

# Where Do Banks End and NBFIs Begin?<sup>1</sup>

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## Abstract

Banks and non-bank financial intermediaries (NBFIs) are commonly viewed as substitutes, with banks inside and NBFIs outside the perimeter of banking regulation, and with the recent expansion of the NBFIs sector implying a contraction of the banking sector. In combination with the belief that regulation post the Great Financial Crisis (GFC) significantly strengthened the banking system, this view implies that regulators must now focus on systemic risks emanating from NBFIs. We argue instead that the bank and NBFIs sectors have interwoven businesses and risks, arising from their endogenous evolution in response to changing economic, financial, and regulatory environments. Therefore, bank risks are better described as having transformed rather than as having migrated to NBFIs. From this alternative perspective, systemic risk regulation must consider the two sectors holistically, rather than separately, and must recognize that banks – in their special role as liquidity providers – are effectively responsible for supporting NBFIs intermediation activities through stress conditions. We support our perspective through a variety of data, case studies, and analyses: (i) The Federal Reserve System's new “From Whom to Whom” data show banks and NBFIs finance each other, with NBFIs especially dependent on banks. (ii) Case studies and data show that NBFIs are analogous to bank special purpose vehicles (SPVs) in that banks remain exposed to credit and funding risks that have seemingly migrated to NBFIs, and that such exposure can be on balance-sheet or off balance-sheet via banks’ provision of significant contingent liquidity to NBFIs. (iii) Theoretical work on fire-sale externalities suggests new mechanisms for risk propagation and amplification via bank-NBFIs funding linkages. (iv) Empirical work confirms bank-NBFIs linkages through the co-movement of their abnormal equity returns and market-based measures of systemic risk. The paper concludes with implications for macroprudential regulation.

Keywords: non-bank financial intermediaries, nonbanks, shadow banking, bank regulation, macroprudential regulation, regulatory arbitrage, systemic risk, credit lines, derivatives margins

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## 1. Introduction

Non-bank financial intermediaries (NBFIs) constitute a part of the global financial system that relative to banks is, by and large, lightly regulated. The light-touch regulation of NBFIs implies that they are either not subject to, or are subject to only lower standards (relative to banks) of, capital and liquidity requirements, resolution planning, and supervisory oversight. Often, even if not always, NBFIs are viewed as separate from banks. In particular, traditional approaches to financial sector regulation view banks and NBFIs as *substitutes*, one inside and the other outside the perimeter of banking regulation, with the growth of one implying the shrinking of the other. Figures 1a-1b seemingly provide support for this substitution view.

**Figure 1a (Source: Financial Stability Board [FSB], 2022)**

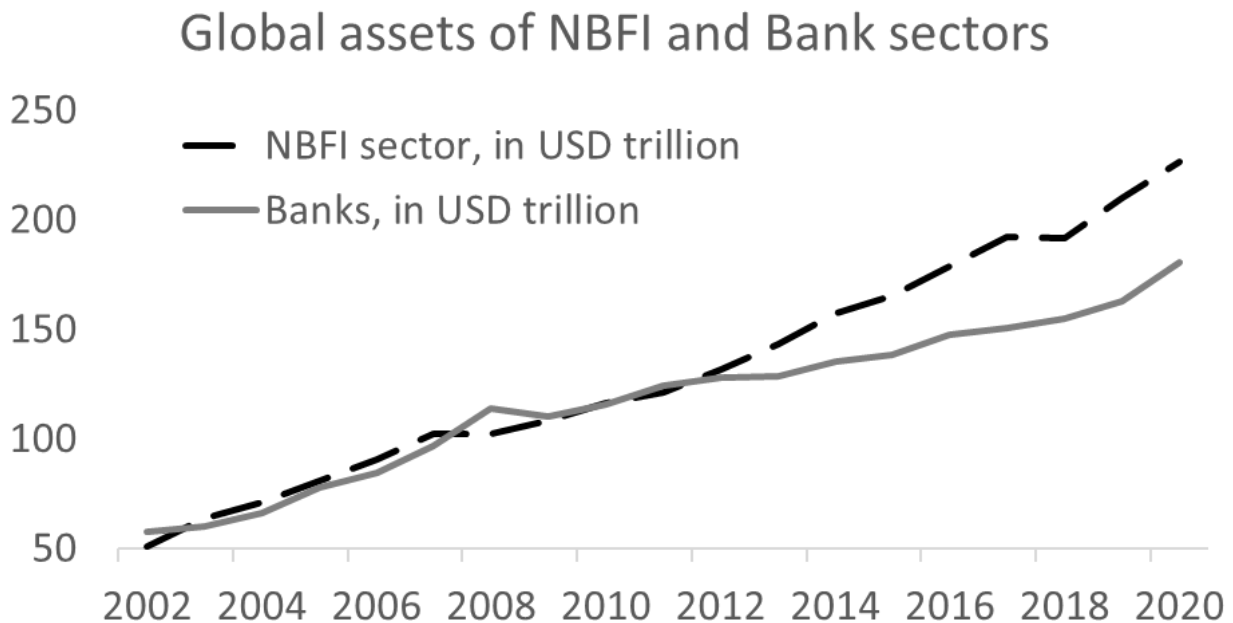
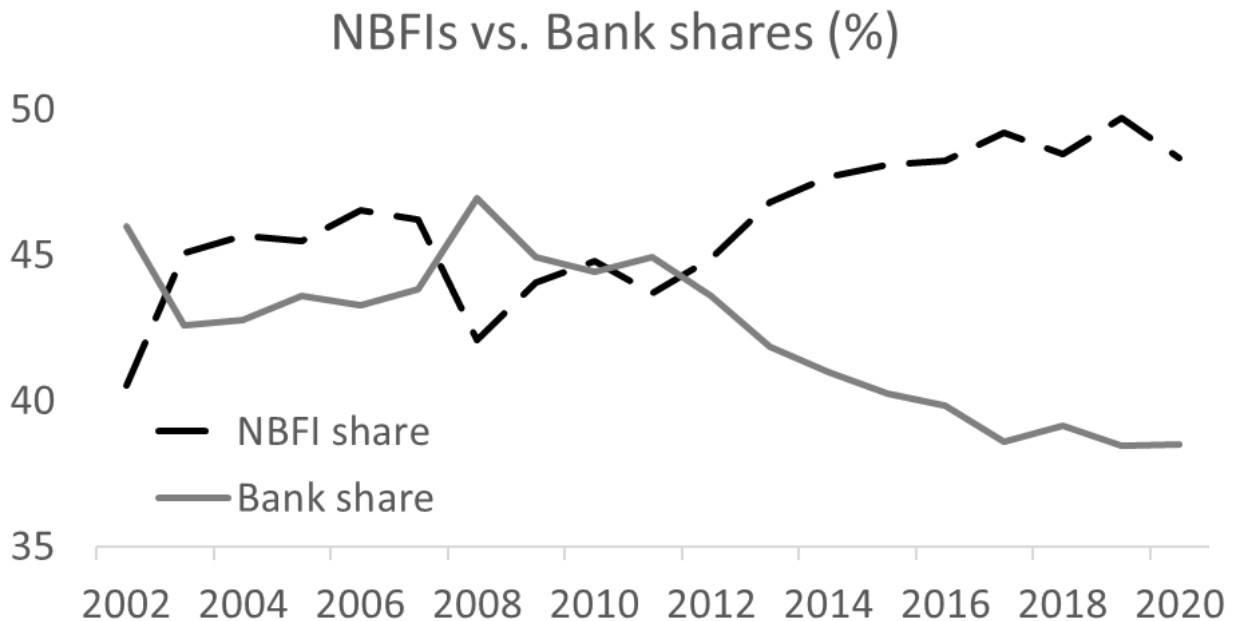


Figure 1a shows that in 2020, NBFIs held over \$200 trillion of assets under management; in other words, they are now a sizable part of the financial sector. Importantly, Figure 1a shows also that since the Global Financial Crisis (GFC), NBFIs globally have experienced steady growth in assets held whereas the banking system's asset growth has decelerated (notably since 2012). Not only have NBFIs outpaced banks in terms of assets held but the gap between the two is widening.<sup>3</sup> Figure 1b shows (also on a global scale) that the NBFIs' share of assets has risen from a pre-GFC level of 45% to around 50% by 2020, with that of banks declining and dropping

<sup>3</sup> In the case of United States, for example, the post-GFC bank reforms, in particular, the requirement on the largest banks to provide living wills under the Dodd-Frank Act, has caused certain intermediation activities to migrate out of the bank holding company structures (Cetorelli and Prazad, 2023).

below 40%. These facts suggest to many that NBFIs have emerged as the dominating financial intermediaries of the global economy.

**Figure 1b. Global asset share of NBFIs and Banks (Source: FSB, 2022)**



We believe that the view that banks and NBFIs are substitutes and the implication that the focus of financial sector regulation should now *shift* from banks to NBFIs are both misplaced. We argue instead that banks and NBFIs are better described as intimately interconnected and evolving endogenously to business, financial and regulatory environments, with their risks intersecting in a complex manner.<sup>4</sup> As a corollary, any discussion about monitoring and regulation of NBFIs should explicitly acknowledge and take into consideration the blurred boundaries between banks and NBFIs.

