger global banks (Becker *et al.*, 2023). Based on these, a granular instrument is constructed as the difference between the weighted and unweighted average of the idiosyncratic shocks:

$$z_t = \sum_b s_{b,t-1} u_{b,t} - \underbrace{\sum_b \frac{1}{N_{t-1}} u_{b,t}}_{=0} \tag{3.9}$$

In the empirical estimation, the second element of the equation is zero by construction[12].

Table B.2 shows the pairwise correlations and their significance between the estimated GIV, the mean leverage of global banks, and the global control variables. The GIV is significantly correlated with global banks' leverage, but exhibits a lower and statistically insignificant correlation with the global controls.

3.5.3 Estimating the effect of global banks' leverage shocks using panel local projections

Using the granular instrument estimated in Section 3.5.2, the dynamic effects of global banks' leverage on global liquidity are studied. For this purpose, panel local projections

[12] Following Aldasoro *et al.* (2023b) and Acalin (2023), the intuition behind this approach is as follows. Ignoring other control variables, and assuming that $\lambda_{b,t} = \lambda$, the granular instrument can be constructed as the difference between the global banks' weighted average leverage L_t and the mean leverage $\bar{L}_t$:

$$\begin{aligned} z_t = L_t - \bar{L}_t &= \sum_b \left(s_b l_{b,t} - \frac{1}{N} l_{b,t} \right) \\ &= \sum_b \left(s_b(\lambda\eta_t + u_{b,t}) - \frac{1}{N}(\lambda\eta_t + u_{b,t}) \right) \\ &= \lambda\eta_t - \lambda\eta_t + \sum_b s_b u_{b,t} - \sum_b \frac{1}{N} u_{b,t} \\ &= \sum_b s_b u_{b,t} - \sum_b \frac{1}{N} u_{b,t} \end{aligned}$$

are employed (Jordà, 2005). As discussed by Jordà (2023), this approach is less sensitive to misspecification than vector autoregressive models and allows a straightforward implementation on panel data. The following panel regression is estimated for each dependent variable and horizon h:

$$y_{j,t+h} = \mu_j^h + \beta^h z_t + \theta^h G_t + \phi^h D_{j,t} + \varphi^h y_{j,t-1} + \epsilon_{j,t+h} \tag{3.10}$$

Where $y_{j,t+h}$ is, for each country j, either the log difference of the exchange rate, the EMBI spread, or the cumulative total cross-border inflows (in per cent of the last four quarters of the mean GDP of the recipient economy in period t), between period t and period $t+h$. μ_j^h is a country fixed effect. The main explanatory variable, z_t, is the granular instrument constructed in Section 3.5.2. G_t is a set of global control variables common to all countries, including the lagged value of z_t and the estimated latent common factors from Section 3.5.1[13]. D_t is a set of domestic control variables related to each country j, including the lagged value of the dependent variable (measured as the change between periods $t-2$ and $t-1$). Finally, $\epsilon_{j,t+h}$ is the error.

3.6 Results

A summary of the estimated effects of the instrument on the dependent variables is presented in Table 3.2 and Figure 3.2. The coefficients for all the controls and horizons are included in Table B.3. Table 3.2 presents for each dependent variable and horizon, the coefficient of the cumulative effect of the global banks' leverage on the EMBI spread, the exchange rate depreciations and the cumulative gross inflows between 1 and 12 quarters ahead. The instrument is normalised, thus the coefficient can be read as the effect of a level standard deviation.

[13] Gabaix & Koijen (2024) suggest including these variables to increase estimator precision.

Dependent	Horizon Variable	1	3	6	9
EMBI spread	z_t	-4.32	-21.32 ***	-11.09 **	-29.3 ***
	R2	0.54	0.20	0.07	0.05
	Observations	2566	2500	2401	2302
	Entities	36	36	36	36
Exchange rate	z_t	0.16	-1.3 ***	-1.53 ***	-2.02 ***
	R2	0.05	0.05	0.04	0.05
	Observations	4500	4488	4401	4218
	Entities	65	65	64	64
Gross inflows	z_t	9.11 **	20.04 **	37.28 **	59.56 **
	R2	0.05	0.06	0.06	0.06
	Observations	5450	5444	5299	5086
	Entities	74	74	74	74

Table 3.2: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. Note: Panel local projections with country fixed effects. Significance levels: *** p<1%, ** p<5%, * p<10%

Higher global banks' leverage is associated with looser global liquidity conditions, characterised by lower EMBI spreads, exchange rate appreciations and larger gross cross-border inflows. These results are statistically and economically significant for cumulative exchange rate variations and gross inflows across all quarters at the 1% level. This implies that the effects of global banks' leverage are persistent and continue to influence these variables beyond the short term. In turn, for the EMBI spreads, the coefficients are significant, with a reversion after four quarters, observing a second decrease and reversion afterwards. In the baseline model, one-way entity clustering is used, in line with the recommendation of Petersen (2008). The results remain robust when considering one-way time clustering as recommended by Almuzara & Sancibrián (2024), two-way clustered errors (country and time) and heteroskedasticity-robust errors. They also remain robust to different specifications of the local and global controls.

The baseline GIV specification is calculated using three latent factors, as described in Section 3.5.1. This is stable to the inclusion of one or two additional factors (Gabaix & Koijen, 2024). In Gabaix & Koijen (2021), the authors run the regression including the estimated latent factors and excluding the instrument to estimate the importance of the common shocks on the dependent variables. Replicating this, the results show that coefficients on the three recovered latent factors from Section 3.5.1 are significant,

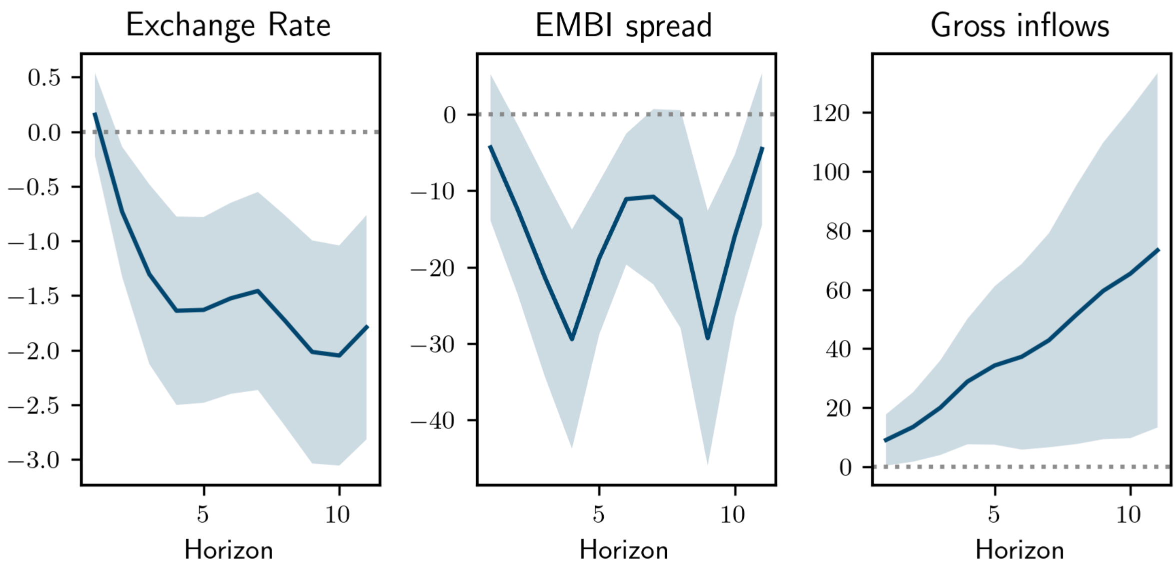

Figure 3.2: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

confirming the importance of their inclusion. The results are shown in Figure B.3

The results confirm the systemic relevance of the G-SIBs, highlighting their role as sources of global shocks rather than just amplifiers or transmission channels of other shocks. These results support the key role of these banks in cross-border finance, which Kumhof *et al.* (2020) associates with their role in global money creation. Additionally, the findings confirm the crucial role of global banks' leverage as a key driver of the global financial cycle (Rey, 2013), particularly in influencing cross-border flows and exchange rates (Bruno & Shin, 2015b). The significant effect on total cross-border flows (including portfolio and foreign direct investment flows) suggests that global banks influence countries' financial conditions through channels beyond direct lending[14], including flows where the direct creditor is not a bank. Moreover, by finding that positive shocks to leverage cause looser global liquidity conditions, the chapter supports theories where financial institutions' leverage is the key state variable in driving financial conditions, which usually include value-at-risk constraints (Brunnermeier & Pedersen, 2009; Danielsson *et al.*, 2012; Adrian *et al.*, 2016) or time-varying risk attitudes (Minsky, 1977; Nikolaidi, 2014). In this line, the results are in line with the procyclicality of banks' leverage, observed by Kalemli-Ozcan *et al.* (2012) for large European investment banks, and by Adrian & Shin (2010) for large investment and commercial banks in Europe and the United States (Kalemli-Özcan & Kwak, 2020).

[14] Channel that, according to Cesa-Bianchi *et al.* (2019a), do not primarily transmit global credit conditions to financial stability.

3.7 Robustness

To assess the robustness of the results, various specifications of the GIV in the baseline model are explored. These include using static factor loadings on common factors, mean asset shares as weights, distinct instruments for US and non-US global banks' granular shocks, and incorporating leads of the instruments. The baseline model results are then compared with regressions using alternative raw measures of global banks' leverage found in the literature, as well as an exchange rate market pressure index. Finally, the validity of the findings is tested by running the regression separately for advanced and emerging economies and for the period after the Global Financial Crisis but before COVID-19. The robustness checks confirm the main results.

Gabaix & Koijen (2024) suggest using additional information to narratively check the top idiosyncratic shocks used in the GIV, to confirm that these are actually valid idiosyncratic shocks. However, as Aldasoro *et al.* (2023b) indicate, it is challenging to precisely identify the shocks when the data is observed at a quarterly frequency, preventing a more accurate application of this validation strategy.

3.7.1 Alternative GIV specifications

Static factor loadings. As discussed before, the empirical GIV literature so far has used static factor loadings when constructing the instrument. Following a similar setting to Acalin (2023), the results are checked using this approach.

In line with the literature, to estimate $u^s_{b,t}$ a two-step procedure is used, first, running the following panel regression:

$$\Delta l_{b,t} = \alpha_b + \gamma X_{b,t} + \lambda^o \eta^o_t + e_{b,t} \tag{3.11}$$

Following Acalin (2023), the change in leverage is used as the dependent variable and bank fixed effects are included. Unlike the author, bank characteristics and the observable common factors η^o_t are included in the regression to maintain comparability with the baseline model. In the second step, using the residuals $e_{b,t}$, a principal component analysis is run, extracting the first three latent common factors η^l_t and loadings λ^l_b:

$$e_{b,t} = \lambda^l_b \eta^l_t + u^s_{b,t} \tag{3.12}$$

The GIV is then constructed using the idiosyncratic shocks as described in Section 3.5.2. Following Acalin (2023), leverage in levels is recovered by taking the cumulative sum of the GIV $z^s_t = \sum_{t=0}^{T} \sum_b s_{b,t} u^s_{b,t}$. Figure 3.3 shows the local projections estimations using this instrument. The results support the baseline model, with only the EMBI spread

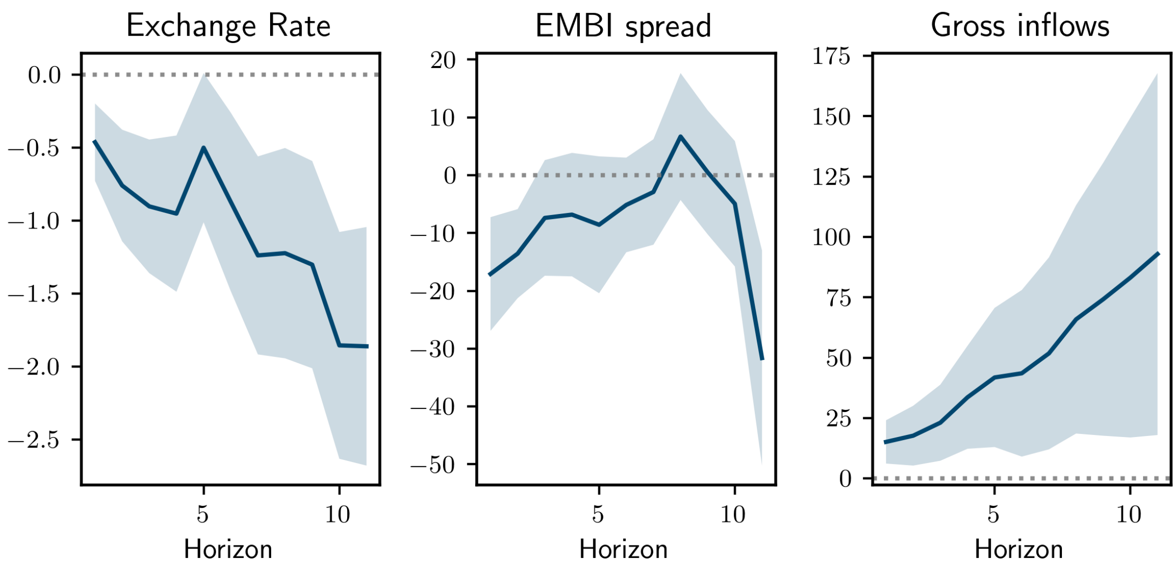

Figure 3.3: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. GIV based on static loadings. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

presenting a different dynamic at longer horizons.

Mean asset shares as weights. In the baseline models, the lagged value of banks' asset shares is used as weights to construct the GIV. This requires the assumption that $u_{b,t}$ is independent of $s_{b,t-1}$. To verify the results without this assumption, the mean value of banks' asset shares s_b is used to construct an alternative instrument: $z^{\bar{s}}t = \sum_b sbu_{b,t}$. Figure 3.4 plots the results of the estimation using this instrument, supporting the main findings.

US and non-US global banks' granular shocks. Gabaix & Koijen (2024) suggest an overidentification test, in which two GIVs are constructed, each based on different types of entities. Following this approach, two instruments are calculated, $z_t^{US} = s_{b,t-1}^{US} u_{b,t}$ and $z_t^{non-US} = s_{b,t-1}^{non-US} u_{b,t}$, using the estimated idiosyncratic shocks from Section 3.5.1 and the asset shares of US and non-US global banks. Using both instruments, the panel regression from equation 3.10 is estimated. Overall, the results support the baseline model, as shown in Figure 3.5. The estimated coefficients for both instruments are similar and significant for exchange rate variations, while the coefficient for non-US global banks is slightly larger for gross inflows. This is consistent with the literature highlighting the role of non-US banks in global banking and, in particular, in the global US dollar system (Aldasoro & Ehlers, 2018a; Acharya *et al.*, 2017).

Meanwhile, the coefficient for the EMBI spread is only significant for non-US banks. This suggests a possible misspecification for this particular variable, which may

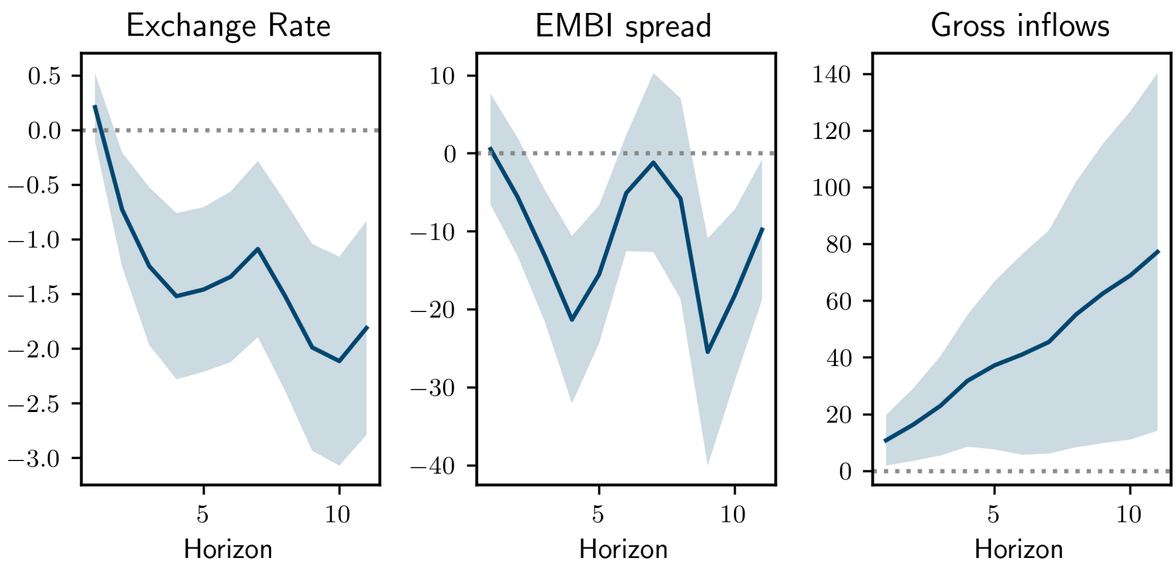

Figure 3.4: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. GIV is based on mean asset shares. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

indicate the presence of heterogeneous elasticities across banks. For instance, Bostandzic & Weiss (2018) find that European banks contribute more to global systemic risk than US banks, not only because of their larger size and lower loan portfolio quality but also because of their higher cross-border interconnectedness. Although the GIV approach allows for heterogeneous elasticities, this extension is left for future research.

Lags and Leads. Alloza *et al.* (2025) indicate that many shocks display persistence, which might require corrections in the local projections estimations. They propose including the leads of the shock. Following this, the lead of the GIV one and two quarters ahead in the baseline regressions is included. Figure 3.6 plots the results, which do not affect the findings of the baseline model.

3.7.2 Raw measures of the global banks' leverage

In the baseline model, the GIV is the main explanatory variable. As already mentioned, this instrument is correlated with the weighted average of global banks' leverage. The exercises also check if the results of the baseline model are sustained when running the same panel regression using alternative measures of global banks' leverage. This includes the unweighted average and the median value of leverage of the 34 GSIBs. Different measures used in the literature are also included: US broker-dealers' leverage (Adrian & Shin, 2010), US commercial banks' leverage, and the market leverage of the primary

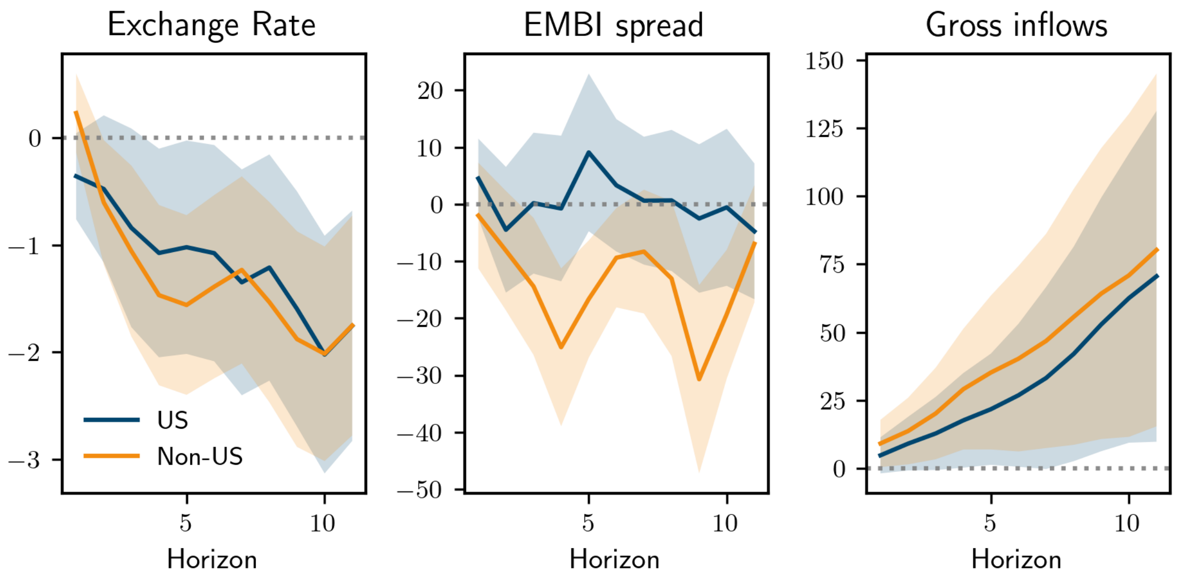

Figure 3.5: Cumulative causal effect of US and non-US global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

