CHAPTER 2

NONBANK FINANCIAL INTERMEDIARIES: VULNERABILITIES AMID TIGHTER FINANCIAL CONDITIONS

Chapter 2 at a Glance

Nonbank financial intermediaries (NBFIs) play a key role in the global financial system, enhancing access to credit and supporting economic growth. Also, NBFIs' financial vulnerabilities might have increased in recent years, amid low interest rates. Case studies presented in this chapter show that NBFI stress tends to emerge with elevated leverage, liquidity mismatches, and high levels of interconnectedness that can spill over to emerging markets. In the current environment of high inflation and tighter financial conditions, central banks can face complex and challenging trade-offs during market stress, between addressing financial stability risks and achieving price stability objectives. Policymakers need appropriate tools to tackle the financial stability consequences of NBFI stress. NBFI direct access to central bank liquidity could prove necessary in times of stress, but implementing appropriate guardrails is paramount.

- **As a first line of defense, robust surveillance, regulation, and supervision of NBFIs are vital**. Priorities should be to close key data gaps, incentivize risk management by NBFIs, set appropriate regulation, and intensify supervision.
- **Central bank liquidity support involves three broad types:**
  (1) **Discretionary marketwide operations** should be temporary, targeted to those NBFI segments where further market dislocation and disintermediation could have adverse financial stability implications, and designed to restore market functioning while containing moral hazard. The timing of a market-wide operation is critical—a framework should be in place based on what can be referred to as "discretion under constraints." Data-driven metrics trigger the potential intervention (the constraints), while policymakers ultimately retain the discretion of whether to intervene.
  (2) **Access to standing lending facilities** could be granted to reduce spillovers to the financial system, although the bar for such access should be very high to avoid moral hazard. Access should not be granted without the appropriate regulatory and supervisory regimes for the different types of NBFIs (some of which may not qualify).
  (3) **Central banks as a lender of last resort** may need to step in if a systemic NBFI comes under stress. Lending to a systemic NBFI should be at the discretion of the central bank, at a penal rate, fully collateralized, and accompanied by more supervisory oversight. A clear timeline should be established for restoring the liquidity of the institution.
- **Clear communication is critical** so that central banks are not perceived as working at cross-purposes, such as purchasing assets to restore financial stability while continuing with quantitative tightening to bring inflation back to target. Announcements of central bank liquidity support should clearly explain the financial stability objective and the parameters of the program.
- **Coordination between the central bank and financial sector regulators is essential** not only for the identification of risks but also for the management of crisis situations as well as for an assessment of supervisory and regulatory deficiencies.

The authors of this chapter are Fabio Cortes, Cristina Cuervo, Torsten Ehlers, Antonio Garcia Pascual (co–team lead), Phakawa Jeasakul, Esti Kemp, Nila Khanolkar, Darryl King, Kleopatra Nikolaou, Thomas Piontek (co–team lead), Felix Suntheim, and Romain Michel Veyrune, under the guidance of Fabio Natalucci.

Introduction

Nonbank and market-based finance has experienced spectacular growth since the global financial crisis. During this period, the share of global financial assets held by nonbank financial intermediaries (NBFIs) has grown from about 40 to nearly 50 percent (Financial Stability Board 2022c), in part a consequence of regulatory and supervisory initiatives that have made the banking system more resilient and have effectively pushed activities to other segments of the financial system. NBFIs include a broad universe of intermediaries. This chapter focuses on a subset that comprises (1) asset managers, such as open-ended investment funds; (2) insurance companies and pension funds; (3) critical financial market infrastructures, such as central counterparties; and (4) other NBFIs, such as structured finance vehicles.[1] NBFIs have become vital to the intermediation of core financial markets, such as government and corporate bonds, and are a crucial driver of global capital flows to emerging market and developing economies. These flows bring benefits to recipient countries and higher returns and portfolio diversification for international investors. Recent empirical studies show that NBFIs may also play a role as shock absorbers by providing credit during stress episodes as bank lending to firms declines, although credit availability comes at a higher price (Adrian, Colla, and Shin 2012; Elliott, Meisenzahl, and Peydró 2023).

At the same time, vulnerabilities related to financial leverage, liquidity, and interconnectedness have built up in certain segments of the NBFI ecosystem. Particularly dangerous is the interaction of poor liquidity with financial leverage: The unwinding of leveraged positions by NBFIs can be made more abrupt by the lack of market liquidity, triggering spirals of asset fire sales and investor runs amid large swings in asset prices. Because dealer banks provide NBFIs mostly with financial leverage, interconnectedness can also become a crucial amplification channel of financial stress. This can generate spillovers to other markets, including core funding markets, as well as to other intermediaries (both banks and NBFIs) and across borders (for example, NBFIs that intermediate capital flows to emerging market and developing economies). In addition, the extended period of low interest rates and loose financial conditions after the global financial crisis may have also resulted in NBFIs shifting investments to riskier assets to find higher returns (Kashyap and Stein 2023).

As central banks tighten monetary policy to tackle high inflation, strains in financial markets can pose a challenge for policymakers given the tension between price stability and financial stability objectives. In a low-inflation environment, central banks can ease monetary or macroprudential policies to respond to financial stress, supporting market sentiment and thus loosening financial conditions. In the current high-inflation environment, given that price stability is the central bank's main objective, the provision of liquidity for financial stability purposes becomes more challenging, including from a communications standpoint, and could undermine the fight against inflation. That is, addressing financial stability risks while pursuing the price stability mandate could introduce a challenging trade-off for central banks, which may require NBFI access to central bank liquidity to tackle financial stress.

The first of two objectives of this chapter is to assess key NBFI vulnerabilities that have the potential to amplify shocks in the context of the ongoing tightening of financial conditions (Table 2.1). In particular, the analysis focuses on vulnerabilities related to leverage, liquidity, and interconnectedness as well as on emerging market and developing economy vulnerabilities that stem from NBFI intermediation of cross-border flows. These flows tend to be more sensitive to global financial conditions, thus contributing to the procyclicality of capital flows. To illustrate the interaction of these vulnerabilities, this chapter features NBFI case studies and highlights the challenges related to data gaps in order to assess financial stability risks.

The second objective of this chapter is to examine the central bank policy toolbox. Central bank policy tools are important at the current juncture given the potential tensions between price stability and financial stability objectives. Policies such as opening central bank liquidity support to NBFIs may mitigate periods of liquidity stress or dislocations in core funding markets. At the same time, they may make achieving price stability complicated while raising moral hazard concerns.[2] This chapter discusses some desirable design features of central bank liquidity support—discretionary marketwide operations, standing liquidity facilities,

[1]This chapter covers a subset of NBFIs and, given that the NBFI ecosystem is very broad and highly heterogeneous, some institutions and vulnerabilities are inevitably discussed only briefly.

[2]For example, buying sovereign bonds to address dysfunction in that market while raising policy rates and reducing the size of the central bank's balance sheets may create communication and implementation challenges, especially if such measures are prolonged and untargeted.

Table 2.1. Preliminary Assessment of Vulnerabilities of Major NBFIs

NBFI (GFA)	Financial Leverage	Liquidity Risk	Interconnectedness	Currency Mismatches
Investment funds, excluding money market funds and hedge funds ($58 trillion, 12 percent of GFA)	Low, but medium for bond funds with derivative exposures	High for fixed-income funds holding illiquid emerging market/ high-yield assets; medium otherwise	High, cross-border spillovers (emerging market and developing economies) and potential links to banks on derivative exposures	Low, but significant externalities to foreign exchange market
Insurance companies ($40 trillion, 9 percent of GFA)	Low	Low, but medium if subject to policy surrenders	Medium; insurance companies are large holders of bank debt; some exposure to margin calls	Low, but medium is subject to policy surrenders
Pension funds ($43 trillion, 9 percent of GFA)	Low, but medium in jurisdictions with a large share of defined-benefit schemes	Low, but could be high in some jurisdictions with a large share of defined-benefits schemes and negative cash flows	Severe data gap does not allow to make any informed assessment here but could be high in some jurisdictions with a large share of defined-benefits schemes and negative cash flows	Low
Money market funds ($8.5 trillion, 2 percent of GFA)	N/A	Low, but medium for prime funds	High; key players in core funding markets	N/A
Structured finance vehicles ($6 trillion, 1 percent of GFA)	Medium/high	Medium	Medium; insurance and pension funds can be large investors in structured finance vehicles	Low
Hedge funds ($6 trillion, 1 percent of GFA)	Medium/high	Medium; most hedge funds have strengthened liquidity terms	Medium/high	Medium
Central counterparties ($0.7 trillion, 0.1 percent of GFA)	N/A	High, but central counterparties have strong risk and financial management controls to reduce such risk	High, given their systemic position across markets	N/A

Sources: Financial Stability Board 2022c; and IMF staff.
Note: GFA = global financial assets; N/A = not applicable; NBFI = nonbank financial intermediary.

or lender of last resort (LOLR)—that support NBFIs based on recent observations and some longstanding principles. Because robust regulation and supervision are the first line of defense to address and mitigate the systemic risks emerging from the NBFI sector, the chapter briefly discusses key regulatory and supervisory priorities for NBFIs.[3]

Nonbank Financial Intermediaries' Use of Financial Leverage Can Amplify Shocks

Very low rates and asset price volatility since the global financial crisis have incentivized investors and institutions to use financial leverage to boost expected returns. However, vulnerabilities stemming from leverage can sometimes be unknown to both authorities and market participants because they are difficult to measure or because leverage is hidden (Adrian and Jones 2018). Financial leverage can take many forms, including the use of repurchase agreements, margin borrowing in prime brokerage accounts, synthetic leverage associated with the use of various financial derivatives (such as futures or swaps), and leverage embedded in structured finance vehicles that provide a high amount of market exposure with low initial committed equity or mezzanine capital.[4]

Hedge funds are one type of NBFIs that can use complex or concentrated investment

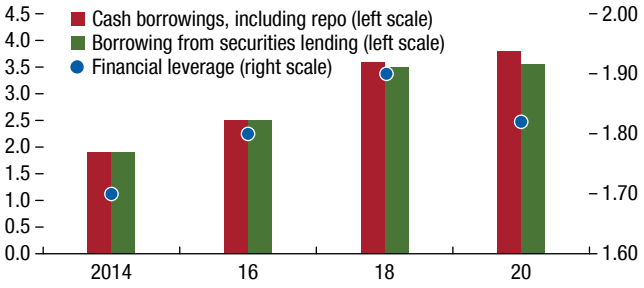
[3]The evolving and growing NBFI sector, the associated financial stability risks, and the regulatory challenges remain topics of key importance. The IMF has done considerable work in this area in recent issues of the *Global Financial Stability Report* (such as Chapter 3 of the October 2022 issue on investment funds, Chapter 3 of the April 2022 issue on fintech, Chapter 3 of the October 2019 issue on institutional investors, and Chapter 3 of the April 2015 issue on insurance). On NBFI regulation, some of the recent detailed proposals are Garcia Pascual, Singh, and Surti (2021), Financial Stability Board (2022a and 2022b), and IOSCO (2019).