As the origin of NBFIs – more often than not – is catalyzed by banking sector regulation, our alternative perspective can be succinctly summarized and understood as an application of Goodhart’s Law (Goodhart, 1975) to the regulatory perimeter of the financial sector:

*As the banking perimeter is used for “control” (regulatory) purposes, but activity around the perimeter can be “manipulated” (via regulatory arbitrage) by banks and NBFIs, the regulatory perimeter inexorably ceases to be useful for control purposes.*

<sup>4</sup> While we do not focus much in this piece on the “financial” environment, recent work suggests that secular decline in interest rates might have played an important role in the shift of assets from banks to NBFIs (see, e.g., Sarto and Wang, 2023). For theory that attributes this to search-for-yield by intermediaries in an environment of high real savings, leading to the growth of non-monitoring banks (which can be interpreted as NBFIs) and in turn to a rise in financial fragility, see Martinez-Miera and Repullo (2017).

A particularly narrow interpretation of this principle is that the use of a regulatory perimeter for control purposes induces a shift of activities from banks to NBFIs. This is essentially the substitution view.

A more nuanced interpretation of the principle is that regulation should not limit itself to looking within the perimeter but must remain cognizant and vigilant of risks building outside. This is essentially the view that regulation of the financial sector should be by function rather than form or the institutional context, as in the “congruence principle” put forward by Metrick and Tarullo (2022) of regulating financial instruments uniformly across banks and NBFIs.

We posit and establish a much broader interpretation: if the motive to shift activities outside of the banking perimeter is primarily to avoid regulatory compliance and costs, then banks, while allowing certain intermediation activities to (seemingly) migrate to NBFIs, will – and in practice do – remain intimately and intricately intertwined with NBFIs. This is at least in part because banks retain an inherent liquidity advantage due to access to retail and corporate deposits as well as to the safety net, the latter being explicit in the form of deposit insurance and the central bank’s lender of last resort (LOLR) financing. Put another way, the evolution of the bank-NBFI relationship is best understood, not as a “migration of risks,” but instead as a “transformation of risks” of the banking system. Figure 2 illustrates this key point via such transformations of three risks (credit risk, funding risk, and derivatives risk), all of which imply that banks either buy assets or asset-backed securities originated by NBFIs, or more typically, banks fund NBFIs, either on-balance-sheet or off-balance-sheet (in a state-contingent manner):

**Figure 2. Formation of Bank-NBFI linkages: A Conceptual Framework**

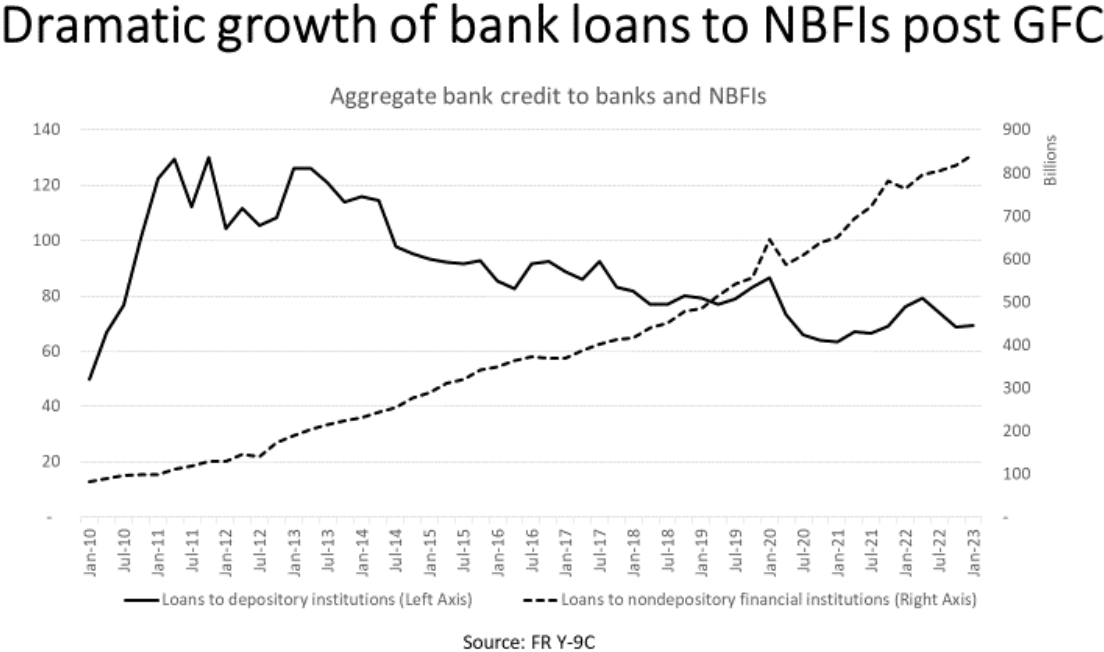
### The Transformation of Risks Across Banks and NBFIs

Type of Risk	Transformation	Risks Historically Within the Banking System...	Transformed to Risks Spread Across Banks and NBFIs
Credit	Loans made and held by banks => bank financing of and investment in NBFIs and their products	<ul style="list-style-type: none"> <li>• Corporate Loans</li> <li>• Mortgage Loans</li> </ul>	<ul style="list-style-type: none"> <li>• Bank holdings of MBS, CLO tranches</li> <li>• Bank loans to private credit companies</li> <li>• Bank loans to mortgage REITs</li> </ul>
Funding	Bank loan origination and servicing => funding of NBFI loan origination and servicing	<ul style="list-style-type: none"> <li>• Mortgage/other ABS origination</li> <li>• LBO Financing</li> <li>• Mortgage servicing obligations</li> </ul>	<ul style="list-style-type: none"> <li>• Bank warehouse credit lines to nonbank originators</li> <li>• Bank loans to private equity companies</li> <li>• Bank-sponsored CP or direct lending to nonbank mortgage servicers</li> </ul>
Derivatives	Bank counterparty risk from derivatives with NBFIs => bank financing of NBFI derivatives margin requirements	<ul style="list-style-type: none"> <li>• Bilateral derivatives with NBFIs</li> </ul>	<ul style="list-style-type: none"> <li>• Bank loans and credit lines to NBFIs to fund initial margin and variation margin calls on cleared derivatives</li> </ul>

(i) *Credit risk*: Traditionally, banks retained direct exposure to corporate and mortgage loans. Of late, however, large volumes of these loans are no longer directly on bank balance sheets. Nevertheless, banks retain indirect loan exposures via holdings of mortgage-backed securities (MBS) and collateralized loan obligations (CLOs), or via loans to private credit (or financing) companies and mortgage Real Estate Investment Trusts (m-REITs). Credit risks of underlying loans seem to leave the banking system, but are partially retained by banks via such holdings and loans to NBFIs.

(ii) *Funding risk*: The origination and loan-servicing activities in mortgages, asset-backed securities and leveraged buyouts, which earlier used to be bank-dominated, are now dominated by NBFIs. However, these activities also remain heavily dependent on banks for direct loans, warehouse financing, credit lines, and bank-sponsored (or credit-enhanced) commercial paper.<sup>5</sup>

**Figure 3a. Bank credit to NBFIs has surged post GFC**



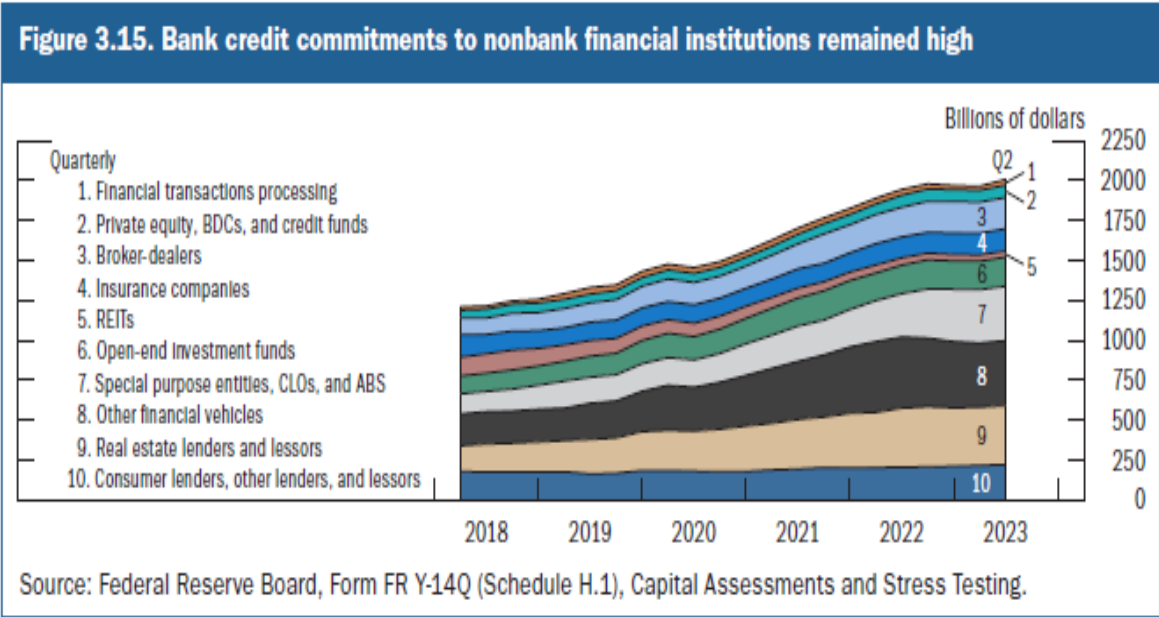
An aggregate consequence for the United States of these two transformations, viz., of credit risk and funding risk, can be seen clearly in Figure 3a: bank credit to NBFIs has risen over time, whereas that to depository institutions (as a financial sector benchmark) has fallen.<sup>6</sup>

<sup>5</sup> For bank financing of mortgage originators, servicers and securitizers, see respectively Jiang (2023), Kim et al. (2018), and Kim et al. (2022). For a description of how post-GFC banking regulation and supervision have induced firms, especially junk-rated, to increasingly borrow directly from NBFIs, see Chernenko, Erel and Prilmeier (2019).

