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Global liquidity: Drivers, volatility and toolkits

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Global Liquidity: Drivers, Volatility and Toolkits

Linda Goldberg

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Abstract

Global liquidity refers to the volumes of financial flows—largely intermediated through global banks and non-bank financial institutions—that can move at relatively high frequencies across borders. The amplitude of responses to global conditions like risk sentiment, discussed in the context of the global financial cycle, depends on the characteristics and vulnerabilities of the institutions providing funding flows. Evidence from across empirical approaches and using granular data provides policy-relevant lessons. International spillovers of monetary policy and risk sentiment through global liquidity evolve in response to regulation, the characteristics of financial institutions, and actions of official institutions around liquidity provision. Strong prudential policies in the home countries of global banks and official facilities reduce funding strains during stress events. Country-specific policy challenges, summarized by the monetary and financial trilemmas, are partially alleviated. However, risk migration across types of financial intermediaries underscores the importance of advancing regulatory agendas related to non-bank financial institutions.

Key words: global liquidity, global dollar cycle, trilemma, exchange market pressure, risk sensitivity, safe haven, capital flows, non-bank financial intermediaries, risk migration

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1 Introduction

In the aftermath of the global financial crisis, policy toolkits developed have aimed to manage parts of the shared financial conditions associated with excessive booms and avoiding damaging busts in credit availability. The toolkits also strongly emphasize the consequences of the considerable advances that have occurred in the area of micro-prudential policy and the supervision of banks. This article provides associated lessons for global liquidity. Following the approach of the Committee on the Global Financial System (CGFS 2011), global liquidity corresponds to the volumes of financial flows - largely intermediated through global banks and non-bank financial institutions – that can be reallocated at relatively high frequencies such as intra-day or intra-month. Global liquidity is central to both international macroeconomics and financial stability, with a particular focus on spillovers of monetary policy and investor risk sentiment, each of which interacts with the vulnerabilities and constraints of institutions participating in international financial markets. It is at these horizons that exchange rates are determined by international capital flow pressures, as financial factors dominate the forces associated with international trade.

This paper’s emphasis is particularly on lessons from granular economic and financial data, as a complement to earlier contributions.¹ The jumping off points for this content are the previous IMF Mundell Fleming lectures that emphasized different challenges associated with global liquidity. Hyun Song Shin (2012) highlighted the importance of understanding frictions and value-at-risk constraints in global banks, drawing on his related research (Adrian and Shin (2008) and Adrian and Shin 2010).² Helene Rey (2014) discussed the global cycle and policy constraints across countries, and later the whole of the IMF 2017 Annual Research Conference (see 2017 ARC) highlighted aspects of international spillovers. Ben Bernanke (2017) discussed issues around spillovers of US monetary policy. Raghuram Rajan (2018) discussed consequences of such spillovers for foreign countries based on his research (Diamond, Hu and Rajan 2020). Pierre Olivier Gourinchas (2023) emphasized that the foundational theory contributions in open economy macroeconomics (Rogoff and Obstfeld 1996) are increasingly able to incorporate economic and financial granularity including networks, frictions, and heterogeneity.

Broadly, the main arguments in this paper are that micro-prudential policies enacted in the home countries of global banks are consequential for international financial flows and for the policy challenges in destination countries for these flows. The policies and frameworks for nonbank financial intermediaries (NBFIs) should also have significant consequences for global liquidity. Indeed, the risk sensitivity of global liquidity has evolved in important ways associated with

¹Some of the material for this paper was delivered as the Mundell Fleming Lecture of the IMF Annual Research Conference, with the 23rd Jacques Polak Conference in honor of Maurice Obstfeld.

²Bruno and Shin (2015) also highlight the financial channel of exchange rates working through banks, focusing attention on the specific mechanisms through which changes in currency value engage with institutional features to influence credit flows.

prudential policies applied in the home countries of financial institutions engaging in international funding flows. The main approach used to develop the arguments is to combine insights from careful empirical research using granular data that inform the constraints, institutional features, and international shock transmission channels through banks and NBFIs.³ These interact with the frontier of agents in need of financing and migrate across the international spectrum of creditors and investors who provide funding. Related analytics inform the mechanisms and frictions that shape the dynamics of capital flows across borders and are even informative in rethinking how to group countries according to their respective policy challenges. Accordingly, this paper stresses three main lessons.

Lesson 1. Prudential policies, effective supervision, and liquidity facilities from the source countries of global liquidity dampen the global financial cycle.

Prudential policies include micro-prudential work done within countries to make individual financial institutions, most specifically banking organizations, more robust. The supervision and regulation of banks that comes to the fore includes practices on how risk is managed within these organizations, the extent of the buffers that institutions have against types of risk, and the approaches for recovery and resolution of the banks if they get into trouble. The risk-absorbing capacity and constraints of individual market participants alter the responsiveness of global liquidity to shocks. In the aftermath of the GFC, large and complex banks have been identified as systemically important. They have been subjected to frameworks and stress testing intended to make these institutions more robust, including through having balance-sheet capital and liquidity that can better absorb shocks. Internal risk management practices are improved. Moreover, improvements have occurred in recovery and resolution planning, which aim to reduce the time and costs of breaking up such banking organizations in the event that they fail. Strong micro-prudential policies and supervision, leading to enhanced risk absorption and improved risk management by globally active banks, are associated with smaller amplitude responses of cross border lending to changes in risk sentiment. Accordingly, less flighty international financial flows relax some of the tight tradeoffs articulated in international monetary and financial stability trilemmas.

Lesson 2. Access to internal and official liquidity lowers the amplitude of global liquidity response to stress events.

Both the structure of banking organizations and the access to official liquidity influence the pattern of cross-border liquidity flows through global banks. Global banks are often complex

³The Bank for International Settlements and other institutions are also active in collecting some of these granular data from across countries, and the countries are investing in even more granular collections and associated repositories.

financial conglomerates, with affiliates in banking and other industries.⁴ Financial capital is moved across borders to affiliated branches and subsidiaries in foreign locations when stresses occur. This liquidity management can be either stabilizing or destabilizing in the global context, and policy frameworks should support the beneficial internal capital market flows within global banks (Cetorelli and Goldberg 2012, Buch and Goldberg 2020). For some funding shocks, a lower amplitude of the global financial cycle and relaxed trilemma tradeoffs should arise from well-designed access to foreign currencies, including access to dollars through central bank swap lines and the Federal Reserve’s Foreign International Monetary Authority (FIMA) repo facilities (Choi, Goldberg, Lerman and Ravazzolo 2022, Goldberg and Ravazzolo 2022). By reducing some of the tail risk on dollar funding costs in systemic events, access to such facilities supports the continued provision of credit and reduced amplification effects when large shocks, including from deteriorated risk sentiment, hit global markets.

Lesson 3. Risk migration poses challenges to moderating the amplitude of global liquidity flows.

Granular data analytics clearly show the challenges from risk migration within global liquidity flows. The broad spectrum of agents receiving global liquidity - including bank and nonbank financial institutions, corporations, and sovereign governments - is distinguished by the riskiness of their projects, available collateral and liquidity, and ultimately, the ability to repay their obligations. In recent history, some financing activity, including for riskier projects and borrowers, has migrated away from funding through banks towards more market-based financing. Some of this manifests as a larger role for international debt securities, instead of cross-border loans. Nonbank financial institutions play important or even dominant roles in some global liquidity flows. Some of this growth has arisen due to technological innovation. While stronger prudential policy has helped stabilize the amplitude of the global factor through banking flows, it also leads to risk migration outside of banking. The shift in funding composition via risk migration can erode some of the recent progress made on dampening the amplification of shocks that occurred after the global regulatory communities focused on large and internationally active banks after the global financial crisis. Risk migration in global liquidity underscores the importance of advancing efforts to address the vulnerabilities associated with some classes of nonbank financial institutions. Weaknesses and systemic risks propagate across borders, and domestic policy around regulation and supervision of financial institutions has externalities.

The remainder of this article is organized into three sections. Section 2 defines global liquidity and its relationship to policy trilemmas, describes key institutions involved in types of flows,

⁴For details on the complexity of these financial conglomerates, see Cetorelli and Goldberg (2014), Correa and Goldberg (2022), and a summary by Buch and Goldberg (2022) of a broader groups of studies through the International Banking Research Network and published in the *Journal of Banking and Finance*.

and provides empirical observations about associated risk sensitivities. The risk sensitivity of Exchange Market Pressure (*EMP*) series by country show a significant evolution of the response of international capital flows to domestic and global factors since the global financial crisis (Goldberg and Krogstrup, 2023). Advanced economies are no longer a cohesive group, since they now divide into the few that receive inflow and appreciation pressures when risk sentiment deteriorates, versus all of the others that experience outflow pressures. These latter advanced economies have international capital flow pressures in response to risk sentiment that more closely resemble patterns for emerging markets. Changes are visible in the key components of global liquidity flows intermediated through bank and nonbank financial institutions (Avdjiev, Gambacorta, Goldberg and Schiaffi, 2023). Bank-based flows have risk sensitivities that have declined with improved regulation and supervision, while flows have migrated to the more heterogeneous financial institutions involved in market-based flows.

Section 3 presents evidence on the effects of prudential instruments, with a particular focus on international spillovers through banks. Policies that strengthen capital and risk management frameworks within banks are emphasized, along with stress-testing advances and improvements in the recovery and resolution frameworks of banking institutions. Policies targeted to the internal capital markets of global banks are discussed, as are central bank swap lines and repurchase facilities in dollars.

Section 4 considers the challenges from risk migration and the growth of market-based financing, before noting some key efforts of the global policy community in addressing amplification through non-bank financial institutions and mutual fund flows. Finally, Section 5 concludes with arguments for a more intensive focus on nonbank financial institutions and the overall frontier of risk migration in global liquidity.