[4]Some transactions can use multiple forms of leverage; for example, collateralized loan obligations can have three layers of leverage: debt issued by sub–investment-grade companies, leverage embedded in the collateralized loan obligation vehicle, and the financing on margin of collateralized loan obligation tranches.

Figure 2.1. Financial Leverage of Nonbank Financial Intermediaries

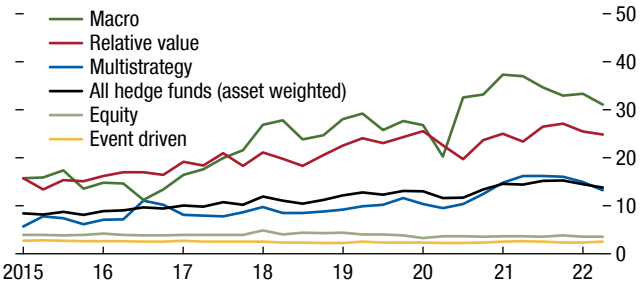
Global hedge funds' cash leverage is more modest in aggregate compared with the use of synthetic leverage.

1. Hedge Funds' Aggregate Secured and Unsecured Borrowing and Financial Leverage
(Trillions of US dollars; relative to net asset value)



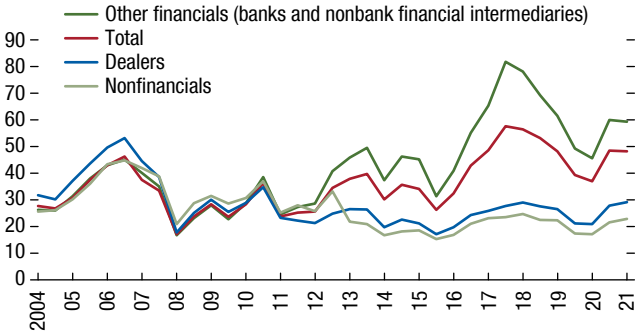
Hedge funds' synthetic leverage through derivatives has risen and is elevated for some strategies.

2. Hedge Funds' Gross Derivative Notional Exposure to Net Asset Value, by Strategy
(Gross notional amount to net asset value)



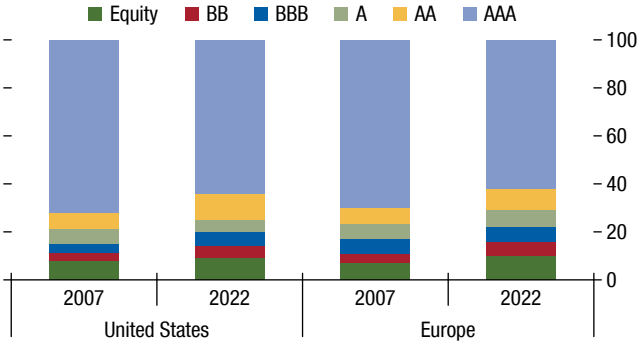
Other financials, such as banks and nonbank financial intermediaries, take on more leverage than others.

3. Proxy for Synthetic Leverage, by Counterparty
(Notional amount to gross market value)



New collateralized loan obligations have a larger equity cushion than those before the global financial crisis.

4. Average US and European Collateralized Loan Obligation Liabilities, by Type and Credit Rating
(Percent)



Sources: Bank for International Settlements; Barclays; IOSCO Hedge Fund Survey; US Securities and Exchange Commission; and IMF staff calculations.
Note: In panel 1, financial leverage is from the IOSCO Hedge Fund Survey and is estimated as the ratio of cash borrowed to net asset value. In panel 2, the data are for US-domiciled hedge funds and are provided by the US Securities and Exchange Commission in its quarterly private fund statistics. In panel 3, "other financials" include central counterparties, banks and securities firms, insurance companies, special-purpose vehicles, hedge funds, and other financial customers. "Dealers" are large commercial and investment banks and securities houses that participate in the interdealer market or have an active business with large customers, such as large corporate firms, governments, and nonreporting financial institutions.

strategies that use leverage. On the basis of available data, regulators in various jurisdictions are making public certain measures of cash and synthetic leverage used by hedge funds. For example, globally, hedge fund cash leverage (in the form of secured and unsecured borrowing) tends to be modest in aggregate at about 1.8 times net asset value, although some individual funds may have much higher multiples (Figure 2.1, panel 1). However, the use of synthetic leverage through derivatives by hedge funds domiciled in the United States has increased from 8 times to 14 times net asset value on an asset-weighted basis, with some investment strategies above 20 times net asset value (Figure 2.1, panel 2).

More broadly, the ratio of notional amount to gross market value—a proxy for synthetic leverage—suggests that financial institutions (banks and NBFIs) take much more derivatives-based leverage than do dealers and nonfinancial companies (Figure 2.1, panel 3).[5]

The collateralized loan obligation market provides a good example of a securitization vehicle where leverage is layered in the form of underlying assets—leveraged loans to sub–investment-grade firms—and embedded

[5]Whereas gross leverage is one metric for leverage, using it as the sole metric may be misleading because derivatives are often used for hedging. Other metrics should be considered to supplement gross leverage for a more comprehensive analysis.

in the capital structure through equity and mezzanine debt (rated A and below) below AAA-rated tranches.[6] Before the global financial crisis, an additional form of leverage was used by investors through the financing of AAA tranches. Compared with the structures that prevailed before the global financial crisis, current collateralized loan obligations have less embedded leverage, with a higher share of equity and mezzanine debt as a cushion to protect AAA bond holders, and the practice of financing AAA tranches appears not to be common anymore (Figure 2.1, panel 4).[7]

Leveraged entities have a higher risk of financial distress because they are more vulnerable to sudden changes in asset prices that may force them to de-lever, amplifying the initial price declines. As discussed later in this chapter, the combination of poor market liquidity, high leverage, and a high degree of interconnectedness between NBFIs and banks is most dangerous to the financial system because it can amplify asset prices changes and spread stress to corners of the financial system that ex ante may seem to have little in common.

Liquidity Vulnerabilities at Nonbank Financial Intermediaries Catalyze Stress

The NBFI sector encompasses a wide range of institutions, some of which typically provide liquidity services to markets and institutions (such as principal trading firms or broker-dealers), while others typically demand liquidity (such as investment funds). Liquidity stress in the NBFI sector can spill over to the broader financial sector—as could be seen during recent stress episodes such as the March 2020 dash-for-cash episode or in association with liability-driven investment funds in the United Kingdom—and eventually to the real economy.[8] To be sure, some NBFIs can also be important providers of liquidity at times of stress. For example, Timmer (2018) finds that insurance companies and pension funds act countercyclically, buying securities after large price declines.

Three key liquidity-related vulnerabilities are associated with NBFIs:

- ***Liquidity mismatches.*** Some NBFIs may hold relatively illiquid assets but allow investors to redeem shares on a daily basis and at a price that does not reflect the liquidation value of the assets. Liquidity mismatches make funds vulnerable to runs because investors have an incentive to redeem ahead of others—which can contribute to volatility in asset markets and threaten financial stability (see Chapter 3 of the October 2022 *Global Financial Stability Report*). Over the past year, the liquidity of open-end funds' holdings has deteriorated to levels last seen at the onset of the COVID-19 pandemic, implying high vulnerabilities of asset markets as a result of liquidity mismatches (Figure 2.2, panel 1).
- ***Liquidity spirals.*** In combination with financial leverage, a lack of market liquidity can lead to so-called "liquidity spirals," where a decline in asset prices leads to a deterioration of funding liquidity, which then spills back to further impair market liquidity (Brunnermeier and Pedersen 2009). Such liquidity spirals are evident in the UK pension fund stress episode, where, amid already relatively poor liquidity in UK gilt markets (Figure 2.2, panel 2), margin calls as a result of large losses in derivative positions caused pension funds to sell gilts in a manner that contributed to further illiquidity in that market (see the case study on UK pension fund stress later in this chapter).
- ***Crowded trades.*** Common exposures to assets, in combination with correlated liquidity shocks, can amplify stress events.[9] For example, redemptions can force investment funds to sell assets, which depresses prices and can lead to further sales by other market participants with similar portfolio holdings, amplifying the initial shock. Over the past two years, the portfolios of investments funds have become more similar compared with previous years according to some measures, raising the threat of correlated liquidity shocks among funds (Figure 2.2, panel 3).

[6]Collateralized loan obligations are asset-backed securities issued by a special-purpose vehicle. The special-purpose vehicle acquires a portfolio of leveraged loans, which it finances through the issuance of securities in the form of bonds—senior and mezzanine tranches—and equity.

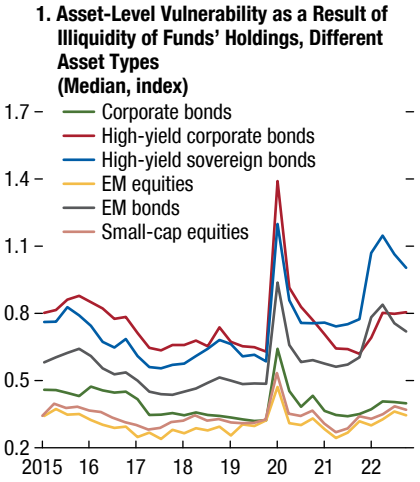
[7]In addition, whereas the rapid growth of leveraged finance and collateralized loan obligations has parallels to developments in the US subprime mortgage market and collateralized debt obligations during the run-up to the global financial crisis, there are significant differences such as collateralized loan obligations being less complex and more transparent (see Sirio and Avalos 2019).

[8]Theory and evidence support the notion that fire sales in securities markets can affect credit supply (Shleifer and Vishny 2010; Diamond and Rajan 2011; Abbassi and others 2016; Irani and others 2021).

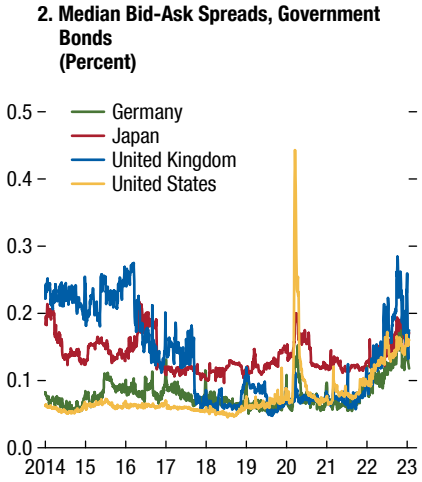
[9]Empirical evidence for this mechanism can be found in Greenwood and Thesmar (2011) for equities and in Falato and others (2021) for bond markets.