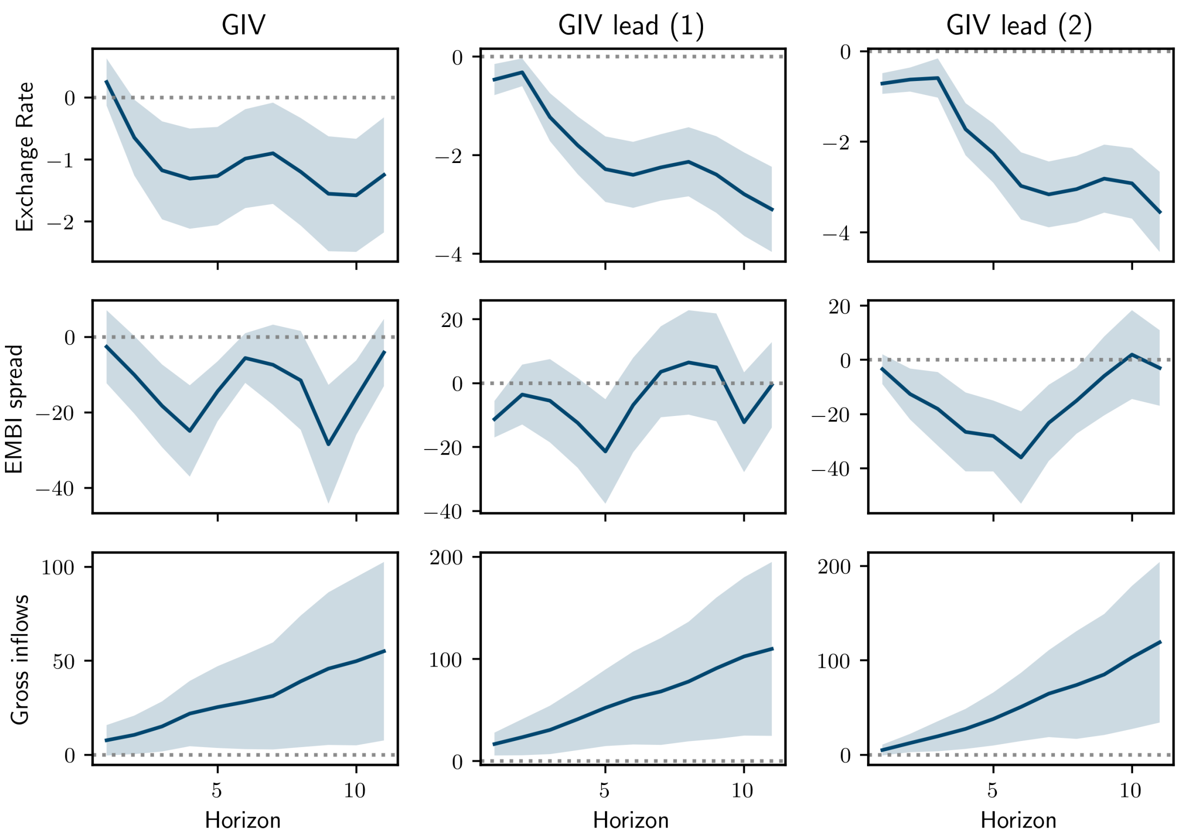

Figure 3.6: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows, including leads of the instrument. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

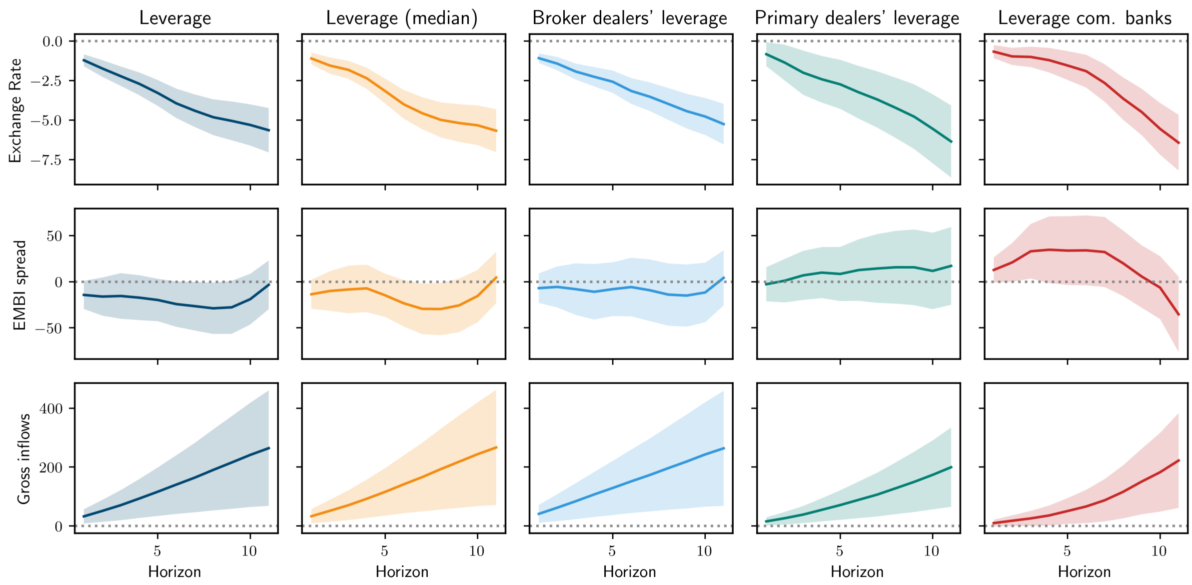

Figure 3.7: Cumulative effect of measures of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

dealer counterparties of the New York Federal Reserve, calculated by He *et al.* (2017)[15].

The results present similar coefficients as observed in Figure 3.7, with the same sign and similar magnitude, except for the EMBI, which presents mostly non-significant coefficients. US primary dealers' market leverage is significant for the EMBI for all the horizons except for the contemporaneous effect.

3.7.3 Alternative measures of exchange rate pressure

The effect of global shocks on the exchange rate can be muted by official interventions in the foreign exchange market and changes in the monetary policy rate. To account for this, the robustness of the results is checked considering the exchange market pressure (EMP) against the US dollar from Goldberg & Krogstrup (2023). The EMP is calculated by a weighted sum of exchange rate depreciations, official foreign exchange intervention, and variations in the monetary policy interest rate. Goldberg & Krogstrup (2023), estimate the EMP for 31 countries, deriving the weightings from the balance of payments relationships, international portfolio demands and valuation changes in these portfolios. Their index is constructed to express equivalent exchange rate depreciation units. The results are presented in Figure 3.8. The coefficients are significant and in line with the effect of global banks' leverage on exchange rates.

[15]The balance sheets of US Broker-Dealers and US commercial banks data were collected from FRED. He *et al.* (2017) measure of the Primary Dealers' market leverage is available and regularly updated at https://zhiguohe.net/data-and-empirical-patterns/intermediary-capital-ratio-and-risk-factor/.

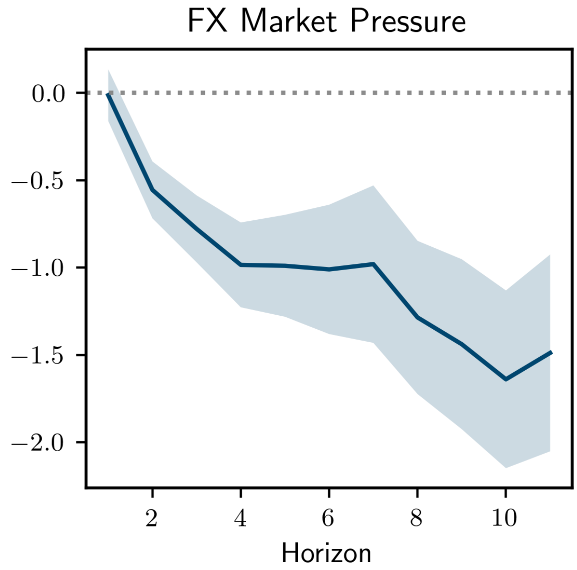

Figure 3.8: Cumulative causal effect of global banks' leverage on Exchange Market Pressure. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

3.7.4 Country and period sub-samples

Advanced and emerging economies. To check if the results are driven by cross-country group heterogeneity, the regression is estimated separately for advanced and emerging countries. For this, the current classification of the IMF for the World Economic Outlook is used. The EMBI is not included among the dependent variables in this section, since this indicator, by definition, does not include advanced economies. The results presented in Figure 3.9, support the baseline model. The coefficients have the same sign and are significant for both groups of countries. However, the effects on gross inflows are stronger for advanced economies. For the exchange rate, the effect for emerging economies is not significant during the first 7 quarters, which might be explained by the exchange rate regime in these economies. Because of this, the EMP index is included in the country comparison. Differently from the exchange rate, the coefficients for the EMP are not only significant for emerging economies, but significantly larger than those from advanced economies.

These results are in line with Aldasoro *et al.* (2023a), who find that their measures of the global financial cycle (the first principal component of gross flows) have stronger effects on the exchange rate of emerging economies, while the effect on gross flows is stronger for advanced economies. This may be related to the different levels of financial integration and vulnerability to global shocks across countries (Kohler *et al.*, 2023). Advanced economies tend to have larger and more leveraged cross-border positions (Lane & Milesi-Ferretti, 2018). Shocks to external funding conditions can reduce the return and

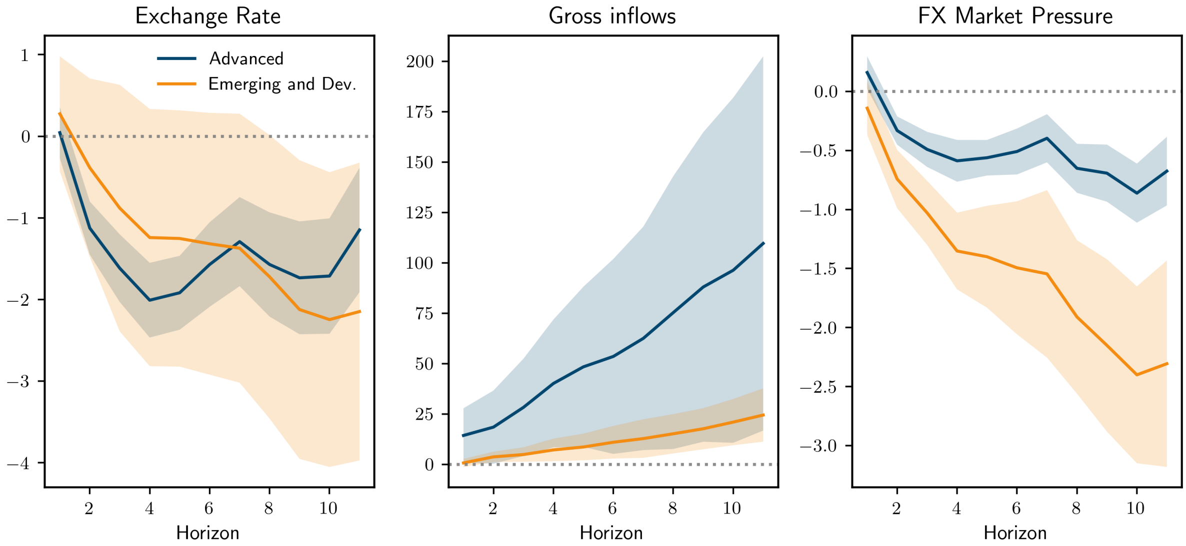

Figure 3.9: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows in advanced and emerging-developing countries

increase the risks of these positions. The unwinding of these positions results in both large gross inflows and outflows, but with smaller effects on the exchange rates. In turn, in less integrated countries, external funding might be used to roll over external obligations or fund trade imbalances. When external financial conditions deteriorate, residents' gross external positions are less elastic, creating stronger pressures on the exchange rate. In that scenario, domestic central banks might intervene directly in the exchange rate market, or change its policy rate (Goldberg & Krogstrup, 2023).

After the Global Financial Crisis and before COVID-19. The role of global banks in the Global Financial Crisis (GFC) triggered several regulatory reforms and changes in these institutions' business models (Claessens, 2017; Buch & Dages, 2018). In particular, Basel III and other financial regulations strengthened the requirements associated with the risk-weighted and unweighted leverage ratios for G-SIBs. Consequently, global banks' leverage substantially decreased compared to pre-GFC values (Adrian *et al.*, 2018; Caldentey, 2017). During the same period, bond markets and non-bank financial institutions overtook traditional banking in cross-border finance (Aldasoro & Ehlers, 2018b; Goldberg, 2022; Kim & Shin, 2021). These transformations could indicate that global banks have become less relevant in driving global liquidity. To test this claim and determine if the main results are driven by periods of stress in global financial markets, the analysis focuses on the period after the GFC and before the COVID-19 shock from the sample. For this, the model is estimated considering the period between 2013 and 2019.

Figure 3.10 shows the results, which are similar to the baseline model, indicating that G-SIBs have been relevant drivers of global liquidity in recent years. These results do

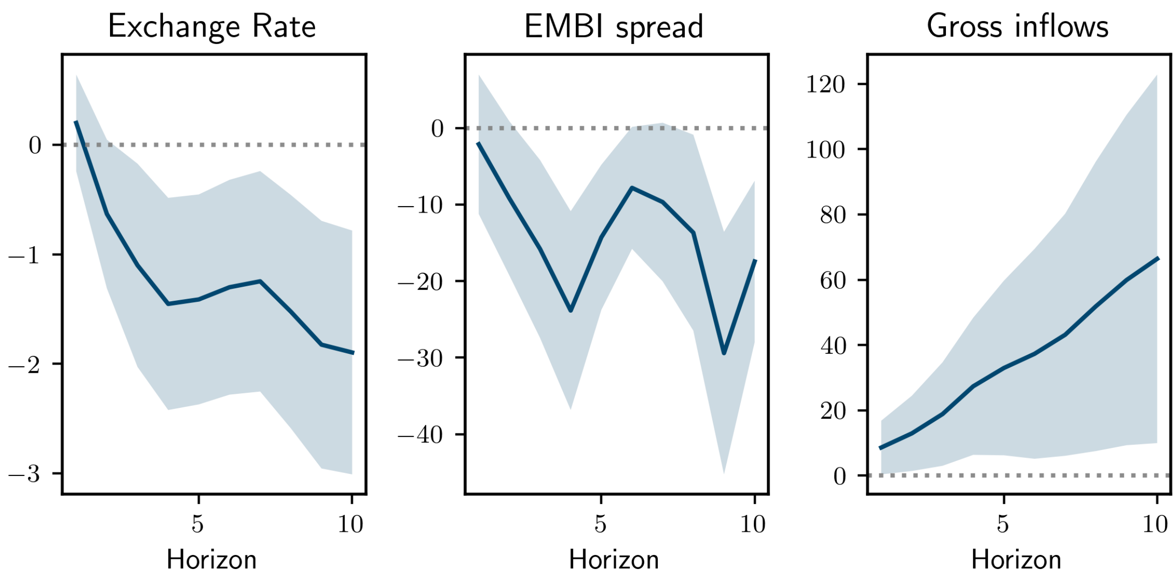

Figure 3.10: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows in advanced and emerging-developing countries between 2013 and 2019

not suggest that regulation was unsuccessful, as it is not explored whether the transmission of common shocks through these banks or the size and volatility of their idiosyncratic shocks have changed.

The significant effects on total cross-border flows and their persistence in the post-GFC period, might be related to the different channels through which global banks' shocks create spillovers to other financial institutions and relevant international investors. Acharya *et al.* (2024), in line with Michell (2024) and Sissoko (2024), present a perspective in which NBFIs and banks are not involved in two separate or competing businesses but are connected in a complex way. This perspective highlights the banks' liquidity advantages, also related to their role in liquidity creation (Beck *et al.*, 2023). An important implication of their perspective is that dependencies between banks and NBFIs have systemic risk consequences, as shocks spread through these local and cross-border connections (Aldasoro *et al.*, 2020b)[16]. However, this chapter does not empirically explore these channels.

3.8 Conclusions

This chapter empirically examined the relationship between the leverage of 34 G-SIBs and global liquidity, using exchange rates, EMBI spreads, and gross inflows as proxy measures

[16]For instance, through asset-dependencies, global banks reducing their portfolio positions can depress asset prices and impact NBFIs holding similar assets, causing them to liquidate other international assets. Similarly, through liability-dependencies, global banks tightening credit conditions to NBFIs can force the latter to reduce their cross-border investments.

of the latter. To address possible endogeneity concerns and explore the causal effects within the model, it employed a granular instrumental variables approach, using the instrumented principal components analysis method to isolate the idiosyncratic shocks. The results present statistically and economically significant effects of global banks' leverage on exchange rate variations, foreign currency government spreads, and gross cross-border inflows. Higher levels of global banks' leverage are associated with lower EMBI spreads, exchange rate appreciations, and larger gross cross-border inflows. While most papers have focused on how global banks' leverage affects cross-border bank flows, this chapter presents evidence that these effects are relevant to total gross inflows. These findings highlight the importance of global banks not only as transmission channels but also as sources of global shocks. Robustness checks confirm the consistency of the results across alternative specifications.

In conclusion, this chapter contributes to the expanding empirical literature on the drivers of the global financial cycle and the role of systemically important financial institutions. The evidence sustains the key role of globally active banks and the importance of monitoring and regulating their balance sheets' dynamics.

4

Is a dollar, a dollar?: Hierarchical funding networks in global banking

4.1 Introduction

Chapter 2 has set out a theory of global money, which has been defined as the dominant cross-border means of payment and settlement. The chapter argued that global banks, as the issuers of global money, drive cross-border financial conditions. In this chapter, we are asking whether US dollars, as the current form of global money, created by global banks, are indeed all the same, or whether even among dollar liabilities there is a hierarchy, where some US dollars are worth more than others. In other words, is a dollar a dollar?

One key characteristic of the global dollar system is the fact that a large share of these dollars is not created by US banks. According to data from the Bank for International Settlements (BIS), non-US banks held about $21 trillion each in US dollar assets and liabilities by 2023—plus off-balance-sheet obligations estimated at twice that amount—surpassing the cross-border positions of US banks (McGuire *et al.*, 2024). However, this characteristic exposes the dollar system to inherent fragility: whereas in normal times, the US dollars issued by non-US banks are treated on par with the dollar liabilities of US banks, this parity breaks down during periods of dollar funding squeezes, during which non-US banks scramble to get their dollar deposits accepted. For example, the drying up of dollar funding played a central role during the Global Financial Crisis of 2008 and the subsequent Eurozone crisis, which impacted European global banks' dollar lending both domestically and internationally. Recent assessments by European regulators confirm that these vulnerabilities persist. A significant share of euro-area banks active in dollar markets face structural funding gaps and rely heavily on unstable short-term wholesale borrowing (European Banking Authority, 2025; Klaus & Mingarelli, 2024).

These concerns echo long-standing questions about the stability of the structure of the international monetary and financial system and the role of globally operating banks therein (Borio *et al.*, 2016; Cohen *et al.*, 2017; Gourinchas *et al.*, 2019). Specifically, questions about the financial stability and structural implications of a system where one currency plays such a central role in the global economy, yet large parts of that currency are not issued by institutions based in that currency's jurisdiction. This chapter contributes to this debate by arguing that even within the US dollar system, there are deep structural and institutional financial relationships that create a hierarchy within US dollar liabilities. This, in turn, has fundamental implications for the stability of the US dollar system and financial autonomy for issuing banks/jurisdictions lower down the hierarchy.

Conceptually, we base our argument on Minskyan-inspired post-Keynesian and critical macro-finance approaches, which focus on the interlocking balance sheets underpinning financial system dynamics, and the fragilities that can emerge from mismatches between those assets and liabilities (Bonizzi & Kaltenbrunner, 2020; Gabor, 2020). More specifically, this thesis understands the global dollar system as a network of interlocking and hierarchical balance sheets of financial and non-financial corporations, within which a subset of global banks functions as issuers of global money. Yet these banks' liabilities differ in their cross-border acceptability, which means that they face uneven funding conditions. Thus, institutions that create dollar deposits are exposed to different "dollar shortage" funding risks when managing net payment outflows (Despres *et al.*, 1966; Kindleberger, 1966; McGuire & von Peter, 2012). These differential funding conditions reflect the hierarchical structure of global banking, with direct implications for the stability of the global financial system and lending conditions for countries across the globe[1].

Empirically, the chapter combines network visualisations of cross-border funding relationships with institutional analysis of infrastructures, business models, and regulation to map the hierarchical network structure of the global dollar system. The analysis shows a highly asymmetric structure of access to global dollar funding: US banks benefit from integrated onshore–offshore positions and central roles in payment and settlement infrastructures that secure them dollar funding access, while non-US global banks depend on branches' wholesale funding, FX swaps from US counterparties, and offshore liabilities. Crucially, this shows how global banking hierarchies are shaped by patterns of daily operations, financial ties, and institutional arrangements developed over time, rather than by size or policy alone. Taken together, the chapter argues that global banks' positions in the hierarchy are determined by the extent of their integration into bank and non-bank funding networks, and by how easily they can place, roll over, and refinance their US-dollar

[1] As argued in Chapter 2, global banks shape the credit conditions for borrowers across the world, which in turn are a key driver of the countries' ability to participate in cross-border transactions.

liabilities—both in normal times and during periods of market stress.

In developing this argument, this chapter contributes to the existing literature on the international monetary and financial system in several ways. First, it highlights the financial structures that underpin international monetary hierarchies. International political economy and Post-Keynesian scholars have long pointed to the hierarchical nature of the international monetary system (Andrade & Prates, 2013; Cohen, 1971; De Conti *et al.*, 2013; Fritz *et al.*, 2018; Kaltenbrunner, 2015; Strange, 1971), yet very few of those scholars have paid analytical attention to the underpinning institutions that create money in capitalism: banks (Bouguelli, 2025). Minskyan approaches to international currency hierarchies have highlighted the importance of analysing underpinning balance sheets, yet these papers have so far been largely conceptual or remained empirically on the macro (balance of payments) level, rather than analysing the underpinning financial structures (Bonizzi, 2017; Bonizzi & Kaltenbrunner, 2019; Kaltenbrunner, 2015; Ramos, 2019). For post-Keynesians, the acceptability of bank liabilities as money, and their hierarchical position, reflects social conventions and public support (Chick, 1983; Lavoie, 2022; Wray, 1998). Yet this approach tends to aggregate the banking system rather than paying attention to the differential position of banks in the global banking network. We argue that analysing this differential position is essential to understanding monetary hierarchies on the macro-economic level. This chapter largely focuses on the differential position of different currencies; these differences are equally important to understand inter-currency hierarchies.