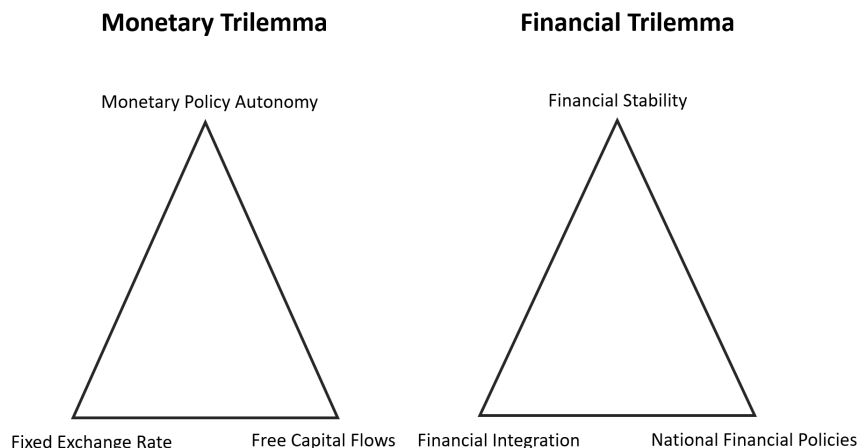


Figure 1: **Monetary and Financial Policy Trilemmas**

Source: Mundell (1960), Fleming (1962), Obstfeld and Taylor (1997), Schoenmaker (2011)

2 Global Liquidity

The long intellectual history of studies of international capital flows provides the foundation for my focus on drivers, volatility and toolkits around global liquidity flows. A brief introduction to this history, including insights from past IMF Annual Research Conferences and other policy venues, is presented (Section 2.1). New stylized facts about global liquidity flows are derived from taking layered empirical approaches (Sections 2.2 and 2.3). These approaches use Exchange Market Pressure (*EMP*) series at the country level, international bank credit and debt securities financing with country and sectoral decompositions, and bank-specific loan series and data from credit registries.

2.1 Global Liquidity and Trilemmas

The well known monetary trilemma shown in Figure 1 posits the incompatibility of three economic features: having monetary policy autonomy, maintaining fixed exchange rates, and having free and open international capital flows. Rodrik (2000) makes the more general point about extensive domestic incompatibilities in a globalized world. Accordingly, another useful example of such incompatibilities is captured by the Financial Trilemma emphasized by Schoenmaker and Oosterloo (2005) and Schoenmaker (2011). It brings into focus the conflicting nodes in the international financial stability realm magnified by the substantial growth in recent decades of cross-border financing. In this case, the three mutually incompatible nodes are: financial stability, nonintervention in cross border financial flows, and national control over financial supervision and regulation.

Empirical evidence shows that countries - including emerging markets - retain some monetary

policy autonomy, especially those with flexible exchange rates. Local interest rates respond to local economic conditions, controlling for foreign economic conditions.⁵ Countries with flexible exchange rates also have better economic outcomes relative to those that operate under fixed exchange rate alternatives, even if domestic policy goals are not completely achieved. Obstfeld and Zhou (2022)’s updated evidence across emerging markets shows that nominal interest rates trend strongly with US rates in the long run. However, there is scope for the independence of short-term and medium-term interest rates which are more tied to changes in domestic variables such as inflation and output.”⁶ This evidence coexists with the highly influential work of Rey (2014),⁷ who argues that exchange rate flexibility does not deliver much insulation to local economies when they are hit by strong global shocks.

Financial stability policy is harder in open economies and financial fragility is more pronounced when local agents choose not to hedge foreign currency credits (Obstfeld, 2014)⁸. Deviations from covered interest parity can imply arbitrage opportunities, and domestic currency bond markets remain vulnerable to large changes in flows associated with financial integration and the openness of capital accounts. This combination inevitably challenges prudential instruments, even if monetary policy is totally effective. The strong financial linkages across countries and the global financial cycle spurred Bernanke (2017) to call for more work on understanding linkages that reflect destabilizing spillovers, as opposed to more benign factors. As he aptly states:

“Financial stability is a public good, which private actors do not take into account in their decisions. Policymakers would thus be well-advised to be prepared to override market outcomes at times to defend financial stability. The significant extent of unhedged dollar borrowing by emerging-market firms may well be a case in point. For now, monetary policy—enhanced by best practices in consultation and communication—should be reserved for macroeconomic objectives. There is plenty of scope for international cooperation to preserve financial stability, however, in areas that include financial regulation, financial supervision, macroprudential policies, and structural reform. A more stable system would benefit everyone and should be a collective enterprise.”

Consistent with these perspectives, those instruments and frameworks received considerable

⁵See for example, Obstfeld, Shambaugh and Taylor (2005), Klein and Shambaugh (2015), and Obstfeld, Ostry and Qureshi (2019). Countries with flexible exchange rates have comparative interest rate independence, shielding themselves more from the contractionary output effects of higher interest rates abroad. Goldberg (2013) shows that this autonomy depends partially on the globalization of credit provision through banks.

⁶A rich parallel literature directly considers monetary policy spillovers across borders, looking at credit flows as a complement to work considering interest rate independence and other work on the effects of economic news and announcements.

⁷See also Rey (2016), Rey (2014), Rey (2017).

⁸IMF 15th Annual Research Conference on “Exchange Rates and Financial Globalization”

attention in the years that followed. The important foundational points about the role of exchange rate flexibility, monetary policy effectiveness, and the value of open capital markets are included in the IMF's Integrated Policy Framework. Recognizing that countries open to international capital flows face difficult tradeoffs in using certain domestic tools, the IMF Integrated Policy Framework (IMF, 2020) includes foreign exchange intervention (FXI), capital flow management measures (CFMs), and macro-prudential measures (MPMs). This emphasis on macro-prudential measures is quite different from how this topic appeared on the radar of some institutions in the early 2000s. In 2001, the IMF Executive Board discussed furthering the compilation, use, and analysis of macroprudential indicators (MPIs) of the health and stability of financial systems (IMF, 2001). The early focus on macroprudential indicators was more closely aligned with early warning indicators than with a toolkit to directly influence the structure of financial activity.

The current framework is, instead, specific about the types of conditions wherein the set of tools can play useful roles in responding to certain shocks (IMF 2020). The Review of the Institutional View on the Liberalization and Management of Capital Flows (IMF 2022) in part responds to the request for rules of the road for capital controls and opens up the possibility for the preemptive use of capital flow management measures to reduce risks from foreign exchange mismatches arising from cross-border borrowing. It also provides methods for evaluating the tradeoffs associated with the application of different measures (Brandao et al. 2020).

In terms of domestic macro-prudential measures, considerable progress has been made in developing and implementing sound policies. Yet, such tools can be limited in their effectiveness if activities fall outside of, or migrate, outside of their reach, including when some items in the toolkit are applied directly to specific types of institutions, instead of activities. Concerns about such limitations were expressed early in the development of the framework by Ostry, Ghosh, Chamon and Qureshi (2012), who explored the empirical consequences of macro-prudential and capital control policies using data from 51 emerging market economies (EMEs) for the period 1995 through 2008. Capital controls and various prudential policies reduced the buildup of financial fragilities during the boom phase and enhanced economic resilience during the foreign capital bust. However, they note the difficulty of effectively using macro-prudential policy when activity can migrate to unregulated venues.

Caution about activity migration and the potential effectiveness of macro-prudential policy was also underscored by other thought leaders. Bruno and Shin (2015) observed that “the shifting patterns of financial intermediation means that tools geared toward the regulated banking sector have diminished efficacy” on the procyclicality of the financial system. Obstfeld and Taylor (2017) emphasized the importance of focusing more on rapidly evolving financial markets, with an acknowledgement that the risky activity pushed outside the perimeters of regulation had been correctly prioritized more in recent years.

Obstfeld (2014) recognized a need for additional changes in features of regulation, liquidity and the international monetary system. His calls for action included: i) domestic regulatory control over large foreign banking organizations (FBOs); ii) enhanced facilities for international liquidity support in key currencies – to the counteract downsides of gross reserve accumulation; and iii) more equity and less debt, noting that this transition was well underway for EMEs. Meanwhile, Rey (2017)’s complementary call for action pointed to a “research agenda for the Global Financial Cycle [including the] source, propagation, amplification mechanisms, endogenous risk build ups; Models with heterogeneous intermediaries and moral hazard (risk-taking not properly priced) . . . ; ex ante: regulatory policies, micro and macro prudential policies, capital flow management policies, review policies subsidising debt.”

The next sections provide perspective on the evolving composition of global liquidity flows and the associated changes in pressures on these flows induced by changes in investor risk sentiment. Insights from data are derived first from broad aggregate series and then from progressively granular data used for delving into the roles of forms of heterogeneity, whether across countries, across borrower types, or across financial institution types. Evidence is presented that demonstrates that key regulatory changes in bank micro- and macro- prudential policies - through bank liquidity, bank capital, and institutional leverage - have influenced the risk sensitivities of global liquidity flows. Afterward, Section 3 considers the evidence on prudential policy spillovers from the perspective of bank-specific data, and draws lessons for the monetary and financial trilemmas.

2.2 International Capital Flow Pressures and Risk

Financial forces within the balance of payments generally dominate payments related to international trade and account for pressures on currency values. On the financial side, global liquidity is the part of international capital flows that is most sensitive to investor pressures. Many studies and commentators use the exchange rate as a summary statistic for the strength of related international capital flow pressures. When coupled with evidence about currency mismatches on balance sheets for sovereigns, financial institutions, or corporates, such pressures are associated with financial stability risks. However, the exchange rate can fall short in this regard, including if official foreign exchange intervention (*FXI*) activity or monetary policy changes are utilized when global liquidity flows shift. The exchange rate is no longer a sufficient statistic reflective of the extent of pressures on the currency.