Figure 2.2. Risks for the Nonbank Financial Intermediary Sector Are on the Rise

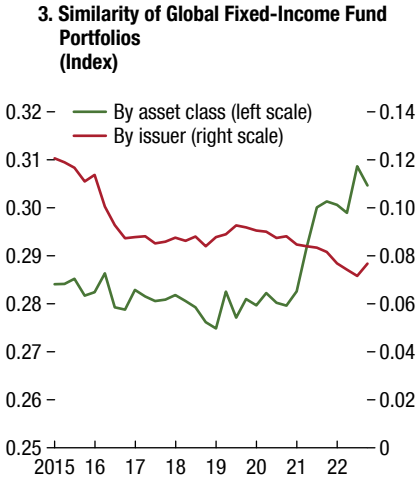
Liquidity mismatches in open-end funds have been increasing again ...



... against a backdrop of deteriorating market liquidity ...



... and common holdings across funds' portfolios may be rising.



Sources: FactSet; Morningstar; Refinitiv; and IMF staff calculations.
Note: Panel 1 shows the evolution of the median asset-level vulnerabilities for different asset classes. The vulnerability measure is constructed based on Jiang and others (2022) and captures the weighted average funds owning an asset, with liquidity defined as the portfolio-level bid-ask spread across funds. See Online Annex 3.2 of the October 2022 *Global Financial Stability Report* for further details. Panel 2 shows the five-day rolling-window average percentage bid-ask spreads of outstanding plain-vanilla, fixed-coupon sovereign bonds issued by Germany, Japan, the United Kingdom, and the United States. Only bonds with maturity longer than one year are considered. Panel 3 shows the average cosine similarity of fixed-income investment-fund portfolios over time. Only funds with assets under management larger than $1 billion and with at least 50 percent of portfolio holdings available are considered. Similarity is defined by asset class and by issuer based on the cosine similarity measure of Girardi and others (2021). Asset classes are equity, investment funds, asset-backed securities, mortgage-backed securities, and bonds by issuer type (sovereign, corporate, financial, agency, municipal) and further classified into high yield and investment grade as well as long term (above 10-year maturity) and short term (below three-year maturity). EM = emerging market.

The Increasing Interconnectedness of Nonbank Financial Intermediaries and the Financial System

NBFIs' growing role in domestic financing and cross-border capital flows is a positive feature of an open and integrated financial system. Having a broader set of financial intermediaries with different risk profiles, specialized expertise and time horizons fosters efficiency and allows for diversification of risks. At the same time, however, increased interconnectedness makes the financial system more complex and can be a source of vulnerability if it becomes a shock amplifier.

Linkages can be within the NBFI ecosystem, whereby an NBFI provides liquidity to or purchases a financial instrument issued by another NBFI. They can also be between NBFIs and the banking sector, whereby banks and NBFIs have exposures to a common counterparty or asset or NBFIs are financed by banks. Because of these linkages, NBFIs using a high degree of leverage or engaging in liquidity and maturity transformation can amplify or spread financial stress.

Available data show that NBFIs' interconnectedness with the rest of the financial system has increased. In aggregate, the portion of domestic funding to other financial intermediaries from banks and insurers has declined since the global financial crisis, while funding among NBFIs has increased (Figure 2.3, panel 1).[10] Large data gaps remain, however, with roughly half of aggregate NBFI domestic funding sources unaccounted for. At the same time, banks' cross-border linkages with NBFIs have risen, underscoring the sector's importance in cross-border intermediation (Figure 2.3, panel 2).[11]

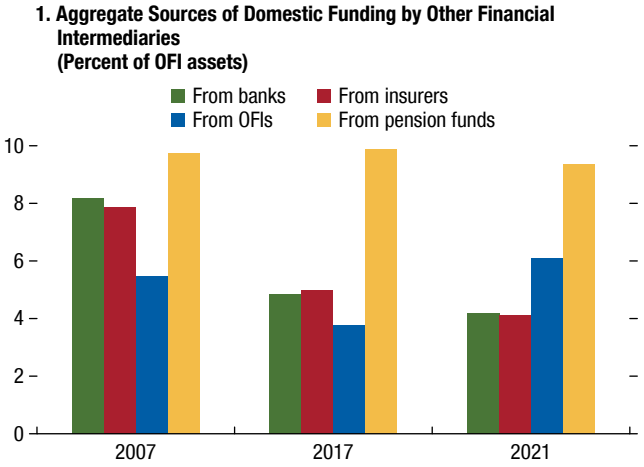
NBFIs are playing a larger role in the intermediation of capital flows to emerging market and developing economies. In the decade between the global financial crisis and the start of the COVID-19 pandemic, emerging market and developing economies benefited from strong capital inflows.

[10]This trend has exceptions, such as the rising exposure of European insurers to higher-yielding bank debt in recent years. See Chapter 1 of the April 2021 *Global Financial Stability Report*.

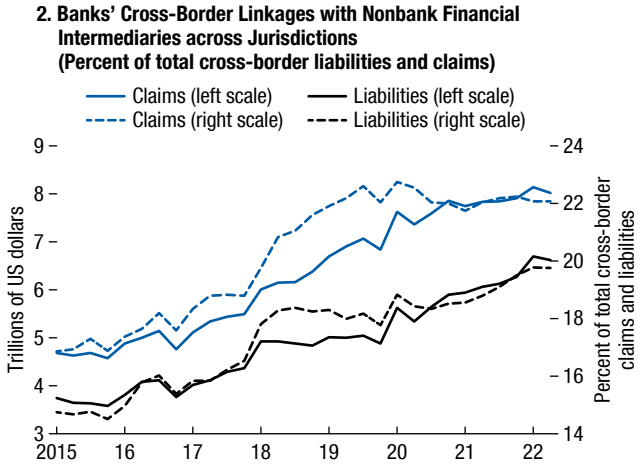
[11]See Garcia Pascual, Singh, and Surti (2021) and Financial Stability Board (2022d).

Figure 2.3. Financial Linkages of Nonbank Financial Intermediaries

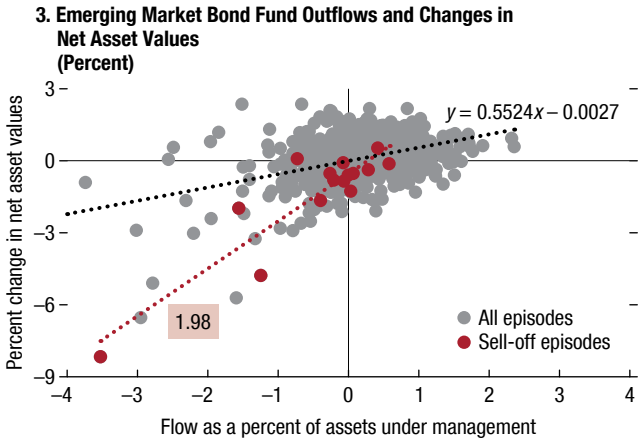
In aggregate, funding sources for OFIs have shifted from banks to other OFIs ...



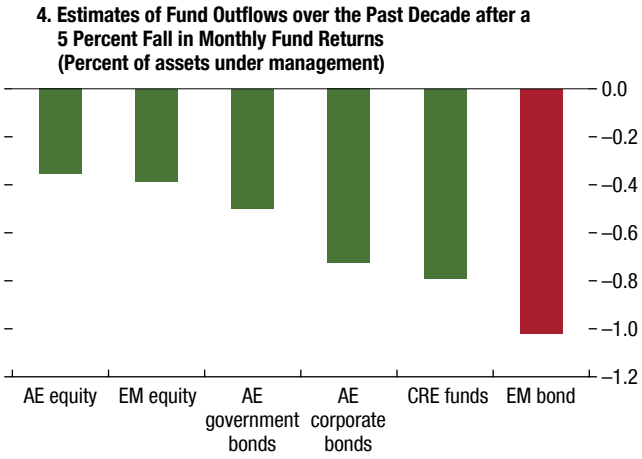
... while banks' direct cross-border linkages with nonbank financial intermediaries have mostly increased.



Global risk-off episodes have led to large falls in fund net asset values.



Outflows from emerging market bond funds have been higher than other assets during stress events.



Sources: Bank for International Settlements; Financial Stability Board 2022d; and IMF staff calculations.
Note: In panel 1, OFIs follow the Financial Stability Board's definition and are a subset of the nonbank financial intermediary sector comprising all financial institutions that are not central banks, banks, public financial institutions, insurance corporations, pension funds, or financial auxiliaries (see Financial Stability Board 2022d). AE = advanced economy; CRE = commercial real estate; EM = emerging market; OFIs = other financial intermediaries.

Foreign-currency-denominated debt accounts for a significant share, mostly in US dollars, financed through NBFIs such as investment funds, whose assets more than tripled in the decade since the global financial crisis. Although these flows have brought many benefits to the recipient economies and diversified emerging market and developing economy funding sources, they have also contributed to building up vulnerabilities such as higher external debt.

Emerging market and developing economy debt funds tend to experience very large redemptions during risk-off episodes (Figure 2.3, panel 3). Funds that are either passively managed or that follow benchmark indices appear to play a particularly important role in accentuating the procyclicality of capital flows. The size of outflows from emerging market and developing economy debt funds is generally larger than for other types of funds during stress episodes (Figure 2.3, panel 4).[12] In addition, liquidity mismatches in emerging market

[12]Further pressure on outflows can be also related to non-benchmarked investors and multisector bond funds in particular. These unconstrained funds can be a source of spillovers to emerging markets and potentially exert a sizable effect on cross-border flows (Cortes and Sanfilippo 2021).

Table 2.2. Regulatory Data Gaps for NBFIs

NBFI (GFA)	Financial Leverage	Liquidity	Interconnectedness	Currency Mismatches
Investment funds (excluding money market funds and hedge funds) ($58 trillion, 12% of GFA)				
Insurance companies ($40 trillion, 9% of GFA)				
Pension funds ($43 trillion, 9% of GFA)				
Money market funds ($8.5 trillion, 2% of GFA)	N/A			N/A
Structured finance vehicles ($6 trillion, 1% of GFA)				
Hedge funds ($6 trillion, 1% of GFA)				
Central counterparties ($0.7 trillion, 0.1% of GFA)	N/A			N/A

Source: IMF staff elaborations.