<sup>6</sup> As a concrete example, Figure A1 in the Appendix from FDIC (2019) shows the declining bank share of the US leveraged loan market (loans to junk-rated, often privately held, borrowers), noting: “But some banks still have direct exposure to revolving credit facilities that are often part of a leveraged loan deal and additional indirect exposure to institutional leveraged loans. This exposure includes (1) pro rata leveraged loans, (2) warehouse lines of

(iii) *Derivatives risk*: Given their funding advantage from deposits and access to official backstops, banks also perform a key function of liquidity insurance for NBFIs too. One relatively unheralded example along these lines is that the post-GFC mandate to clear most derivatives has transformed bank exposure to counterparty risk from NBFIs derivatives contracts into liquidity risk from providing NBFIs with loans and credit lines to meet their contingent liquidity needs from initial and variation margin requirements.<sup>7</sup> More broadly, Figure 3b from Federal Reserve’s Form FR Y-14Q (Schedule H.1) shows that bank credit line commitments to almost every variety of NBFIs has grown sharply during 2018-2023.

**Figure 3b. Bank credit commitments to the full range of NBFIs (2018-2023) has also surged (Source: FSR (2023), Page 35, Figure 3.15)**



In this way, NBFIs are analogous to bank special-purpose vehicles (SPVs) set up for regulatory arbitrage in that risks that historically stayed within the banking system, viz., credit risk, funding risk, and derivatives risk, seem to move but do not completely leave the banking system. Building on this observation that bank risks have transformed rather than moved to NBFIs, we gather evidence from a rich variety of data sources and case studies to characterize

*credit used for collateralized loan obligations, and (3) subscription finance loans. Bank exposure to risk from nonbanks that participate in leveraged lending is opaque, and the nature and size of the risk is obscured.”*

<sup>7</sup> Not only are the initial margin positions increasingly large (Figure A3), the revisions in initial margins under stress are also substantial, e.g., at the onset of the COVID-19 pandemic in Q1 2020 in equity, interest-rate and commodity future markets (Figure A4). The revisions amplified the “dash for cash” on bank credit lines in March 2020 (Kashyap, 2020, Acharya, Gopal, Jager and Steffen, 2023), including from NBFIs as we document in Section 3.

the interwoven businesses and risks of the bank and NBFIs sectors. In Section 2 we establish, using the new version of the Federal Reserve System’s U.S. Flow of Funds data called “From Whom To Whom” (or FWTW) introduced in 2023, that bank and (individual) NBFIs sectors are significantly interconnected on the liability side as they rely on each other for funding, with NBFIs increasingly dependent on banks. To the best of our knowledge, this interdependence is not known or fully appreciated in the academic literature.

Next, in Section 3 we lay out in detail the transformation of risks of the banking system when intermediation activity shifts from banks to NBFIs, as explained in Figure 2. First, we explain how in case of many NBFIs, notably in private credit markets and mortgage origination and servicing, credit risks seemingly move off bank balance-sheets to NBFIs, but banks actually retain some of those risks that will result in losses in stress scenarios. Next, we point out that banks have an inherent advantage in providing liquidity insurance to backstop NBFIs funding risks and illustrate the implications of that observation with two recent examples. One, banks provide committed lines of credit to NBFIs that operate with funding rollover risk and these risks can materialize during times of stress, as was the case for REITs during the March 2020 “dash for cash.” Two, banks provide contingent liquidity to NBFIs to meet derivatives margin obligations, as was the case for UK pension funds and European electricity producers in 2022.

To summarize, NBFIs growth does not happen in a vacuum outside the banking regulatory perimeter, but is in fact in large part facilitated by banks, themselves engaged in optimizing business activities at the regulatory perimeter. Hence, what shifts fundamentally with the evolution of regulatory perimeter and the extent of (private) regulatory cost perceived by intermediaries is the interflow of risks between banks and NBFIs; changes in the activities themselves are often or at best superficial. It is, therefore, easy to fall into the trap of considering bank and non-bank activities separately, rather than viewing them jointly and recognizing both their asset commonality and their funding- or liability-side linkages.<sup>8</sup> Conversely, recognizing the linkages between banks and NBFIs leads to novel insights on risk propagation between the two.

In Section 4, we start with how commonalities in business models between banks and NBFIs in intermediating for the real economy lead to channels of risk propagation with potential systemic consequences (e.g., fire-sale externalities). We then sketch how the liability-side linkages we characterize add indirect channels of risk propagation (specifically, once banks are affected by NBFIs via fire-sales, banks pull back on lending and credit-line extension to NBFIs, amplifying stress further), and explain why existing approaches that seek to quantify such externalities need to be enriched to factor in this amplification mechanism. We then provide in Section 5 quantitative analysis confirming that linkages between banks and NBFIs are indeed reflected in the co-movement of their abnormal equity returns and market-based measures of

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<sup>8</sup> Note that when we use the term “liability-side linkages” between banks and NBFIs, what we have in mind is simply that the two sets of intermediaries fund each other. It will be clear from the context of course that funding by a bank of an NBFIs is a liability of the NBFIs and an asset of the bank, and vice-versa when an NBFIs funds the bank instead, or that a state-contingent funding promise such as a credit line is an off-balance-sheet liability of the bank.

systemic risk (employing as an example NYU Stern’s *SRISK*<sup>9</sup> measure of expected capital shortfall for banks and NBFIs under aggregate stress).

We believe that this set of observations is novel to the literature and has rather deep implications for macroprudential regulation.<sup>10</sup> We conclude in Section 6 by drawing out these implications. We first rationalize the observed extension of central bank LOLR (and other official backstops) to NBFIs, given our perspective that they are intimately tied to the banking system; for instance, during the GFC and at the onset of COVID-19 pandemic, a range of NBFIs were granted access to such backstops, directly or indirectly via banks. We then derive implications for the ex-ante macroprudential regulation of NBFIs to limit the need for such extension, primarily to suggest better monitoring of bank-NBFI funding linkages, ex-ante pricing of NBFI access to LOLR, ex-post supervision of NBFIs that access LOLR, and broadly, an integrated approach to managing risks across the bank and NBFI sectors.

To elaborate, our perspective on bank-NBFI linkages calls for an integrated approach to monitoring their linkages and factoring them into assessments of the systemic risk of the financial sector as a whole. While a migration of risks outside of the banking system may seem desirable, perhaps even necessary, as a step towards de-risking of the banking system, direct or indirect risk retention by the banking system of migrated risks partially annuls any such de-risking. Furthermore, given that the migration of risks is typically toward entities subject to weaker capital and liquidity requirements, namely NBFIs, our holistic viewpoint may well reveal the financial system as a whole as financially more fragile than a viewpoint that separates banks and NBFIs and ignores their extensive linkages.<sup>11</sup>

As mentioned above, Metrick and Tarullo (2022) – motivated by growing risks in NBFIs – suggest a “congruence principle” of regulating risks, e.g., using haircuts for NBFIs on various transactions to mimic bank capital rules. While eminently sensible, we observe – as they do –

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<sup>9</sup> See Acharya, Engle and Richardson (2012) and [vlab.stern.nyu.edu/srisk](http://vlab.stern.nyu.edu/srisk).

<sup>10</sup> Related theoretical and/or empirical work that features co-existence of banks and NBFIs has focused on contagion via credit risk transfer (Allen and Carletti, 2006), spillovers in the design of capital requirements (Harris, Opp and Opp, 2014) and haircuts for refinancing by NBFIs (Plantin, 2015), split governance rights via variation in covenant tightness between loans held by banks and those held by NBFIs (Mitchell, Nini and Yu, 2020), differential exercise of lender bargaining power by banks and NBFIs based on their access to safety nets (Donaldson, Piacentino and Thakor, 2021), and determination of asset activity shifts between banks and NBFIs based on their capacity to provide balance-sheet financing (Buchak et al., 2022). To the best of our knowledge, however, this literature has not focused on bank-NBFI liability-side linkages.