A recent literature on the offshore US dollar market has highlighted the creation of the global currency by private institutions non-resident in the United States and the hierarchies that exist between those dollars and those created by US banks (Binder, 2024; Klooster & Murau, 2025; Murau *et al.*, 2022). For example, Murau *et al.* (2021) indicate that the "centrality of the USD (. . .) enables US institutions to provide the ultimate means of settlement and makes the Fed the system's hierarchically highest balance sheet" (p. vi). However, this literature tends to be centred on entities' differential access to policies that stabilise offshore dollar markets—in particular, emergency lending by the Federal Reserve and regulatory privileges—while paying comparatively less attention to the US dollar funding-generating networks that underpin the IMFS.

A complementary IPE strand adopts a network-based view to analyse the distribution of cross-border creditor–debtor relationships and how hierarchical structures emerge from patterns of financial connectivity, where hierarchical positions of states or national banking systems are related to connectivity through cross-border financial ties (Oatley *et al.*, 2013; Winecoff, 2015). Yet this literature overlooks institutional aspects of financial linkages, in particular the nature of the specific counterparty and where they are placed in the financial hierarchy.

This chapter brings these literatures together by extending Minsky's insights that monetary systems are organised in hierarchical tiers of liabilities requiring settlement at higher levels, with a network approach that allows us to analyse how hierarchical tiers of liabilities are reproduced through the concrete structures of cross-border funding relationships. From a network perspective, the density and interconnectedness of global banks' dollar funding relationships, shaped by the institutional characteristics of their counterparties, determine their ability to settle liabilities and thus their position in the global funding and financial hierarchy. The argument is that the wider and more stable these funding networks are— both with clients and with other globally operating banks— the higher a bank's position in the global financial structure and the more accepted their US dollar liabilities. While this acknowledges the Federal Reserve as the ultimate settlement authority and the transformative reach of its emergency lending, it puts analytical priority on the financial structures that motivate policy actions and argues that these interventions are themselves responses to the existing structure of cross-border dollar networks rather than their source (McCauley, 2024).

The rest of the chapter is structured as follows: Section 4.2 reviews the literature on monetary and financial hierarchies. Section 4.3 develops the conceptual framework, which Section 4.4 applies by combining network visualisations with institutional analysis to examine the US-dollar funding structures of global banks. Section 4.5 concludes.

4.2 Literature review: Monetary and Financial Hierarchies

Early IPE work on the asymmetric nature of the international monetary and financial system focused on the internationalisation of state-issued currencies and their monetary functions abroad, identifying a hierarchy in which only some currencies acquire global monetary roles while others remain confined to domestic use (Cohen, 1971; Helleiner & Kirshner, 2009; Strange, 1971). In a similar vein, existing Post-Keynesian work on the international currency hierarchy highlights differential international liquidity premia across national currencies as the mechanism underpinning this hierarchy, and the resulting external vulnerability of issuing countries (Bonizzi & Kaltenbrunner, 2020; De Conti *et al.*, 2013; Fritz *et al.*, 2018; Prates & Marques-Pereira, 2020)[2]. Yet very few of those scholars have paid analytical attention to the underpinning institutions that create international money. In turn, Minskyan approaches to international currency hierarchies have highlighted the importance of analysing underpinning balance sheets, but largely

[2]See Orsi (2019) for a review of the relationship between both literatures.

through conceptual or macro-level empirical analyses, rather than examining the concrete financial structures through which these hierarchies materialise (Bonizzi, 2017; Bonizzi & Kaltenbrunner, 2019; Kaltenbrunner, 2015; Ramos, 2019).

This is surprising insofar as, in their closed-economy analyses, post-Keynesians explicitly highlight banks as issuers of credit money. In this tradition, the general acceptability of banks' liabilities as money by non-banks stems from social norms and conventions (Chick, 1983; Davidson, 1994; Dow, 1996b; Moore, 2000; Sissoko, 2024), shaped by state endorsement (Bell, 1998; Dequech, 2013; Wray, 1998), and by central bank policies that safeguard the payment system (Caldentey, 2022; Rochon & Rossi, 2007). This matters because banks do not face financing constraints when issuing credit, creating deposits in the process. However, banks face refinancing risk from net deposit withdrawals requiring borrowing from other banks or the central bank (Kumhof & Salgado-Moreno, 2024; Reale, 2022)[3]. This creates a hierarchy of institutions and of forms of money: non-bank money consists of bank liabilities, while banks' money consists of central bank liabilities (Bell, 1998; Mehrling, 2012; Tymoigne, 2006b; Wray, 2012). However, post-Keynesians have not focused much on the hierarchies between different banks, nor on the cross-border activities of banks (Bouguelli, 2025; Reale, 2025).

Recent IPE work adopting a Critical Macro Finance approach, focuses on hierarchies within the global US-dollar system, shifting the attention to private financial structures[4]. Conceptualizing the IMFS as interlocking networked balance sheets of financial actors, these authors examine how private institutions create and distribute US dollars offshore, arguing that hierarchical structures, both within and between currencies, are shaped by the geopolitical forces that drive the selective stabilisation of certain liabilities (Binder, 2024; Braun *et al.*, 2021; Murau, 2018; Murau *et al.*, 2022, 2020; Murau & van't Klooster, 2023). For Murau *et al.* (2022), both "geopolitics and market mechanisms have given rise to a complex hierarchical system" (p. 496) where, "(i)n normal times, global access to USD liquidity is shaped by private credit markets" (p. 501).

However, this literature explains hierarchy primarily through top-down institutional mechanisms—such as regulatory privileges and emergency lending—while often stopping short of analysing the concrete network structures through which balance-sheet relationships operate[5]. For instance, Murau *et al.* (2022) propose a framework where

[3] Kumhof & Salgado-Moreno (2024), notes when "all banks expand or contract in lockstep, a bank will tend to gain as many deposits as it loses in the above-mentioned manner, and only the small difference remaining after netting deposit inflows and outflows will need to be refinanced, if there is a shortfall, or lent out, if there is a surplus" (p. 1). As Rochon (1999) highlights, this was discussed by Moore (1989), Lavoie (1996a) and Keynes (1930).

[4] As Klooster & Murau (2025) notes, this work draws on related agendas such as the 'Money View' (Mehrling, 2011), critical macro-finance (Dutta *et al.*, 2020; Gabor, 2020), and the BIS empirical research (Aldasoro & Ehlers, 2018b; Avdjiev *et al.*, 2016; Borio & Disyatat, 2015).

[5] Networks are briefly mentioned in the literature: "the monetary system is portrayed as a self-referential

countries' positions in the US dollar hierarchy are "institutionally configured and mediated" through inherently political decisions (p. 2–3). For instance, Murau *et al.* (2021) argues that the "international hierarchy below the apex is determined by the mechanisms through which non-US central banks can access emergency USD liquidity from the Fed" (p. vi). In this vein, Klooster & Murau (2025) link the limited internationalisation of the euro to neglected areas of offshore monetary governance: trade strategies to promote offshore euro creation related to cross-border value chains, the lack of emergency liquidity provision for offshore euros, and the limited supply of euro-denominated public safe assets. Braun *et al.* (2021) show that European monetary technocrats played a key role in enabling the growth of the Eurodollar market, by declining to impose regulatory restrictions on offshore dollar deposits, coordinating liquidity-support arrangements among European central banks, and promoting the recycling of petrodollars through European banks after the oil-price shock.

The underpinning networks of financial institutions that have macro-level outcomes have been highlighted by a recent IPE literature on global financial networks. Yet, this literature largely focuses on purely quantitative indicators of inter-actor relationships (Oatley *et al.*, 2013; Winecoff, 2015)[6]. For example, Winecoff (2015) describes global banking as a system of cross-border contractual ties, where the system itself—not individual components—is the unit of analysis. Similarly, Oatley *et al.* (2013) see the IMFS as a hierarchical network, where creditor-debtor ties, mostly mediated by financial institutions, link nodes unevenly. Importantly, this hierarchy is not simply imposed but emerges from the collective, market-oriented actions of countless units (Farrell & Newman, 2019; Oatley *et al.*, 2013). Nevertheless, except for Haberly & Wójcik (2022), this literature tends to overlook the qualitative nature of financial linkages, that is, the nature of the institutions that forge these links, often treating them as homogeneous. It rarely theorises hierarchy itself or examines how the characteristics of counterpart institutions shape the stability and terms of financial relationships. As a result, the ways in which differences in credit relationships and their institutional context structure hierarchical networks remain underexplored.

This chapter brings these three literatures together to analyse the hierarchical funding networks of globally operating banks that underpin the global dollar system. Conceptually, it draws on the Minskyan three-level settlement framework to distinguish

network of expanding yet unstable debt claims" (Murau, 2017, p. 14); "approaching global finance as a network of balance sheets connected [where] (t)ime-critical liquidity [are…] systemic nodal points in networks of interconnected balance sheets" (Gabor, 2020, p. 49. Added parenthesis); "[there is an] internal tendency to credit money systems to form hierarchies, precisely because such systems need central nodes for clearing and settlement" (Murau *et al.*, 2022, p. 2. Added parentheses)

[6]There is an extensive literature exploring the interbank networks in domestic financial systems (Elliott & Golub, 2022; Jackson & Pernoud, 2021). Most of these papers also find hierarchical networks in the interbank market.

within global banks' funding relationships and to explain how these shape the hierarchical structure of global banking.

4.3 Hierarchical settlements in international global banking networks: a balance sheet approach

This section presents a conceptual framework to examine the hierarchical funding fragilities in global banking through a networked balance-sheet approach of layered international settlements. First, it presents the key insights from Hyman Minsky on which it draws. Second, it shows how tiered funding relationships determine banks' funding risk and position in the international financial system, revealing systemic vulnerabilities that affect global liquidity across the world. It argues that funding risks in global banking are best understood through the types of settlement that an international payment can trigger. In this view, global banks may settle payments within their own balance sheets, through interbank credit with other global banks, or at the highest tier through the reserves of the Federal Reserve. Finally, the section examines this settlement process in detail using a set of stylised balance-sheet examples.

As discussed in the introduction to this thesis, Minsky's writings on international finance provide an account of structural features of global finance that remain relevant today. Minsky conceptualised the modern capitalist economy as a network of interconnected balance sheets and corresponding cash flows across economic units (Bonizzi & Kaltenbrunner, 2019). Within this network, the assets and liabilities of financial institutions are mutually constituted, and the degree of 'moneyness' of each liability depends on its position within a tiered structure of settlement (Bonizzi, 2017; Bonizzi & Kaltenbrunner, 2019, 2020). The balance-sheet network is therefore hierarchical, with each layer corresponding to a different type of institution. As emphasised in Minsky (1986d), distinctions between financial institutions, particularly in their liability structures and the extent to which their liabilities are accepted as money, reflect legal arrangements and institutional histories rather than economic function alone. Within this hierarchy, commercial banks occupy a central position because of their size and because their liabilities constitute a large share of the money supply, distinguishing them from other money lenders whose activities are constrained by pre-existing funds.

This hierarchy of money implies the existence of distinct monetary instruments serving different settlement purposes (Minsky, 1986d). Central bank liabilities, as the strongest promises to pay in domestic currency, have historically been issued to a limited set of institutions, primarily commercial banks. These banks, in turn, issue private settlement money in the form of deposits, which traditionally occupy a secondary position in the monetary hierarchy due to the institutional relationship between banks and the state.

Minsky further argued that institutional and market developments shape hierarchies not only across financial sectors but also within the banking system itself. In his analysis of the US domestic system, Minsky (1994) documents how the National Banking Act established a geographically and functionally hierarchical correspondent banking network whose structure persisted beyond the Act's formal repeal. Such layered banking relations can generate systemic fragilities by transmitting shocks and spillovers during periods of financial stress (Minsky, 1975). This perspective on stratified interbank relations provides a foundation for analysing hierarchies among banks, and, as developed in this chapter, among global banks.

Extending this balance-sheet network perspective to the international sphere, Minsky recognised the global role of the US dollar and of globally active banks within the international monetary and financial system. He argued that the functioning of a complex international economy requires an international currency and identified the US dollar as fulfilling this role, with international dollar liquidity generated through the banking process itself (Minsky, 1978, 1979). The international role of the dollar reflects a dense web of dollar-denominated financial contracts that generate a global matrix of payment commitments, effectively positioning the United States at the centre of the system, analogous to a banker to the world economy (Minsky, 1978, 1986a).

Minsky also acknowledged that non-US banks participate directly in this international dollar network by issuing US-dollar deposits (Minsky, 1986c). Dollar-denominated financial linkages extend beyond US institutions, even when loans, deposits, and borrowers are located outside the United States (Minsky, 1986a). Nevertheless, non-US banks occupy a lower hierarchical position than US banks, as their dollar liabilities ultimately require reliable access to dollar income, assets, or funding channels located in New York. This hierarchical distinction implies that non-US banks face specific forms of US-dollar funding risk, rather than merely reflecting country-level balance-of-payments constraints (Despres *et al.*, 1966; Kindleberger, 1966; McGuire & von Peter, 2012).

Finally, Minsky highlighted that, for his time, the unresolved problem of an international lender of last resort within a system characterised by extensive offshore US-dollar banking. For him, the expansion of dollar-denominated activity beyond US regulatory boundaries raised fundamental questions about crisis management and liquidity provision (Minsky, 1979, 1986c). While direct access to the Federal Reserve remained restricted to US-chartered institutions, dollar liquidity for non-US banks depended on their own marketable dollar assets and on their home central banks' dollar reserves and swap arrangements with the Federal Reserve (Minsky, 1986a).

4.3.1 Hierarchical settlement

Extending this perspective, the framework developed here conceptualises the global banking system as a hierarchy of settlement relations, where at the lowest level, a global bank with a larger client network can settle payments internally on its own balance sheet; if net withdrawals occur, at the next level interbank credit with other global banks allows deferred settlement; finally, on the highest level direct or indirect access to the Federal Reserve's emergency lending enables final settlement[7]. This framework extends existing analyses of offshore US dollar creation—which focus mainly on Federal Reserve liquidity provision—by revealing how access to US dollar funding through client and bank networks determines banks' positions in the lower tiers of the hierarchy. It focuses on the institutional characteristics of their counterparties and access to key infrastructures that determine their ability to settle US dollar liabilities. In sum, their hierarchical position in these institutionally grounded US funding networks shapes their US dollar funding conditions. In turn, as highlighted by Minsky (1979) and explored in Chapter 3, these funding conditions will shape their credit conditions and global liquidity.

This chapter's argument is that the network of funding relationships provides global banks (as a collective) with a privileged position as the bank of the world. Hierarchy, thus, arises not from a top-down imposition but from relationships that reinforce central positions and make the structure persistent over time. International financial hierarchies are, in fact, hierarchical networks: structures in which hierarchy emerges and is sustained by the organisation of financial relationships themselves rather than being simply externally imposed. A collective of individual financial contracts shapes the structure of the system, which is not organised as a simple vertical chain of debts but as a web of unevenly distributed and asymmetrically connected financial relationships. The hierarchical position of institutions emerges from patterns of centrality and connectivity, where the cross-border "moneyness" of global banks' liabilities reflects the structure and depth of the financial networks in which they are embedded. This centrality is both a cause and a consequence of market size, macroeconomic conditions, and a country's political power. But these fundamentals alone do not fully explain the structure of global financial networks (Oatley *et al.*, 2013). What matters is the type and density of financial ties and their systemic embeddedness.

When global banks become central nodes, they function as "hubs", gaining systemic prominence through centrality and prestige (Farrell & Newman, 2019; Winecoff, 2015). In this way, inertia in global banking structures is reinforced by node fitness ("better [bank] get rich") and preferential attachment ("the rich [bank] get richer"), amplified by access to

[7] In that sense, "(i)n the offshore world, settlement is the disciplining mechanism for the offshore dollar money and capital markets"(Aldasoro *et al.*, 2024, p. 3).

information and relationships (Oatley *et al.*, 2013, p. 138). This can be illustrated with the case of large US banks such as J.P. Morgan and Citigroup, which have long occupied central positions in global financial networks. As Bridges (2024) shows, National City Bank (now Citigroup) expanded internationally by embedding itself within British-led financial networks, gaining access to London's acceptance market and relying on relationships with UK banks to intermediate its overseas operations. Likewise, J.P. Morgan consolidated its position through Guaranty Trust, which operated from London and other European centres, relying on correspondent ties and Morgan affiliates. Both institutions grew by operating through—and gradually reshaping—the networks that structured international finance, maintaining their prominence across successive decades. At the same time, UK banks adapted this transformation by redenominating their financial relationships in US dollars, thereby retaining central positions within the evolving IMFS.

Understanding the global financial system as a hierarchical network helps explain how financial power operates through interconnections and why crises at the core produce systemic fragility, while peripheral shocks are more easily contained. The implications for global financial stability are significant, as these networks shape asymmetric spillovers—resilient to peripheral disruptions but fragile at the core (Oatley *et al.*, 2013). In periods of severe stress, these patterns intensify: even some global banks located at the core depend on an inner group of US institutions that form the nucleus of the system. As the following sections show, this applies particularly to non-US global banks, though important differences exist among them. The hierarchical network structure analysed here, therefore, explains how these institutions' access to US-dollar funding becomes a source of fragility and how financial stress is transmitted internationally through their lending conditions, as explored further in Chapter 2.

However, not all links in the network are equal, even when they appear similar quantitatively. This chapter highlights that the hierarchical nature of funding depends on the type of counterparty involved. When a non-bank makes a payment, settlement may occur within the same bank, across banks through interbank credit, or ultimately through central bank reserves. Each level entails credit from a higher tier and comes with increasingly restrictive funding conditions. Banks' ability to settle at lower tiers—or their need to obtain funding at higher ones—shapes their overall funding structures and the credit conditions they offer. This perspective extends quantitative network approaches by grounding observed link structures in the balance-sheet relations that sustain monetary hierarchy. Accordingly, the balance sheet analysis of international settlements of this section (and the empirical networks of the next one) examines global banks' funding relations through three interconnected networks: their links with non-banks, with other banks, and their direct or indirect connections to the Federal Reserve. In doing so, the analysis uses the notion of monetary hierarchy not to position global banks relative to other types of institutions, but rather to situate their relative position to one another within the financial hierarchy of the global banking system.

However, counterparty type alone cannot explain the structure of cross-border funding. The persistence and depth of these links depend on units' access to the key infrastructures through which transactions are executed. Nationality, business model, and business history determine formal access to these infrastructures, such as the Clearing House Interbank Payments System (CHIPS), the Society for Worldwide Interbank Financial Telecommunication (SWIFT), and the Continuous Linked Settlement (CLS), as well as access to deposit funding from US residents and credit lines from the Federal Reserve.

4.3.2 International payments and settlements in the global banks' balance sheets

To explore in more detail how these different levels of settlement occur, Figure 4.1 uses stylised balance sheets to illustrate a simple cross-border payment between Country 1 and Country 2 and the different balance-sheet operations required to settle it at successive levels of the global banking system.

Then each panel of Figure 4.1 moves through progressively more complex arrangements: interbank credit, correspondent banking via nostro/vostro accounts, and settlement through US-based global banks, which settle with each other through the reserves of the Federal Reserve. The payer and the payee can be firms or their domestic banks, without altering the analytical implications. For simplicity, this chapter abstracts from the local-currency dimension and assumes that the payer's local bank/firm already holds a positive US-dollar balance with the non-US global bank[8]. Because few domestic banks maintain direct bilateral accounts globally (Pantelopoulos, 2022), global banks act as intermediaries, recording payments on their own balance sheets and enabling settlement between otherwise unconnected institutions (Arauz, 2021)[9]

At the lowest level of this hierarchy, the settlement between two non-banks can occur entirely in the balance sheet of the global bank. Most cross-border US dollar

[8]In line with Chapter 2, the key point is that cross-border payments depend not only on existing US dollar holdings but also on access to credit from institutions whose liabilities are widely accepted across jurisdictions. Unlike domestic banks, whose liabilities are rarely accepted abroad, global banks can facilitate payments between third countries because their US-dollar liabilities function as a globally recognised means of payment. This capacity allows global banks to expand balance sheets and extend credit beyond pre-existing holdings of dollars, thereby shaping the conditions under which countries participate in international transactions.

[9]A correspondent banking relationship is a bilateral agreement in which one "correspondent" bank provides services and holds an account on behalf of another "respondent" bank. The respondent calls this record a nostro account, while the correspondent refers to it as a vostro account (Cipriani *et al.*, 2023; Clavero, 2023, p. 39).