Note: This table is to be read jointly with Table 2.1 on NBFI vulnerabilities. Red denotes no/very little data in areas with high or medium/high vulnerabilities; orange denotes no/very little data in areas with low/medium vulnerabilities; yellow denotes some data in select jurisdictions in areas with high or medium/high vulnerabilities; light green denotes some data in select jurisdictions in areas with low or medium vulnerabilities; dark green denotes broadly adequate data irrespective of level of vulnerabilities. GFA = global financial assets; N/A = not applicable; NBFI = nonbank financial intermediary.

and developing economy debt funds—given the medium to low liquidity of most fixed-income assets in these economies—may exacerbate the scale of redemptions under stress market conditions.

Regulatory Data Gaps

Regulatory data gaps for NBFIs are significant, and they inhibit the ability of the regulator to assess and monitor systemic risks.[13] Although the availability of regulatory data has improved over time, gaps in most NBFIs remain meaningful and uneven among jurisdictions in comparison to the banking sector where data quality and availability are generally adequate. The simple heat map in Table 2.2 provides a qualitative assessment for regulatory data gaps across types of NBFIs and vulnerabilities.

Significant data gaps exist for monitoring the liquidity vulnerabilities of investment, money market, and hedge funds. Although most regulators require high-level reporting of asset liquidity, data are typically not reported at a sufficient frequency or in detail. Some jurisdictions require rule-based liquidity classification disclosures (most funds in the United States and European Union as well as alternative investment fund managers), whereas others require reporting on specific factors, such as credit rating, as proxies for liquidity, which are often insufficient for analyzing liquidity risks. The data gap is wider on the liability side: Funds often have limited visibility for their investor base because of the complex nature of distribution channels. Where investor data are available, the reporting may not consider arrangements such as notice periods and gates. Differences in methodologies on liquidity metrics also hamper cross-border comparability.[14]

Likewise, data gaps are a key hindrance for leverage analysis of investment funds.[15] The United States and European Union members collect detailed data on leverage metrics for hedge funds, although these data arrive with a significant lag and at a low frequency. Many other jurisdictions, including many emerging market and developing economies, lack a definition of leverage, which also hampers cross-border comparison. Leverage disclosures for investment funds that are not hedge funds are often not detailed enough to allow for assessments of the extent of leverage that is less visible to regulators.

[13]This section focuses only on regulatory data gaps; other gaps such as for public data, investor data, and "available for purchase" data are not covered.

[14]In addition, granular data are scarce for liquidity management tool disclosures, especially for tools such as swing pricing, and are mostly absent for access to credit lines.

[15]In many countries, reporting is subject to a threshold, resulting in industrywide data gaps.

For pension funds, significant data gaps limit the assessment of leverage and liquidity, particularly with regard to the use of derivatives. Pension funds' use of synthetic leverage through derivatives is often managed by third-party asset managers, making it difficult for regulators to get a precise understanding of the leverage of these funds. In addition, corporate sponsors typically extend commitments to provide extra liquidity to their pension schemes if needed, but details of these commitments are often beyond the required regulatory reporting, thereby making it difficult to analyze sources of liquidity during adverse market events. To hedge their sizable foreign asset positions (OECD 2021), some pension funds engage in foreign exchange derivative contracts, which are typically over the counter and are difficult for regulators to monitor.[16]

Relatively tight regulations for insurance companies, particularly strict capital requirements, limit the degree to which these companies invest in riskier assets. These regulations typically require an assessment of a broad range of risks including leverage and foreign exchange risks, which would thereby be included in regulatory reporting. However, as insurance companies make extensive use of third-party investment managers, a detailed and timely examination of the actual underlying risk exposures may not always be feasible. This can obscure synthetic leverage used by investment managers to enhance returns. Also, exposures to illiquid private credit exposures such as collateralized loan obligations can disguise the embedded leverage in these structured products.

Data gaps loom even larger for unregulated or even unregistered types of NBFIs, such as family offices. Considering the unregulated nature of these entities, regulatory data are practically nonexistent, except in situations where partial data are collected through banks and regulated NBFIs concerning their transactions with such NBFIs. Although not all types of risk are equally relevant for the diverse set of unregulated or unregistered institutions, individual entities can be large and play important roles in specific financial market segments. Wide data gaps make it challenging for regulators and supervisors to gauge the systemic risks that can build up (an example is the family office Archegos, whose outsized equity derivative liabilities in relation to a set of major banks only became visible to regulators after its failure).

[16]In some cases, not hedging against currency risks is an explicit part of the investment strategy of pension funds in order to generate additional returns and avoid high costs for hedging currency risks of long-maturity assets.

Major data gaps exist in the reporting of derivative exposures across NBFIs. Important details such as the direction of positions—long versus short—and information about counterparties are often missing in disclosures. For exchange-traded and centrally cleared over-the-counter derivatives, detailed data are available through central counterparties but are highly confidential and, therefore, require robust data-sharing arrangements with the relevant supervisors. Recent over-the-counter derivative-market reforms in the Group of Twenty have helped introduce central clearing requirements for interest rate and credit derivatives across a broad range of advanced and major emerging market economies. However, the reforms have generally not extended to foreign exchange and commodity derivatives.[17]

Four Case Studies of Nonbank Financial Intermediaries

Given the growth in the NBFI sector and the vulnerabilities described, this chapter examines four recent episodes involving NBFIs and markets where NBFI vulnerabilities are building. The aim is to emphasize the potential for financial leverage, market liquidity, and interconnectedness to interact and cause spillovers in the financial system.

Case Study 1: UK Pension Fund Stress: Could It Happen Elsewhere?

The UK pension fund and liability-driven investment strategies episode in 2022 is an example of the interplay of leverage, liquidity mismatches, and interconnectedness.[18] In late September 2022, concerns about the UK fiscal outlook led to a sharp rise in UK gilt yields that, in turn, led to large mark-to-market losses in levered

[17]In some jurisdictions, supervisors have mandated the collection of detailed derivative transaction data across all major types of derivatives (such as through the European Union's European Market Infrastructure Regulation). However, the complexity of processing and analyzing these data and the fact that derivative trading is concentrated in a few jurisdictions (in particular, the United Kingdom, the United States, and the European Union) limits the use of activity-based data collection to a small number of advanced jurisdictions.

[18]Liability-driven investment strategies allow pension funds to hedge the interest rate and inflation risk that arises from their long-term liabilities, using leveraged investments to both maintain hedges and to invest in riskier assets to meet their return targets. UK insurers are also users of liability-driven investment strategies, but they were less affected by the events in September 2022 because of a combination of factors including greater expertise in liquidity risk management, lower use of financial leverage, and shorter liabilities.

fixed-income positions of defined-benefit pension funds, causing margin and collateral calls. To meet these calls, pension and liability-driven investment funds were forced to sell gilt securities, pushing gilt yields even higher in a self-fulfilling price dynamic. To prevent risks to financial stability, on September 28, 2022, the Bank of England announced temporary and targeted purchases of long-dated conventional gilts and subsequently index-linked gilts, which was effective in stabilizing gilt yields. Key elements of the intervention were the use of backstop pricing for the purchases, the short period of purchases, and the demand-led, timely but orderly, unwind of those purchases. The objective of the intervention was to buy time for liability-driven investment funds to rebalance, without further amplifying the underlying shock.

This episode raises the question as to whether a similar stress event could happen in other jurisdictions that have pension funds that use financial leverage. While UK pension funds had been stress-tested against a rise in bond yields, the sharp increase in September 2022 was much larger than used in stress tests and such gaps might be exposed in other jurisdictions. Pension funds achieve financial leverage by using repurchase agreements and derivatives such as interest rate swaps. Among a global sample of large pension plans that disclose data on derivative exposures, the average ratio of gross notional exposure of derivatives to assets has increased over the past decade, with some pension plans that have significantly increased the use of derivatives (Figure 2.4, panel 1). These pension funds are also active users of repurchase agreements, which can contribute to further increasing financial leverage.[19] Recent surveys also suggest increasing interest in investing in liability-driven investment strategies that use leverage (Figure 2.4, panel 2). Over the past decade, pension funds have also increased their overall prevalence, particularly as a share of global GDP, increasing from 40 to almost 60 percent during 2011–21. Those pension funds using financial leverage could be subject to margin and collateral calls during periods of high market volatility in the future, which given their large footprint might contribute to exacerbated periods of stress in financial markets. As a result, authorities should make sure that those leveraged pension funds have adequate liquidity risk management processes in place to account for large margin and collateral calls.

Despite the similarities between pension plans in the United Kingdom and other jurisdictions, the UK pension fund industry has some unique features that contributed to amplify stress in the 2022 crisis:

- UK pension plans have less diversified portfolios, with a larger share invested in fixed income. A more diversified portfolio allows funds to better withstand shocks and access liquidity in different asset classes and geographies. UK pension plans also have an elevated share of defined-benefit assets, only behind Japan and The Netherlands among the top seven global pension fund jurisdictions (Figure 2.4, panel 3). Defined-benefit pension funds are generally active users of liability-driven investment strategies to hedge long-dated liabilities. UK funds also have elevated duration risk compared with other jurisdictions that have significantly shorter duration that results in less price sensitivity to rapid increases in bond yields.
- The UK stress event was exacerbated by the fact that the country's pension plans owned a large share of the gilt market—a share of more than 50 percent of certain long maturities—illustrating the elevated interconnectedness between pension funds and the domestic sovereign and corporate bond markets (Figure 2.4, panel 4). Pension funds in other jurisdictions—particularly The Netherlands and Switzerland—have an even higher share. However, this might be mitigated in those countries because of their lower share of defined-benefit plans and more diversified overall portfolios.[20]
- UK pension funds are also subject to other jurisdiction-specific factors, which made them more vulnerable. Their funds have a sizable share of small- to medium-sized plans that can have more concentrated investment strategies and use pooled liability-driven investment asset management vehicles, making it more challenging for managers of those vehicles to coordinate with plan sponsors to promptly raise cash to pay for margins.

The rise in bond yields over the past year means that pension plans are in a better position in terms of solvency, given that the gap between the value of their assets and liabilities has improved significantly. This trend likely ameliorates, but does not eliminate, the vulnerabilities mentioned earlier.

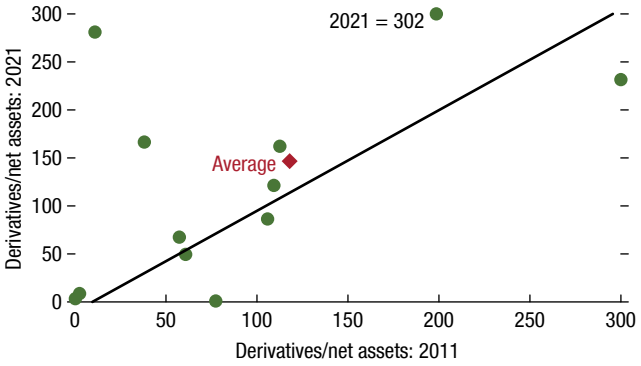
[19]Repurchase agreements were key contributors that exacerbated the UK liability-driven investment episode in 2022, as the value of collateral pension funds used to borrow in the repo market declined sharply.