<sup>11</sup> Historically too, there is ample support for this view (see, e.g., Pozsar et al., 2010, and Acharya, Schnabl and Saurez, 2013). In particular, innovation – and changes in laws and regulations – that took place in the 1990s enhanced asset securitization, and the mode of intermediation shifted from one centered on banks taking deposits and issuing (and holding to maturity) loans, to one where loans could be packaged into securities and sold to investors. With this shift, several non-bank activities grew in importance, providing specialized services in support of the securitization process (specialty lenders, dealers, asset managers, insurers, among others). However, banks did not remain passive observers but rather adapted, transforming their business scope and increasingly incorporating under their organizational umbrella those nonbank types (Cetorelli, Mandel and Mollineaux, 2012), ripping synergistic benefits from it (Cetorelli, Jacobides and Stern, 2021). And in addition to transforming their scope, banks also played a crucial role in supporting the growth of nonbanks (Mandel, Morgan and Wei, 2012).



that the complex and multi-dimensional nature of bank regulation makes such congruence difficult to achieve. More fundamentally, however, our analysis emphasizes that regulators must also focus on the linkages between banks and NBFIs, including the extent to which traditional measures of bank risk capture direct and indirect exposures to NBFIs and the extent to which NBFIs' intermediation activity through periods of stress is dependent on the banking system. It would be interesting in future work to examine how the (inevitable) gaps in application of the congruence principle interact with transformations of bank risks and bank-NBFI linkages, and how macroprudential regulation can be designed to remain robust to such transformations.

## 2. Funding Interconnections across Banks and NBFIs

As shown in Figures 1a-1b, NBFIs have increased their share of total financial assets in the global economy since the end of the financial crisis, and conversely, banks have followed a declining trend. A possible reading of this stylized fact is that nonbanks have been expanding their role as financial intermediaries, supplanting banks along the way. This view would suggest that banks and nonbanks are *substitutes*, and that the trends in Figures 1a-1b are a result of nonbanks having a competitive edge over banks (due to, e.g., technological innovation or lower regulatory costs) in the activities or assets where NBFI share has grown.

An alternative view is that banks and nonbanks operate in a more symbiotic relationship with activities or assets shifting to NBFIs, but with banks ultimately providing financing to NBFIs for these risks in an outright or in a contingent manner. The declining share of banks in terms of total financial assets then does not necessarily imply their shrinkage. Instead, it suggests a potential *transformation* of banks' role, from being direct providers of intermediation services to firms and households, to one of being financiers of intermediation activity by nonbanks.<sup>12</sup> This *complementarity* is likely driven by banks' special access to funds and liquidity, given their access to deposit savings (Kashyap, Rajan and Stein, 2002) and being seen as safe havens during stress given their exclusive access to official backstops such as deposit insurance and lender of last resort (Gatev and Strahan, 2006). Banks remain a natural repository of funds from firms and households, and correspondingly they are an important *source* of funds and liquidity to NBFIs. This dual intermediary role seems unique to banks: there are other institutions – among NBFIs – that are a natural repository of funds from the real sector (e.g., money market mutual funds, open-end funds, insurers, etc.); however, and different from banks, they do *not* represent any meaningful source of credit and liquidity to any other NBFIs.

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<sup>12</sup> Similar dynamics have been observed historically. For example, banks were already experiencing a diminishing trend in balance sheet activity in the 1990s, at the same time that money market funds, insurers, broker-dealers and other nonbank segments were growing. This trend was documented in Boyd and Gertler (1995) who argued and provided evidence indicating that banks' role as intermediaries was not diminishing, but rather banks were in the process of shifting away from lending and interest income into off-balance-sheet fee-based activities.

We provide support for this alternative conjecture by analyzing the asset-liability interconnections among banks, NBFIs, and the real sector of the economy, using a new version of the Financial Accounts of the United States (Flow of Funds), introduced in the Spring of 2023. While the traditional version quantifies the aggregate asset and the liability positions of each sector operating in the United States, and divides those aggregates by product, the new version – FWTW (From Whom To Whom) – breaks down each sector’s assets and liabilities into pairwise position vis-a-vis all other sectors. For example, while the traditional database provides the liabilities of banks by product (e.g., deposits, repurchase agreements, etc), the new FWTW database details how much of those liabilities and how much of each product issued by the banking sector are held by Life Insurers, Finance Companies, the Real Sector, etc. In other words, the FWTW data quantify the entire bilateral matrix of asset-liability interconnections.

**Figure 4a: Matrix of asset/liability interdependence (Figures are in \$ Trillions. Source: Flow of Funds, From Whom To Whom)**

2023q1 ISSUERS	HOLDERS															TOTAL
	ABS	Banks	B/Ds	eREITs	FCs	GSEs	Life Ins.	MMMFs	mREITs	MFs	OFB	PC Ins.	PFs	Real	RoW	
ABS	-	0.143	0.004	0.000	0.001	0.011	0.573	0.045	0.000	0.039	0.068	0.116	0.027	0.045	0.375	1.45
Banks	-	3.127	0.685	0.043	0.056	1.096	0.555	0.429	0.021	0.232	0.247	0.143	0.301	18.800	4.425	30.16
Broker/Dealers	0.000	1.370	1.285	(0.008)	(0.004)	0.112	0.009	0.459	(0.002)	0.030	0.003	0.003	(0.038)	0.571	1.587	5.38
Equity REITs	0.029	0.224	(0.000)	0.009	0.005	0.012	0.130	0.000	0.015	0.061	0.002	0.024	0.062	0.169	0.160	0.90
Finance Companies	-	0.196	0.000	0.003	0.005	0.002	0.153	0.006	0.001	0.099	0.018	0.035	0.086	0.289	0.445	1.34
GSE and Agency	-	3.209	0.102	0.001	0.001	0.234	0.276	0.791	0.171	0.543	0.000	0.135	0.408	1.892	1.361	9.12
Life Ins.	0.178	0.328	0.008	0.007	0.004	0.145	0.519	0.009	0.002	0.010	0.000	0.023	1.006	6.708	0.206	9.15
MMF	-	-	-	-	-	-	0.077	-	-	0.237	0.435	0.042	0.288	4.385	0.200	5.66
Mortgage REITs	-	0.044	0.066	0.001	0.001	0.014	0.042	0.052	0.000	0.029	0.001	0.010	0.024	0.038	0.199	0.52
Mutual Funds	-	0.014	-	-	-	-	1.471	-	-	-	-	0.031	4.868	10.700	1.052	18.14
Other Fin. Bus.	-	0.049	0.878	0.005	0.003	0.004	0.027	0.019	0.002	0.011	0.107	0.006	0.068	0.399	0.037	1.62
PC Ins.	0.001	0.035	(0.001)	0.005	0.003	0.008	0.027	0.001	0.002	0.007	0.000	0.200	0.061	1.876	0.326	2.55
Pensions	-	-	-	-	-	-	-	-	-	-	-	-	-	27.100	-	27.10
Real	1.275	16.200	0.679	0.256	1.197	10.500	3.477	1.214	0.333	3.365	0.186	1.214	12.400	43.400	22.100	117.80
Rest of World	0.001	3.799	0.520	0.007	0.466	0.098	1.156	0.438	0.004	0.928	0.233	0.570	0.670	8.257	-	17.15

Figure 4a below shows such a matrix of asset and liability interconnections as captured in 2023q1. In the matrix, the sectors are reported both as *Issuers*, in which case the numbers represent their liabilities, and as  *Holders*, in which case the numbers represent their assets. The issuing sectors are depicted in each row, and the holders in each column. For the purpose of our study, and for convenience, some sectors have been aggregated. For instance, in the matrix below, “Banks” is the sum of “holding companies” (the unconsolidated balances of top tier bank/financial holding companies) and all “private depository institutions” (U.S.-chartered depository institutions, foreign banking offices operating in the U.S., banks in U.S.-affiliated areas, and credit unions). The sector “Real” sums the balances of households, government and non-financial corporations. The NBFIs space is retained at the sub-sector level of ABS issuers, Broker-Dealers, Money Market Mutual Funds, Mutual Funds, Equity and Mortgage REITs,

Finance Companies, GSEs (government sponsored enterprises) and Agencies, Life and Property and Casualty Insurers, and Pension Funds. Also for convenience, we aggregate across all financial liability instruments issued by each sector. To illustrate how to read the matrix, take for instance the sector Banks. The row total (the rightmost column) indicates aggregate liabilities issued by banking institutions of about \$30.2 trillion. Not surprisingly, the largest holder of banks' issued liabilities is the Real sector, holding \$18.8 trillion, and the Rest of the World, with about \$4.4 trillion. The remaining liabilities are held in different proportions within the banking sector itself (\$3.1 trillion) and by NBFIs.