Figure 4.1: Cross-border payments settlement at different hierarchical levels. Source: own elaboration. Note: the dashed lines represent reductions in the item.

flows involve no physical movement of currency but rather changes in the ownership of dollar-denominated deposits across countries (Aldasoro *et al.*, 2020a; Hardy & Zhu, 2023). As shown in Panel A of Figure 4.1, if the payer holds a US dollar deposit at a non-US global bank, settlement occurs through a simple reallocation of liabilities: the payer's account is debited and the payee's credited (Berthou, 2023). This process can take place entirely within a single global bank, provided both parties hold accounts at the same institution. In that sense, the connectedness of the global bank in the network of non-bank funding is crucial, since banks with a dense base of non-bank relationships face a lower likelihood of net deposit withdrawals and are less reliant on higher tiers of settlement. More units across the world hold accounts in the same banks, a higher probability that the withdrawal of one liability holder from these banks will be matched by the inflow of another unit to the same bank. In this way, the broader a global bank's international customer base, the more independent it becomes from other global banks when settling payments (Berthou, 2023).

When net deposit reversals do occur, additional credit or settlement operations between global banks are required. The system-wide balance remains zero, since one bank's deficit is another's surplus. This settlement can be deferred if the surplus bank provides credit to the deficit bank (Panel B in Figure 4.1). The willingness of surplus banks to extend credit depends on how they assess the borrowing bank's creditworthiness, shaped by its history, structure, and institutional features (Minsky, 1994; Reale, 2022, 2024, 2025)[10]. In this way, a global bank "can keep creating [US dollar] loans, far in excess of the [US dollar] deposits that it manages to collect back, as long as it maintains the trust of its clients and of other [global] banks (which agree to provide [US dollar] liquidity to banks whose loan portfolio is increasing at a fast pace, through the interbank lending system)" (Lavoie, 2016b, p. 61. Added brackets).

Here, the difference between US and non-US banks becomes essential. Banks' nationality matters not only because it shapes their network of funding relationships with domestic depositors, domestic banks, and the central banks of their country, but also because it shapes their relationships with US non-banks, US banks, and the Federal Reserve. These relationships determine the credibility of their access to onshore US dollars—not only through the central bank lending, but more importantly, through daily operating private funding channels such as customer deposits and interbank credit. As Binder (2024) notes, offshore dollars carry not only a promise of repayment but also an expectation of access to onshore US dollars in case of need. In this line, Aldasoro *et al.* (2024) indicate, par convertibility between offshore and onshore US dollars is sustained by

[10] Reale (2025) indicates that there is limited theoretical treatment of the causes and consequences of banks' inability or unwillingness to roll over interbank debts. Exceptions include Loizos (2020) and Alves Jr *et al.* (2008).

interbank credit and arbitrage in interest rates. In periods of stress, funding counterparties may engage in flight to safety, shifting the liabilities of US banks, putting pressure on the US dollar funding costs of non-US banks.

If the payment is transferred to a US bank, or non-US banks do not provide the interbank credit, the settlement will be conducted using previously accumulated nostro accounts (Panel C in Figure 4.1 shows an example with a US bank), or through new interbank lending, either directly with the payee bank (Panel D in Figure 4.1), or from another US bank. The centrality of global banks in the network of interbank financial relationships provides funding advantages: those operating as central nodes benefit from cheaper funding in the form of liquid vostro accounts (similarly to a large base of demand deposits from non-banks). This, in turn, enhances their creditworthiness and enables them to borrow at lower rates from other banks.

If both non-US banks are willing to hold accounts at the same US bank, settlement occurs within that institution's balance sheet. If they rely on different US banks, a higher level of settlement is required, involving bilateral accounts, interbank credit between US banks (Panel E in Figure 4.1), or accumulated reserves at the Federal Reserve (Panel F in Figure 4.1), where only the ownership of Fed liabilities changes. Panel F of Figure 4.1 illustrates, using the same international payments as in the previous panels, how this multi-layered banking structure operates hierarchically through distinct levels of settlement: first, between domestic units via global banks; second, between global banks (onshore and offshore); and finally, between US global banks through the Federal Reserve's balance sheet (Arauz, 2021; He & McCauley, 2012; Lavoie, 1992).

If the deficit US global bank lacks prior reserves and alternative sources are unavailable or too costly, it must borrow newly created reserves from the Federal Reserve (Fullwiler, 2008). However, access to Federal Reserve lending is not equal for all global banks. For those banks located in the US, an emergency line (as shown in Panel G in Figure 4.1) would usually include different criteria, such as collateral[11]. Importantly, and as it will be explored in more detail in the next section, the nationality and business model of banks (branches vs subsidiaries) located in the US are key determinants of their access to the Fed emergency liquidity.

For those non-US global banks operating offshore, when they face simultaneous funding reversals from both non-banks and other global banks, an international lender of last resort becomes necessary. In such cases, the main instrument is the central bank swap

[11] Even for banks with the same nationality and business model, other factors can affect their access to the central bank emergency lending, such as collateral, credit risk, and regulatory compliance (Tropeano, 2025b). See also Wray (2013). This has been explored for the Eurozone in multiple papers (Cesaratto, 2013; de Souzaa, 2024; Eichacker, 2022; Gabor, 2016; Lavoie, 2015; Van't Klooster, 2023).

line, through which the Federal Reserve provides indirect access to US dollar liquidity to different jurisdictions. Yet, as will be discussed in the next section, this mechanism is extended only to a limited number of national banking systems that are highly integrated into the US system and whose distress poses potential stability risks to it. As shown in Panel H in Figure 4.1, the Fed and a central bank in Country 1 exchange reserves, with a forward agreement for reversal[12]. The central bank in Country 1 then lends to its domestic global banks. Because these institutions do not hold accounts at the Fed, the reserves are intermediated through their US-based affiliates or correspondent banks, which in turn register the reserve increase on their Fed accounts[13]. To access these facilities, banks have to operate in countries that have these credit lines with the Federal Reserve, and then fulfill the eligibility criteria of their central bank. Within this structure, the Federal Reserve's policies must account for global dollar demands, even though foreign banks lack direct access to its facilities and must instead rely on central bank swaps or liquid dollar assets (Gabor, 2020; Minsky, 1986a)[14].

In summary, Figure 4.1 illustrates how international payments are settled through successive balance-sheet layers, from transactions recorded within a single global bank, to settlements between global banks through interbank credit or correspondent accounts, and finally through the reserves held at the Federal Reserve. It shows that when payments cannot be completed at lower levels, they require credit from institutions positioned higher in the hierarchy, revealing how the structure of funding relationships and the capacity to access successive tiers of settlement underpin the hierarchical organisation of global banking. Access to reserves or to Vostro accounts with US-based banks is not uniform. It depends on a bank's embeddedness in private funding networks and on the size and stability of its dollar deposit base: institutions with broad, diversified client and interbank relationships can sustain liquidity through internal flows, while more peripheral banks, reliant on narrower or more volatile funding sources, depend on costly credit or accumulated balances at core US institutions. In this sense, access to dollar liquidity is not a matter of policy entitlement but the structural outcome of banks' positions within the hierarchy of global funding relationships.

[12]Other central banks can use their previous holdings of US dollar assets to provide funding to the banks of their countries. Braun *et al.* (2021) indicates that "the moneyness of Eurodollar deposits is even more institutionally demanding. Even if a central bank decides to backstop the foreign-currency liabilities of its domestic banks, its ability to do so is limited by its own foreign-currency reserves" (p. 799).

[13]For a detailed explanation, see Aldasoro *et al.* (2020a).

[14]"(A)ccess to the Federal Reserve is restricted to member banks or U.S. chartered banks. (...). Dollars to meet withdrawals will be available either from a bank's own resources (securities that are marketable for dollars in New York are part of every international bank's position) or from the home Central Bank. A Central Bank's ability to provide dollars depends upon its dollar balances and arrangements with the Federal Reserve for swaps of its domestic currency for dollars. The Federal Reserve exercises its responsibilities for resolving any international rollover or flight problem by keeping orderly conditions in the United States money market and by providing dollars to domestic banks and to foreign central banks by way of discount, swap or similar arrangements" (Minsky, 1986a, pp.8-9).

4.4 The US dollar-based global banking system

Building on this conceptualisation, the current section combines network visualisations of cross-border funding relationships in global banking with institutional analysis of infrastructures, business models, and regulation to empirically map the hierarchical network structure of the global US dollar system.

4.4.1 Global banks' US dollar funding networks

To make this hierarchy explicit, this section visualises the structure of global financial networks organised around the key financial relationships introduced in the previous section: funding links with non-banks worldwide and in the US, with other banks, particularly US and other global banks, and both direct and indirect connections to the Federal Reserve. Figures 4.2, 4.3, and 4.4 show banking system cross-border funding from non-banks, banks, and access to liquidity arrangements from the Federal Reserve, considering the key role of US counterparties.

Bilateral US-dollar banking networks with non-banks and banks in Figures 4.2 and 4.3 are estimated using the BIS Locational Banking Statistics. Cross-border liabilities outstanding, covering all instruments and total liabilities, are organised into a total bilateral matrix by reporting and counterparty country. A parallel matrix isolates liabilities to non-bank counterparties, allowing bank and non-bank exposures to be distinguished. Because the BIS does not publish fully disaggregated bilateral positions in US dollars, published USD totals by reporting country and by counterparty country are used to recover the currency dimension. Where sector-specific USD totals are unavailable, total USD liabilities are allocated proportionally using each country's all-currency liability structure. The bilateral USD network is obtained by applying a bi-proportional (RAS) adjustment to the all-currency matrix, ensuring consistency with observed USD aggregates while preserving the underlying pattern of cross-border linkages. The Appendix presents the methodology to estimate the network of the first two figures using BIS data. Figure 4.4 shows the global network of US-dollar liquidity arrangements among central banks, using data from Bahaj *et al.* (2024) and Bahaj & Reis (2022). Nodes represent central banks and are scaled by the US-dollar exposure of their domestic banking systems based on BIS locational banking statistics, while edges capture bilateral liquidity arrangements, with thickness reflecting their maximum size. Countries are arranged radially according to their degree of access to the Federal Reserve. This classification defines the radial structure used in Figures 4.2 and 4.3. Background greyscale intensity indicates the type of liquidity access: standing Federal Reserve swap line counterparts (darkest grey), temporary swap line counterparts and FIMA repo participants (medium greys), and central banks with only indirect access (lightest greys for second- and third-degree connections).

The distribution of non-bank US dollar funding already reflects a hierarchical structure in the Global Dollar System, concentrated in the United States and a small number of advanced financial centres closely integrated with it[15]. Figure 4.2 illustrates this by mapping the global network of USD-denominated financial linkages involving non-banks. Each node represents a country, while the directed edges correspond to cross-border US dollar bank liabilities. Node size reflects the total volume of US dollar liabilities of that country's banking system. The edges are weighted by the magnitude of exposures and colour-coded by direction: from the US non-banks (red) to foreign banks, from foreign non-banks to the US (blue), and between non-US jurisdictions (yellow).

The figure reveals a highly asymmetric configuration centred on the United States. A small number of advanced economies—including the Euro Area countries, the United Kingdom, Japan, Canada, and Switzerland—also emerge as large, highly connected nodes, functioning as regional centres in the global provision of US dollar liquidity. These countries are highly interconnected, with each other and with the US (both as holders of claims on US-based banks and as banking systems funded by US non-banks), reflecting institutional integration through shared infrastructures, market access, and regulatory alignment. In contrast, most emerging and developing economies appear as peripheral nodes, with fewer and weaker connections with each other, and little direct access to US-based non-bank funding.

[15] He & McCauley (2012), indicate that 64% of the offshore issuance of US dollars was concentrated in ten jurisdictions, situated in countries with the highest credit ratings according to rating agencies.

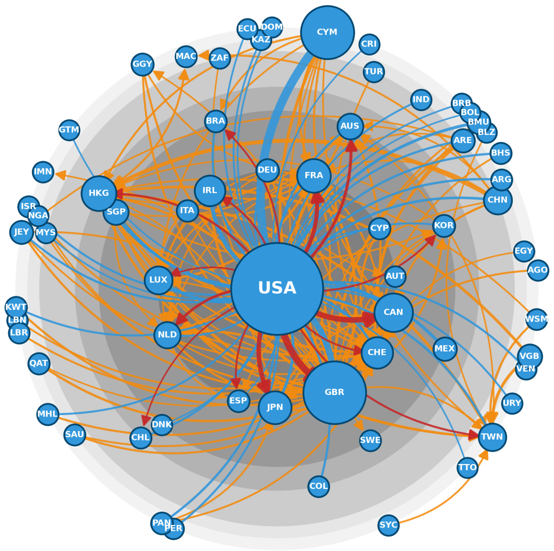

Figure 4.2: Estimated network of non-bank holdings of banks' USD liabilities.

Source: BIS locational banking statistics. Note: Nodes are banking systems sized by USD liabilities held by non-banks. Directed links show bilateral exposures above USD 500 million (red: liabilities from US banks; blue: held by US non-banks; yellow: non-US). Countries are ordered by proximity to the Federal Reserve.

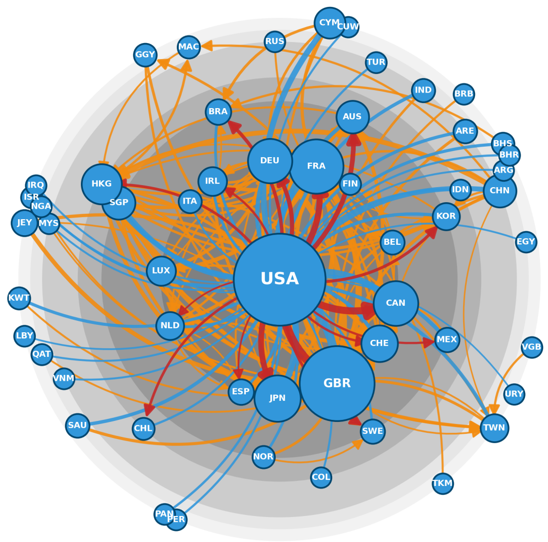

Figure 4.3: Estimated network of bank holdings of banks' USD liabilities.

Source: BIS locational banking statistics. Note: Nodes are banking systems sized by USD liabilities held by banks. Directed links show bilateral exposures above USD 500 million (red: liabilities from US banks; blue: held by US banks; yellow: non-US). Countries are ordered by proximity to the Federal Reserve.

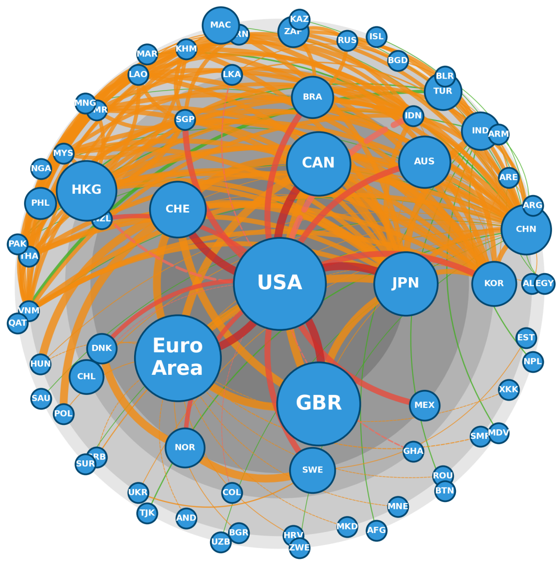

Figure 4.4: Network of USD bilateral liquidity lines by degree.

Source: Own elaboration based on Bahaj *et al.* (2024). Note: Nodes are central banks sized by the total USD exposure of their banking systems. Links denote liquidity arrangements (solid: swaps; dashed: repos). Colours indicate network position (C6, C14, FIMA, second- and third-degree, and more distant nodes).

These differential funding constraints increase the market power of US global banks. Compared to the non-bank network, the structure of bilateral US dollar liabilities among banks in Figure 4.3 displays even greater centralisation, with US banks maintaining stronger connections with other core systems, such as France, Germany, and the United Kingdom. The network shows fewer significant links overall, highlighting the central role of a smaller group of banking systems in cross-border dollar flows.

Figure 4.4 visualises the global structure of US dollar liquidity arrangements between central banks, drawing on the dataset from Bahaj *et al.* (2024). The figure illustrates the web of direct and indirect credit lines with the Federal Reserve. Each node represents a central bank, sized according to the total US dollar exposure of its domestic banking system, based on BIS locational banking statistics. Edge thickness indicates the maximum size of the bilateral liquidity line, as recorded by Bahaj *et al.* (2024). Countries are arranged radially by their degree of access to the Federal Reserve, following the same layout as in Figures 4.2 and 4.3. The colour of each edge denotes the central bank's position within the Federal Reserve's dollar liquidity network. The C6 central banks (dark red) include the six central banks with standing swap lines with the Federal Reserve: the European Central Bank (ECB), Bank of England (GBR), Bank of Japan (JPN), Bank of Canada (CAN), Swiss National Bank (CHE), and Sveriges Riksbank (SWE). The C14 (red) covers eight additional central banks that were granted temporary swap lines during market crises. FIMA participants (light red) are jurisdictions eligible to access the Federal Reserve's FIMA repo facility by posting US Treasury securities as collateral. Countries shown in orange and green have second- and third-degree connections, which are not directly linked to the Fed, but may obtain dollar liquidity via intermediaries that are.

As mentioned earlier, decisions by the US government, international financial institutions, and particularly the Federal Reserve over which countries receive emergency lending play a central role in shaping international financial hierarchies (Mehrling, 2015; Patrício Ferreira Lima, 2022). However, most of these decisions are not merely political innovations, but validations of previous structures, too connected to fail. As McCauley (2024) highlights, the Fed's swap-line partners largely correspond to the currencies most used to borrow dollars in FX swaps. According to successive BIS Triennial Surveys, the fourteen central banks included in the network have covered over 80 per cent of global dollar FX-swap turnover since the global financial crisis. In line with this, Aldasoro *et al.* (2020c) show that, during periods of stress, drawings on central bank swap lines closely matched the estimated short-term dollar funding needs of national banking systems. Since these short-term needs are typically met through FX swaps, the evidence suggests that the Fed's swap lines effectively backstop the main channels through which global banks obtain dollar funding offshore.

Importantly, the network based on Bahaj *et al.* (2024) indicates that even central banks without direct swap lines can influence dollar funding conditions through second- and third-degree connections in the central bank liquidity network. Nevertheless, the configuration still reveals a highly stratified system. The US has dense, reciprocal links to a small number of highly connected central banks from the most systemically important jurisdictions. By contrast, most emerging market and developing countries occupy the outer layers of the network. These jurisdictions lack direct Fed access and depend on regional or global hubs for emergency support. In this sense, the global network of swap lines and liquidity arrangements reproduces and reinforces the structures described before.

4.4.2 Infrastructures in global banking

While the previous section illustrated how cross-border dollar payments are settled through a hierarchical banking structure, these settlement processes do not occur in an institutional vacuum. A bank's position within this hierarchy (and how it settles net payments) depends critically on how it is embedded within financial infrastructures, geographic jurisdictions, and distinct business models.

However, a country-level perspective cannot explain why only a handful of banks from each of these countries play a major role in the Global Dollar System. Global banking activity and cross-border interbank payments are highly concentrated in a small number of global financial institutions. This implies that the understanding of global banking cannot be separated from a granular perspective at the global bank level. A handful of Globally Systemically Important Banks (G-SIBs) account for the majority of cross-jurisdictional bank liabilities reported to the BIS (as shown in Figure 4.5)[16]. Moreover, as shown in Figure 4.5, G-SIBs account for an even larger share of cross-jurisdictional liabilities within the banking systems of their home countries.

Bank-level relationships are the infrastructure for international settlements. This concentration is mirrored in global payment flows. In the correspondent banking network, most interbank payments are executed by the same group of institutions. As shown in Figure 4.6, thirty G-SIBs dominate payment activity across major international currencies (Board, 2017). This implies that global banks do not merely process large payment volumes; their balances are the first layer of infrastructure for international settlements themselves. In a triangular relationship, global banks enable payments between units—including domestic banks—without direct bilateral accounts by settling transactions through transfers of ownership of their own liabilities between counterparties. Thus, international payments rely not on a centralised system, but on a hierarchical network of

[16] This includes US dollar deposits held by foreign governments and FX reserve managers, who allocate a large share of their reserves to both US and non-US G-SIBs, whether onshore or offshore (Pozsar, 2016a; Pozsar & Sweeney, 2016).