[20]The Netherlands also benefits from being part of the wider and more liquid euro area bond market. In addition, the Dutch pension system may benefit from the existing undergoing reform (to be completed by January 1, 2027) which transitions its defined-benefit pension system to a largely defined contribution-style arrangement.

Figure 2.4. Pension Funds and Financial Stability

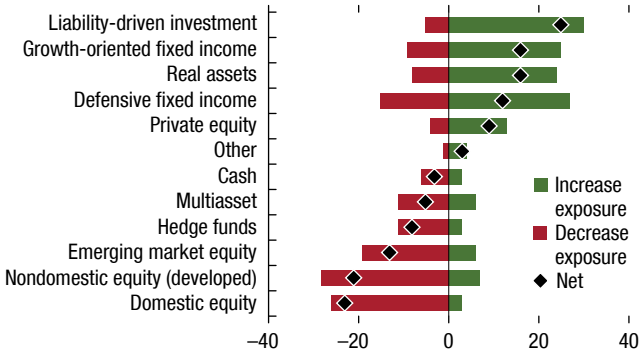
The financial leverage of selected pension funds has risen over the past decade ...

1. Financial Leverage of Selected Pension Funds (Percent)



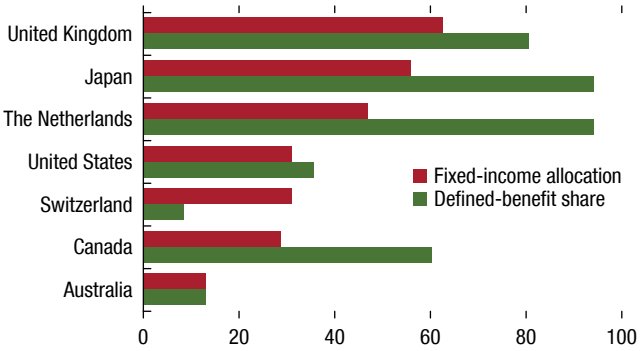
... while surveys indicated increasing willingness to increase exposure to riskier liability-driven investment strategies.

2. 2021 Survey of One-Year-Ahead Asset Allocation Plans of European Pension Funds (Percent)



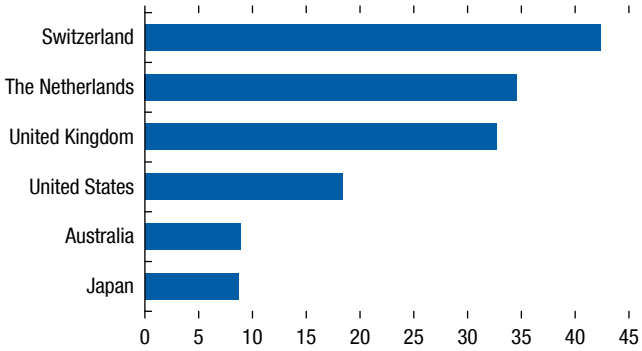
UK pension funds had less diversified portfolios and an elevated share of defined-benefit plans ...

3. Pension Fund Fixed-Income Allocation and Share of Defined-Benefit Plans (Percent)



... and UK pension funds own a sizable share of their domestic sovereign and corporate bond markets.

4. Pension Fund Share of Domestic Sovereign and Corporate Bond Market Ownership (Percent)



Sources: Annual reports of selected pension funds; Bloomberg Finance L.P.; Financial Stability Board; Mercer European Asset Allocation Insights 2021; UK Pension Protection Fund Purple Book; Willis Towers Watson Global Pension Assets Study 2022; and IMF staff calculations.
Note: Panel 1 uses the gross notional exposure of derivatives as a proxy for the financial leverage of pension funds. Note that these funds are also active users of repurchase agreements, which can further increase their financial leverage. This panel includes a sample of 12 pension funds in seven jurisdictions (Canada, Japan, The Netherlands, Norway, Sweden, United States, United Kingdom) that provide data on derivatives' gross notional exposures in their annual reports. These 12 funds have combined assets under management of more than $5 trillion, which is almost 10 percent of global pension fund assets. Panel 2 is based on a survey on the European defined-benefit pension industry by Mercer, covering pension funds in 11 jurisdictions. In panel 3, the seven jurisdictions account for more than 90 percent of global pension fund assets.

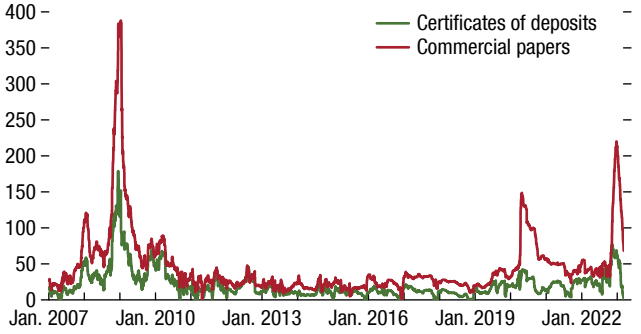
Case Study 2: Recent Stress in Debt Markets and Project Finance Lenders in Korea

Financial stress emerged in Korea's debt markets in October 2022 amid tightening financial conditions and falling property prices. The default of a commercial paper issued against real estate project finance loans—a market in which NBFIs such as insurance companies and nonbank credit intermediaries actively participate—set off a broad-based repricing of asset-backed securities, corporate bonds, and short-term notes. Spreads between commercial papers and monetary stabilization bonds—perceived as a risk-free rate—widened to 220 basis points, a level not seen since the global financial crisis (Figure 2.5, panel 1). Corporate bond yields also rose sharply across the board. Complicating matters, the default occurred against the backdrop of increased borrowing needs from both banks—in part owing to the postpandemic normalization of prudential policy—as well as a state-owned energy firm to cover its operating loss.

Figure 2.5. Recent Financial Stress in Local Debt Markets in Korea

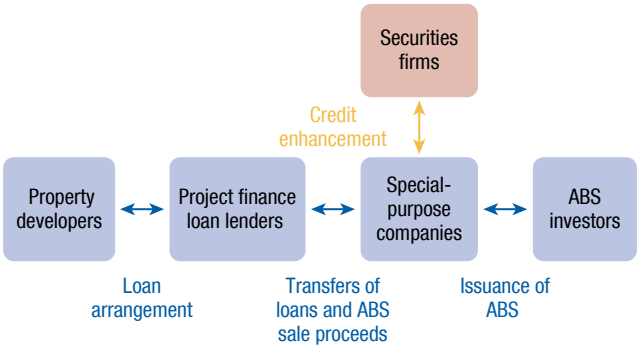
Financial stress remains, as shown by still-high spreads of money market instruments.

1. Three-Month Money Market Spreads (Basis points; relative to the Bank of Korea's monetary stabilization bonds)



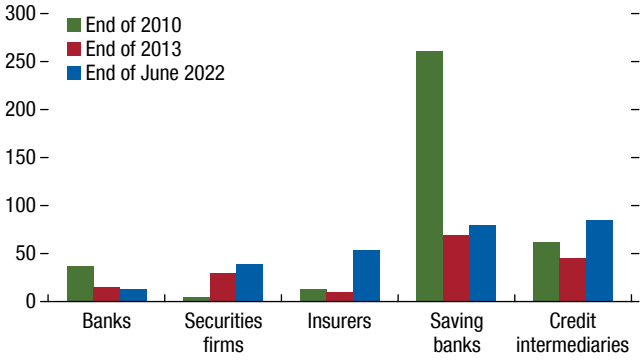
Securities firms are also exposed to project finance loan-backed securities as they are the leading provider of their credit enhancements.

2. Securitization Process of Real Estate Project Finance Loans: Asset-Backed Securities



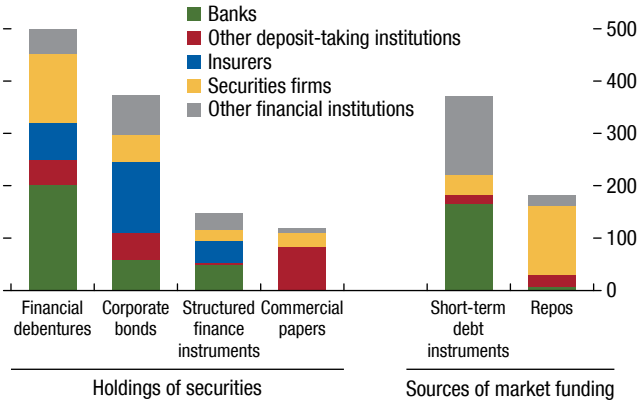
Nonbank financial intermediaries have sizable exposure to real estate project finance loans relative to their own capital.

3. Financial Institutions' Exposure to Real Estate Project Finance Loans (Percent of own capital)



Nonbank financial intermediaries could amplify financial stress given their sizable holdings of debt securities along with their reliance on market funding.

4. Financial Institutions' Selected Holdings of Securities and Selected Sources of Market Funding (Trillions of Korean won)



Sources: Bank of Korea; Bloomberg Finance L.P.; CEIC; and IMF staff calculations.
Note: In panel 4, securitized financial products would appear under "structured finance instruments." ABS = asset-backed securities.

The funding structure of project financing loans in the Korean case appears fragile, as NBFI lenders use high levels of leverage. These lenders issue short-term asset-backed securities with maturity of up to one year through special-purpose companies to finance longer-term project finance loans with maturity of three to five years (Figure 2.5, panel 2). As of June 2022, outstanding project finance loans amounted to KRW112 trillion (5 percent of GDP). The main NBFI lenders were insurance companies (39 percent) and nonbank credit intermediaries (24 percent).[21] About 35 percent of project finance loans were securitized, and another type of NBFI, securities firms, usually provided substantial credit guarantees to asset-backed securities. The maturity mismatch of these asset-backed securities makes them vulnerable to market sentiment, rising interest

[21]About 70 percent of project finance loans are originated for residential real estate development.

rates, and refinancing risk. Although it is unlikely that the delinquency rate for project finance loans will rise to the peak of 2013 (8.2 percent that year), the real estate sector continues to face headwinds, with falling property prices. NBFIs are exposed to these delinquencies because in addition to issuing short-term debt against these loans, they also commit their own capital to them (Figure 2.5, panel 3). More broadly, the debt market stress also revealed vulnerabilities related to NBFIs, which fund their sizable holdings of debt securities with short-term market funding (Figure 2.5, panel 4).