Goldberg and Krogstrup (2023)’s new *EMP* index captures together the roles of the actual rate of currency depreciation or appreciation, the *FXI* conducted, and changes in monetary policy rate. The *FXI* and monetary policy changes are converted into exchange rate depreciation

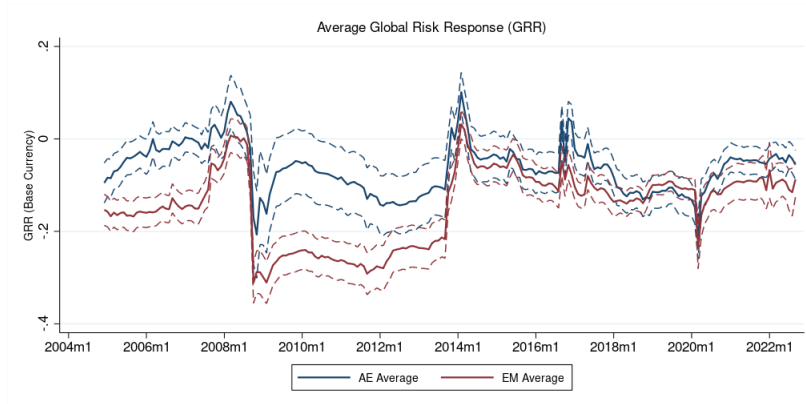
equivalents based on relationships in the balance of payments and international financial flows.⁹ For example, the derived conversion factor on FXI gives the imputed amount of currency depreciation that would have been needed to offset that amount of gap in the balance of payments met foreign asset sales. Conversion factors are country- and time- specific, and depend on country-specific international portfolio shares, the currency denominations of external asset and liability positions, and the role of wealth effects through these international positions. In general, the conversion factors on FXI are larger for countries with smaller external positions and shallower foreign exchange markets, so that each dollar of FXI offsets more market pressure than would otherwise be observed for larger countries with deeper external markets. The gaps between exchange rate depreciation and exchange market pressure vary over time and across countries, as the gaps only arise when FXI or monetary policy is changed. Goldberg and Krogstrup (2023) document that FXI is not only used in extreme stress periods. Indeed, FXI tends to contribute more to the EMP in normal times, relative to periods of extreme financial stress.¹⁰

A first empirical observation relevant for global liquidity and international capital flow pressures in response to risk sentiment is based on comparing 5-year rolling windows of correlations between the EMP and a measure of risk sentiment (in this case, the VIX). I compute this type of series, defined by Goldberg and Krogstrup (2023) as the Global Risk Response (GRR) index, for 40 countries using monthly data starting in 2000 through 2022. Dividing these countries into buckets of advanced economies (AEs) and emerging market economies (EMs), I then compute unweighted period averages, along with the respective in-period standard error bands. The AE patterns are indicated in blue in Figure 2, with EM GRR averages and standard error bands indicated in red. This graphic shows the broadly accepted "fact" that increases in the VIX elicit a much greater risk-off pressure on emerging market currencies (the GRR is more negative), compared with the depreciation pressure experienced by the average advanced economy. The differences are even more pronounced in the near term aftermath of the GFC, while prior relationships resume with some volatility starting around 2015.

This well-accepted narrative about advanced economies versus emerging markets is not fully correct, as the risk responses have evolved over time. In fact, the evolution is so substantial that the pattern is the underpinning of a larger literature and set of observations under the headings of dollar convenience yields and the roles of the U.S. as a liquidity provider or global insurer. Forbes and Warnock (2021) find that the relationship between extreme capital flow episodes and many global variables (particularly global risk measures) has weakened, while oil prices appear

⁹Goldberg and Krogstrup (2023) discuss the shortcomings of prior constructions and the reasons for their specific construction of the EMP .

¹⁰The magnitudes of country-specific interventions, even given similar stress levels, also vary across episodes. For example, during the GFC, China accumulated considerable reserves and prevented approximately 15 percent appreciation against the USD , while during the COVID Crisis, interventions played a much smaller role for the renminbi/dollar exchange rate (Goldberg and Kalisa 2022).



(a) AEs vs EMs

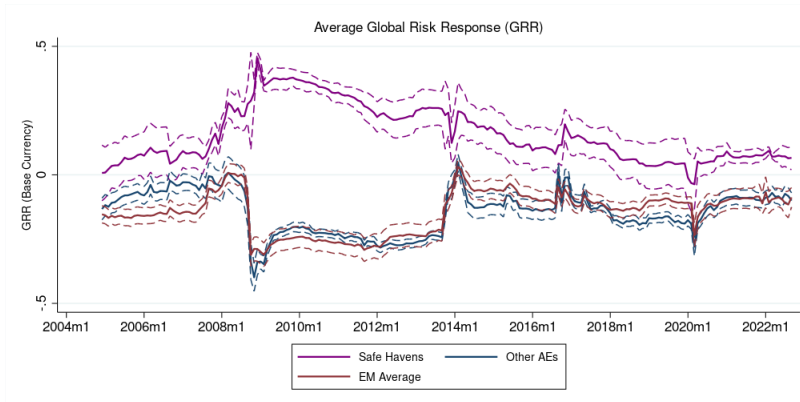
Figure 2: **Global Risk Response by AE and EM Country Groups**

EM Countries: Armenia, Benin, Bolivia, Botswana, Brazil, Chile, China, People’s Republic, Colombia, Croatia, Hungary, India, Jordan, Malaysia, Mexico, Morocco, Peru, Poland, Romania, Russia Federation, Senegal, South Africa, Thailand, Tunisia, Ukraine, Uruguay

AE countries: Australia, Canada, Czech Republic, Denmark, Euro area, Hong Kong, Israel, Japan, Korea, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom, Japan, Switzerland, Denmark, and Hong Kong.

Source: Author’s calculations at the country month-level of *GRR* using Goldberg and Krogstrup (2023) Exchange Market Pressure index and the *VIX*. Solid lines reflect unweighted averages of *GRR* values for countries in a particular bucket, while dashed lines indicate standard error bands.

to be playing a larger role. Examples of different approaches linking liquidity, the U.S. dollar, and risk include Gourinchas et al. (2012), Cohen, Domanski, Fender and Shin (2017), Maggiori (2017), Jiang, Krishnamurthy and Lustig (2018), Gourinchas, Rey and Sauzet (2019), Jordà, Schularick, Taylor and Ward (2019) and Kalemli Ozcan (2019). The *GRR* analytics show that some currencies - the Japanese yen and the Hong Kong dollar against the U.S. dollar, and the Swiss franc and Danish krona against the euro - exhibit the characteristics of so-called "safe haven" currencies through effective appreciations or staying neutral as risk conditions deteriorate (see details in Goldberg and Krogstrup 2023). Separating the *GRR* series for these specific currencies from the broader group of advanced economies presents a strikingly different set of observations about how to sort countries into groups. This separation is shown in Figure 3. The *GRR* comparisons continue to show that risk sensitivities of exchange market pressures have evolved significantly for both advanced and emerging market economies. However, abstracting from the so-called safe haven currencies, the other advanced economies and emerging markets actually exhibit similar risk sensitivities in the period after the GFC. Meanwhile, risk sensitivities have trended downward for the so-called safe havens while continuing to be positive and associated with currency appreciation tendencies.



(a) Safe Havens vs Other AEs vs EMs

Figure 3: **Global Risk Response by Safe Haven, Other AE, and EM Country Groups**

EM Countries: Armenia, Benin, Bolivia, Botswana, Brazil, Chile, China, People’s Republic, Colombia, Croatia, Hungary, India, Jordan, Malaysia, Mexico, Morocco, Peru, Poland, Romania, Russia Federation, Senegal, South Africa, Thailand, Tunisia, Ukraine, Uruguay

Other AE countries: Australia, Canada, Czech Republic, Denmark, Euro area, Hong Kong, Israel, Japan, Korea, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom.

Safe Haven Advanced Economies: Japan, Switzerland, Denmark, and Hong Kong.

Source: Author’s calculations at country month-level of the *GRR* using Goldberg and Krogstrup (2023) Exchange Market Pressure index and the *VIX*. Solid lines reflect unweighted averages of *GRR* values for countries in a particular bucket, while dashed lines indicate standard error bands.

2.3 Global Liquidity Subcomponents

The risk sensitivities reflected in the *GRR* values of Section 2.2 have their foundations in the types of global liquidity flows and the constraints that bind for institutions involved respectively in the supply and demand for liquidity. This focus on financial frictions is an important hallmark of the contributions of post-GFC modeling. Global liquidity in the international context is understood through considering the paths and counterparties in volumes (in US dollars) of international banking flows and issuance of international debt securities. A basic schematic, Figure 4, facilitates high-level insights into these components of global liquidity flows.¹¹ The schematic shows that global liquidity flows to borrowers in Country A can be intermediated through both bank and non-bank financial institutions.¹²

Global banks engage in three categories of cross-border lending (left side of Figure 4). The inter-bank flows are with the unrelated domestic banks. The intra-bank flows are with global

¹¹This exhibit is inspired by the type of graphics provided in BIS (2022). I extend this visual in multiple directions, including to bank and non-bank global liquidity providers, with bank and non-bank borrowers, and broader categories of cross-border flows.

¹²With this schematic, the implication across decades of developments in policy and technology will be considered in Section 3.1.