Figure 4b and 4c below show the same matrix of asset-liability interconnections, with the numbers calculated as shares, respectively, of each issuing sector's total liabilities, and each holding sector's assets. Starting with Figure 4b, the matrix shows the perspective from the issuers' side. We call this the "Matrix of Dependence", as it portrays the extent to which a sector "depends" on any other sector as a source of its funding liabilities. Looking at the *Banks* row, the matrix shows (as already observed above) that the banking sector is highly dependent on the real sector (62% of the total), and the Rest of the World (15%). Excluding the within-sector dependence of banks on banks (10%), the aggregate dependence of the banking sector on NBFIs is non-negligible at 13% (representing commercial paper and deposits from money market funds, bonds from insurance companies, pension funds and mutual funds, repos with broker-dealers, among others) and also non-negligible in an absolute dollar sense; however, no individual NBFIs sub-sector represents a dominating source of bank financing. In contrast, if one looks at the rows displaying NBFIs issuers, across the broad individual NBFIs sub-sectors are highly dependent on Banks (as displayed by the Banks column in Figure 4b). As the entries in the column indicate, Banks represent meaningful proportions of many of the individual NBFIs sub-sector's total liabilities (e.g., Broker-Dealers depend on banks for 25% of their aggregate liabilities, Equity REITs 25%, ABS issuers 10%, Finance Companies 15% and GSEs 35%). While fragility arising from bank financing dependence on NBFIs is well-recognized (see, for example, the evidence in Forbes, Friedrich and Reinhardt, 2023, for the COVID shock), that due to – an even greater – NBFIs dependence on banks is surprisingly not as well-appreciated and mostly not studied.

Figure 4c presents the complementary perspective from the holder's side, whereby the figures are calculated as percentages of each sector's total holdings. We call this the "Matrix of Exposures", as it portrays the extent to which a sector is exposed to another by virtue of holding the latter's liabilities. As the matrix indicates, there is a form of asymmetry from the exposure side as well: banks may not highly depend on NBFIs as a share of their own total issuance, but those dollar amounts are nevertheless important shares from the NBFIs sectors' aggregate holdings. For instance, as shown in the Banks' row of Figure 4c, the banking sector's liabilities represent 16% of broker-dealers' total holdings and 13% of those of Equity REITs. On the other hand, as illustrated in the Banks' column, with the exception of GSEs and Agencies, none of the NBFIs sectors' liabilities represent meaningful shares of the banking sector's total holdings. (Of

course, and as for the matrix of dependence in Figure 4b, the *aggregate* exposure of banks to all NBFIs sectors is non-negligible, totalling about 20% of banks' holdings.)

**Figure 4b: NBFIs depend more on banks (Source: Flow of Funds, From Whom To Whom)**

MATRIX OF DEPENDENCE																
ISSUERS	HOLDERS															TOTAL
	ABS	Banks	B/Ds	eREITs	FCs	GSEs	Life Ins.	MMMFs	mREITs	MFs	OFB.	PC Ins.	PFs	Real	RoW	
ABS	0	10	0	0	0	1	40	3	0	3	5	8	2	3	26	100
Banks	0	10	2	0	0	4	2	1	0	1	1	0	1	62	15	100
Broker/Dealers	0	25	24	0	0	2	0	9	0	1	0	0	-1	11	30	100
Equity REITs	3	25	0	1	1	1	14	0	2	7	0	3	7	19	18	100
Finance Companies	0	15	0	0	0	0	11	0	0	7	1	3	6	22	33	100
GSE and Agency	0	35	1	0	0	3	3	9	2	6	0	1	4	21	15	100
Life Ins.	2	4	0	0	0	2	6	0	0	0	0	0	11	73	2	100
MMF	0	0	0	0	0	0	1	0	0	4	8	1	5	77	4	100
Mortgage REITs	0	8	13	0	0	3	8	10	0	6	0	2	5	7	38	100
Mutual Funds	0	0	0	0	0	0	8	0	0	0	0	0	27	59	6	100
Other Fin. Bus.	0	3	54	0	0	0	2	1	0	1	7	0	4	25	2	100
PC Ins.	0	1	0	0	0	0	1	0	0	0	0	8	2	74	13	100
Pensions	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
Real Sector	1	14	1	0	1	9	3	1	0	3	0	1	11	37	19	100
Rest of World	0	22	3	0	3	1	7	3	0	5	1	3	4	48	0	100

The figures represent (in %) the composition of liabilities for each segment issuer (on each row), by each corresponding holder (on each column).

**Figure 4c: NBFIs are more exposed to banks (Source: From Whom To Whom)**

MATRIX OF EXPOSURES																
ISSUERS	HOLDERS															TOTAL
	ABS	Banks	B/Ds	eREITs	FCs	GSEs	Life Ins.	MMMFs	mREITs	MFs	her Fin. B	PC Ins.	PFs	Real	RoW	
ABS	0	0	0	0	0	0	7	1	0	1	5	5	0	0	1	
Banks	0	11	16	13	3	9	7	12	4	4	19	6	1	15	14	
Broker/Dealers	0	5	30	-2	0	1	0	13	0	1	0	0	0	0	5	
Equity REITs	2	1	0	3	0	0	2	0	3	1	0	1	0	0	0	
Finance Companies	0	1	0	1	0	0	2	0	0	2	1	1	0	0	1	
GSE and Agency	0	11	2	0	0	2	3	23	31	10	0	5	2	2	4	
Life Ins.	12	1	0	2	0	1	6	0	0	0	0	1	5	5	1	
MMF	0	0	0	0	0	0	1	0	0	4	33	2	1	4	1	
Mortgage REITs	0	0	2	0	0	0	0	2	0	1	0	0	0	0	1	
Mutual Funds	0	0	0	0	0	0	17	0	0	0	0	1	24	9	3	
Other Fin. Bus.	0	0	21	2	0	0	0	1	0	0	8	0	0	0	0	
PC Ins.	0	0	0	2	0	0	0	0	0	0	8	0	0	2	1	
Pensions	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	
Real	86	56	16	78	69	86	41	35	61	60	14	48	61	35	68	
Rest of World	0	13	12	2	27	1	14	13	1	17	18	22	3	7	0	
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

The figures represent (as %) the composition of holdings of each segment (in each column) by each corresponding issuer (on each row).

We find in unreported results that the information extracted from the matrix of data in 2023q1 represents a reasonably robust pattern of interconnections observable over the longer time-series. Figure 4d reports the averages over the twenty-year time-series of these forms of dependence and exposures. Again, the matrix unveils an important *asymmetry* in terms of funding dependence, with a large cross section of NBFIs sectors much more dependent on banks, and with banks not as dependent on any individual NBFIs sector (although, we reiterate, with a meaningful *aggregate* dependence from this segment of the financial ecosystem).

**Figure 4d: Summary of Bank-NBFI Dependence and Exposures (Source: Flow of Funds, From Whom To Whom)**

Issuer	Holder	Average	Average	Issuer	Holder	Average	Average
		Issuer	Holder			Issuer	Holder
		Share	Share			Share	Share
Banks	ABS	0%	0%	ABS	Banks	10%	1%
	Banks	12%	12%	Banks	Banks	12%	12%
	Broker/Dealers	3%	15%	Broker/Dealers	Banks	23%	5%
	Equity REITs	0%	24%	Equity REITs	Banks	33%	1%
	Finance Companies	1%	6%	Finance Companies	Banks	19%	2%
	GSE and Agency	4%	9%	GSE and Agency	Banks	29%	11%
	Life Ins.	2%	6%	Life Ins.	Banks	3%	1%
	MMF	3%	18%	MMF	Banks	0%	0%
	Mortgage REITs	0%	3%	Mortgage REITs	Banks	11%	0%
	Mutual Funds	1%	4%	Mutual Funds	Banks	0%	0%
	Other Fin. Bus.	1%	23%	Other Fin. Bus.	Banks	0%	0%
	PC Ins.	0%	5%	PC Ins.	Banks	1%	0%
	Pensions	1%	2%	Pensions	Banks	0%	0%
	Real	57%	14%	Real	Banks	15%	54%
	Rest of World	15%	17%	Rest of World	Banks	21%	13%

Overall, Figures 4a-4d provide descriptive initial support for the alternative view expressed above that banks play a relatively unique, dual role as financial intermediaries: banks are strongly dependent on firms and households for their own funding (or viewed conversely, are a repository of firms' and households' savings), *and are themselves significant* providers of funding to NBFIs. Importantly, those intermediary sectors that are equally dependent for funding on the real sector (Money Market Funds, Mutual Funds, Pension Funds and Insurers), are not natural funding sources for other NBFIs as a whole or for any other individual NBFI type. Moreover, the combination of the two matrices – the matrix of dependence and the matrix of exposures – paints interesting patterns of symbiotic relationship between banks and nonbanks, and suggests specific channels of risk propagation, a theme we will develop later.