The Korean authorities introduced measures to alleviate systemwide funding stress and ensure that real estate project finance loans are rolled over: asset purchases, provision of liquidity and credit guarantees, relaxation of prudential policy, and use of administrative directives. Asset purchases, which were carried out largely by major state-owned and private financial institutions, targeted mostly investment-grade corporate bonds and commercial papers (notably, those backed by project finance loans). While continuing to focus on curbing inflation, the Bank of Korea provided additional liquidity to banks by relaxing its collateral rules and to securities firms by using repo transactions. Public financial institutions also provided credit guarantees to support the origination of project finance loans. The normalization of some prudential measures was postponed, and several property-related restrictive regulations were relaxed. Administrative directives were used to reduce bond issuances by banks and state-owned enterprises.

Market stabilization measures have helped ease liquidity stress, although some strains linger. Credit spreads started to narrow in late December 2022 after a purchase of higher-risk asset-backed securities was carried out, and the Bank of Korea provided liquidity to securities firms in an amount larger than initially announced. However, credit spreads remain wide, especially for lower-rated borrowers, reflecting market concerns about a further correction of property markets. Notwithstanding their effects in containing market stress, it is important that support measures remain temporary, with a clear exit strategy, to limit moral hazard concerns and fiscal risks. The authorities should also take proactive actions to manage potential solvency issues related to real estate-related financing.

Case Study 3: Commodity-Trading Firms and Financial Stability Risks

Commodity-trading firms are critical intermediaries between the producers and users of key commodities such as agricultural products, fossil fuels, metals, and minerals. In some cases, they are also important producers of commodities (for example, producers of minerals, fossil fuels, and agricultural products). Inventories constitute a large part of their assets, typically financed by a high level of short-term debt that is largely composed of bank loans (Figure 2.6, panel 1).

The relatively high level of short-term debt can give rise to liquidity risks, especially because large trading firms tend to hold fewer liquid assets than short-term debt (Figure 2.6, panel 2). In the current environment of tighter financial conditions and relatively high volatility in commodity prices, short-term debt rollovers have become more challenging.[22] Banks may not be as willing to provide large amounts of short-term lending and may view commodity-trading firms as riskier, especially if commodity price fluctuations are higher. Adequate equity ratios (Figure 2.6, panel 2) and prompt sales of existing inventory can mitigate these risks somewhat, provided that market functioning remains orderly.

Commodity-trading firms also use commodity-derivative contracts to both hedge against price declines (of their large inventories) and (to a lesser extent) to speculate. In a volatile market environment, commodity traders can quickly be faced with higher margin requirements, requiring the immediate transfer of liquid assets (in particular, cash) as collateral, as witnessed ahead of the nickel market suspension at the London Metal Exchange in March 2022 (see Box 1.1 in the April 2022 *Global Financial Stability Report*). During that episode, a number of commodity-trading firms cautioned that the liquidity challenges they face may threaten their ability to continue supplying commodities to the economy.

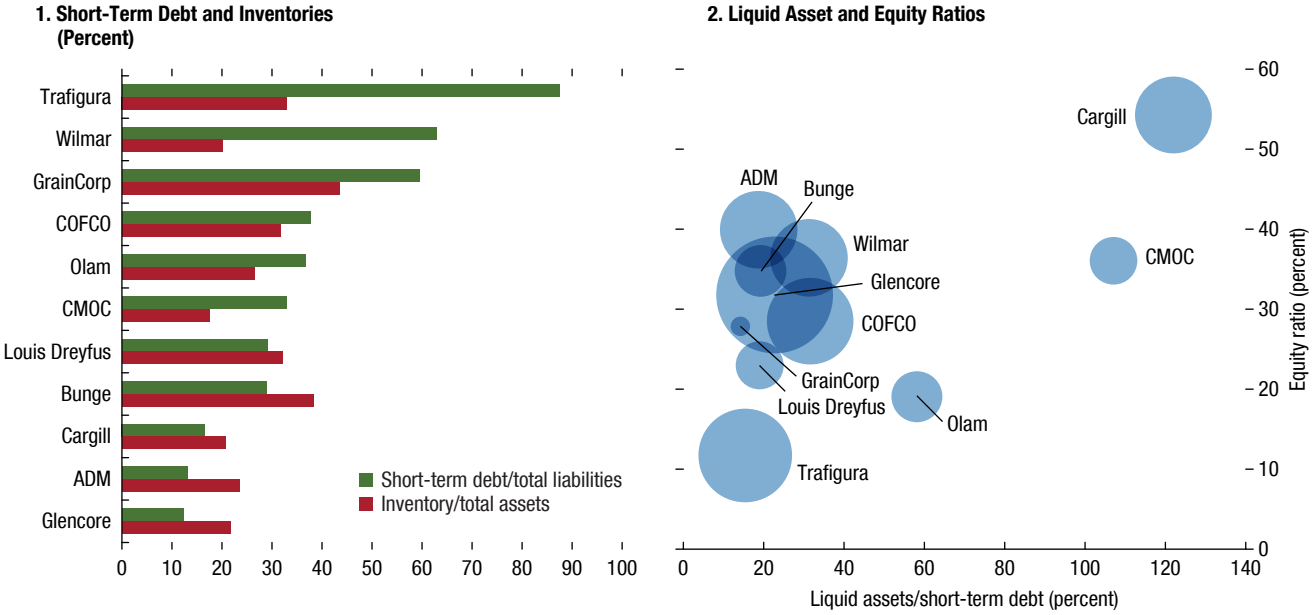
The hidden risks from trading commodity derivatives point to significant regulatory and data gaps. Even though commodity-trading firms are heavily engaged in complex and risky derivatives trading, they are not subject to the same level of regulation or supervision as financial institutions. In addition, some very large commodity traders (not shown in Figure 2.6)

[22]See Dempsey, Harry, and Neil Hume. 2022. "Trafigura's Finance Chief Warns of Commodity Industry Stress." *Financial Times*, March 23.

Figure 2.6. Financial Structure of Commodity-Trading Firms

Commodity-trading firms hold large amounts of inventories often financed by short-term funding ...

... making them vulnerable to funding shocks and margin calls, despite generally high equity ratios.



Sources: Bloomberg Finance L.P.; S&P Capital IQ; and IMF staff calculations.
Note: Data are as of the third quarter 2022 or the latest available fiscal year. The panels cover major listed commodity-trading firms for which data are publicly available. Short-term debt comprises all financial debt with a remaining maturity of less than one year. In panel 2, the equity ratio is defined as total equity over total assets. The size of the bubbles indicates firm size, ranging from $4 billion to $140 billion. Liquid assets are cash, cash equivalents, and short-term investments. ADM = Archer-Daniels-Midlands; CMOC = CMOC Group Limited, formerly China Molybdenum; COFCO = China Oil and Foodstuffs Corporation.

are private companies that are subject only to very limited (or no) public reporting requirements. To the extent that derivative trades happen on exchanges, the corresponding positions can be monitored, but they do not allow market regulators and supervisors to make a holistic assessment of commodity-trading firms' risk exposures. For over-the-counter trades, the scarcity of reported data on commodity derivatives makes it particularly difficult to monitor large risk exposures. These positions can become large enough that a materialization of risks can impact the functioning of a corresponding commodity market on a regulated exchange, as during the nickel market suspension.[23]

Case Study 4: Vulnerabilities in Private Credit Markets

Private credit refers to the provision of credit by NBFIs to often smaller borrowers through direct lending (about 40 percent) and other structures (Figure 2.7, panel 1) (see Block and others 2023). In terms of size, the private credit market rivals the institutional leveraged loan market, which is driven by large bank syndications. Both markets had approximately $1.4 trillion outstanding in 2022.[24] Some of the vulnerabilities highlighted in this chapter—liquidity mismatches and use of financial leverage—appear to be less prominent in this sector. These vehicles typically do not carry maturity or asset-liability mismatches because investors' capital is locked in for many years, so there is no run risk. They also appear to use limited financial leverage. Banks can provide such leverage as credit lines, collateralized borrowing, and capital call lines (Aramonte and Avalos 2021).[25] However, interconnectedness is a key channel of

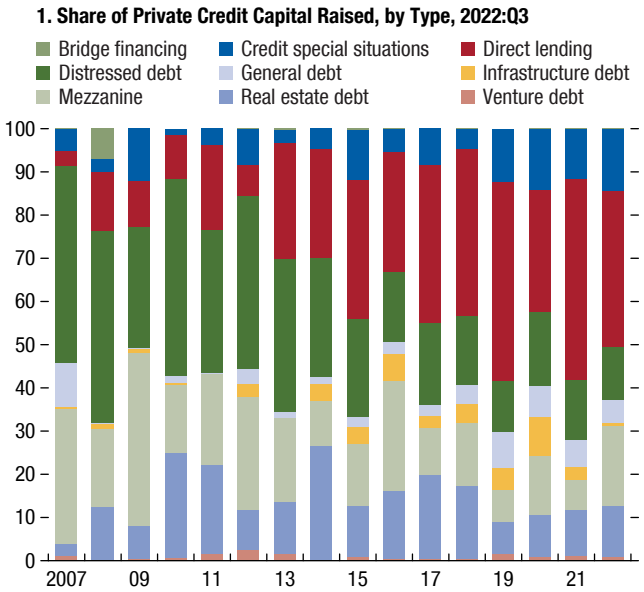
[23]As a response, the London Metal Exchange has introduced reporting requirements for over-the-counter derivative positions of its members for a range of metals.

[24]See the October 2022 *Global Financial Stability Report*. Private credit, provided by dedicated funds, is often referred to as "direct lending" because it is not issued or traded in the public markets and the debt is not originated by regulated bank syndicates. Most private credit is provided as direct lending for private companies that cannot access—or that want to circumvent—public markets or that want certainty of execution and confidentiality.

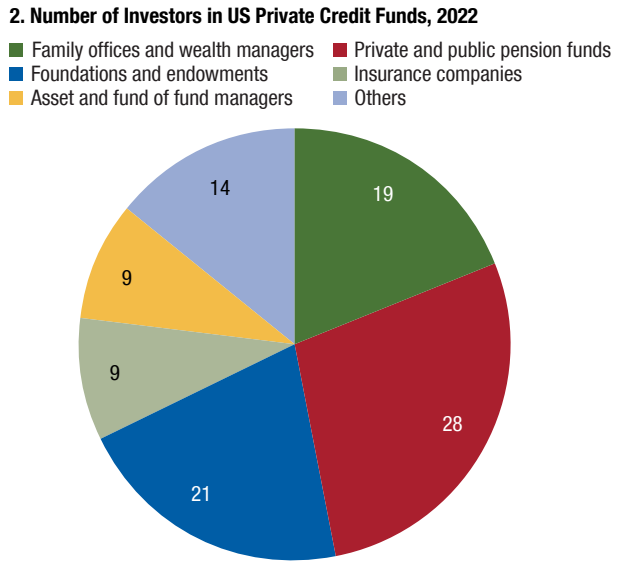
[25]A "capital call line" is a line of credit typically provided by a bank to a private equity firm that can be used to enhance debt fund returns or to provide bridge financing for limited partnership capital.