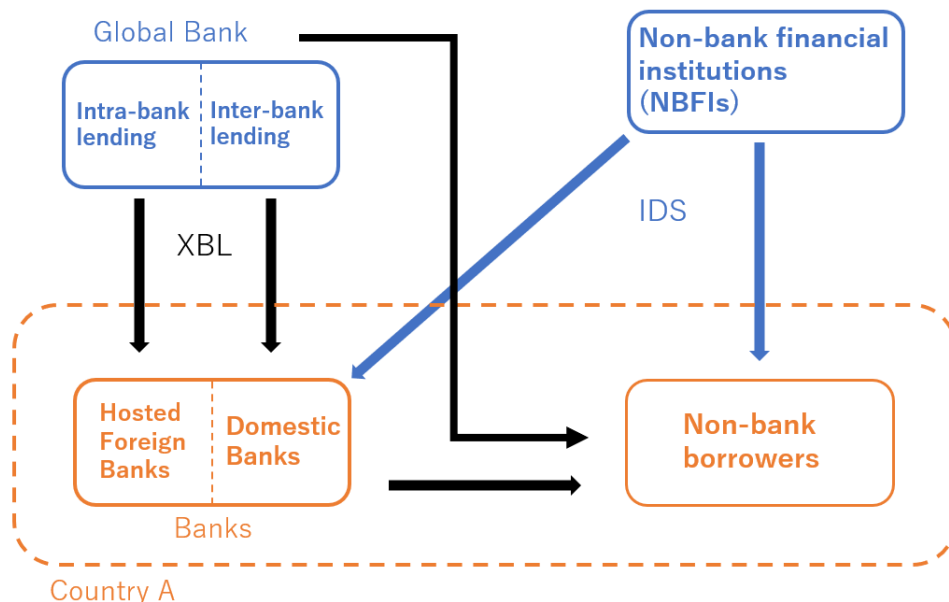


Figure 4: **Bank and Non-bank Global Liquidity Channels**

Source: Author's construction.

bank branches and subsidiaries located in Country A. Also described as inter-office lending or internal capital market flows, these flows arise as global banks manage liquidity across the parts of their organizations located around the world. The broad category of cross-border loans (*XBL*) captures flows to both bank and non-bank borrowers which could be a combination of non-bank financial firms, corporations or governments. The issuers in the syndicated cross-border loan market tend to be large non-financial corporations, exporting and importing firms, and leveraged non-bank financial firms.¹³ Non-bank financial institutions (NBFIs) also provide cross-border funding to domestic banks and to non-bank borrowers within Country A (right side of Figure 4). Non-bank funding, sometimes described as market-based finance, takes the form of purchases of international debt securities (IDS) issued by banks or by non-banks. The NBFIs purchasers of these securities tend to be pension funds, insurance companies, money market funds, and hedge funds.

Some data aggregates from the Bank for International Settlement (BIS) delineate the players in global liquidity along lines similar to those in this figure. The high-level trends are well illustrated by Figures 5 and 6, constructed using data from Q1 2000 through Q2 2021, and taking the borrowing country's perspective. Dramatic changes have taken place in the composition of global liquidity both for advanced economies and for emerging markets. Consistent with the structure of Figure 4, in these next exhibits the types of borrowers are banks (left side exhibits)

¹³While domestic banks and hosted foreign banks both intermediate funds to non-bank borrowers in Country A, this form of intermediation is not part of global liquidity.

and non-banks (right side exhibits) with summed flows across countries by quarter in Figure 5.

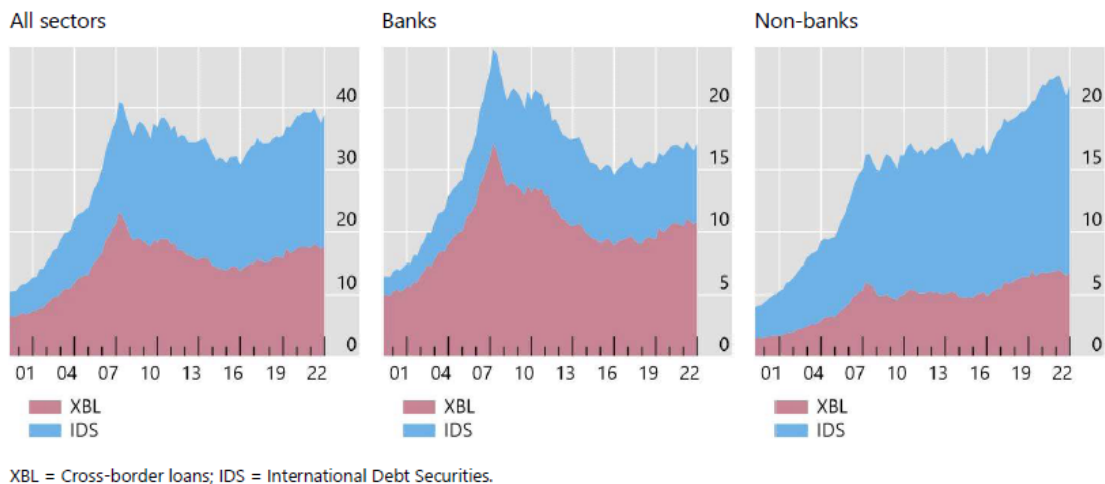
Banks both in advanced economies and in emerging markets have had relatively steady outstanding volumes of total global funding in recent years (Figure 5). Cross-border loans (represented in red) are the largest form of international funding for banks. About two-thirds of this bank-to-bank funding is associated with internal capital market transfers that are part of the liquidity management within global banks; the other one third represents the more typical interbank positions, with flows that are often short maturity and relatively volatile. The post-GFC period is characterized by some bank funding also in the form of international debt securities issuance. The most dramatic shifts in the composition of global liquidity are for non-bank borrowers within both advanced and emerging market economies. The relative size of the blue areas in the right panels of Figure 5 shows the now dominant positions in the total volumes of outstanding positions.

These aggregate statistics mask the extent of evolution for countries, irrespective of their size. Another window on the extent of change is opened by considering the ratio, by country and by quarter, of each country flow value to country GDP, and then considering the median ratio across countries in each category by quarter. This information is presented in the panels of Figure 6. These exhibits show that, while banks have experienced moderate shifts in funding sources, nonbanks have tilted sharply toward market-based finance. Post GFC, the median advanced economy has outstanding international debt securities issued by non-banks at about 25 percent of GDP. The shares for the median emerging market economy are lower, but the growth rate has been more recent, with sharp increases over a decade from around 5 percent to 13 percent of GDP.

2.4 Risk Sensitivity of Global Liquidity Subcomponents

The growth in gross global liquidity components, including as a share of GDP, is not necessarily a specific area of concern. However, the composition of these flows and their drivers is important for financial stability concerns, debt sustainability, economic growth, and also the potential effectiveness of domestic policy instruments. As discussed in Section 2.1, the balance of the global versus local factors as drivers in part describes the ability of local policy to effectively target domestic real variables. Within the global factor, the time variation and data granularity emphasized in recent research further inform the overall stringency of the monetary and financial trilemmas.

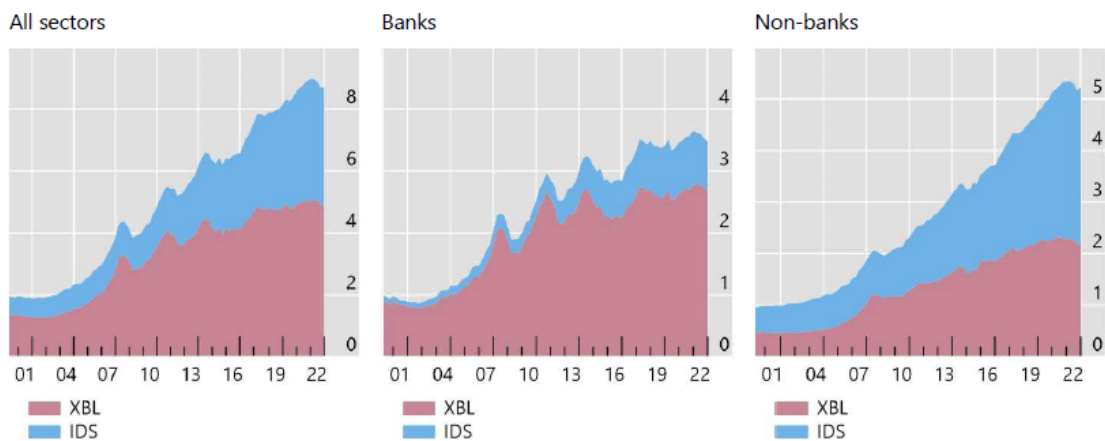
Empirical evidence shows that prior to the GFC, global liquidity to EM borrowers was mainly driven by global factors, whereas local idiosyncratic factors were the principal drivers of liquidity flows to AE borrowers (Avdjiev, Gambacorta, Goldberg and Schiaffi, 2023). However, after the GFC, this pattern reversed for cross-border loans: the relative importance of global drivers for loans to AE borrowers dramatically increased, while they became more of a residual factor in loans to EM borrowers. Consistent with some of the *GRR* results provided in Section 2.2, in the recent



XBL = Cross-border loans; IDS = International Debt Securities.

Sources: BIS Locational Banking Statistics by residence; BIS International Debt Securities Statistics.

(a) Advanced Economies



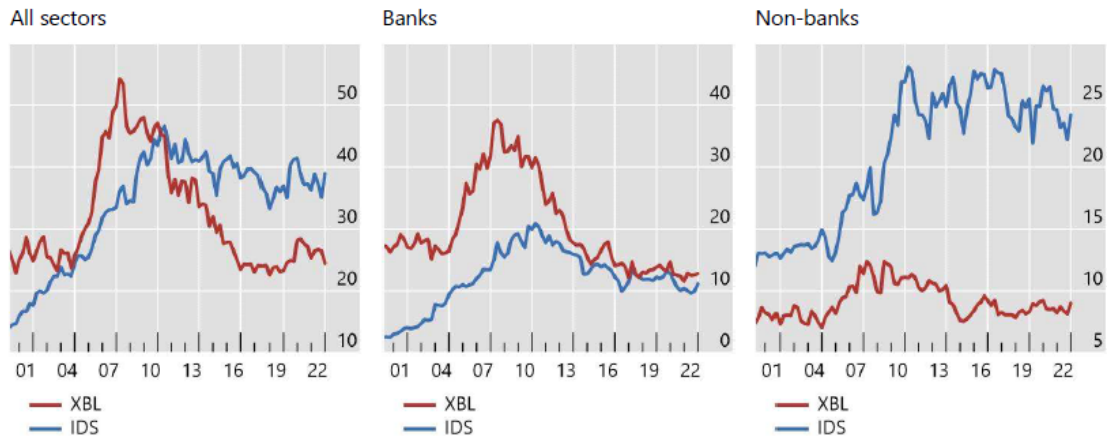
XBL = Cross-border loans; IDS = International Debt Securities.