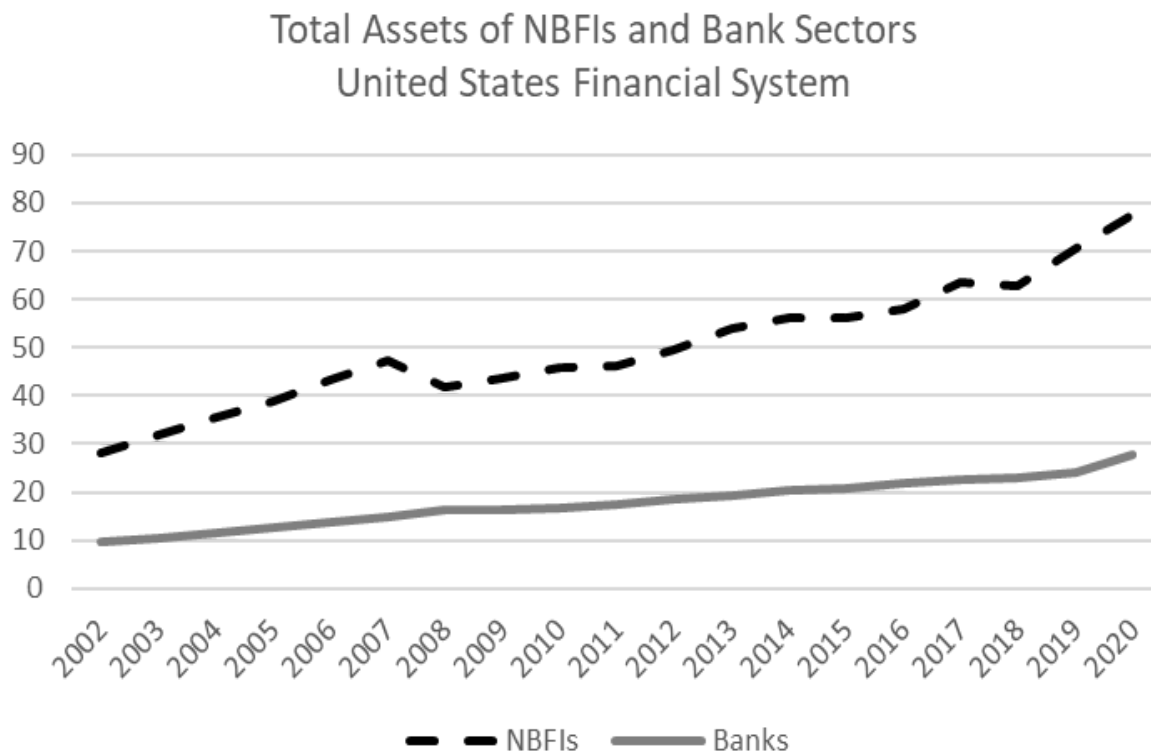
The patterns that emerge from the U.S. data, in particular the significant funding dependence of many NBFI sectors on banks, is especially telling if one takes into account the historical trends in terms of NBFIs' and banks' growth: as we saw in Figure 1a and 1b, at the

global level, the growth and increasing dominance of NBFIs is a relatively recent (post-GFC) phenomenon. For the United States, a system historically less bank-based than the rest of the world, NBFIs instead have been the dominating sector since much earlier.

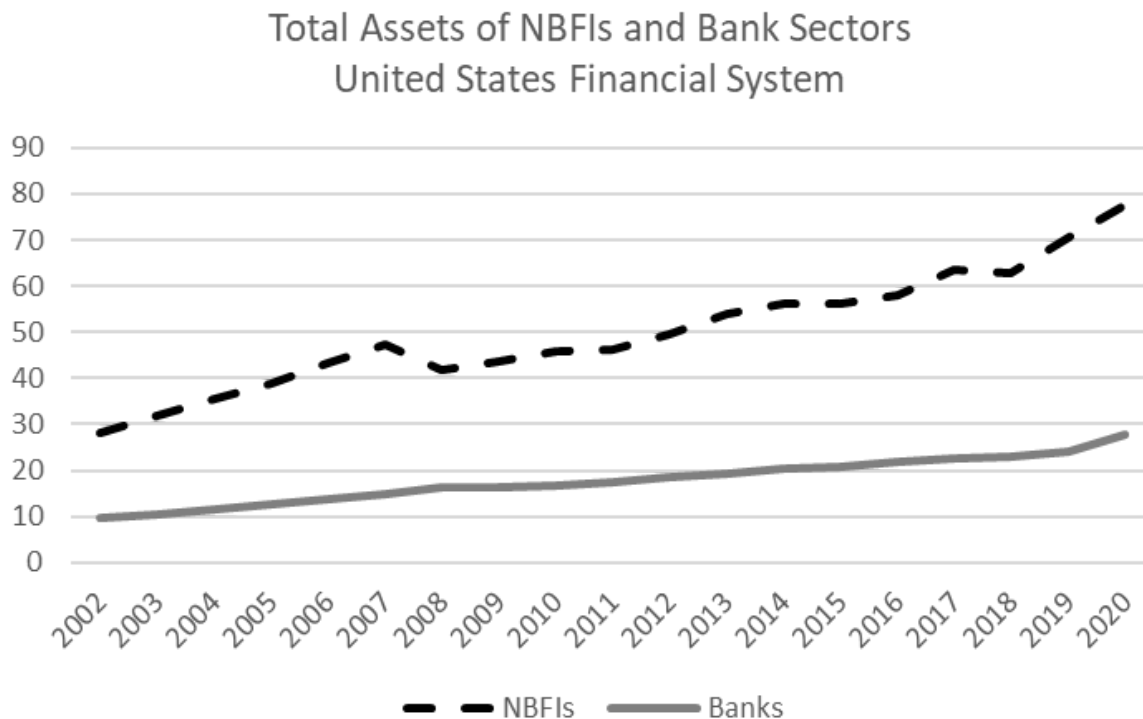
Figures 5a and 5b are the equivalent of Figures 1a and 1b, but depicting the NBFIs’ and banks’ asset size trends just for the U.S. The time-series evolution for the two segments is roughly the same as the one for the global system, but in terms of scale, NBFIs together represent a much higher share of total U.S. financial assets than banks (averaging around 60-65 percent) throughout the entire time period starting in 2002. Note, however, that the GFC led to a decline in the NBFIs share due to the risks of asset-backed commercial paper conduits and special investment vehicles (SIVs) reverting to bank balance-sheets, with the share picking up steadily thereafter (likely due to the growth of private credit, which we turn to in Section 3).

Overall, the funding dependence of many U.S. NBFIs sectors on the U.S. banks corroborates our conjecture of their conjoined evolution and a much more central role for banks than their asset size (or growth trend) relative to NBFIs would suggest.

**Figure 5a (Source: Financial Stability Board, 2022)**



**Figure 5b (Source: Financial Stability Board, 2022)**



Before proceeding, two points are in order. First, as mentioned above, FWTW data also include details on the composition of holdings by financial instrument. For instance, Figure A2 in the Appendix shows the composition of banks’ holdings of NBFIs’ liabilities (again as of 2023Q1). It illustrates that the overarching funding by banks of NBFIs is via credit instruments (federal funds, repos and bonds) with the notable exception of GSEs and mutual funds where it is in the form of Agency- and GSE-backed securities, and mutual fund shares, respectively. In principle, time-series evolution in the composition of these holdings can shed further light on the transformation of risks from banks to NBFIs. Second, FWTW data for “banks” include assets and liabilities of both depositories and bank holding companies or BHCs (the largest non-depository NBFIs inside BHCs being broker-dealers). Using detailed individual BHC-level data, it is possible to adjust FWTW matrices so that “banks” represent only bank depositories and broker-dealers inside BHCs are separated and merged with FWTW “broker-dealers” entry. The resulting matrices do not affect our overall inference and are available upon request.

### **3. Transformation of Bank Risks: NBFIs as Special Purpose Vehicles of Banks**

A Special Purpose Vehicle (SPV) is a legal entity that raises funds and purchases assets independently of its sponsor. For example, a commercial bank might sponsor an SPV that sells various tranches of asset-backed securities to raise funds with which to purchase pools of mortgages from the sponsoring bank. Because the SPV is legally remote from its sponsor, the SPV structure, at least in theory, enables the bank to shed the risks of particular assets. In the

example, investors in the asset-backed securities theoretically have recourse only to the pools of mortgages purchased by the SPV; they should theoretically not have recourse to the sponsoring bank. In practice, however, bank sponsors do come to the rescue of their failing SPVs, either to maintain their reputation as sponsors or in performance of certain explicit guarantees to the SPV (Acharya, Schnabl, and Suarez, 2013, and Gorton and Souleles, 2007).

In this paper, we use the term SPV as a metaphor for financial business arrangements through which risks appear to move out of the banking system to NBFIs, while, in reality, those risks remain or can rebound, at least in part, to participating banks. Recognizing these metaphorical SPVs is important, both to judge whether current banking regulation accounts for risks that can rebound to banks in this way and to assess the extent to which these risks might result in authorities either rescuing banks directly or rescuing them indirectly by rescuing the bank-dependent NBFIs. Conversely, ignoring such SPVs is tantamount to overlooking potentially significant sources of bank-NBFI interdependence.

In Section 2, we documented how banks remain exposed to NBFI risks given they are significant providers of funding to NBFIs. We now illustrate further the key point of Figure 2 in the Introduction that a number of bank risks appear to simply get transformed into risks that are spread across banks and NBFIs, with many NBFIs emerging effectively as SPVs of banks.

### **3.a. Private Credit Market as Bank SPV**

The private credit market is a good example of an SPV in the metaphorical sense outlined above. In this market, NBFIs make loans, which are typically secured or relatively senior in the capital structure of borrowers, predominantly medium- and small-sized businesses. Assets under management for private lending are currently between \$1 and \$1.5 trillion and have grown over the last couple of decades to over 30% of the total outstanding of high yield bonds, syndicated senior loans, and private credit.<sup>13</sup> What makes private credit a metaphorical SPV, however, is that banks make loans to private credit asset managers.