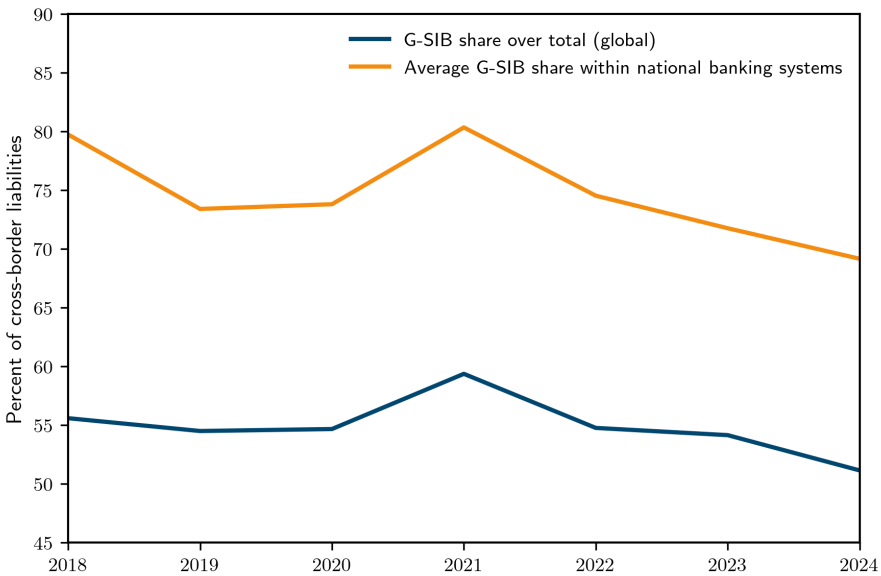

Figure 4.5: Concentration of cross-jurisdictional bank positions among G-SIBs. Source: Own elaboration based on Global Systemically Important Banks (G-SIB) indicators from the Basel Committee on Banking Supervision and locational banking statistics from the BIS. Note: Aggregate share of cross-jurisdictional bank positions accounted for by a selected group of G-SIBs relative to the global total, and the average across G-SIB home countries of the share of cross-jurisdictional bank positions accounted for by the same G-SIBs within their respective national banking systems.

correspondent relationships (Dörry *et al.*, 2018).

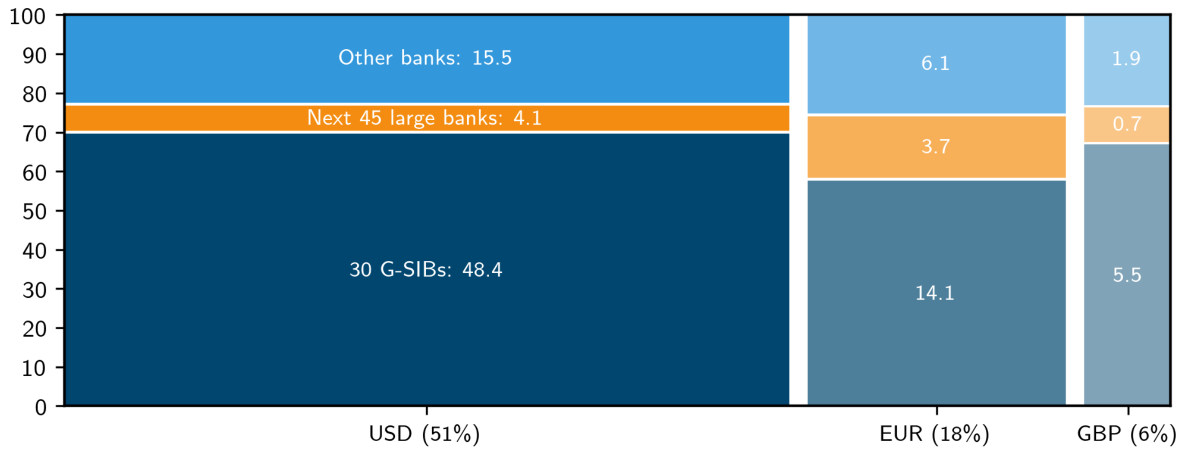

Figure 4.6: Share of value sent or received through a correspondent in 2016. Source: Board (2017). Note: For USD, 217 banks provided answers; for EUR, 175; for GBP, 105.

Built and operated by the same institutions that dominate cross-border activity, infrastructures that facilitate cross-border payments reflect and reproduce the centrality of global banks in international US dollar transactions. As McDowell (2023) highlights, 96% of international dollar payments processed through correspondent networks are cleared through banks connected to CHIPS. Typically, fewer than fifty US banks and US branches of foreign banks participate in CHIPS. Its final net settlement—just a fraction of gross flows—occurs through the Federal Reserve's Real Time Gross Settlement system, Fedwire Funds Service, where CHIPS is both a customer and a competitor (Cipriani *et al.*, 2023; Coppola, 2021; Faudot, 2018). Similarly, SWIFT, established in 1973 by 239 banks from 15 countries, securely transmits international payment instructions (Cipriani *et al.*, 2023). To reduce settlement risk in FX transactions, major banks also created the US-based CLS system in 2002. CLS settles FX trades in 18 currencies via a payment-versus-payment mechanism that eliminates settlement risk. As of 2022, it had 76 direct members—mainly banks—that also serve as intermediaries for smaller institutions (Cipriani *et al.*, 2023; Kloks *et al.*, 2023). CLS now handles around 60% of global FX settlements (Faudot, 2018).

Most US dollar liabilities issued by non-US banks are booked offshore, with only about 22 per cent held in US affiliates and 78 per cent issued outside the United States (Aldasoro *et al.*, 2020c). After the global financial crisis, many non-US banks shifted the booking of dollar liabilities from their US affiliates to home-country entities, a trend evident across both European and non-European institutions (Aldasoro & Ehlers, 2018a). By 2018, over half of these liabilities were reported domestically, even as some systems—such as Australia, Canada, and Japan—expanded their US presence[17]. Nonetheless, a large share of dollar intermediation continues to occur outside both the United States and banks' home jurisdictions.

However, funding from US residents plays a key role, and business models and organisational structures shape banks' access to it. While global banks actively use internal liquidity transfers to match funding across borders (Goldberg, 2022), institutional segmentations shape these internal markets. When non-US global banks attract funding in the US, this can allow them to expand their claims from US banks or, if they hold a Fed account, from the Federal Reserve, enabling them to settle future payments from abroad to the US. Because of this, the business models and organisational structures of individual non-US global banks in the United States shape their capacity to sustain international US dollar operations, revealing important institutional asymmetries. Generally, foreign banks can maintain either branches, subsidiaries, or both[18]. Subsidiaries resemble domestic banks and focus on local-currency retail operations (Acharya *et al.*, 2017). In contrast, branches

[17]Offshore US dollars issuance was historically dominated by European banks, institutions from Japan, Canada, and, more recently, China have become increasingly active. Chinese banks, in particular, have emerged as key lenders to emerging and developing economies, often using US dollar-denominated instruments (Casanova *et al.*, 2024).

[18]US banking by foreign entities can take place through six main types of organisations: representative offices, branches, agencies, subsidiary banks, Edge Act and Agreement corporations, and international banking facilities (Acharya *et al.*, 2017).

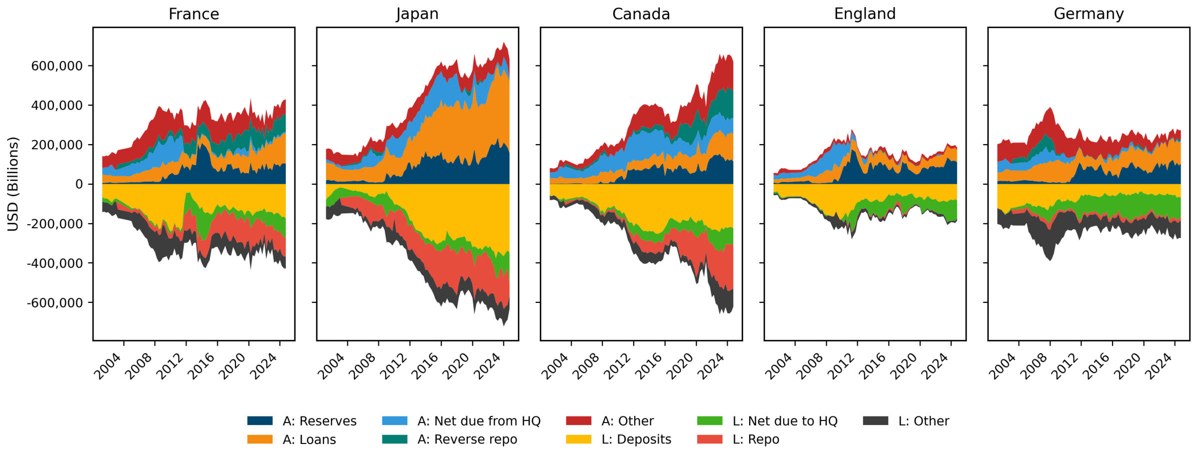

Figure 4.7: Assets and liabilities of banks' Foreign Branch Offices by nationality. Source: Own elaboration with data from Call Reports data (FFIEC 002).

specialise in cross-border and wholesale services, such as corporate and investment banking, and are funded through centralised, often offshore, channels (Aldasoro *et al.*, 2022b,a). As Figure 4.7 shows, foreign branches of different nationalities have different funding models, with some of them relying more heavily on repos, or internal capital markets (Aldasoro *et al.*, 2022a).

Many are not eligible for the US Federal Home Loan Bank System (Ashcraft *et al.*, 2010)[19]. Regulatory asymmetries also shape competitive dynamics. Foreign branches face lower leverage ratio requirements and are exempt from FDIC deposit insurance fees (Anderson *et al.*, 2025). Meanwhile, although US banks can issue offshore dollar deposits through international banking facilities, these are restricted to foreign counterparties and do not apply to Caribbean branches (Cipriani & Gouny, 2015). Together, these regulatory differences influence the structure and cost of dollar funding, generally favouring US-based banks. The 2018 US tax reform further tilted the playing field by reducing incentives for offshore bond issuance (Kamaras, 2023). These structural factors are reflected in how non-US banks manage their dollar balance sheets. In most banking systems, branches hold a larger share of dollar positions than subsidiaries, in some cases accounting for over 50 per cent of total US dollar liabilities (Barajas *et al.*, 2019). Foreign branches also dominate in short-term funding markets, accounting for more than 90 per cent of Eurodollar borrowing and the majority of borrowing in the federal funds market since 2016 (Afonso *et al.*, 2024)[20].

[19]Borrowing from FHLBs in the fed funds market implies a lower Liquidity Coverage Ratio requirement than Eurodollars and selected deposits, affecting regulatory costs (Afonso *et al.*, 2024). Historically, as He & McCauley (2012) indicate, the absence of reserve requirements for offshore dollars in London, was what allowed Libor-based loan rates to be competitive with the prime-based loan rates in the United States

[20]In turn, the Federal Home Loan Banks are the main lenders in the Fed Funds Market in the federal funds market, while non-depository financial institutions are the main lenders in the Eurodollar market (Afonso *et al.*, 2024). Almost 70% of the FHLBs' lending is explained by 20 borrowing banks (Kloks

These institutional constraints shape their funding model. Non-US banks with restricted access to the insured domestic US deposit base rely heavily on cross-border loans and short-term market-based funding, which are more volatile and often unsecured (Barajas *et al.*, 2019). Such reliance increases sensitivity to credit risk perceptions, especially during periods of market stress (Ivashina *et al.*, 2015). Consequently, conditions in US dollar markets disproportionately affect non-US institutions and the lending terms they extend to counterparties, particularly in emerging markets (Barajas *et al.*, 2019; Ehlers *et al.*, 2020)[21]. In particular, non-bank financial institutions (NBFIs) also play a central role in this market-based funding. Among them, money market funds (MMFs) are key providers of short-term wholesale funding. Around 60 per cent of their private-sector assets are held in repos (Aldasoro & Doerr, 2025)[22]. While European banks have scaled back their MMF borrowing, institutions from Japan, Canada, China, and several emerging markets have increased their exposure.

During the 2007–2011 crisis, large MMF withdrawals caused acute liquidity and solvency problems for many non-US banks (European Systemic Risk Board, 2011). Regulatory changes—such as the 2016 SEC reforms requiring a shift from unsecured to secured lending—further tightened conditions for non-US borrowers (Aldasoro *et al.*, 2022a; Anderson *et al.*, 2025; Kloks *et al.*, 2024). Despite these constraints, many non-US banks responded by drawing down reserves at the Federal Reserve and expanding their dollar borrowing elsewhere (Aldasoro *et al.*, 2017). In early 2020, when US MMFs pulled back, other non-bank actors filled the gap, often by drawing on existing credit lines (Aldasoro *et al.*, 2021).

Empirical evidence from the FX swaps market, where most interbank dollar lending now occurs, supports the key role of US banks. Wallen (2020) shows that when European banks reduce their US dollar lending via FX swaps at quarter-end, largely due to regulatory window-dressing, US banks step in to fill most of this gap. Yet, cross-currency basis spreads still widen, indicating that US banks may use these windows to exercise market power by restricting supply. Using CLS FX swap data, Kloks *et al.* (2024) show that the market is dominated by G-SIBs, with US entities as the main dollar lenders, typically funding other G-SIBs in the Eurozone and the UK. These European banks then act as net lenders to other participants[23]. As Pozsar (2017) emphasises, US banks enjoy a

et al., 2024).

[21] Aldasoro *et al.* (2022a) show that frictions in USD repo and unsecured markets can create heterogeneous funding costs in short-term markets for different non-US banks. Acharya *et al.* (2017) show that following the asset-backed commercial paper funding shock, foreign banks increased their lending rates for USD syndicated loans.

[22] Non-US MMFs hold over 70 percent of their assets in bank liabilities, 60 per cent of which are in US dollars (Aldasoro & Doerr, 2023).

[23] Contrary to the idea of European banks withdrawing, the authors argue that they remain active borrowers, replacing lost repo funding with FX swap borrowing.

structural advantage in this market, in part due to privileged access to term funding via the FHLB system.

In episodes of stress, when non-bank funding dries up, and US banks are unwilling to provide credit, non-US global banks must turn to central bank facilities. The Federal Reserve, as the sole issuer of US dollar reserves, can adjust the cost and conditions for reserve lending, which affects US dollar funding conditions both domestically and globally (Fullwiler, 2013; Rossi, 2007)[24]. As Pozsar (2016b) argues, the Federal Reserve effectively establishes a global corridor for dollar interest rates—anchored by access to its balance sheet—which constrains the upper and lower bounds of global dollar funding costs. The 2007–08 financial crisis and the 2020 COVID-19 shock underscored this dependence. In the former, as traditional market-based dollar funding sources, such as the asset-backed commercial paper market, collapsed, foreign banks substantially increased their use of the Federal Reserve's Term Auction Facility (Acharya *et al.*, 2017; Cetorelli & Goldberg, 2011). Alternative emergency liquidity sources included the Discount Window and advances from the Federal Home Loan Banks, although the latter were only accessible to non-US banks with a US subsidiary presence (Acharya *et al.*, 2017). In these crises, to mitigate the structural constraints faced by non-US banks lacking direct access to US-based facilities, the Federal Reserve extended its reach through bilateral swap lines with selected foreign central banks. These swap lines allow selected central banks to borrow dollars against their own currencies and lend them to domestic banks, effectively externalising the Federal Reserve's lender-of-last-resort function[25]. As Dafermos *et al.* (2022) highlight, swap lines are designed to provide temporary liquidity support for the duration of the transaction, but not to facilitate exchange rate interventions. In 2008, temporary lines were extended to 14 central banks; five were made permanent in 2013. In March 2020, the Federal Reserve expanded the program again, lowered pricing, increased the frequency and maturity of operations, and introduced the Foreign and International Monetary Authorities (FIMA) repo facility. The FIMA facility allows eligible central banks to exchange US Treasuries for dollars, broadening access beyond those with swap lines.

4.5 Conclusions

Global banks are different not because they are large, but because of the networks of financial relationships they have constructed over time. These characteristics are not simply associated with the macroeconomic fundamentals of their country of origin, nor

[24]However, this influence over global US dollar credit conditions is limited. The effectiveness of Fed interventions depends on global banks' assessment of counterparty risk. If perceived risk remains high, lower funding costs alone may not restore lending, particularly in emerging economies reliant on non-US banks (Lavoie, 2016a).

[25]Importantly, the Fed delegates credit risk assessment and collateral requirements to the borrowing central bank (Aldasoro *et al.*, 2020a).

with firm-level fundamentals observable in their financial statements. Rather, they reflect an institutional position within the global financial system and a degree of systemic embeddedness, captured both qualitatively and through their position in global financial networks.

Because these networks underpin international payments and financial operations, credit relationships between global banks are crucial for the smooth functioning of the global dollar system. Disturbances in these relationships can therefore generate contagion effects in the credit conditions they set. However, these relationships are asymmetrical, since some banks, particularly non-US banks, are more dependent on others, especially US banks. As a result, spillover effects are also asymmetrical, with important implications for international financial stability and the scope of international cooperation policies.

This asymmetry reflects the hierarchical structure of the global banking system. While global banks lower in the hierarchy play a crucial role in the creation, distribution, and circulation of international payment instruments, their operations ultimately depend on their relationships with global banks higher up in the hierarchy. Although contagion effects can in principle occur in multiple directions, spillovers are stronger when disturbances originate at the top of the hierarchy. These categories are not fixed and, in practice, form a continuous and evolving hierarchy of financial institutions and instruments. Nevertheless, this framework is useful to understand why countries whose financial institutions occupy different positions in the hierarchy face very different capacities to manage balance-of-payments constraints through the issuance of financial claims. As the credibility of these promises to pay global money depends on the access of their issuers to global money proper, their acceptance varies across the hierarchy and over time with cyclical changes in global credit conditions.

Within this hierarchical system, the Federal Reserve plays a central but limited role. By administering the cost of settlement balances, it influences the balance sheet dynamics and interest rate environment of global banks. However, as Chapter 2 shows, monetary policy alone may not be sufficient to offset deteriorations in creditworthiness assessments within private funding networks. Even when reserve funding costs decline, interbank trust may not be fully restored, implying that additional policy tools and forms of international cooperation are required. From this perspective, central bank swap lines are themselves asymmetrical, reflecting existing network positions rather than neutralising them.

This helps explain why, during the Global Financial Crisis, even countries with flexible exchange rates and extensively internationalised local currencies required support from the Federal Reserve to maintain the parity of their US dollar-denominated deposits. In periods of stress, both onshore and offshore issuers of US dollars can be perceived as less creditworthy relative to other global banks, depending on their position within global funding networks. Dollar hierarchy, therefore, operates within the US dollar system itself, and not only across currencies.

Finally, by highlighting the importance of financial networks, this chapter sheds light on how changes in the international currency hierarchy might occur. Garofalo *et al.* (2025) show that cross-border credit to Russia between 2014 and 2021 shifted sharply from US dollars to euros, and that a large share of the new euro lending was provided by banks that had previously intermediated US dollar credit. This suggests that the rise of a new global money would rely on pre-existing networks of financial relationships between international banks and other actors, including borrowers, depositors, other banks, and, crucially, on relationships with onshore banks and the central bank associated with the aspiring global currency, in order to ensure the smooth settlement of final payments.

5

Conclusion

5.1 Introduction

This dissertation has examined the constitutive role of global banks in the international monetary and financial system. By placing their balance sheets, expectations, and preferences at the analytical core, it has shown how these institutions shape both the cyclical and hierarchical distribution of global money. The central argument is that global banks, through the expansion and contraction of their balance sheets, create US dollar liquidity and, in doing so, shape a hierarchical structure of access to global money across institutions and countries.

The analysis focused on the factors that condition global credit and liquidity—namely, global banks' desired balance-sheet structures, their funding relations, and their assessments of borrower creditworthiness—and on the implications these have for the external constraints faced by different economies. The discussion was developed through an alternative analytical framework grounded in post-Keynesian and, more specifically, Minskyan economic theory, conceiving the global dollar system as a network of interlocking and hierarchical balance sheets within which a subset of global banks functions as issuers of global money. This perspective highlighted the active, pro-cyclical, and structurally asymmetrical nature of global money creation. Moreover, some of these channels have been empirically explored, showing causal effects from global banks' balance sheets to global financial conditions. Finally, the thesis also provided a more granular analysis of the structural and institutional determinants of the funding risks of different global banks in the US dollar system.

The remainder of this chapter reflects on the findings of this thesis and their implications for theory, policy, and future research. This concluding chapter consists of four sections. After this introduction, Section 5.2 presents a summary of the research and findings of this thesis. Section 5.3 explores the possible implications of the thesis's findings for economic theory and policies. Finally, Section 5.4 concludes with some potential paths for future research.

5.2 Summary and Main Findings

Addressing hypothesis **H1**, Chapter 2, drawing on the post-Keynesian endogenous money theory and the Minskyan tradition, developed a theoretical framework to explain how global banks shape cross-country US dollar credit conditions and, through them, countries' ability to participate in cross-border transactions and to finance external imbalances.

This chapter first introduced a simple model of how banks set credit conditions in a closed economy, where their deposits are accepted as a means of payment and settlement. It emphasised two key aspects: first, that banks adjust their credit conditions when seeking to reshape their balance sheet structures; and second, that they assess the creditworthiness of each borrower according to their prevailing lending standards, thereby setting borrower-specific credit terms. Variations in both the banks' desired balance sheet structures and their creditworthiness assessments can, therefore, generate fluctuations in credit conditions, both across and within borrowers.