Sources: BIS Locational Banking Statistics by residence; BIS International Debt Securities Statistics.

(b) Emerging Markets and Developing Economies

Figure 5: **Volumes of External Debt Flows – Amount Outstanding in Trillions of USD**

Source: Avdjiev, Gambacorta, Goldberg and Schiaffi (2023) based on 64 borrowing countries and 44 lending countries for BIS Locational Banking Statistics.

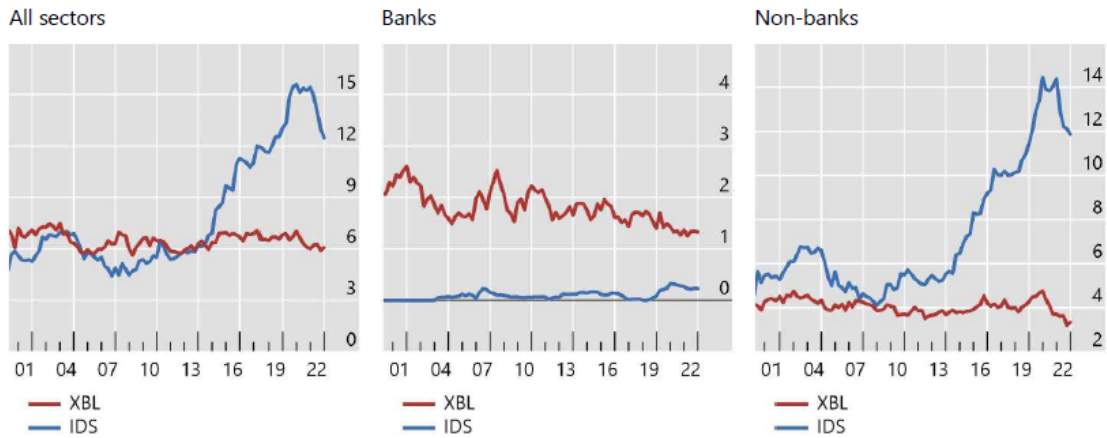


XBL = Cross-border loans; IDS = International Debt Securities.

Economies included (32) are those with nominal GDP data from IMF-WEO. Annual GDP data converted to quarterly using linear interpolation.

Sources: IMF, *World Economic Outlook*; BIS Locational Banking Statistics by residence; BIS International Debt Securities Statistics.

(a) Advanced Economies



XBL = Cross-border loans; IDS = International Debt Securities.

Economies included (147) are those with nominal GDP data from IMF-WEO. Annual GDP data converted to quarterly using linear interpolation.

Sources: IMF, *World Economic Outlook*; BIS Locational Banking Statistics by residence; BIS International Debt Securities Statistics.

(b) Emerging Markets and Developing Economies

Figure 6: Volumes of External Debt Flows Relative to GDP

Source: Avdjiev, Gambacorta, Goldberg and Schiaffi (2023) based on 64 borrowing countries and 44 lending countries for BIS Locational banking statistics. GDP series are from the IMF IFS.

decade cross-border loan sensitivity has also been characterized by more differentiation among EMs and greater roles for local factors. Global factors have increased in importance for other advanced economies, and declined in importance for emerging markets, with some convergence in patterns across the country groups. These types of observations suggest more scope for countries to benefit from flexible exchange rates which play insulating roles and have effective monetary policy in response to local shocks.

Digging deeper within these observations about global liquidity flows, the sensitivities to risk and foreign monetary policy of different types of flows vis-a-vis specific borrower types also have changed dramatically. Avdjiev, Gambacorta, Goldberg and Schiaffi (2023) estimate the respective effects for cross-border loans and market-based finance, also separating borrowers according to institutional type (total, banks, non-banks) and country type (safe havens, other advanced economies, emerging markets). Focusing specifically on results for sensitivity to risk conditions reinforces the importance of distinguishing between flows to so-called safe havens versus those to other advanced economies in the post GFC period. These patterns contrast with those observed pre-GFC, when cross-border bank lending to banks in safe haven countries contracted as risk sentiment deteriorated, as it did for other categories of countries. After the GFC and taper tantrum, periods of deteriorating risk sensitivity tended to be characterized by global liquidity flowing into banks and non-bank borrowers within safe haven countries. Across other countries, deteriorated risk conditions continued to be associated with funding outflows.

Time variation is a strong feature of sensitivity to risk conditions. Pre-GFC, interbank lending sensitivity was more volatile than cross border lending to nonbank borrowers. Post-GFC, and focusing on other advanced economies and emerging markets, all borrower types experienced reduced cross-border lending sensitivity to risk sentiment. Bank lending, on average, no longer contracts sharply as risk sentiment worsens.

Sensitivities of cross-border market-based funding for bank and non-bank borrowers have evolved quite distinctly compared with bank-based flows. International debt securities issuance by EME non-banks remained just as negatively correlated with risk as had characterized pre-GFC, in contrast with the respective dynamics for bank lending. However, more generally the sensitivity of funding flows to finance banks' issuance of international debt securities is not precisely estimated over time or across countries. It is clear that this country-level data disaggregation is not fully sufficient for generating strong and consistent insights, as highly heterogeneous institutions are involved in nonbank financial flows. The composition of funding providers varies considerably over time and across countries. Providers have distinct vulnerabilities and balance-sheet constraints that continue to be insufficiently understood. Overall, it cannot be concluded that the risk sensitivities of *IDS* issued by both banks and non-banks are systematically weaker, and for some countries these sensitivities might be higher than previously.

In sum, the post-GFC period has been characterized by dramatic changes in the composition of bank and market-based funding, especially for non-bank borrowers, and in global liquidity risk sensitivities. Data at different degrees of granularity show that advanced economies are better understood by separating out the so-called safe haven experiences from the experiences of other advanced economies. Global liquidity flows through banks are less flighty and risk sensitive, while it is more difficult to singularly characterize the patterns for NBFIs as they are highly diverse intermediaries. I return to these points in Section 4, along with arguing that understanding dynamism and risk shifting across financial institutions and instruments ultimately is key to understanding the frictions and designing appropriate toolkits in local economies. Some of the constraints on local policy will be strongly influenced by financial regulation in creditor economies.

3 Prudential Spillovers: Evidence from Granular Data

The identified changes in risk sensitivities of global liquidity flows through banks and in market-based funding from non-bank financial institutions have a range of potential explanations. This section considers the growing empirical evidence on the role of regulatory policies and frameworks. Before turning to the evidence from granular data, I first provide some background by dividing recent decades of global liquidity flows into three episodes, each of which is tied to regulatory change and risk migration.

3.1 Global Liquidity Periods: Recent History

Obstfeld and Taylor (2005) argued that, after the first era of financial globalization prior to 1914 and a broad-based collapse during the interwar period, the world economy experienced the second era of financial globalization from 1980 through 2000. In this section I present my own perspective on that second era of financial globalization, extending it through the present time. For this purpose I return to the stylistic diagram introduced as Figure 4, and build on it to create a new dynamic visualization with three sub-periods.

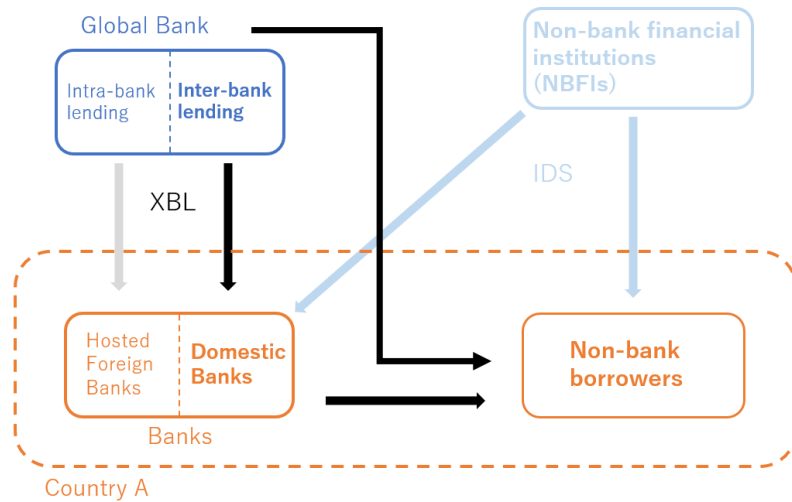
The period from the early 1980s through the early 1990s corresponds to banks' role as the dominant source of funds in the supply of global liquidity. Shown in the upper panel of Figure 7 using bold lines, cross-border lending through banks was directed towards bank and sovereign borrowers. This period was also distinguished by sovereign debt crises in emerging markets, sometimes combined with domestic banking fragility and outright crises (see Caprio, Klingebiel, Laeven and Noguera 2005 and Laeven and Valencia 2013). The sovereign crises were resolved by different efforts toward renegotiation of debt burdens with creditors that were mainly banks, including through the Paris Club (see Reinhart and Rogoff 2009, 2011).