A recent set of transactions is particularly illustrative of private credit as an SPV (see Figure 6). PacWest, a regional bank that had been losing deposits in the wake of the regional banking crisis of March 2023, sold \$2.3 billion of loans backed by various accounts receivable to Ares Management, which is one of the largest private fund managers in the world. The purchase of these loans, however, was financed in part by Barclays, i.e., while the loans seemingly left the banking system through their sale from PacWest to Ares, some of the risk of these same loans returned to the banking system through the financing of Ares' purchase by Barclays.<sup>14</sup>

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<sup>13</sup> See Blackstone (2022), Figure A5, and also Gopal and Schnabl (2022) who document that finance companies and FinTech lenders increased lending to small businesses after the GFC, substituting for a reduction in bank lending.

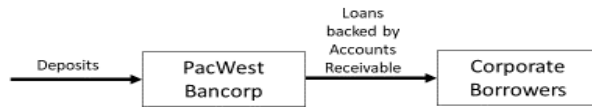
<sup>14</sup> See Lex (2023). The SPV analogy is not perfect for this specific set of transactions because the relevant entity of Barclays is outside of the UK ring-fenced bank.



**Figure 6:**

### Bank Financing of Private Credit Companies

*Previously*



*June 2023: Ares Management bought loan portfolio from PacWest Bancorp, partly financed by Barclays PLC*



The SPV metaphor also captures the challenges of calibrating prudential regulation accurately as risks transform dynamically across banks and NBFIs. For instance, in the context of Figure 6, are capital requirements for loans made by banks directly to nonfinancial corporations (account receivables financed by PacWest) calibrated suitably relative to capital requirements for loans made by banks to a private credit manager holding those loans (Barclays to Ares)?<sup>15</sup> Put another way, it is not at all clear if a stricter regulation of either banks or NBFIs – without addressing risk transformations across these sectors – necessarily reduces risks in the financial system at large.

### 3.b. Mortgage Origination and Servicing as Bank SPV

Mortgage origination and servicing constitute another significant instance of NBFIs operating as metaphorical SPVs of banks, with the SPV metaphor stretched to include not only the transfer of outright or balance-sheet risk but also the transfer of funding risk. Historically, banks originated mortgages to be securitized into agency mortgage-backed securities (MBS). Essentially, banks made mortgage loans and then sold these mortgages to investors in the form of MBS. Furthermore, banks often retained mortgage servicing rights, which means that banks collected fees for passing payments from borrowers to investors and for advancing payments to investors when borrowers become delinquent. (These advances are ultimately recovered either by subsequent borrower payments or through government mortgage insurance.)

Over the last couple of decades, however, the bank share of mortgage origination has fallen from about 70% to less than 50% (see, for example, FDIC, 2019, and Figure A6). In parallel, the bank share of mortgage servicing rights has fallen to about 40% (Bancroft, 2022). At

<sup>15</sup> The answer to calibration questions like these is further complicated by the fact that many private credit companies make loans through insurance company subsidiaries, which necessarily convolutes banking and insurance regulation.

first glance, the shift of mortgage origination and servicing to NBFIs appears to move risk from the banking system to NBFIs. However, these NBFIs can also be viewed metaphorically as bank SPVs. First, banks provide warehouse credit lines to nonbank mortgage originators, which draw down these lines as they make or purchase mortgage loans and pay off these drawdowns as they sell these loans into securitizations. Second, banks finance the payment advances required of nonbank mortgage servicers either through credit lines or by sponsoring the issuance of commercial paper. Hence, the funding risks of mortgage origination and servicing, which seem to have left the banking system with declining volumes, actually return to the banking system through credit lines and other financing arrangements. As a case in point, NBFIs originators and servicers – and by implication the banks funding their operations – were rescued from stress during the COVID-19 pandemic by the government-sponsored enterprises (GSEs) and other government insurers, which likely implies that banks would have otherwise experienced significant stress as well.<sup>16</sup>

We have described in some detail how private credit funds and mortgage origination and servicing illustrate NBFIs as bank SPVs. There are, however, many other significant examples. As an alternative to making mortgage loans or purchasing MBS, banks lend money to mortgage REITs (m-REITs), often in the form of repurchase agreements, who, in turn, purchase MBS. As an alternative to making loans to finance corporate acquisitions, banks make loans to private equity companies to finance such acquisitions, including subscription finance loans, which are secured by investor commitments to private equity funds to enable them to invest swiftly without irregular capital calls on their investors. Finally, as an alternative to securitizing corporate or consumer loans themselves, banks provide warehouse funding to collateralized loan obligations (CLOs), other asset-backed security (ABS) issuers, and equity REITs.

### **3.c. Contingent Funding of NBFIs by Banks**

Another mechanism through which NBFIs appear to be bank SPVs is via their reliance on banks for funding commitments (liquidity or credit lines), a form of contingent funding which is typically availed under stress and when availed transfers NBFIs risks back to banks.

There are many theories of why banks are unique as delegated monitors in lending (Diamond, 1984) and in providing consumption smoothing to depositors (Diamond and Dybvig, 1983). However, somewhat less appreciated is the one in which banks perform the unique intermediation function of providing liquidity insurance to the real economy by providing lines of credit that can be drawn down by borrowers. Banks are able to manage the resulting liquidity risk more efficiently (e.g., by economizing on cash reserves) than other intermediaries as they have access to deposits and by the virtue of diversification that the *state-contingent* borrower demand for drawdowns is not perfectly correlated with that of depositors (Kashyap, Rajan and

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<sup>16</sup> See Loewenstein (2021) for further details.

Stein, 2002).<sup>17</sup> Banks may also possess a unique advantage in providing liquidity insurance if in times of stress, when such demands become more correlated in the economy, banks have access to official backstops such as deposit insurance, central bank’s lender-of-last-resort financing, access to funds from Federal Home Loan Banks (in the United States), or implicit guarantees of bailouts due to their being too big to fail. These official backstops may induce a “flight to safety” of deposits towards banks in times of stress (Gatev and Strahan, 2006). In practice, banks indeed seem unique among financial intermediaries in providing credit lines to the rest of the economy, and their ability to provide liquidity insurance does come under some stress during times of aggregate risk due to correlated drawdowns (Acharya, Almeida and Campello, 2013, Acharya and Mora, 2015), vindicating the underlying theory.

However, even more under-appreciated than this theory and evidence is the fact that banks *also* perform this special role of providing liquidity insurance for NBFIs.<sup>18</sup> In particular, banks extend liquidity insurance in the form of credit lines (or commitments) to aid warehouse financing of originators such as CLOs and REITs and to post initial and variation margins on cleared derivatives to counterparties including the central counterparties or CCPs themselves.<sup>19</sup> Figure A2 in the Appendix, using data from Federal Reserve’s Form F-Y14Q (Schedule H.1), provides a composition of bank credit lines to NBFIs by the type of NBFIs during 2018-2022, illustrating that their total outstanding volume rose substantially over this period. Figure A8 in the Appendix confirms that this growing trend has in fact been a feature since 2009 (following a dip during the GFC) based on data from Dealscan (on credit commitment originations, i.e., the “flow”) and Compustat (on outstanding credit commitments, i.e., the “stock”). Figure A8 also shows that CLOs, REITs, real estate lenders and lessors, and broker-dealers are important recipients of bank credit commitments.<sup>20</sup>

Below, we provide more detailed evidence on this liquidity provision by banks, in the aggregate for the NBFIs as well as specifically for REITs, and with illustrative examples in the case of derivatives margining, viz., the U.K. Pension Fund and the European Electricity Producers’ crises of 2022, highlighting for each the attendant liquidity risks in times of stress.

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<sup>17</sup> Diamond and Rajan (2001) argue that it is precisely the threat of disintermediating depositor runs that gives banks incentives to make prudent loans (more generally, also extend credit lines) and manage their risks well.

<sup>18</sup> Notable exceptions to our knowledge include Yankov (2020), Acharya, Gopal, Jager and Steffen (2023), and Kiernan, Yankov and Zikes (2023).

<sup>19</sup> This special role of banks for NBFIs financing and liquidity-risk management can be understood also in the context of Figures 4a-4d (Section 2) based on the Flow of Funds (FWTW) data, which illustrate that even if asset origination activities move from banks to NBFIs, a substantial pool of the real sector savings remains with banks in the form of deposits and does not migrate to NBFIs (of course, some of the real sector savings are channeled also to money market funds, insurance companies and pension funds). Buchak et al. (2022) argue that this also explains why easily securitized mortgage risks are retained by NBFIs but those that require balance-sheet financing are retained by banks. They do not, however, study bank-NBFI liability-side linkages.

<sup>20</sup> Acharya, Gopal, Jager and Steffen (2023) document using Compustat data that outstanding commitments relative to assets are at a quarterly median of 12.5% for non-financial corporations and 17.3% for NBFIs, during 2005-2020. Note that the coverage of credit lines and NBFIs in datasets such as Dealscan and Compustat is limited compared to the more comprehensive F-Y14Q data which are provided by banks to regulators.