Figure 2.7. Private Credit Markets
(Percent)

Direct lending is the main source of private credit financing.



Pension funds are the largest investors in private credit vehicles.



Sources: Goldman Sachs; PitchBook Leveraged Commentary & Data; Preqin; and IMF staff calculations.
Note: Q3 = quarter 3.

risk, given that most private credit investors are usually institutional investors in the NBFI ecosystem that could face a capital call in the event of broader market stress or face losses on their investments (Figure 2.7, panel 2).

Rapid growth of private credit markets may have increased vulnerabilities in the financial system, with potential systemic implications. Privately financed leveraged buyout transactions with high debt multiples tend to be more vulnerable to economic slowdowns. Competition in private credit has led to deterioration in covenant quality, and managers of private credit deals often finance deals of other managers, which concentrates risk.[26] Lending is largely opaque, driving an accumulation of asset quality performance risks that may be hard for market participants and regulators to discern until it is too late to counteract. In all, private credit is a relatively new asset class, with performance untested in a prolonged economic downturn. If private credit were suddenly restricted in a market stress event, smaller borrowers could face rollover risks if bank financing is unable to handle the new credit demand under current regulations. Because of the low transparency and limited liquidity in private credit markets, spillovers to other markets could occur during a stress episode as investors are forced to sell other assets with more timely mark-to-market pricing and more liquid secondary markets in order to access cash.

Policies to Support Financial Stability in a High-Inflation Environment

The case studies illustrate how NBFI stress often emerges as a result of a combination of vulnerabilities related to elevated financial leverage, liquidity, and interconnectedness.[27] Under the current high-inflation environment, higher interest rates and tighter financial conditions can interact with these vulnerabilities in the NBFI ecosystem, potentially triggering investor runs and asset fire sales. In such circumstances, central banks may then face a challenging trade-off between safeguarding financial stability and simultaneously maintaining price stability. Consequently, ongoing monitoring and timely

[26]Wiggins, Kaye. 2022. "Selling to Yourself: The Private Equity Groups that Buy Companies They Own." *Financial Times*, June 21.

[27]The Financial Stability Board's 2023 workplan outlines work being taken forward to address NBFI vulnerabilities, with a particular focus on not only addressing the rise in demand for liquidity in stress periods but also considering the lack of resilience of liquidity supply in a stress episode.

identification of vulnerabilities in the NBFI ecosystem is particularly important at this juncture to ameliorate the difficult trade-off between the price stability and financial stability mandates. The appropriate policy response by central banks should account for the emerging vulnerabilities in NBFIs; the monetary policy framework in place; and, critically, the supervisory, regulatory, and legal framework of each jurisdiction.

Closing Data Gaps, Enhancing Risk Management, and Strengthening Regulation and Supervision

Several key guardrails are essential to safeguard financial stability. They include (1) closing data gaps to facilitate appropriate and timely risk assessment by market participants (by encouraging market discipline) and supervisory authorities, (2) incentivizing stronger risk management by the NBFIs themselves, (3) implementing adequate and comprehensive regulatory standards, and (4) conducting appropriately resourced and intensive supervisory oversight. With these elements in place, the need for action by central banks should be reduced, or at least limited to tail risks, thereby mitigating the risk of moral hazard.

To carry out adequate supervision and regulation, the availability of reliable and comparable data is a key prerequisite. Closing data gaps should therefore be a policy priority. Adequate data coverage enables regulators and central banks to analyze risk profiles appropriately and calibrate necessary regulatory approaches.

In terms of robust risk management and regulation to manage the risks from a growing NBFI sector, NBFI entities themselves should improve their risk management to address the vulnerabilities to which they are exposed. In addition, adequate regulation proportionate to the risks of different types of NBFIs is key moving forward. The heterogeneity of NBFI business models suggests that a one-size-fits-all approach to regulation is not appropriate. NBFIs need to be regulated and supervised from a myriad of different angles. Conduct requirements such as public disclosure are important to support market discipline and price discovery, as are governance requirements to ensure proper risk management, and prudential regulations (such as capital and liquidity management tools) to address quantifiable risks (such as credit, market, and liquidity). Jurisdictions should ensure that supervision is adequately intrusive to ensure compliance with all relevant regulatory elements for each sector (see Box 2.1 for a brief overview of NBFI supervisory and regulatory priorities).[28]

Guidelines for Central Bank Intervention to Provide Liquidity

Central bank intervention should aim to address liquidity and not solvency problems. The latter should be left to relevant fiscal (or resolution) authorities. Liquidity should be provided to counterparties that are compelled by supervision and regulation to internalize liquidity risk (the "stick") so that central banks may need to intervene only to address systemic liquidity risks (the "carrot"). A significant part of the risk should remain in the marketplace ("partial insurance") to minimize moral hazard. The financial stability intervention should be parsimonious to avoid conflicting with the monetary policy stance, especially in a tightening cycle. This means pricing it to be relatively expensive to avoid attracting opportunistic demand. Finally, central banks should introduce appropriate risk mitigation (for example, haircuts) and agree on loss sharing with the fiscal authorities to manage risks to their own balance sheet.[29]

What is different about NBFIs, and when should they be eligible for central bank liquidity? NBFIs were traditionally not at the center of the financial system and credit intermediation compared with banks. Hence, NBFIs are usually not central bank counterparties for monetary policy purposes, although there have been exceptions (that is, discount houses in the United Kingdom and primary dealers and money market funds in the United States). NBFIs have grown to become key financial intermediaries, including in liquidity provision during normal times, as banks have stepped back. Liquidity support to the NBFI sector has been provided primarily through the standard counterparties (banks). Therefore, opening access to central bank liquidity to NBFIs could be necessary if there is a high risk of contagion either to systemically important institutions or markets or if the sector or entities are important for financial intermediation and credit provision.

[28]For a detailed discussion of policy options for investment funds see Garcia Pascual, Singh, and Surti (2021) and Chapter 3 of the October 2022 *Global Financial Stability Report* as well as Claessens and Lewrick (2021) and Financial Stability Board (2022a, 2022b).

[29]The fiscal authorities commit to underwrite part or all the losses that the central bank may incur because of the liquidity support either by providing guarantees or by setting up a special-purpose vehicle. Partial risk sharing could be considered to incentivize prudent program design.

Table 2.3. Liquidity Frictions: Diagnoses and Potential Responses

Nonbank Financial Intermediaries	Risks	Security Types	Central Bank Responses
Nonbank intermediaries	Securities dealers lose access to funding because of uncertainty about: • Counterparty creditworthiness • Collateral values	Sovereign bonds	Collateralized lending (for example, repo): expanded eligibility for counterparties
		Corporate bonds, asset-backed securities	Collateral upgrade (that is, swaps)
		Commercial paper	Asset purchases: expanded counterparties and asset universe
	Securities dealers cannot sell assets at reasonable prices	All types of securities	Asset purchases: expanded counterparties and asset universe
Investment funds (including money market and hedge funds)	Funds face temporary redemption pressures (liquidity mismatches)	All types of securities	Collateralized lending (for example, repo): expanded eligibility for counterparties
	Funds face persistent redemption pressures (liquidity mismatches)	All types of securities	Asset purchases: expanded counterparties and asset universe
Pension funds	Funds face early/unexpected redemption	All types of securities	Asset purchases: expanded counterparties and asset universe
	Funds face liquidity pressure arising from derivative/valuation	All types of securities	Collateralized lending (for example, repo): Expanded eligibility for counterparties
Insurance	Insufficient liquidity buffer/ unexpectedly high pay-off	All types of securities	Asset purchases
Central counterparties	Central counterparties lose access to funding (and cannot sell high-quality liquid assets)	High-quality liquid assets	Idiosyncratic (lender of last resort)
Systemic nonbank financial intermediaries regardless of the type	A systemically important (solvent) nonbank financial intermediary loses access to funding	Various, including credit claim	Idiosyncratic (lender of last resort)

Source: IMF staff.
Note: The central bank response would depend on the nature of the liquidity issue. Collateralized lending would respond in priority to temporary funding pressure, whereas asset purchases would address market illiquidity and liquidity drain with less chance of recovery.

The challenge is to transpose the well-established principles for central bank liquidity provision to NBFIs while addressing the "new" risks appropriately. It is therefore paramount to guarantee that appropriate guardrails are in place, including in terms of NBFI supervision and regulation (Box 2.1).

On lending, the central bank could expand eligible collateral (with appropriate haircuts) or expand the counterparty list to add NBFIs if the new counterparties are appropriately regulated and supervised (see Table 2.3).[30] In practice, NBFIs generally use financial market infrastructures of a given jurisdiction and settle the transactions with their banking agents, which is usually one of the standard counterparties. To improve efficiency during stress periods, eligible counterparts could pre-position collateral at the central bank; this entails placing securities in a central bank account, which are then readily available for them to pledge as collateral against any lending operation.

On purchasing, the central bank could broaden the list of counterparties in asset purchase operations to those that are not part of monetary operations. This should be done as appropriate to avoid relying on dealer banks' intermediation or expanding the universe of purchased assets.

Regarding the type of central bank interventions, there are three broad categories: (1) discretionary marketwide operations, (2) standing lending facilities, and (3) discretionary provision through LOLR arrangements.

First, discretionary marketwide operations may be required to deal with broad market liquidity stress events. "Marketwide" refers to asset-purchase and lending operations aimed at re-establishing proper

[30]For example, in response to funding pressures during the global financial crisis, the Federal Reserve established the Primary Dealer Credit Facility, which provided primary dealers (securities dealers licensed and supervised by the Federal Reserve) with committed funding collateralized by investment-grade securities. In other markets (for example, Hungary and India), central banks expanded term repo operations to NBFIs (for example, mutual funds and insurance companies) to address sectoral liquidity stresses. Collateral swaps are also an effective tool to support a return to market-based activity when markets are hampered by uncertainty about underlying collateral asset value.

functioning of a market segment (such as government bonds, see Case Study 1) or to cope with stress in an NBFI segment (such as money market funds). "Discretionary" means that the timing and amounts of the operation are decided by the central bank. Lessons from previous stress events highlight that such operations should be (1) temporary, (2) targeted at those segments of the NBFI ecosystem where further market dislocation and disintermediation could have adverse macro-financial stability implications, and (3) designed to restore market functioning while containing moral hazard (King and others 2017). In the past, programs have been "time-bound" if the amount announced is sufficiently large to influence market expectation. Alternatively, the program could be "state contingent" and "self-liquidate" to facilitate exit once market stress abates.[31] In addition, central banks should guarantee that appropriate risk mitigation measures are in place.