Building on this domestic framework, the chapter then extended the analysis to a global level, highlighting two defining features of the current International Monetary System: the US dollar's role as the dominant cross-border means of payment and settlement—referred to as global money—and the concentration of these US dollar liabilities in a small group of globally active financial institutions—global banks. From this perspective, the chapter argued that two global bank–related factors determine cross-border US dollar credit conditions: their balance sheet dynamics and their assessments of countries' external creditworthiness. The latter depends on expectations regarding a country's future access to global money through trade surpluses, foreign asset holdings, or borrowing potential. Such expectations, however, are inherently uncertain and evolve with both domestic developments and global financial conditions. Consequently, changes in global banks' creditworthiness assessments can restrict access to external credit, even without any deterioration in borrowers' underlying economic fundamentals. At the same time, global banks adjust their lending conditions to manage leverage, liquidity, and profitability targets, influenced by their liquidity preferences, regulatory environments, and macro-financial conditions in advanced economies. These dynamics, in turn, act as exogenous sources of pressure on countries' balance of payments, potentially triggering financial stress even when domestic fundamentals remain stable.

Chapter 3 provided the empirical counterpart to the theoretical framework developed in Chapter 2, and verified hypothesis **H2**, by examining how idiosyncratic shocks to global banks' leverage affect global liquidity conditions. Using a novel empirical strategy combining Granular Instrumental Variables and Instrumented Principal Component Analysis, the chapter identified exogenous leverage shocks across 34 Global Systemically Important Banks and traced their effects on exchange rates, Emerging Market Bond Index spreads, and cross-border inflows for 74 economies between 2000 and 2022. The results show that positive shocks to global banks' leverage cause appreciations in exchange rates, lower US dollar sovereign spreads, and larger gross cross-border inflows. These effects are statistically and economically significant, robust across alternative specifications, and persist over several quarters. The findings demonstrate that global banks act not only as transmission channels but also as independent sources of global shocks, confirming their central role in driving the Global Financial Cycle through balance-sheet dynamics. In doing so, the chapter provides causal evidence that fluctuations in global banks' leverage endogenously shape international liquidity conditions, supporting the Minskyan view that financial institutions' balance sheets and risk perceptions are key state variables in the evolution of global financial stability.

Chapter 4 examined the hierarchical structure of the global US-dollar banking system, arguing that differences in banks' funding fragilities and resilience originate in the organisation of their cross-border balance-sheet relationships rather than in size, policy, or country fundamentals alone. Building on the Minskyan perspective, the chapter conceptualised the global dollar system as a network of interlocking balance sheets organised in layers of settlement. In this framework, hierarchy arises endogenously from the structure of funding relations: global banks with broad and diversified client and interbank networks can settle a greater share of payments within their own balance sheets, while those with narrower or more volatile funding bases depend on higher-tier credit and face tighter funding conditions.

The chapter argued that institutional characteristics—particularly banks' nationality, business model, regulatory treatment, and integration into key infrastructures—determine their capacity to obtain and manage US-dollar funding. Network visualisations of cross-border dollar funding revealed a highly asymmetric configuration centred on the United States and a few advanced financial centres. US banks occupy the core due to their integrated onshore–offshore balance sheets and direct participation in payment and settlement infrastructures, whereas non-US global banks rely on offshore booking, interbank borrowing, and market-based funding from non-bank financial institutions, exposing them to recurrent dollar-funding pressures. This hypothesis supports **H3**.

Finally, the chapter argued that these hierarchies are not exogenously imposed but reproduced through daily financial practices and institutional arrangements, including central-bank liquidity facilities that validate rather than create existing patterns of interdependence. From this perspective, the global dollar system is best understood as a hierarchical network of funding and settlement relations, where institutional position and balance-sheet structure jointly determine banks' access to dollar funding and their fragilities.

5.3 Theoretical and policy implications

The insights generated by the thesis have several theoretical implications for post-Keynesian and Minskyan approaches to international finance. While the post-Keynesian literature emphasises that banks are different (because their liabilities are accepted as money) and that global money is different (because only a few currencies are internationally accepted, making access to them a constraint for cross-border transactions), this thesis argues that global money is still bank money, and that global banks are a distinct category within the banking system itself. They differ not only from non-bank financial institutions but also from banks whose liabilities, regardless of denomination, are accepted only within domestic monetary spaces. Because of this, global banks are not merely large banks with global presence, but the issuers of international purchasing power that enables cross-border transactions. In this sense, they are both key market participants and institutional infrastructures of the global monetary system.

This makes the credit conditions they set systemically relevant to global liquidity, cross-border transactions, and balance-of-payments constraints. These credit conditions, in turn, are driven by their desired balance sheet structure, including key ratios such as leverage, liquidity, and many others. These ratios, in line with the Minskyan literature, are driven not only by regulation but, more importantly, by their time-varying subjective expectations, risk aversion, and liquidity preference under conditions of fundamental uncertainty. Thus, variations in global banks' leverage and credit assessments can amplify or constrain global financial activity even when the underlying credit demand remains unchanged. The financial structures, composition, and interconnections of balance sheets shape how credit is created, transmitted, and withdrawn. The granularity and interconnectivity of these banks imply that research should further study individual institutions, since idiosyncratic shocks can become systemic. In this sense, the stability of the international financial system depends on the configuration and behaviour of its key institutions, not merely on aggregate indicators.

These factors affect not only the cost and availability of credit for different borrowers, depending on their creditworthiness, but also the definition of the credit standards. In booms and busts, what is considered creditworthy can change. Moreover, this thesis highlights the forward-looking nature of external creditworthiness, a key yet underexplored factor in the balance-of-payments constraint literature. Access to US dollars depends not only on past performance or current fundamentals, but also on global financial institutions' expectations of a country's future capacity to obtain US dollars through trade, income, or, more importantly, future borrowing possibilities. These expectations are inherently uncertain and shaped by the evolving perceptions of risk and liquidity. The balance-of-payments constraint is thus not a static limit but a reflection of changing financial beliefs.

These assessments are hierarchical by definition. There are always better and worse types of borrowers in the eyes of the lenders. In turn, the borrower-lender relationship is hierarchical itself. The post-Keynesian perspective argues that, at least initially, the borrower also funds the bank (by holding its deposits). But it is the general acceptability of the bank's liabilities which makes the borrower occupy a subordinated position.

The thesis demonstrates that financial and monetary hierarchies are strongly shaped by the network of financial links and settlement dependencies among institutions. Hierarchical positions are relational and reproduced through these credit and payment linkages. Institutions whose liabilities are more widely accepted occupy higher positions; those that depend on them inherit lower, more constrained roles in the system. The direction and resilience of global financial flows are shaped by ongoing funding relations among banks, non-banks, and central banks. These relationships transmit credit conditions, influence risk perceptions, and mediate how stress propagates through the system. Understanding the structure of these relationships is therefore essential to analysing financial stability and the geography of global credit.

The capacity to create and distribute global money is embedded in specific institutional arrangements—regulatory frameworks, legal regimes, and infrastructures of settlement—that reflect national jurisdictions but operate transnationally. Institutional asymmetries, particularly the privileged access of US banks to the Federal Reserve and of non-US global banks through swap-line arrangements, define global financial resilience. The international payments architecture, centred on the US dollar and the US banking system, anchors the entire structure of global liquidity. The capacity to settle obligations in globally accepted money ultimately determines which liabilities serve as safe and liquid assets. Settlement infrastructures are thus the operational expression of monetary hierarchy and the channel through which global financial asymmetries are continuously reproduced.

The policy implications of this thesis differ across country types: between the US, other jurisdictions that host global banks, and the rest of the world. The discussion below presents these implications, starting with the rest of the world and proceeding in reverse order of systemic centrality.

For most countries—especially emerging and developing economies—the central policy challenge is to build resilience against sudden reversals in the credit conditions set by global banks. The objective is not to eliminate foreign credit, but to maintain stable access for moments of need, while relying on domestic credit when possible. Paraphrasing Joan Robinson (1962), the misery of being exposed to foreign credit booms is nothing compared to the misery of not having foreign credit at all. As this thesis has shown, borrower economies can strengthen their external positions—accumulating reserves, improving credit ratings—but these measures are not sufficient. Credit conditions can shift abruptly due to global factors such as changes in monetary policy, global risk appetite, or regulatory adjustments, with little regard for local fundamentals. This underscores the need for macroprudential and cross-border flow management tools that counteract the external financial cycle.

The procyclical nature of global financial flows also has implications for exchange rate dynamics. In a system where exchange rates are increasingly driven by financial conditions rather than trade fundamentals, the destabilising effects of cross-border flow movements can dominate. Financially driven appreciations weaken competitiveness (Maggiori, 2022), while depreciations tend to raise inflation and suppress output (Adrian *et al.*, 2011). These effects are particularly relevant when trade is invoiced in dominant currencies such as the US dollar (Gopinath, 2015; Gopinath & Itskhoki, 2021), creating feedback loops between financial frictions and dollar pricing (Basu *et al.*, 2020).

These dynamics reinforce one of the core arguments of this thesis: that cross-border financial relationships—especially with global banks—are central to the external vulnerability of borrower economies. This provides a strong rationale for FX interventions and cross-border flows management as stabilisation tools. These measures are effective because they operate through segmented markets and directly affect the balance sheets of financial institutions. In this sense, the approach supported by the IMF and BIS's new Integrated Policy Frameworks—combining FX interventions with macroprudential policies—resonates with the thesis's findings: stabilising access to global liquidity requires managing the financial relationships that define it (Basu *et al.*, 2020; Borio *et al.*, 2022).

For countries that can regulate global banks, this research is relevant for both micro- and macroprudential supervision and offers insights into how to monitor global bank-level and system-wide exposures to the identified risks. This thesis has argued that global banks' leverage is not only a measure of the institution's ability to service its debt commitments, but a key measure of risk and liquidity preferences, with direct implications for credit conditions. Regulation and macroeconomic policies should then monitor changes in these variables to stabilise credit conditions, avoiding negative spillovers across the world.

The thesis has also highlighted the currency-specific funding risks of non-US banks. US dollar funding is highly pro-cyclical. While post-crisis regulatory frameworks, such as the Liquidity Coverage Ratio and the Net Stable Funding Ratio, have strengthened resilience at the individual institution level, they remain largely currency-agnostic. As a result, vulnerabilities can still arise from mismatches between the maturity and liquidity of the US dollar assets and liabilities. As the IMF's *Global Financial Stability Report* (IMF, 2018) suggests, regulators should adopt currency-specific liquidity frameworks to better manage these risks, improving the transparency of maturity and currency mismatches. Supervisors have strengthened monitoring through, for example, the European Systemic Risk Board's oversight of dollar vulnerabilities and the European Central Bank's liquidity stress tests in foreign currencies—yet data gaps and non-harmonised ratios still hinder consistent cross-country assessment. Coordination among national supervisors is equally essential to reduce regulatory arbitrage and cross-border spillovers. In this regard, prudential oversight should explicitly account for the global nature of liquidity creation, with particular attention to the systemic footprint of global banks and their linkages with NBFIs that rely on short-term wholesale funding in US dollars.

For the United States, the key policy implication concerns its role as the anchor of the global liquidity network. As shown in Chapter 4, the hierarchical structure of the global banking system means that US monetary policy affects not only domestic conditions but also the funding costs and balance-sheet dynamics of global banks. The current design of central bank swap lines reflects this asymmetry: they function as secured dollar loans, with foreign currency reserves as collateral, and are available only to a limited group of central banks.

While these instruments help stabilise the system during moments of stress, they are not sufficient to address persistent credit tightening if global financial institutions' credit assessments continue to deteriorate, nor do they ensure timely access to dollar liquidity beyond core economies. To reduce the fragility of the global liquidity network, US authorities should broaden access to US dollars—either directly or indirectly through development finance institutions—to support systemically important economies that remain outside the existing swap-line network.

These policies are, at least, conservative in the sense that they do not propose how to construct an alternative IMFS. More adventurous action plans for changing the world are left for future research. However, this thesis offers a basis to think, in the terms of Tooze (2022), about financial fictions (fin-fis) and the possible futures of the international monetary and financial system. By highlighting the importance of the network of financial relationships, this thesis helps us consider how a reshaping of the international currency hierarchy might occur. Garofalo *et al.* (2025) finds that US dollar–denominated cross-border credit to Russia decreased significantly between 2014 and 2021, while lending in euros increased over the same period. More importantly, using confidential Bank of England data, they find that half of the new euro lending originated from banks that had previously lent US dollars to Russia before 2014. This example highlights, in line with the thesis, that the rise of a new global money would certainly benefit from a pre-established network of financial relationships between international banks and various actors (final borrowers, depositors, and other banks). Crucially, this includes financial relationships with onshore banks and the central bank of the country associated with the aspiring global money, to ensure a smooth mechanism for settling final payments.

Moreover, policies and discussions aimed at reducing the centralisation of the IMFS in a few currencies tend to focus on the creation of new common currencies—increasingly framed as Central Bank Digital Currencies (Kuehnlenz *et al.*, 2023), private stablecoins, or new payment systems as formal infrastructures (Fritz *et al.*, 2023; Bruchanski & Molinari, 2023)—with the aim of fostering net instead of gross settlements in US dollars or other global monies. However, from this thesis's perspective, cross-border payments require elastic credit from institutions whose liabilities are accepted in the payee country. Because of this, a more multipolar IMFS requires new financial ties, where units from peripheral economies have confidence in each other's currencies, but also where their banks (including their central banks) are willing to lend to one another—that is, to take the credit risk of the other economy.

5.4 Future research

This thesis's main findings open different avenues for future research, both theoretically and empirically oriented.

This thesis has shown why global banks remain systemically relevant within an IMFS increasingly dominated by NBFIs. Global banks' integration into payment and settlement infrastructures ensures that they continue to anchor global liquidity creation and distribution. Yet the growing dominance of NBFIs raises new questions about the evolving structure of the IMFS: what specific roles do these institutions play, how do they interact with global banks, borrowers, and other NBFIs, and what are the implications of their rise for the cyclical and hierarchical features of the IMFS?

Although post-Keynesian research has long examined the role of NBFIs and shadow banking in processes of financialisation (Botta *et al.*, 2015; Caverzasi *et al.*, 2019; Sawyer, 2013), Michell (2024) notes that "the degree to which 'bank' and 'non-bank' financial intermediation are integrated is underemphasised" (p. 182). Building on earlier post-Keynesian contributions, Sissoko (2024) conceptualises NBFIs as part of an "extended banking system" that operates alongside, and in close interaction with, traditional banks—a view shared by Caverzasi *et al.* (2019) and Canelli *et al.* (2025), who show how NBFIs support banks in establishing new channels of credit provision through both direct funding relationships and market-based intermediation. Yet not all NBFIs play the same role, and existing studies range from broad generalisations of their dependence on banks to detailed classifications that obscure systemic patterns. While Weigandi (2025) proposes a taxonomy of NBFI activities highlighting their nexus with banks, this work remains focused on domestic contexts and does not fully capture the international dimensions. Using the insights of this thesis to extend this analysis to the international sphere constitutes a promising direction for future research, examining how the expansion of NBFIs is reshaping both the cyclical and hierarchical features of global finance.

Both Chapters 2 and 4 explored hierarchical aspects of the international monetary and financial system. Chapter 2 showed how creditworthiness assessments generate a hierarchy of borrowers, while Chapter 4 analysed the institutional and network foundations of hierarchy among global banks. Yet an open theoretical question remains as to how these institutional and financial hierarchies translate into the hierarchy of currencies. Understanding this connection is essential for clarifying the mechanisms through which the predominance of the US dollar is reproduced, how alternative currencies interact within multi-tiered monetary spaces, and under what conditions shifts in hierarchy may occur. Future research could build on this thesis by tracing how hierarchies of credit and settlement intersect, and by examining the institutional arrangements that grant certain currencies wider international acceptability. This could illuminate the relational microfoundations, balance-sheet configurations, and infrastructural underpinnings of the currency hierarchy.

Another theoretical avenue concerns the balance-of-payments constraint and the nature of external vulnerability in a hierarchical international monetary and financial system. This thesis explored external constraints, emphasising that countries' access to global liquidity depends on the evolving balance-sheet positions and expectations of global banks. However, the specific mechanisms through which these translate into differentiated external constraints remain theoretically underexplored. Future research could build on this thesis by analysing how changes in global banks' leverage, liquidity preferences, and creditworthiness assessments shape borrowers' external financing conditions, and how these dynamics interact with countries' structural characteristics that shape their relative external creditworthiness. Exploring this perspective could clarify how external vulnerability emerges not only from trade or debt imbalances, but from the institutional and financial structures that determine uneven access to global money.

Chapters 2 and 3 formalised several theoretical intuitions through behavioural equations and a stylised model. These were intentionally simple frameworks designed to clarify key mechanisms, rather than to provide general-equilibrium representations or counterfactual analyses. Developing more comprehensive formal models that build on the theoretical insights advanced in this thesis, therefore, constitutes a natural direction for future research.

As discussed in the introduction, the role of global factors, cross-border flows, and global banks remains central to the research agenda in empirical international finance. Within the mainstream literature, recent extensions of the Portfolio Balance approach have incorporated intermediary frictions to account for the limited risk-bearing capacity of financial institutions (Bruno & Shin, 2015a; Camanho *et al.*, 2022; Gabaix & Maggiori, 2015), contributing to the growing field of intermediary asset pricing (Brunnermeier *et al.*, 2021). In these frameworks, the leverage of financial intermediaries—constrained by regulation and risk aversion—plays a crucial role in the dynamics of asset prices and cross-border flows. However, with the partial exception of Kumhof *et al.* (2020), these models generally assume that financial institutions do not create purchasing power endogenously. As a result, they cannot fully account for the mechanisms highlighted by this thesis, in which the capacity of global banks to expand their balance sheets determines both the creation and distribution of global liquidity. Moreover, while these models have been instrumental in formalising the Global Financial Cycle, they still struggle to reproduce several empirical regularities—such as the correlation between gross inflows and outflows, time-varying risk premia, and real-economy effects—observed in the data (Miranda-Agrippino & Rey, 2022). The formalisation of the theoretical insights developed here could help close this gap by integrating endogenous money creation into the modelling of international financial dynamics.

The most promising route for such formalisation lies within post-Keynesian modelling traditions. In particular, the Stock–Flow Consistent (SFC) approach (Godley & Lavoie, 2006b) provides a coherent framework for analysing open-economy dynamics with endogenous money creation and explicit balance-sheet linkages across sectors and countries. Existing multi-country SFC models typically combine a Tobinesque portfolio-choice mechanism—rooted in the same theoretical lineage as the Portfolio Balance approach—with fully specified stocks and flows of financial instruments. As Lavoie & Daigle (2011, p. 435) note, while these models share some similarities with the older open-economy portfolio models à la Branson & Henderson (1985), they differ crucially in that SFC frameworks track the evolution of balance sheets through time rather than relying on static equilibria. This feature allows for the explicit modelling of short- and long-run adjustment dynamics and the feedback effects of exchange rates and asset prices on macroeconomic variables (Lavoie & Zhao, 2010).

Extending this thesis's theoretical perspective within an open-economy post-Keynesian framework would therefore be a valuable next step. A formal model could incorporate global banks' balance sheets explicitly, allowing both observed and desired balance-sheet structures to be endogenised, following the approach of Nikolaidi (2014) and Dafermos (2018). Such a model could include multiple currencies, exchange rate dynamics, and heterogeneous domestic policy regimes, including capital controls. It could also capture how changes in global banks' expectations, liquidity preferences, and funding choices propagate through the international monetary system and shape the time-varying nature of balance-of-payments constraints. In this context, stock–flow–consistent models offer a natural platform for exploring the feedback effects between global financial conditions and domestic macroeconomic adjustment, as they can trace the accumulation of positions and liabilities over time across institutional sectors.

In more complex formulations, global banks' strategies to adjust their balance sheets—such as reducing dividends or share buybacks, issuing new equity (Lavoie, 2019)[1]—or deleveraging through asset sales and funding contraction—could be explicitly modelled.[2] These mechanisms would enable the analysis of balance-sheet adjustments and financial stress transmission in a more realistic open-economy context.

Recent post-Keynesian adaptations of the Mundell-Fleming framework offer another complementary avenue for extending the theoretical perspective developed in this thesis in smaller models. Models incorporating a vertical balance-of-payments constraint curve in the domestic interest rate–output space (Dvoskin *et al.*, 2024; Marins, 2023; Serrano & Summa, 2015) could be extended to a two-country setting, where higher US dollar interest rates tighten the external financing constraints of other economies. Such extensions would allow for an integrated treatment of domestic macro-financial dynamics and global monetary hierarchy within a unified analytical framework.

The thesis also provides paths for future empirical research. While Chapter 3 empirically examined the prediction from Chapter 2 that changes in global banks' desired leverage ratios affect cross-border flows, US dollar spreads, and exchange rates, Chapter 2 also advanced a further argument. It suggested that shifts in banks' forward-looking assessments of borrowers' external creditworthiness can themselves be a source of vulnerability for these economies. There is empirical research on the local factors that shape countries' access to cross-border bank credit (Avdjiev *et al.*, 2019b; Koepke, 2019), but little evidence on how changes in banks' expectations about these factors, rather than

[1]However, these actions may not achieve their intended objectives during periods of financial stress. As Borio & Zhu (2012) note, banks are often reluctant to issue equity or cut dividends in turbulent times, as such measures are interpreted as signs of weakness.

[2]Asset sales can indirectly affect financial conditions through their impact on asset prices and, consequently, on the collateral values that underpin creditworthiness (Ramskogler, 2011).

observed data, affect such access. Although survey-based expectation data at the unit level are increasingly studied in macroeconomics (Shleifer, 2019), this literature rarely overlaps with research on global banking. An important recent exception is Li & Ongena (2025), who use granular data on banks' expectations over time and show that growth expectations are strongly related to cross-border credit. This suggests that the role of global banks' expectations in shaping their assessments of external creditworthiness could be studied empirically with a similar approach, drawing on datasets that capture these institutions' forecasts of countries' external accounts.