The next period of global liquidity flows, described in the middle panel of Figure 7, is characterized by the expanded roles of global banks following domestic liberalizations. Often following crises, countries liberalized their capital accounts and relaxed regulatory restrictions that limited the participation of foreign banks in the domestic economies. During this period approximately starting in the mid-1990s, global banking also expanded by establishing branches and subsidiaries in foreign locations. Accordingly, direct lending from these affiliated banks within the host country to other non-bank customers increased, as did their provision of other banking services.¹⁴ Supporting local claims by the affiliated banks, parent global banks provided intra-bank funding flows to affiliates and liquidity management across the global banks gained importance. Alongside the growth of this type of banking, the early 2000s were characterized by global banking expanding and becoming more complex, for example as documented for US banking organizations by Goldberg and Meehl (2020) and Correa and Goldberg (2022), and across countries by Cetorelli and Goldberg (2014). Part of the increase in complexity was due to the addition of some related NBFIs within the bank holding companies prior to the GFC.

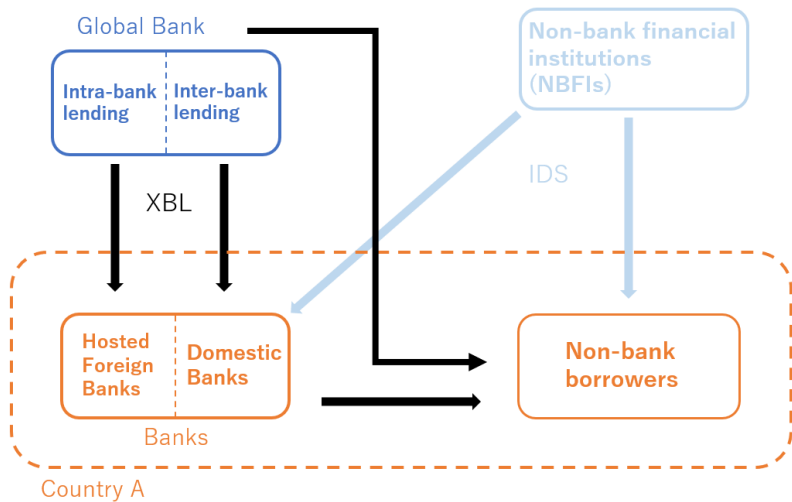
The period after the GFC is shown in the lower panel of Figure 7. Post-GFC efforts concentrated on international and systemically important banks, with the attention of regulators and supervisors focused on risk frameworks and risk absorbing capacities within the organizations. Advances in bank stress testing have been another key innovation, as has the supervisory focus on recovery and resolution frameworks for large and systemically important banks, for example, requiring that banks submit of so-called living wills. Substantial changes occurred in the risk-absorbing capacity of banks as reflected in generally higher levels of bank capitalization, reduced leverage, and improved liquidity management frameworks. Other related efforts took aim at the complexity of these large banking organizations, leading to changes in organizational complexity and geographic complexity (Correa and Goldberg, 2022). Some supervisory efforts focused on the liquidity management of global banks, and the use of internal capital markets between the parent organization and its foreign affiliates.

In addition to efforts to reduce the tail risks faced by institutions and the consequences should tail risks materialize, this period saw alterations in the overall macroeconomic environment. Across countries, liquidity conditions were particularly ample during the zero lower bound period and in the initial years of the COVID-19 pandemic. The post-GFC period saw a rapid expansion of global liquidity directly flowing to non-bank borrowers and an increasing role for NBFIs. The full effects of the rapid increases in policy interest rates starting in 2022 remain to be determined.

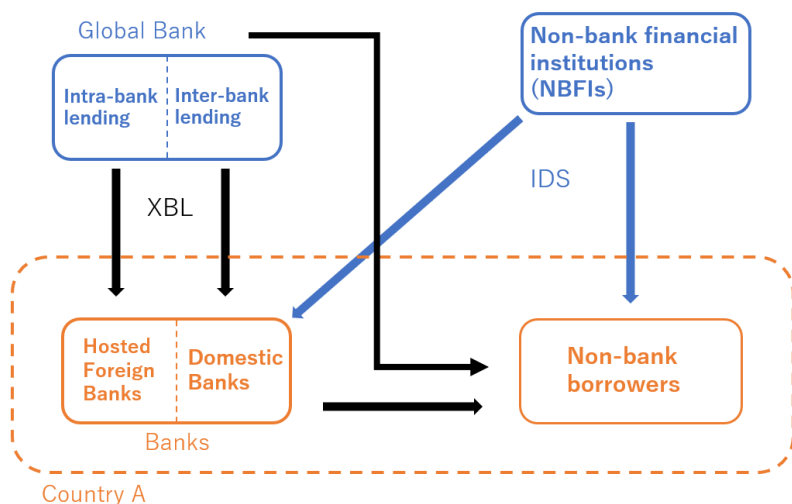
¹⁴See Goldberg (2007) for implications of the entry of foreign banks and Buch and Goldberg (2020) for a broader discussion of the benefits and costs of global banking.



(a) Period (1) - 1980s to early 1990s: Increase in cross-border bank lending



(b) Period (2) - mid-1990s to GFC: Enhanced roles of global banks' hosted branches, subsidiaries



(c) Period (3) - post GFC: Increased roles of NBFIs and debt securities

Figure 7: **Three Periods of Global Liquidity**
 Source: Author's construction, with introspection

3.2 Prudential Spillovers Using Country Aggregates

Risk migration occurred, with funding flows from global banks less likely to be to riskier categories of borrowers. Risk migration occurred on multiple levels, as the composition of lending changed to represent a larger share of interbank lending to affiliated branches and subsidiaries, with a smaller footprint of the interbank market in bank funding (Avdjiev, Gambacorta, Goldberg and Schiaffi 2020). Moreover, stronger capitalization and higher liquidity buffers in banks are associated with more stable international liquidity provision in the form of cross-border lending. The amplitude of risk transmission across borders is magnified through lower capitalized banks, and diminished when these banks lose market share. In the aftermath of the GFC, lower capitalized banks lost market share in providing global liquidity.

Further disaggregations reveal additional differences across advanced economies, distinguishing between the safe havens and other advanced economies, and emerging markets. The magnification of the risk shock interaction with bank health is found to be particularly important for emerging market borrowers, compared with other advanced economy borrowers (Avdjiev, Gambacorta, Goldberg and Schiaffi 2023). The behavioral shifts were also more gradual. Findings support the general observation that better risk absorbing capacity and risk management in banks also played a stabilizing role in global liquidity flows during the COVID-19 pandemic. Data limitations make it more challenging to empirically introduce meaningful indicators at the country-time level of the leverage and liquidity transformation capacity of NBFIs. Two proxy NBFi indicators used in this study are the asset share of NBFIs with high leverage and the asset share of NBFIs with high liquidity transformation. The categorization of types of NBFIs relies on work done by the Financial Stability Board (FSB 2019), while the associated shares are computed at the home-country level and are then turned into host-country measures using as weights bilateral portfolio series from the CPIS database (IMF Coordinated Portfolio Investment Survey). Institution specific details on leverage are not available, including for institutions involved in global liquidity flows.

An interesting observation about composition is that the shares of high leverage NBFi types associated with global liquidity inflows are quite different across so called safe havens, other advanced economies, and emerging markets (Avdjiev, Gambacorta, Goldberg and Schiaffi 2023). The share has been consistently higher for emerging markets, representing about 45 percent of the flows, even if down from 60 percent pre-GFC. For other advanced economies, the share of high leverage NBFIs in flows is considerably lower, at about 20 percent since 2014, having been about twice as high during the GFC. Advanced economies have global liquidity provision with a high share of NBFIs characterized by a high degree of liquidity transformation, while the NBFIs funding emerging markets have a much lower share of this characteristic.

This point reinforces the message that NBFIs should not be viewed as a homogeneous mix of providers, they do not have similar business models or financial constraints, and their evolution emphasizes the importance of more granular analytics to understanding NBF-related flow responses to global and local factors. These types of findings underscore the importance of the repeated call for better and more granular data on NBFIs that has been a focus across country regulators and central banks, the Financial Stability Board, and at the IMF. The large increase in the role of NBFIs in global liquidity provision is coincident with tremendous heterogeneity across the universe of NBFIs and a lack of sufficient transparency about the health and robustness of individual institutions, or even at the sectoral level, within countries. The empirical tests using these types of data find that higher sensitivity to risk of funding flows through NBFIs is weakly associated with more highly leveraged-type institutions in flows.

3.3 Prudential Spillovers Using Bank-Specific Data

The evidence already presented shows an evolving relationship between banking characteristics and banks' cross-border-lending sensitivity to risk using data aggregated at the country-time level. Additional evidence on bank lending spillovers across borders is also explored by researchers with access to specific types of more granular data. In this context, prudential policy spillovers across borders are relevant, since prudential policy - for example in the home country of a global bank - influences capital and liquidity ratios, and spills over to lending and, by extension, to the sensitivity of this lending to the risk conditions and monetary policy that enter the global factor of global liquidity. Researchers work with either bank-specific, credit registry, or other transaction-type databases to generate related evidence about drivers of prudential spillovers across borders, and interactions between prudential policies and monetary spillovers.

Examples include the results of initiatives of the International Banking Research Network (IBRN), a network of researchers across about 30 central banks and international organizations. The core objectives of the IBRN are to conduct rigid policy relevant experiments based on micro-level banking data, to replicate analyses across countries, to draw broader lessons from these studies in overview papers and meta analyses, to publish results in high-level journals, and to provide informed input into policy discussions within institutions and policy forums.

In one IBRN initiative, 15 country teams examined the domestic effects and international spillovers of prudential instruments using detailed confidential micro-banking data. In addition, researchers from the Bank for International Settlements (BIS) and from the European Central Bank (ECB) provided cross-country perspectives. Teams seeking evidence for international policy spillovers considered multiple channels through banks. Inward transmission addresses how foreign regulations affect the domestic activities of domestic banks or foreign affiliates (bank branches or subsidiaries) located in the host country. Outward transmission to foreign economies addresses

the effects of foreign policies on the foreign activities of a reporting country's global banks. All country teams implemented the same baseline regression models for analyzing inward or outward transmission. In addition, country teams addressed issues specific to their banking markets or banks' business models. In some cases, teams differentiated the adjustment of lending by their global banks' branches (which are subject to the capital requirements of their parents) versus subsidiaries (which are, in addition, subject to regulations in the host country).