Regarding the timing of discretionary marketwide interventions, early provision of liquidity may be preferable to avoid contagion and lessen solvency risk, although it risks increasing moral hazard. A framework based on "discretion under constraints" should be in place. This means data-driven metrics should guide the decision to intervene (the constraints), while policymakers ultimately retain the discretion on whether to intervene. The metrics may be based on a heatmap of indicators—such as funding spreads, premium in relation to a risk-free benchmark, margin requirements, trading volumes, bid-ask spread, and price volatility—with appropriate thresholds. This can be complemented with more sophisticated methods based on forecasts of the short-term distributions of these indicators.[32] The thresholds should ensure that the central bank will contemplate intervening only to respond to extreme tail risks. While these metrics are important guideposts, policymakers' judgment remains crucial in the decision to provide liquidity and ameliorate systemic risk.

Second, access by NBFIs to central banks' standing lending facilities could be granted to reduce the risk of fire sales and spillovers to the financial system. In contrast with discretionary marketwide operations, standing facilities are permanently available at the initiative of the eligible counterparties.[33] Importantly, the bar for such access should be very high to avoid moral hazard.[34] Central banks should coordinate with NBFI regulators to ensure that the appropriate regulatory and supervisory regimes are in place proportionate to the risk profiles of the different types of NBFIs, some of which may not qualify because of a high-risk profile. The central bank should also charge a sufficiently high rate to discourage recourse to the facility in normal times (IMF 2020).

Third, in case of idiosyncratic (not marketwide) stress at a systemically important NBFI, central banks should be prepared to act as LOLR. In some cases, an ex-ante designation of a systemically important NBFI may be in place with accompanying appropriate supervisory and regulatory guardrails (in nonsystemic cases, the institution may be left to the relevant resolution/bankruptcy procedures to instill market discipline). General LOLR principles applied to banks, or standard counterparties provide the template for responses in such cases. The principles affirm that lending should be at the discretion of the central bank, after exhausting other liquidity support options, only to solvent firms, at a penal rate, fully collateralized, and with more intrusive supervisory oversight (Dobler and others 2016). To compensate for the higher risk taken by the central bank, including possibly because of lower-quality collateral and large exposure, conditions could be imposed on the borrower. These might include conditions on the use of the funds and conditions that the measures taken should have a clear timeline to reestablish the liquidity of the institutions. Extra attention is also needed to protect the central bank through loss-sharing arrangements with the government. Finally, LOLR may be necessary even when standing lending facilities are available. For example, this may happen if a systemically important institution has exhausted its eligible collateral, then

[31]State-contingent operations involve setting parameters, such as maximum credit spreads, at which the operations are conducted. When credit spreads "normalize," counterparts resort to market-based transactions and the operation is no longer needed. Self-liquidating operations are operations that, in duration, span the expected period of liquidity stress. Examples include purchases of short-term commercial paper and the provision of short-term funding.

[32]Lafarguette and Veyrune (2021) provide an illustration concerning the foreign exchange market.

[33]Standing lending facilities are defined here as precommitted, on demand, and unlimited short-term funding (see Adrian, Laxton, and Obstfeld 2018 and Maehle 2020).

[34]NBFIs have been included in the monetary policy framework to improve control of the short-term rate when the list of standard counterparties was too restrictive for efficient monetary policy implementation (for example, money market funds in the United States).

the LOLR may provide emergency liquidity against lower quality collateral, but with tighter risk-mitigation measures and conditionality.[35]

Transposing LOLR principles to NBFIs is challenging. Criteria for solvency and viability are not as clearly defined for NBFIs as for banks. LOLR could be provided only to institutions fully in the surveillance perimeter of the central bank, which supposes full information transfer from the NBFI regulators and enough capacity at the central bank to process this information.

Clear communication is critical. In the current high-inflation environment, central banks may be perceived as working at cross-purposes during periods of market stress—they may need to provide liquidity to restore financial stability while bringing inflation back to target, both by hiking the policy rates and possibly by shrinking their balance sheets. In these circumstances, central banks should use separate tools aimed at price stability and financial stability, if available. A clear separation of tools may support communication and strengthen the effectiveness of policy action. The communication should clarify the source of the stress; the objectives of the intervention and its modalities; the time horizon of the intervention, if appropriate; and the time and threshold for exit that preferably does not overlap with the timing of monetary policy operations.

Crisis Management: A Coordinated Response

Regulatory coordination across sectors and jurisdictions is essential both for identifying risks and managing crisis situations. Specifically, internationally coordinated reforms can reduce the risks of cross-border spillovers, regulatory arbitrage, and market fragmentation. Most NBFI regulators across sectors have adopted a risk-based supervisory framework that enables interventions to be adequately calibrated to risks and vulnerabilities and that has mechanisms in place to share information with other regulators and central banks. Jurisdictions should ensure that their data-sharing arrangements ensure timely coordination to swiftly identify cross-sectoral risks and determine further action as needed. Most jurisdictions also have contingency and business continuity requirements for their NBFIs that should be monitored as part of regular supervisory activities. However, the Financial Stability Board recently noted that resolution regimes for systemic NBFIs, including central counterparties and insurers, should be strengthened, and that such regimes should be introduced where they do not exist.[36] The Financial Stability Board also identified the need to address obstacles (for example, legal, regulatory, and operational) to cross-border funding in resolution, including the ability to mobilize collateral across borders.

Cross-Border Considerations

Well-designed policies to address liquidity stresses in NBFIs can have a favorable effect on international spillovers by reducing the procyclicality of cross-border flows and mitigating exchange rate pressures. This is especially the case in emerging market economies that are exposed to large portfolio flows. To harness the benefits that growing cross-border flows bring to emerging market and developing economies, a combination of both recipient and source country policies is needed (Garcia Pascual, Singh, and Surti 2021). In source countries, such policies include robust regulation of NBFIs and well-designed central bank interventions. In recipient emerging market and developing economies, the appropriate mix of macro-financial policies is critical and may include foreign exchange intervention, macroprudential measures, and capital flow measures.[37] Cross-border coordination in the introduction of policy measures would reduce regulatory arbitrage and improve implementation.

[35]An example of a systemically important NBFI (where idiosyncratic support may be justified) may be a central counterparty that clears a significant proportion of risks in a particular market, or any other NBFIs deemed to be systemic by policymakers because of size, centrality in the financial system, the financial services provided, or other reasons. In particular, the activity of central counterparties is narrowly based, with risks directly tied to the price volatility of collateral, which is mostly observable. Any such support can be predicated on compliance with the relevant Principles of Financial Markets Infrastructures and on any risk management criteria that the central bank (or other regulator) may have set.

[36]The Financial Stability Board (2022a, 2022b) calls for urgent work to address cross-border resolution challenges in the nonbank sector.

[37]For information on the IMF's Integrated Policy Framework, see http://www.imf.org/en/Topics/IPF-Integrated-Policy-Framework. For further information on capital flows, see IMF (2022). See also Chapter 3 of the April 2020 *World Economic Outlook*.

Box 2.1. Regulatory and Supervisory Priorities for Nonbank Financial Intermediaries

Regulators should prioritize periodic comprehensive systemic risk assessments across all nonbank financial intermediaries (NBFIs). Such assessments should include systemwide stress testing as well as stress testing of those NBFI subsectors and markets that pose high systemic risks. Certain vulnerabilities, such as liquidity spirals, crowded trades, and indirect interconnectedness, need additional marketwide assessments, especially for high-risk markets such as derivatives, repo, securities lending, and leveraged loans, among others. A special focus should be placed on interconnectedness, as this vulnerability cannot be assessed using microprudential (financial-institution-level) stress testing.

With respect to liquidity mismatches, the structural resilience of open-ended investment funds should be improved. For funds holding very illiquid assets, the liquidity offered to investors should be calibrated closer to the liquidity of funds' assets. Regulators should also focus on greater, more effective, and consistent use of liquidity management tools (such as swing pricing, antidilution levies, in-kind redemptions, and redemption gates, among others) with suitable implementation guidance (see Chapter 3 of the October 2022 *Global Financial Stability Report*). Where private incentives do not align with financial stability goals, mandating the use of some liquidity management tools or granting power to the regulators to activate at least some of those tools, in the public interest, may be necessary. Jurisdictions should also improve their ability to assess liquidity mismatches in the investment fund sector, including by closing knowledge gaps on the liability side—what is called "knowing your investor risk profile." Moreover, funds' liquidity risk management practices could be strengthened. Finally, where policy has been agreed already, such as the Financial Stability Board's policy proposals to enhance money market fund resilience, it is important that jurisdictions take steps to implement the agreed reforms.[1]

[1]The US Securities and Exchange Commission has consulted on a proposed rule on money market fund reform (see https://www.sec.gov/rules/proposed/2021/ic-34441.pdf). The Bank of England and the Financial Conduct Authority published a discussion paper on the resilience of money market funds (see https://www.fca.org.uk/publication/discussion/dp22-1.pdf) and expect to consult on a set of reforms in 2023.

Regulation should also aim to improve leverage disclosures, risk management, and consistency in measurement and consider leverage caps where appropriate. Data granularity for hedge funds and overall improvement in disclosures for other leveraged funds should be prioritized. For other highly leveraged NBFIs, regulators should consider improved reporting in line with their structure and use of leverage, especially off-balance-sheet items and over-the-counter derivatives. At a cross-border level, international standard setters should lead improvements in cross-border consistency in the measurement of leverage beyond hedge funds. Regulators for lenders/counterparties (for example, banks) should improve risk management in such entities with respect to their NBFI exposures. The lack of such management was highlighted in the Archegos and UK liability-driven investment cases. In some cases, regulators might consider leverage caps.

Microprudential stress testing for liquidity and leverage risks should be required and improved. Regulators may consider issuing guidance, as appropriate, for a minimum level of stress testing requirements and frequency to improve the overall quality of stress testing in the NBFI sector.

Financial Sector Assessment Programs have repeatedly noted insufficient resourcing of NBFI supervisory authorities coupled with, in some cases, lack of operational independence, both of which hamper supervisory abilities. Robust resources and independence in line with international standards should be a priority. Also, regulators collecting a substantial amount of granular data but lacking the processing and analytical capabilities should focus on building such capacity. Coordination across sectors is key, given the diversity of regulators supervising NBFIs as should be leveraging on financial stability committees for the collection and analysis of information. Cross-border cooperation needs to be strengthened, particularly on data sharing, supervision, and the use of liquidity management tools. Global standard-setting bodies can play a crucial role in this regard.

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