Chapter 3 also argues that the significant effects on total cross-border flows (and not only bank flows), and their persistence in the post-GFC period, might be related to the different channels through which global banks' shocks create spillovers to other financial institutions and relevant international investors. The nexus between banks and NBFIs is attracting increasing attention from both market participants and regulators. Cross-border linkages between banks and NBFIs are significant in the US (Aldasoro & Doerr, 2023; Aldasoro *et al.*, 2020b). Both US banks and NBFIs show increased exposure when foreign counterparties are included, with NBFIs holding more foreign bank assets, and US banks receiving more funding from foreign NBFIs. An important implication of their perspective is that dependencies between banks and NBFIs have systemic risk consequences, as shocks spread through these local and cross-border connections (Aldasoro *et al.*, 2020b). For instance, through asset-dependencies, global banks reducing their portfolio positions can depress asset prices and impact NBFIs holding similar assets, causing them to liquidate other international assets. Similarly, through liability-dependencies, global banks tightening credit conditions for NBFIs can force the latter to reduce their cross-border investments. Future empirical work could combine balance-sheet data from both sectors to trace these channels of transmission and quantify their role in amplifying global liquidity cycles.

A further avenue for empirical research concerns currency-specific funding risks. Most empirical literature has focused on currency risks as market risks that generate capital losses on balance sheets with currency mismatches. In turn, this thesis has engaged with the issue of currency-specific funding risks. A promising avenue for future research is to examine these risks across global banks. These institutions issue liabilities in multiple currencies, allowing their funding costs in US dollars, euros, pounds, and others to be compared in order to test whether priced credit risk differs by currency. This perspective allows three questions to be explored: first, the foreign discount in global banking; second, the role of network centrality across nationalities; and third, bank-level determinants. Regarding the first, empirical work has found that foreign corporates pay a higher rate than US corporates when issuing bonds in local currency (Wang, n.d.; Geng, 2024). Future research could extend this literature to global banking, testing the arguments developed in Chapter 4, which suggest that non-US banks are more vulnerable to US dollar funding risks than US banks. This empirical approach is consistent with Aldasoro *et al.* (2024), who argue that "the key point of integration is par settlement between offshore and onshore, and the key stabilisation mechanism ... is the rate of interest" (p. 5). Second, currency-specific funding risks may differ among the nationalities of non-US banks. This is in line with Minskyan traditions that link hierarchy to liquidity premia and lower funding costs, yet empirical work remains limited. A promising direction for filling this gap is to relate these funding asymmetries to the network centrality measures derived from the networks estimated in Chapter 4. Finally, bank-level data can shed further light on these issues. Existing studies show that MMF funding shocks can alter banks' lending capacity and funding costs (Ivashina *et al.*, 2015; Correa *et al.*, 2016), with heterogeneous effects across institutions depending on their balance sheet structures (Aldasoro *et al.*, 2022a). Future work could combine these insights by providing causal evidence on how US MMF funding shocks affect the currency-specific funding costs of non-US banks, and whether capital, liquidity, or regulatory constraints condition their resilience.

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A

Supplementary Material for Chapter 2

A.1 Set-up and notation

This appendix provides additional details on the theoretical framework introduced in Chapter 2. It details the analytical derivations for the comparative statics presented in Section 2.2. It formally proves the signs of the partial derivatives regarding interest rate spreads and credit restrictions.

A.1.1 Derivation of the banking spread

Starting from the target Return on Equity condition (Equation 2.1):

$$r^T + i_{cb} = \frac{A(i_{cb} + \sigma_{b,t}) - L(i_{cb} - \mu)}{E}. \tag{A.1}$$

Using the balance sheet constraint $L = A - E$ and the leverage definition $\lambda = A/E$:

$$\begin{aligned} r^T + i_{cb} &= \frac{A(i_{cb} + \sigma_{b,t}) - (A - E)(i_{cb} - \mu)}{E} \\ r^T + i_{cb} &= \lambda(i_{cb} + \sigma_{b,t}) - (\lambda - 1)(i_{cb} - \mu) \\ r^T + i_{cb} &= i_{cb} + \lambda\sigma_{b,t} + (\lambda - 1)\mu. \end{aligned} \tag{A.2}$$

Solving for the mark-up $\sigma_{b,t}$ yields Equation 2.2:

$$\sigma_{b,t} = \frac{r^T - (\lambda - 1)\mu(\phi)}{\lambda}. \tag{A.3}$$

Proof of comparative statics. Differentiating (A.3) with respect to the bank's target parameters yields:

1. **Leverage λ:**

$$\frac{\partial \sigma_{b,t}}{\partial \lambda} = \frac{-\mu\lambda - [r^T - (\lambda - 1)\mu]}{\lambda^2} = -\frac{r^T + \mu}{\lambda^2} < 0. \tag{A.4}$$

   Since $r^T, \mu \geq 0$, higher leverage allows for a lower spread.

2. **Target profitability r^T:**

$$\frac{\partial \sigma_{b,t}}{\partial r^T} = \frac{1}{\lambda} > 0. \tag{A.5}$$

   Since $\lambda > 0$, a higher target return requires a higher spread.

3. **Target liquidity ratio ϕ:** Recall that $\mu'(\phi) < 0$ (banks pay less on illiquid liabilities or pay more to attract liquid deposits), and since $\lambda > 1$.

$$\frac{\partial \sigma_{b,t}}{\partial \phi} = -\frac{\lambda - 1}{\lambda}\mu'(\phi) > 0. \tag{A.6}$$

4. **Risk/Liquidity attitudes θ:** As stated in Section 2.2, $\lambda'(\theta) < 0$ and $\phi'(\theta) > 0$. Using the chain rule:

$$\frac{d\sigma_{b,t}}{d\theta} = \underbrace{\frac{\partial \sigma}{\partial \lambda}}_{(-)} \underbrace{\frac{\partial \lambda}{\partial \theta}}_{(-)} + \underbrace{\frac{\partial \sigma}{\partial \phi}}_{(+)} \underbrace{\frac{\partial \phi}{\partial \theta}}_{(+)} > 0. \tag{A.7}$$

A.1.2 Effective credit demand and restrictions

To formalise the role of notional demand, we formalise effective credit $C_t^{ED,j}$ as the minimum of the borrower's notional demand $C^{D,j}$ and the bank's maximum credit limit $C^{\max,j}$.

The maximum credit limit is derived from the binding creditworthiness constraint (Equation 2.6 holds with equality):

$$C_t^{\max,j} = \frac{E_{b,t}[CF_T^j]}{\delta^{\min}(\theta_{b,t})(1 + i_{b,t}^j)}. \tag{A.8}$$

The effective credit volume is therefore:

$$C_t^{ED,j} = \min\left(C^{D,j},\ C_t^{\max,j}\right). \tag{A.9}$$

This creates two distinct regimes:

Unconstrained ($C^{D,j} < C_t^{\max,j}$). In this regime, credit restrictions are zero ($cr_t^j = 0$). Effective credit is determined entirely by notional demand. The elasticity of credit with respect to interest rates depends on the borrower's demand function:

$$\frac{\partial C^{ED,j}}{\partial i} = \frac{\partial C^{D,j}}{\partial i}.$$

Constrained ($C^{D,j} \geq C_t^{\max,j}$). In this regime, the bank restricts credit. The intensity of this restriction cr_t^j is the portion of notional demand that is unsatisfied:

$$C^{ED,j} = (1 - cr_t^j)C^{D,j} = C_t^{\max,j} \implies cr_t^j = 1 - \frac{C_t^{\max,j}}{C^{D,j}}. \tag{A.10}$$

Substituting (A.8) into this expression recovers Equation 2.6.

Assuming binding constraints and a given (or inelastic) notional credit demand, we differentiate cr_t^j:

$$\frac{\partial cr_t^j}{\partial i_{b,t}^j} = -\frac{1}{C^{D,j}}\frac{\partial C^{\max}}{\partial i} = -\frac{1}{C^{D,j}}\left(-\frac{E_{b,t}[CF_T^j]}{\delta^{\min}(1+i)^2}\right) > 0. \tag{A.11}$$

Similarly for the creditworthiness standard $\delta^{\min}$:

$$\frac{\partial cr_t^j}{\partial \delta^{\min}} = -\frac{E_{b,t}[CF_T^j]}{C^{D,j}(1+i)}\left(-\frac{1}{(\delta^{\min})^2}\right) > 0. \tag{A.12}$$

Similarly, for the expected cash flows:

$$\frac{\partial cr_t^j}{\partial E_{b,t}[CF_T^j]} = -\frac{1}{C^{D,j}} \cdot \frac{1}{\delta^{\min}(1+i)} < 0. \tag{A.13}$$

Higher expected cash flows increase the maximum credit limit, reducing the restriction ratio. This derivation confirms that in the constrained regime, notional demand $C^{D,j}$ remains a scaling factor for the restriction ratio cr_t^j, which implies that effective credit is still demand-driven. Fluctuations in either credit conditions or a firm's expected performance dictate its regime. These factors can trigger a transition between the unconstrained and constrained states, or, if the firm remains constrained, alter the intensity of the restriction. The most creditworthy firms will remain in the unconstrained regime.

B

Supplementary Material for Chapter 3

B.1 Formal derivations and comparative statics

B.1.1 Setup and assumptions

This appendix derives the comparative statics for the model presented in Chapter 3. The system jointly determines cross-border flows FL, the exchange rate e, the country risk premium ρ, and the lending spread σ via the leverage ratio ψ. We treat the expected rate of depreciation Δe^e and the domestic economy and US policy rates i, and i_{US} as exogenous. The system is defined by:

$$\psi(e) = \frac{1}{\omega(\varphi_{b,0} + \varphi_1 \lambda_{b,t} e)} \tag{B.1}$$

$$\sigma(\psi) = \frac{r - (\psi - 1)\mu}{\psi}, \quad \sigma'(\psi) < 0, \tag{B.2}$$

$$FL - f(Z) = 0, \quad Z \equiv i - i_{US} - \Delta e^e - \sigma(\psi) - \rho, \quad f'(\cdot) > 0, \tag{B.3}$$

$$e - (\chi - \gamma FL) = 0, \quad \gamma > 0, \tag{B.4}$$

$$\rho - g(D) = 0, \quad D \equiv \frac{L\,(1 + i_{US} + \sigma(\psi) + \rho)}{\bar{X}} - \delta^{\max}, \quad g'(\cdot) > 0. \tag{B.5}$$

B.1.2 Equilibrium mapping and Jacobian

To derive the comparative statics, we begin by defining the equilibrium mapping $\mathbf{F}(\mathbf{y}, \xi) = 0$, where the vector of endogenous variables is $\mathbf{y} = [FL, e, \rho]^\top$. Substituting the leverage function $\psi(e, \xi)$ into the spread definition $\sigma(\psi)$, the system becomes non-recursive: the exchange rate e feeds back into capital flows FL and the risk premium ρ through the banking leverage channel.

Totally differentiating the system with respect to all variables yields the matrix equation:

$$\mathbf{J}\, d\mathbf{y} = \mathbf{b}\, d\xi$$

where $\mathbf{J}$ is the Jacobian matrix of partial derivatives with respect to $\mathbf{y}$, and $\mathbf{b}$ captures the direct effects of the parameter change $d\xi$.

To simplify the algebra and highlight the economic mechanisms, we define two key semi-elasticities. First, let Ω capture how depreciation raises spreads by forcing deleveraging:

$$\Omega \equiv \sigma'(\psi)\psi_e > 0.$$

Second, let A_t be the feedback elasticity of the risk premium to the stock of debt:

$$A_t \equiv g'(D)\frac{L}{\bar{X}} \in (0, 1).$$

Using these definitions, the Jacobian matrix $\mathbf{J}$ can be written compactly as:

$$\mathbf{J} = \begin{pmatrix} 1 & f'(Z)\Omega & f'(Z) \\ \gamma & 1 & 0 \\ 0 & -A_t\Omega & 1 - A_t \end{pmatrix} \tag{B.6}$$

We determine the system's stability properties by calculating the determinant $|\mathbf{J}|$. Expanding along the first column, we find that the interaction terms involving J_{32} cancel exactly, leading to a simple exact result:

$$\begin{aligned} |\mathbf{J}| &= 1 \begin{vmatrix} 1 & 0 \\ -A_t\Omega & 1 - A_t \end{vmatrix} - \gamma \begin{vmatrix} f'(Z)\Omega & f'(Z) \\ -A_t\Omega & 1 - A_t \end{vmatrix} \\ &= (1 - A_t) - \gamma\Big(f'(Z)\Omega(1 - A_t) - (-A_t\Omega)f'(Z)\Big) \\ &= (1 - A_t) - \gamma f'(Z)\Omega\Big(1 - A_t + A_t\Big) + \\ &= \underbrace{(1 - A_t)}_{\text{Risk feedback}} - \underbrace{\gamma f'(Z)\Omega}_{\text{Flow-Leverage Feedback}} \end{aligned}$$

For the equilibrium to be stable, we require $|\mathbf{J}| > 0$. This implies $\gamma f'(Z)\Omega < (1 - A_t)$: the combined feedback from the leverage–flow loop and the risk–debt loop must not be explosive.

B.1.3 Short-run comparative statics

We now analyse the effect of an exogenous increase in global banks' leverage. Mathematically, we solve for $d\mathbf{y}/d\xi$ using Cramer's rule. First, we define the shock vector $\mathbf{b}$, which collects the partial derivatives of the system equations with respect to ξ:

$$b_1 = -f'(Z)\sigma'(\psi)\psi_\xi > 0 \quad \text{(Direct inflow increase)}$$

$$b_3 = A_t\sigma'(\psi)\psi_\xi < 0 \quad \text{(Direct debt service reduction)}$$

Cross-border flows FL. To find the impact on cross-border flows, we apply Cramer's rule by replacing the first column of $\mathbf{J}$ with the shock vector $\mathbf{b}$. Expanding the resulting determinant yields:

$$\frac{dFL}{d\xi} = \frac{\det(\mathbf{J}_{FL})}{|\mathbf{J}|} = \frac{b_1(1-A_t) - b_3 f'(Z)}{|\mathbf{J}|}$$

Given our assumptions that $b_1 > 0$ and $b_3 < 0$, and knowing the stability condition ensures both $1 - A_t > 0$ and $|\mathbf{J}| > 0$, the numerator is strictly positive. Therefore, cross-border flows unambiguously increase:

$$\frac{dFL}{d\xi} = -\frac{1}{\gamma}\frac{de}{d\xi} > 0$$

Exchange Rate e. To find the change in the exchange rate, we replace the second column of $\mathbf{J}$ with the vector $\mathbf{b}$ and compute the determinant:

$$\frac{de}{d\xi} = \frac{\det(\mathbf{J}_e)}{|\mathbf{J}|} = \frac{-\gamma(b_1(1-A_t) - b_3 f'(Z))}{|\mathbf{J}|}.$$

Focusing on the dominant flow channel (treating the secondary debt-service feedback b_3 as negligible relative to b_1), and knowing that the direct inflow effect b_1 is positive, and the stability condition holds ($1 - A_t > 0$), the numerator is clearly negative:

$$\frac{de}{d\xi} < 0$$

Thus, an exogenous increase in global banks' leverage leads to an appreciation. The denominator $|\mathbf{J}|$ is smaller than in the exogenous-leverage case (due to $-\gamma f'\Omega$), meaning the endogenous leverage response amplifies the appreciation.

Risk Premium ρ. For the risk premium, we replace the third column of $\mathbf{J}$ with $\mathbf{b}$. Expanding the resulting determinant along the second row:

$$\det(J_\rho) = b_3(1 - \gamma f'\Omega) - \gamma A_t \Omega\, b_1$$

To mathematically determine the sign of the first term, we must rely on the system's stability condition. For the equilibrium to be stable, the determinant of the Jacobian matrix must be strictly positive ($|\mathbf{J}| > 0$). Rearranging this inequality allows us to isolate the flow-leverage feedback term ($\gamma f'(Z)\Omega < 1 - A_t$). By definition, the feedback elasticity of the risk premium to the stock of debt is bounded between zero and one. Consequently, the term $(1 - A_t)$ must be strictly less than 1. This implies that:

$$1 - \gamma f'(Z)\Omega > 0 \tag{B.7}$$

And since b_3 is negative, under the assumption of a stable equilibrium, both terms are unambiguously negative. Since $|\mathbf{J}| > 0$, we have:

$$\frac{d\rho}{d\xi} < 0.$$

Under these assumptions, the risk premium falls unambiguously in the short run. The leverage shock directly reduces the debt-service ratio (b_3 effect), and the feedback from inflow-induced appreciation further compresses spreads ($-\gamma A_t \Omega b_1$ effect).

B.1.4 Medium-run dynamics and feedback

In the medium run, the stock of liabilities adjusts to the new flow conditions. Since the shock increases inflows ($dFL/d\xi > 0$), the stock of external debt L accumulates over time ($dL/d\xi > 0$). The total change in the risk premium then includes this feedback effect:

$$\frac{d\rho_{mt}}{d\xi} = \frac{d\rho_{st}}{d\xi} + \frac{\partial \rho}{\partial L}\frac{dFL}{d\xi}. \tag{B.8}$$

While the short-run effect is unambiguously negative (risk reduction), the medium-run effect is ambiguous. The accumulation of foreign debt L raises the debt-service ratio and puts upward pressure on ρ. If this quantity effect is strong enough to offset the initial price effect (lower spreads), the fall in the risk premium will be erased over time.

B.2 Data and descriptive statistics

Table B.1: Summary country statistics for quarterly exchange rate depreciations, EMBI spreads and gross inflows over GDP

Country	Exchange Rate		EMBI spread		Gross inflows	
	Mean	**Std**	**Mean**	**Std.**	**Mean**	**Std.**
AGO	9.72	17.33	732.45	236.30	-3.90	34.16
ARG	11.43	21.25	1352.79	1161.44	16.69	18.86
AUS	-0.15	8.79	-	-	32.61	39.63
AUT	-	-	-	-	26.36	83.13
BEL	-	-	-	-	86.80	150.91
BGR	-0.21	6.81	220.02	142.14	59.79	74.91
BOL	0.29	1.81	610.94	291.62	22.08	37.88
BRA	2.32	13.40	379.74	265.09	20.81	17.20
BRN	-0.51	3.71	-	-	12.89	27.67
CAN	-0.14	6.15	-	-	49.90	22.89
CHE	-1.25	5.82	-	-	46.41	139.25
CHL	1.02	8.54	153.98	48.09	33.91	26.49
CHN	-0.39	2.92	150.06	60.49	23.16	16.92
COL	1.96	9.40	-	-	31.95	15.60
CRI	1.39	4.26	358.51	113.48	41.25	19.12
CYP	-2.41	6.29	-	-	449.47	684.63
CZE	-1.10	8.72	-	-	38.54	43.62
DEU	-	-	-	-	40.96	45.48
DNK	-0.20	6.79	-	-	40.56	67.87
DOM	2.72	10.52	467.13	254.39	32.58	15.62
ECU	-10.78	103.38	1031.74	659.11	16.87	25.83
EGY	4.55	12.77	395.86	240.36	31.81	23.89
ESP	-	-	-	-	65.47	49.87
FIN	-	-	-	-	-17.75	176.97
FRA	-	-	-	-	76.35	75.11
GBR	0.59	7.13	-	-	90.52	144.73
GEO	0.67	6.46	453.55	241.58	76.20	39.35
GHA	6.98	9.68	552.93	384.56	33.53	22.16
GRC	6.77	2.86	-	-	55.14	70.78
GTM	0.02	2.12	955.25	832.19	19.01	14.76
HKG	0.01	0.30	302.60	165.70	193.35	236.09

Table B.1: (continued)

Country	Exchange Rate		EMBI spread		Gross inflows	
	Mean	**Std**	**Mean**	**Std.**	**Mean**	**Std.**
HUN	0.71	9.89	-	-	80.22	212.74
IDN	1.61	7.61	249.03	97.31	12.54	15.49
IND	1.39	4.97	249.93	78.80	27.96	11.73
IRL	-	-	-	-	489.18	451.84
ISL	1.40	10.25	-	-	129.89	347.30
ISR	-0.30	5.78	-	-	30.60	22.89
ITA	-	-	-	-	30.95	30.38
JAM	2.79	3.87	433.75	129.52	35.51	26.55
JPN	0.54	7.46	-	-	-10.61	23.02
KEN	1.19	5.28	368.29	153.34	-	-
KOR	0.29	6.60	-	-	15.02	15.91
LKA	3.56	8.31	682.41	947.83	19.88	16.59
LVA	-0.47	5.90	-	-	63.28	84.87
MDA	0.96	5.95	-	-	51.57	37.96
MEX	1.51	7.42	248.87	89.59	16.65	14.03
MLT	-2.22	5.40	-	-	665.20	1019.76
MUS	1.23	5.63	-	-	446.14	853.55
MYS	0.32	4.93	161.94	57.90	27.47	41.87
NGA	3.34	7.59	423.48	299.17	9.83	15.24
NIC	2.33	0.52	-	-	37.87	55.20
NLD	-	-	-	-	136.60	213.81
NOR	0.45	8.72	-	-	61.50	66.47
NZL	-0.46	8.95	-	-	23.00	30.96
PAK	3.45	6.14	682.86	470.30	11.66	12.30
PAN	0.00	0.00	238.71	103.52	81.86	81.04
PER	0.17	4.16	257.18	161.23	30.22	21.43
PHL	0.67	4.69	246.83	155.13	13.67	16.46
POL	0.10	9.85	115.32	70.81	33.00	25.26
PRT	-	-	-	-	58.22	68.98
PRY	1.64	8.67	243.92	30.86	10.15	13.44
QAT	0.00	0.00	-	-	29.90	70.39
ROU	1.93	8.11	225.61	77.95	40.23	39.03
RUS	2.12	12.43	454.22	638.45	12.93	31.06
SAU	0.00	0.00	-	-	15.79	17.37