Identified in part based on the variation in the use of prudential instruments over time, the key findings are summarized in Buch and Goldberg (2017). Some countries observe that prudential instruments spill over internationally and through banks via lending growth. Potentially important country- and sector-specific dynamics are documented in individual country analyses. Heterogeneity in spillovers through lending across countries, time, and prudential instruments is common. This heterogeneity is at the bank level, where the effects of prudential instruments on lending can differ with the balance-sheet characteristics and business models of the banks participating in international lending. For example, foreign affiliates with higher shares of illiquid assets and with stronger reliance on deposit funding tend to have loan growth that responds more to loan-to-value ratio limits and sector-specific capital buffer changes in the foreign parent's location. Degrees of internal liquidity management via internal capital markets can matter, significantly differentiating across these hosted affiliates in terms of how general capital requirements imposed in the parent's country spill over into lending in the host market. These same characteristics do not appear to be as important for the inward transmission of foreign policies into the domestic lending of global banks.

The economic magnitudes of international spillovers of changes in prudential policy instruments through about 2014 were not large on average. However, the pattern of results highlighted the potential for larger and more consequential spillovers through global liquidity as the use of macroprudential instruments increases. Banks with higher initial capital were poised to increase lending internationally, and sometimes pivoting from domestic loan growth, when foreign countries tightened their capital requirements. Changes in some prudential instruments may thus spur the repositioning of market share across banks and foreign countries.

The span of evidence garnered from a range of country experiences with international spillovers of prudential instruments through bank lending growth shows the importance of heterogeneity and the importance of really understanding the specific frictions in place in each country through hosted foreign banks and domestic banks. There was no one-size-fits-all channel or even direction of transmission that dominated spillovers of changes in prudential policy, since this interacts with the balance-sheet characteristics and business models of banks. This is also one of the broad points laid out in some discussions of the IMF Integrated Policy Framework. In the case of the IBRN work, almost all prudential instruments have been associated with both positive and

negative spillovers, within and across transmission channels.

A further set of studies considered the interaction between prudential policies and monetary policy spillovers.¹⁵ Niepmann, Schmidt-Eisenlohr and Liu (2021) investigate specifically the effect of stress tests on the cross-border transmission of monetary policy via the U.S. banking sector on U.S. banks' new loan originations. Relevant to the global financial cycle, this study is consistent with a more accommodative U.S. monetary policy stance during the zero-lower-bound period and is associated with more bank lending to emerging market economies. But the truly novel finding, again a lesson from using granular data, is how the magnitude of this international spillover effect depends on how banks fared in the Federal Reserve's annual Comprehensive Capital Analysis and Review (CCAR). Only banks that comfortably passed the CCAR stress tests issued more loans to borrowers in emerging market economies. Banks also shifted their lending to safer borrowers within emerging markets in response to monetary easing, leaving the risk of their overall loan books unchanged. This type of evidence implies bank differentiation across borrowers associated with shocks, when there are different constraints in place for the lenders.

Also relevant for global liquidity flows are the dynamics of internal capital market lending within global banks. Recall from the discussion of Figure 7 that global banks use their internal capital markets to move global liquidity where prioritized within their banking organizations. The affiliate locations engage in banking activities with local customers, and analytics show that this flow of credit is more insulated from global factors compared with cross-border lending. While this form of financing for activity could be preferable for local borrowers, at times host countries have resisted foreign entry out of concern for lost market share and reduced profitability of entrenched domestic financiers.

Still, global banks demonstrate a prioritization across affiliate locations when their balance sheets are shocked. When U.S. parent banks were hit by funding shocks in the Great Recession, each global bank reallocated liquidity in its organization according to its own locational pecking order (Cetorelli and Goldberg, 2012). Flows to affiliate locations that are core - that is, locations that are important for the specific parent bank's revenue streams or funding - are relatively protected. Despite the general message above about the relative stability of local lending through global bank affiliates, locations that are overall less important to that global parent (periphery) experience sharper changes in available local liquidity. In general, affiliate locations that are more peripheral are less protected. Policy frameworks should support the beneficial internal capital market flows within global banks (Buch and Goldberg, 2020).

Combining such insights with the evidence about banks' risk management and risk-absorption capacity again emphasizes the importance of granular data and the heterogeneity of experiences in understanding the consequences of changes in risk sentiment or in funding conditions. Global

¹⁵See Bussière, Cao, de Haan, Hills, Lloyd, Meunier, Pedrono, Reinhardt, Sinha, Sowerbutts et al. (2021).

liquidity responds more to risk shocks when banks are less well capitalized and have more binding restrictions on their balance sheets. These banks contract cross-border lending to a greater degree. At the same time, internal capital market flows vis-a-vis affiliates may respond to a greater degree for the foreign locations that are not part of the core business of the banking organization. In this case, more of the risk-sentiment shock would pass through into the lending to local borrowers by hosted foreign banks, even while we more generally observe relatively stable lending by the hosted foreign banks in these information-rich environments.

3.4 The Roles of Central Bank Swap Lines and Funding Facilities

U.S. monetary policy and the status of the U.S. dollar receive particular attention in discussions of global liquidity and in the channels for the effects of risk and monetary policy developments. Their roles in invoicing international trade and settlement are well documented, as are the implications for goods pricing and inflation (Goldberg and Tille 2008, 2009; Boz, Casas, Georgiadis, Gopinath, Le Mezo, Mehl and Nguyen 2022; Gopinath, Itskhoki and Rigobon 2010; and Gopinath, Boz, Casas, Díez, Gourinchas and Plagborg-Møller 2020). The extensive use of the dollar in international financial transactions is also well documented (ECB 2022; Goldberg, Lerman and Reichgott 2022). New granular data analytics reveal details about the preferences of particular types of nonbank financial institutions and the ultimate location of the investors behind these financial positions (Maggiori, Neiman and Schreger 2020; ECB 2022). From the perspective of corporate borrowers, periods of reliance on cheaper foreign currency debt increase their vulnerabilities to shocks to dollar funding markets.

When tail risk events relevant for global liquidity occur, these high-stress episodes can be reflected in the higher cost of dollar funding facing borrowers in offshore markets. Some stress-related amplification effects from the demand for extra liquidity arise as borrowers increase their demand for (dollar) liquidity in order to meet existing balance-sheet funding needs or to put themselves in more liquid positions. At the same time, funding providers might contract the supply of (dollar) credit and liquidity. At least from the perspective of liquidity for insurance purposes, access to lender-of-last-resort and (dollar) liquidity facilities should weaken the amplitude and amplification of some global liquidity responses to risk shocks. This principle has been emphasized in various IMF programs. In dollar funding, the Federal Reserve's swap lines with central banks and the Foreign and International Monetary Authority (FIMA) Repo Facility introduced in March 2020 - enter prominently, with features and operational considerations discussed in (Choi, Goldberg, Lerman and Ravazzolo, 2022).

In early March 2020, global asset managers facing redemptions sold some of their foreign assets

and currency holdings to raise cash and reduce risk, rather than take even larger losses on their global holdings. Moreover, in corporate bond markets, investors in need of cash sold their dollar-denominated assets first in order to meet immediate dollar obligations (Cesa-Bianchi, Czech and Eguren-Martin, 2023). Many countries experienced significant outflows from their local debt and equity markets. During the early months of the COVID-19 pandemic, the risk sensitivities of different components of global liquidity flows were differentiated across countries and declined with access to dollar facilities (Goldberg and Ravazzolo, 2022). Bond funds appear to have reverted very quickly across all groups of countries, before increasing well beyond pre-pandemic levels. While patterns were similar across all groups of countries in terms of facility access, the proportionate increases were greatest for countries with central banks that had temporary swap lines.

Analytical results support the conjecture that access to dollar facilities during a period of high risk stabilizes credit flows through banks and bond funds, but also depends on the features of funds.¹⁶ Swap line countries on average had inflows through international bond funds when risk sentiment deteriorated, with patterns shifting to relatively milder outflow sensitivity in the initial pandemic period. Distinct patterns arose from the bond flow dynamics of the countries whose central banks had standing swap lines compared with the countries whose central banks had temporary swap lines, since the standing swap countries had much stronger inflows on average associated with increased risk sentiment, and a much stronger flattening of this sensitivity in the initial part of the pandemic. The normalization was much slower for equity funds, where on average flows did not return to pre-pandemic values until the third quarter of 2020. These findings reinforce the importance of accounting for the heterogeneity of non-bank financial institutions and the types of mutual fund flows. Chari, Stedman and Lundblad (2022) show extensive heterogeneity across bond and equity funds, and across institutional funds versus retail funds, in response to risk levels and risk aversion, with distinctions sorting along passive versus active funds and along the composition of these funds. Converse, Levy-Yeyati and Williams (2020) show that exchange traded fund (ETF) flows exhibit greater sensitivity to global financial conditions, and also appeal to a different clientele than traditional mutual funds. ETF investors are shown to particularly value liquidity and to be relatively inattentive to local economic conditions in the countries where the funds invest.

¹⁶Goldberg and Ravazzolo (2022) consider separately data for mutual funds and EFTs invested in bonds and equities across countries.

4 Risk Migration and Toolkits

The issue of the contributions of prudential regulation to global liquidity’s risk sensitivity warrants a more targeted focus from research and policy. The specific area of focus is on the importance of micro-prudential policies and effective supervision, not just the macro-prudential toolkit as applied to impact bank lending. Risk migration occurs in response to stricter regulation and supervision. Micro-prudential policies induce improvements by damping the amplification of risk sensitivity in global liquidity and credit supply. However, over the medium to longer term, these policies may also induce risk migration away from the most tightly regulated banks, and potentially induce shifts away from the locations with stricter regulation and supervision. Risk migration can occur from bank to non-bank funding sources and from loans to market-based finance.

As already noted, after the global financial crisis, internationally active banks with stronger balance sheets and risk-absorbing capacity expanded their market share relative to banks that had to focus more on repairing their balance sheets, including some of the European global banks that had previously been large participants in international lending. Over time, the regulatory and supervision frameworks applied to banks required that more capital be set aside in association with riskier borrowers and emphasized better risk management processes. This led to some migration of that financing activity to other sources of finance, including market-based finance through NBFIs in the period from 2013 to 2021.

The evolution of risks occurred in the context of the organizational complexity of large global banks, since complexity and lengthy bankruptcy processes slowed the resolution of failed organizations and magnified the costs of bank failures (Fleming and Sarkar, 2014). Changes in organizational structure occurred to minimize the impact of regulatory costs (Flood, Kenett, Lumsdaine and Simon, 2020).¹⁷ Improved recovery and resolution frameworks and living wills also played a role in risk migration and risk exposures in banks. Living will regulation pushed large and complex U.S. banking organizations to reduce organizational complexity, with the effect of raising banks’ exposure to liquidity risks while reducing idiosyncratic and systemic risk exposures (Correa and Goldberg, 2022).

Prudential regulations have also led to changes in the locations of credit provision for global banks, with some evidence that activity shifted to locations that are not included in bilateral cooperative agreements (Beck, Silva-Buston and Wagner, 2023). While improvements in bank regulations have reduced the attraction of such locations for banking, arbitrage opportunities around regulation and taxation still attract NBFIs. Cross-border financial centers are locations

¹⁷Some banking organizations may also have used a variety of legal entities, such as asset-backed-commercial paper vehicles, to arbitrage regulations and increase risk-taking (Gong, Huizinga and Laeven, 2018).

that cater predominantly to non-residents. Pogliani, von Peter and Wooldridge (2022) consider the importance of migration, since funds are channeled across borders often via entities with a minimal physical presence, such as booking offices, special purpose entities (SPEs) and shell companies. They are neither an ultimate source nor a final destination for investments and are usually embedded in small economies. However, the lower-regulation locations are increasingly used. Capital requirements for captive insurance companies are argued to be lower and more flexible in some cross-border centers than they are in larger economies. In the area of digital innovation, a number of economies have banned or restricted cryptocurrency businesses, whereas many cross-border centers have enabled their expansion. NBFIs now account for the largest share of intermediation via cross-border centers.¹⁸

These developments have implications for challenges that global liquidity flows create for the monetary and financial trilemmas. Even if domestic toolkits are not complete, the tradeoffs in the financial trilemma should be improved if both global banks and overseas non-bank financial intermediaries abroad are more robust, without amplification effects that worsen the effects of shocks, whether associated with risk sentiment or other causes. From a borrowing country's perspective, perhaps the future is one where every institutional provider of funding is rated, and there is a required diversification of providers as well as a threshold rating of providers. Perhaps this type of approach can help deal with regulatory fragmentation, since some of the migration of risk undermines the improvements initially achieved through both banks and NBFIs.

5 Conclusions and Forward-Looking Agendas

This article has considered global liquidity and issues around the risk sensitivity of flows. Three primary lessons are emphasized. First, prudential policies, effective supervision and liquidity facilities from the source countries of global liquidity dampen the global financial cycle. Second, access to internal organizational liquidity and official-sector liquidity can lower the amplitude of global liquidity response to stress events. And, third, risk migration poses challenges to moderating the amplitude of global liquidity flows.

Prudential policies spill over across borders, as evidence shows that having more robust global banks is associated with less risk-sensitive global liquidity flows through these banks. Prudential and supervisory improvements have included those around capital, liquidity, risk management, recovery and resolution frameworks, living wills, and enhanced stress testing.

Also relevant for some forms of global liquidity are the frameworks that have taken aim at the cross-border liquidity management within global banks: financial capital moves across borders

¹⁸Other research efforts use securities-level data to reclassify investors and borrowers by nationality instead of residency. See Maggiori, Neiman and Schreger (2020) and Coppola, Maggiori, Neiman and Schreger (2021).

to and from affiliated branches and subsidiaries in foreign locations. Depending on the specific conditions and the country, this liquidity management can either be stabilizing or destabilizing in the global economic context, perhaps not fully accounted for in individual bank decision making.

Other developments that should dampen the amplitude of the global financial cycle and relax trilemma tradeoffs include those in the area of access to dollars through central bank swap lines and the Federal Reserve's Foreign International Monetary Authority (FIMA) repo facilities. By reducing some of the tail risk on dollar funding costs in systemic events, access to such facilities supports continued credit provision and reduced amplification effects when large shocks, including those from deteriorated risk sentiment, hit global markets. However, NBFIs and corporations also have critical needs in offshore dollar funding markets (CGFS, 2020). Since most central banks provide direct access to liquidity only to supervised banking institutions, the NBFIs obtain such dollars when intermediated through the banks.¹⁹

Challenges arise from risk migration and technological developments, since NBFIs are increasingly important in global liquidity and some activity is already shifting to low-regulation environments. Extensive related work is underway and being prioritized across central banking and international financial institutions. The Financial Stability Board's work program targets monitoring and enhancing the resilience of the non-bank financial intermediation sector while preserving its benefits (FSB, 2021). Current FSB priorities are focused on fintech monitoring and information advantage, leverage, data gaps, and regulatory frameworks. (Carstens, 2021) and the Bank for International Settlements emphasize the need for regulating the NBFIs system and addressing vulnerabilities related to liquidity mismatches, leverage, risk management, and market structures, in addition to having more transparency through data. Recent IMF work examines the relationship between investment funds and financial stability (IMF 2021). This work makes the point that the stability of cross-border funding is intimately related to the success of source country policies in increasing the stability of funds intermediated by open ended investment funds. An October 2022 IMF Global Financial Stability Report chapter provided further empirical analysis of policy levers, including swing pricing and liquidity measures.

Research efforts shine a spotlight on the important mechanisms involved in shock transmission and amplification across specific types of institutions. Topics that would benefit from additional research include: institutional oversight and regulation; access to liquidity backstops with moral hazard risks, where procyclicalities arise in financing flows; differences in dynamics through new and old players in financial markets along with entry costs to intermediate and participate in liquidity provision; and differences in behaviors in normal times versus crisis periods when stresses

¹⁹While Obstfeld (2014) noted that access to dollar liquidity facilities would reduce the need for central banks to hold large stocks of foreign exchange reserves, it also remains to be seen whether lower reserve holdings materialize given the collateral needs for repurchase transactions at the FIMA repo facility.

are broad-based. In addition, it is important to understand how NBFIs contribute to monetary policy implementation, with details about the granular composition of the types of institutions, including insurance companies, investment funds, and pension funds.

As a final point, the international financial and research communities can collectively consider questions about the optimal composition of global liquidity flows. It is clear that funding should be somewhat diversified to minimize the concentration of counterparty risk. A mix of domestically owned and foreign banks provides additional dimensions of diversification, as do diversified business models within banking organizations. However, less well developed is the optimal structure of debt versus equity. Obstfeld (2014) indicated a future international financial system with more equity and less debt. The desirability and then attainment of this possible future is a challenge for research and policy toolkit applications. There are many open questions. As a next step on the frontier of risk management, what is the optimal configuration of how risks are absorbed into debt and equity? What are the transition path and issues in this next transition, including reforming policies that distort the current mixture? What other framework developments are needed around equity flows? Such advances should help recipient countries manage the important trilemmas that occur in our interconnected world.

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Appendix Table 1 – Classification of non-bank financial intermediation by economic functions (EFs)				
Economic function	Definition	Typical entity types	Leverage	Liquidity Transformation
EF1	Management of collective investment vehicles with features that make them susceptible to runs	MMFs, fixed income funds, mixed funds, credit hedge funds, real estate funds	Low	High
EF2	Loan provision that is dependent on short-term funding	Finance companies, leasing/factoring companies, consumer credit companies	High	Low
EF3	Intermediation of market activities that is dependent on short-term funding or on secured funding of client assets	Broker-dealers, securities finance companies	High	Low
EF4	Facilitation of credit creation	Credit insurance companies, financial guarantors, monolines	n.a.	n.a.
EF5	Securitisation-based credit intermediation and funding of financial entities	Securitisation vehicles, structured finance vehicles, asset-backed securities	High	Low

The FSB Policy Framework acknowledges that shadow banking may take different forms across jurisdictions due to different legal and regulatory settings as well as the constant innovation and dynamic nature of the non-bank financial sector. It also enables authorities to capture new structures or innovations that may create financial stability risks from NBFIs, by looking through to the underlying economic function and risks of these new innovative structures. Thus, the entity types listed should be taken as typical examples. NBFIs is a broad measure of all non-bank financial entities, composed of all financial institutions that are not central banks, banks or public financial institutions. In this table we consider the narrow measure of NBFIs include NBFIs entities that authorities have assessed as being involved in credit intermediation activities that may pose bank-like financial stability risks (i.e. credit intermediation that involves maturity/liquidity transformation, leverage or imperfect credit risk transfer) and/or regulatory arbitrage, according to the methodology and classification guidance used in the FSB's annual NBFIs monitoring exercise. The leverage position has been evaluated based on the ratio $L1 = \text{total financial assets} / \text{equity}$. Liquidity transformation is evaluated using the ratio $LT1 = (\text{Total financial assets} - \text{liquid assets} + \text{short term liabilities}) / \text{Total financial assets}$. For details, see FSB (2020). Source: FSB, Global Monitoring Report on Non-Bank Financial Intermediation 2019 (published January 19 2020) and Avdjiev, Goldberg, Gambacorta, Schiaffi (2023)

Figure A1: Classifications of NBFIs

Source: Avdjiev, Gambacorta, Goldberg and Schiaffi (2023), based on FSB (2019).