Table B.1: (continued)

Country	Exchange Rate		EMBI spread		Gross inflows	
	Mean	**Std**	**Mean**	**Std.**	**Mean**	**Std.**
SGP	-0.51	3.73	-	-	220.84	211.29
SLV	-4.72	31.81	500.14	396.14	27.70	25.80
SVN	-0.70	7.15	-	-	38.25	51.50
SWE	0.41	8.42	-	-	43.44	56.32
THA	-0.20	4.86	-	-	12.19	25.55
TUR	7.64	14.51	397.31	186.81	27.48	19.60
UGA	1.97	7.03	-	-	25.90	42.05
UKR	4.19	12.22	928.03	887.60	49.31	48.74
URY	2.63	10.40	398.00	491.12	36.25	42.69
VNM	1.13	1.75	5090.97	10021.09	38.66	16.99
ZAF	2.19	11.83	260.06	111.57	10.42	24.22
ZMB	4.31	14.98	753.51	1024.56	37.63	54.39

	z_t	Leverage	ln (VIX)	Federal Funds rate	World GDP	US GDP
z_t	1.0					
Leverage	0.32 ***	1.0				
ln (VIX)	-0.07	0.13	1.0			
Federal Funds rate	-0.08	0.34 ***	-0.06	1.0		
World GDP	0.02	0.02	-0.26 **	0.09	1.0	
US GDP	0.01	-0.06	-0.29 ***	0.07	0.91 ***	1.0

Table B.2: Pairwise correlations

Dependent	Horizon Variable	1	2	3	4	5	6	7	8	9	10	11
EMBI spread	z_t	−4.32	−12.46 **	−21.32 ***	−29.43 ***	−18.86 ***	−11.09 **	−10.77 *	−13.7 *	−29.3 ***	−15.9 ***	−4.52
	z_t lag (1)	−6.41	−13.92 **	−13.22 *	−0.81	2.09	−4.38	−9.91	−26.66 ***	−18.55 ***	−18.34 ***	1.91
	Latent 1	9.57	−5.32	−26.06 ***	−35.89 ***	−31.83 ***	−28.16 ***	−18.24 **	−16.17 *	−22.85 **	−20.76 **	−17.95 *
	Latent 2	3.06	0.29	4.19	−5.63	−29.66 *	−47.93 **	−50.46 **	−53.62 ***	−69.65 ***	−84.64 ***	−82.08 ***
	Latent 3	−41.43 ***	−43.83 ***	−43.32 ***	−39.64 ***	−33.09 ***	−27.4 **	−13.22	−2.92	−1.63	3.15	4.91
	ln.VIX	39.3 ***	35.52***	25.33***	10.58	9.17	27.75***	20.79**	30.66**	47.71**	40.3 **	−3.46
	FF rate	63.8 *	82.6 **	−27.51	−125.68 **	−123.31 **	−31.05	−28.26	−6.01	42.93*	4.44	−59.55
	GDP growth World	−65.47 **	−70.72 ***	−54.71 *	−21.72	0.13	42.8	83.78**	117.79 ***	131.14 ***	93.42***	9.1
	GDP growth US	30.04*	42.41**	30.16*	13.41	13.03	−13.3	−45.76 **	−77.28 ***	−95.84 ***	−64.75 **	−42.88 *
	Domestic credit	−1.82	−2.52	−3.75	−1.85	−0.51	−1.25	−1.67	−1.17	−2.15	−4.09	−4.5
	GDP growth	−0.02 **	−0.03 ***	−0.03 ***	−0.04 ***	−0.05 ***	−0.05 ***	−0.05 ***	−0.05 ***	−0.06 ***	−0.06 ***	−0.06 ***
	Inflation	34.78**	39.63**	33.48**	20.44**	7.98	−1.17	−6.69	−12.03 *	−13.25	−12.29	−12.06
	Deposit rate epol	−1.69	−0.76	0.5	0.79	1.2	2.33	3.21	3.45	3.8	3.91	6.12*
	kai	−129.3 *	−150.09 *	−110.89	−54.58	−26.15	−30.88	−31.21	−54.73	−76.71	−85.34	−85.98
	FX Regime	1.06	−3.87	−2.55	−2.06	−17.73	−34.08	−41.02	−36.89	−34.97	−32.67	−25.76
	Constant	120.51 ***	190.14 ***	219.91 ***	237.42 ***	291.27 ***	361.09 ***	394.84 ***	417.11 ***	444.49 ***	457.82 ***	438.85 ***
	EMBI spread lag (1)	0.72***	0.56***	0.45*	0.37	0.34	0.28	0.24	0.19	0.14	0.1	0.02
	R2	0.54	0.32	0.20	0.13	0.09	0.07	0.05	0.05	0.05	0.05	0.07
	Observations	2566	2533	2500	2467	2434	2401	2368	2335	2302	2269	2236
	Countries	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Exchange Rate	z_t	0.16	−0.73 **	−1.3 ***	−1.64 ***	−1.63 ***	−1.53 ***	−1.46 ***	−1.73 ***	−2.02 ***	−2.05 ***	−1.79 ***
	z_t lag (1)	−1.04 ***	−1.36 ***	−1.59 ***	−1.56 ***	−1.47 ***	−1.53 ***	−1.61 ***	−1.97 ***	−2.0 ***	−1.83 ***	−1.69 ***
	Latent 1	1.28***	0.81***	0.24	0.28	0.31	0.75**	0.48	0.71**	0.65**	0.53*	1.21***
	Latent 2	1.47***	2.02***	2.13***	1.67**	1.98**	2.22**	3.09***	3.48***	3.4***	3.05***	3.59***
	Latent 3	−0.76 ***	−0.8 ***	−1.32 ***	−1.37 ***	−1.33 ***	−1.48 ***	−0.9 ***	−0.78 ***	−0.33	−0.08	−0.23
	ln.VIX	−0.11	−0.17	−0.49	−0.67 **	−0.79 **	−1.22 ***	−1.72 ***	−2.1 ***	−2.46 ***	−2.36 ***	−2.81 ***
	FF rate	1.18	0.83	1.05	0.37	1.07	1.58	0.17	0.21	−1.73	−1.18	−1.31
	GDP growth World	−4.16 ***	−5.4 ***	−5.68 ***	−5.08 ***	−5.77 ***	−5.47 ***	−5.97 ***	−6.09 ***	−6.26 ***	−6.57 ***	−6.8 ***
	GDP growth US	3.08***	4.39***	4.26***	4.01***	4.46***	4.08***	4.46***	4.49***	4.16***	4.76***	4.91***
	Domestic credit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	GDP growth	0.0***	0.0***	0.0***	0.0***	0.0***	0.0*	0.0***	0.0	0.0*	0.0	0.0
	Inflation	0.38**	0.31	0.22	0.14	0.04	−0.06	−0.22	−0.5	−0.51	−0.5	−0.66
	Deposit rate epol	0.15**	0.23***	0.27***	0.25**	0.28**	0.31**	0.33**	0.34*	0.27	0.18	0.16
	kai	0.41	0.51	1.67	2.26	2.85	3.46	3.71	3.37	2.69	2.38	2.77
	FX Regime	0.54	0.57	0.57	0.72	0.67	0.55	0.51	0.47	0.31	0.37	0.64
	Constant	−1.76	−1.75	−1.79	−1.63	−1.33	−0.78	−0.37	0.44	1.78	2.64	2.49
	Exchange Rate lag (1)	0.0	0.0	0.0	0.0	0.0	0.0	−0.01	−0.02	−0.03	−0.02	−0.03 *
	R2	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.04
	Observations	4500	4494	4488	4481	4462	4401	4340	4279	4218	4157	4096
	Countries	65.0	65.0	65.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
Gross inflows	z_t	9.11**	13.54**	20.04**	28.89***	34.32**	37.28**	42.85**	51.39**	59.56**	65.39**	73.29**
	z_t lag (1)	10.22*	17.17**	25.17**	31.78**	34.99**	41.74**	49.21**	58.52**	64.67**	73.75**	82.37**
	Latent 1	−12.29 *	−17.67	−19.19	−24.0 *	−26.27 *	−34.37 **	−38.57 **	−48.58 **	−51.58 **	−57.98 ***	−60.61 **
	Latent 2	−38.26 ***	−59.79 ***	−77.86 ***	−96.44 ***	−110.98 ***	−130.63 ***	−142.32 ***	−154.42 ***	−158.84 ***	−163.64 ***	−165.17 ***
	Latent 3	4.91	3.11	6.37	9.85*	7.04	0.33	−2.14	−6.49	−10.96	−18.08	−25.45
	ln.VIX	−7.44 **	−9.7 *	−11.46 *	−11.9	−13.54	−6.27	0.55	5.16	7.54	14.04	19.63
	FF rate	−53.19 ***	−67.24 ***	−63.24 ***	−65.12 **	−42.06	3.03	68.93	101.7	134.16	159.05	199.86 *
	GDP growth World	84.83***	134.73 ***	176.48 ***	218.16 ***	236.17 ***	264.48 ***	274.1 ***	292.15 ***	291.13 ***	288.74 ***	273.71 **
	GDP growth US	−62.63 ***	−98.73 ***	−129.04 ***	−161.04 ***	−175.58 ***	−194.22 ***	−199.74 ***	−214.48 ***	−212.85 ***	−204.95 **	−192.65 **
	Domestic credit	0.05	0.07	0.1	0.13	0.15	0.18	0.2	0.22	0.24	0.26	0.28
	GDP growth	0.0	−0.01 **	0.0	−0.01	−0.01	−0.01	−0.01	−0.02	−0.01	−0.02	−0.02
	Inflation	5.03**	6.32*	9.41**	10.71*	12.48*	15.13*	22.58**	25.76**	28.67**	30.27**	36.26**
	Deposit rate epol	−3.44	−5.57	−8.04	−10.9	−13.34	−15.99	−18.82	−21.45	−23.49	−25.47	−27.5
	kai	−214.52 **	−315.29 **	−408.98 **	−491.96 **	−581.41 **	−666.36 **	−747.5 **	−815.53 *	−877.73 *	−929.43	−974.86
	FX Regime	16.77	29.11	45.41	63.24	82.12	99.69	116.57	134.67	155.15	175.06	194.44
	Constant	100.75 ***	145.78 **	179.08 **	213.16 *	245.12	283.22	315.58	347.63	368.84	392.39	410.16
	Gross inflows lag (1)	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***	0.0***
	R2	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Observations	5450	5447	5444	5438	5370	5299	5228	5157	5086	5015	4944
	Countries	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0	74.0

Table B.3: Cumulative causal effect of global banks' leverage on EMBI spreads, exchange rate depreciations and gross cross-border inflows. Note: Panel local projections with country fixed effects. Significance levels: *** p<1%, ** p<5%, * p<10%

B.3 Figures

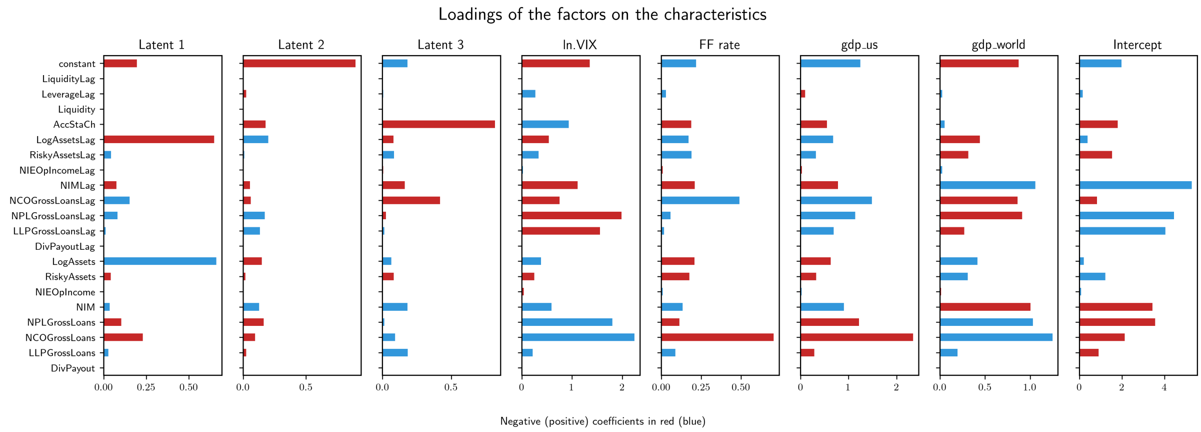

Figure B.1: Loadings of factors on characteristics. Note: Negative (positive) coefficients in red (blue).

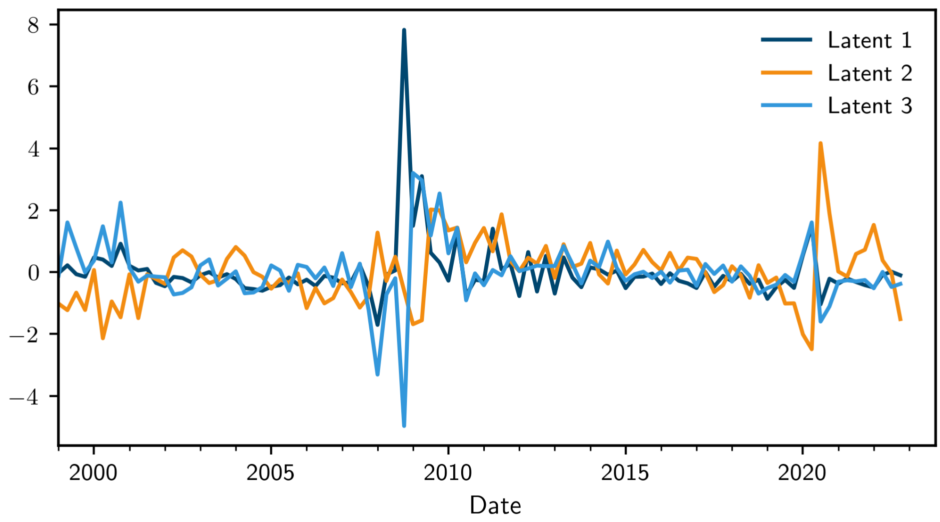

Figure B.2: Estimated latent factors

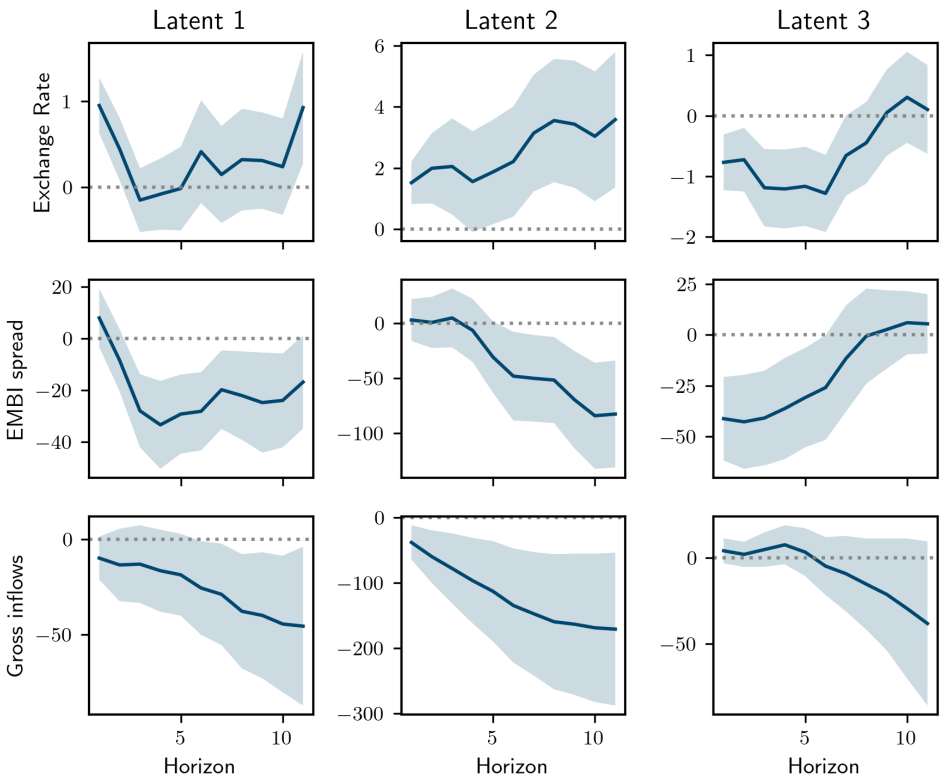

Figure B.3: Cumulative effect of the estimated latent factors, EMBI spreads, exchange rate depreciations and gross cross-border inflows. Excluding the GIV from the regression. Note: The figure shows the cumulative impulse average responses in each country. The areas denote the 95 per cent confidence interval.

C

Supplementary Material for Chapter 4

C.1 Banking USD Dollar Network Estimation

We begin with the BIS locational banking statistics for cross-border liabilities at quarter t (e.g., 2024 Q4). From the full series, we select only entries with "Amounts outstanding / Stocks" (Measure), "All instruments" (Type of instruments), "Cross-border" (Position type), and "Total liabilities" (Balance sheet position), and we restrict to "All currencies". We then pivot this subset into an $N \times N$ matrix:

$$A = [a_{n,k}]$$

where $a_{n,k}$ is the total outstanding claims (liabilities) of banks reporting in country n on all sectors of country k, summed across all currencies. Missing or "Grouped" rows and columns are dropped or filled with zero so that every bilateral pair (n, k) is represented.

To distinguish between sectors, we construct a second matrix:

$$NB = [nb_{n,k}]$$

using the same filters as above, but restricting the "Counterparty sector" to "Non-banks, total". This matrix isolates cross-border liabilities vis-à-vis non-bank counterparties only. We then compute:

$$B = [b_{n,k}] = [\max(a_{n,k} - nb_{n,k}, 0)]$$

as the residual component, representing liabilities vis-à-vis banks and non-banks. Next, to recover the USD-only component of these positions for each counterparty sector, we exploit the fact that BIS also publishes aggregate USD-denominated liabilities by reporting country (counterparty = "All countries (total)") and by counterparty country (reporting

= “All reporting countries”). Let

$$r_n = \sum_k x_{n,k}^{USD}, \qquad c_k = \sum_n x_{n,k}^{USD}$$

be, respectively, the total USD cross-border liabilities by reporting country n and to counterparty country k. We extract these two marginal vectors by sub-setting the BIS table to “US dollar” (Currency denomination) and “Total liabilities” grouping on the two special “All” rows, and merging the results onto the country list of A. To ensure consistency, one of r_n or c_k is rescaled so that:

$$\sum_n r_n = \sum_k c_k,$$

The grand total of USD liabilities in the system. Because BIS does not publish sector-specific USD row totals by reporting country, we approximate these vectors by allocating the total USD liabilities r_n proportionally across sectors. Specifically, we construct:

$$r_n^{NB} = r_n \times \frac{\sum_k nb_{n,k}}{\sum_k a_{n,k}}, \qquad r_n^{B} = r_n - r_n^{NB},$$

where the ratios are based on each country’s share of non-bank liabilities in the all-currency matrix. In contrast, the USD column totals c_k^{NB} and c_k^{B} are observable: they are directly extracted by filtering the BIS dataset by `currency = "US dollar"`, counterparty sector (e.g., “Non-banks, total”), and `reporting = "All reporting countries"`. If these sector-level column totals are not available (i.e., BIS suppresses them), we apply the same proportional method used for the rows.

Finally, we perform a biproportional (“RAS”) adjustment of the full bilateral matrix A so that its rows and columns match the USD marginals r and c while preserving the original pattern of non-zero links in A. Concretely, starting from $X^{(0)} = A$, we iterate

$$X_{n,k}^{(g+1/2)} = X_{n,k}^{(g)} \times \frac{r_n}{\sum_{k'} X_{n,k'}^{(g)}},$$

$$X_{n,k}^{(g+1)} = X_{n,k}^{(g+1/2)} \times \frac{c_k}{\sum_{n'} X_{n',k}^{(g+1/2)}},$$

alternating row- and column-scaling until $\|X^{(g+1)} - X^{(g)}\|_F$ falls below 10^{-8}, or a maximum of 500 iterations is reached (the subscript F denotes the Frobenius norm of the matrix).

The resulting matrix

$$X = [x_{n,k}]$$

is our estimated USD-denominated bilateral liabilities network.