### 3.c.i. Bank Credit Lines to NBFIs (and REITs in particular)

Kashyap (2020) and Acharya, Engle, Jager and Steffen (2021) provide an account of the “dash for cash” in the form of drawdowns on bank credit lines by non-bank corporations during the first three weeks of March 2020 at the onset of the COVID-19 pandemic.<sup>21</sup> As Figure A8 in the Appendix (left panel) from Acharya et al. (2021) shows, credit line drawdowns peaked at over \$330 billion and stabilized only after decisive fiscal and monetary policy actions that started on March 23, 2020 and took firm shape by April 9, 2020. The right panel of the figure shows that the drawdowns were concentrated in sub-investment-grade firms and BBB-rated firms (the latter being at the cusp of investment grade were facing the “cliff” risk of becoming “fallen angels” by a downgrade to sub-investment grade status).

Acharya, Gopal, Jager and Steffen (2023) describe the extent to which NBFIs drawdowns on bank credit lines contributed to this dash for cash in March 2020; their findings are reproduced in Figures 7a-7b below. The left plot in Figure 7a shows the drawdowns on bank credit lines to NBFIs (in USD billion) over the period 2005-2020, using changes in outstanding credit commitments to NBFIs in Compustat data. The right plot of Figure 7a, using the same dataset but now also including drawdowns by non-financial corporations, shows the percentage share of NBFIs drawdowns in total (NBFIs plus non-financial corporation) drawdowns. Focusing first on the March 2020 period, NBFIs drawdowns – at over \$110 billion – constituted a significant (approximately) 29 percent of the overall drawdowns on bank credit lines. This is substantially higher than that during the GFC (2008q4) when the NBFIs drawdown share fell to a low of around 20% due to the large-scale non-financial corporate drawdowns (Ivashina and Scharfstein, 2010). Indeed, the NBFIs drawdown share reached a similar level as in March 2020 during the oil-price correction of eighteen months starting in Dec-2014, when non-banks experienced tight funding conditions.<sup>22</sup>

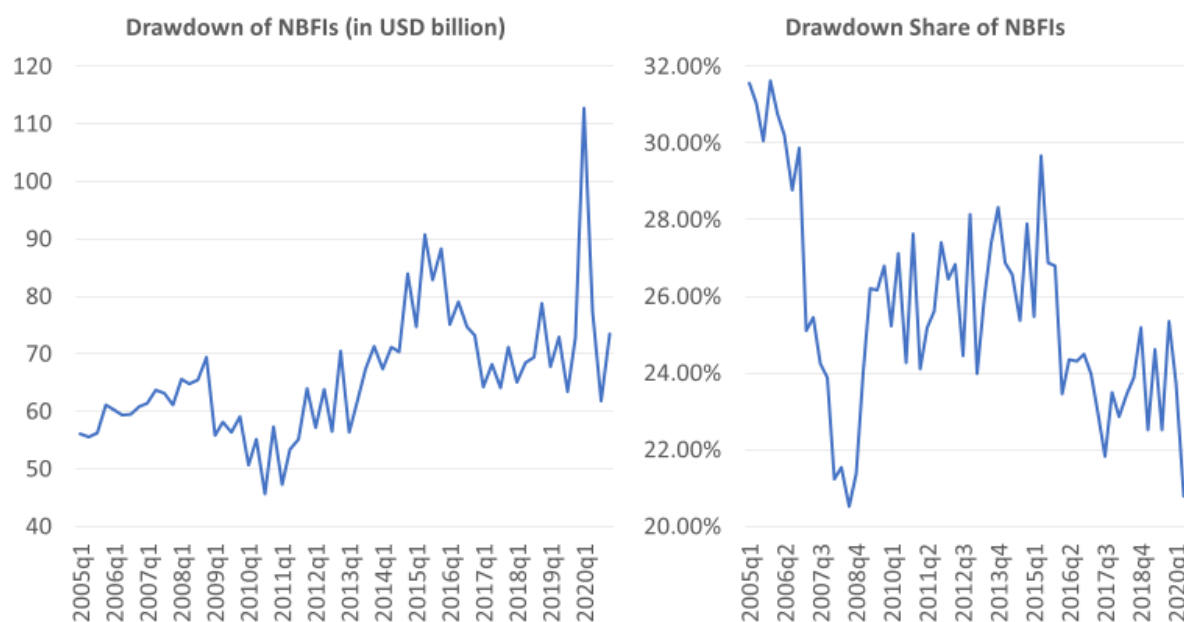
While Figure 7a shows an increase in the overall NBFIs drawdown amounts over time, mirroring the increase in outstanding credit commitments to NBFIs, Figure 7b shows that there was also a greater intensity in the dash for cash by NBFIs in March 2020 relative to that of non-financial corporations. Specifically, while the median utilization rate in BBB and sub-investment-grade non-financial corporations was 10% and 36%, respectively, that in NBFIs was 28% and 49%, respectively, highlighting both the significant funding stress experienced by NBFIs (which in turn affected non-financial corporations) and its transmission to banks.

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<sup>21</sup> See Acharya, Jager and Steffen (2023) for a comprehensive review of drawdown and repayment outcomes on contingent bank credit under stress and their real implications.

<sup>22</sup> Post-pandemic monetary tightening also seems to have led to funding rollover risks for some NBFIs, notably REITs. In the most well-known case, Blackstone’s \$69 billion REIT (BREIT) experienced significant redemptions from Asian investors during Dec 2022 to Jan 2023, forcing it to curb redemptions and aggressively raise long-term equity. See, <https://www.reuters.com/business/finance/blackstone-limits-redemptions-69-billion-reit-2022-12-01/> and <https://www.barrons.com/articles/blackstone-caps-breit-withdrawals-large-redemption-requests-51675265136>.

**Figure 7a: Quarterly Drawdowns of Bank Credit Lines to NBFIs – absolute and as share of total drawdowns by non-bank corporations (Source: Compustat)**



Source: Acharya, Gopal, Jager and Steffen (2023)

**Figure 7b: Bank Credit Line Utilization by Non-financial Corporates and NBFIs during the COVID-19 shock (Source: Compustat and Acharya, Gopal, Jager and Steffen, 2023)**

Median Credit Line Utilization Rates in 2020Q1		
Rating category	Non-financial corporates	NBFIs
AAA–A	0%	0%
BBB	10%	<b>28%</b>
non-IG	36%	<b>49%</b>
non-rated	36%	30%

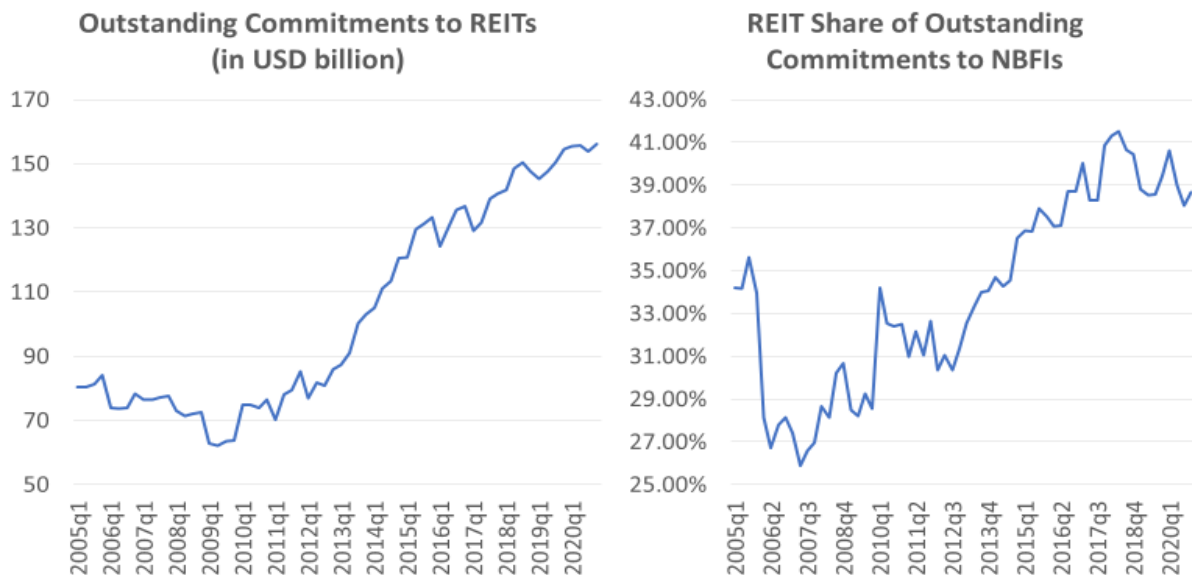
Next, we focus on one category of NBFIs, viz., the Real Estate Investment Trusts (REITs), which emerged by 2023 as the largest users of bank credit lines.<sup>23</sup> REITs tend to use

<sup>23</sup> As mentioned earlier, other NBFIs categories that use bank credit lines significantly include CLOs and derivatives counterparties (including CCPs).

bank credit lines as warehouse financing, drawing them down to make their real-estate purchases (or mortgages in case of the “m-REITs” sub-category of REITs). In parallel, REITs seek a mix of debt and equity financing in their capital structures, with m-REITs being more reliant on sale-and-repurchase (“repo”) financing than other REITs. Figures 8a-8c, also from Acharya, Gopal, Jager and Steffen (2023), illustrate the role played by REITs in the NBFIs and overall credit line drawdowns.

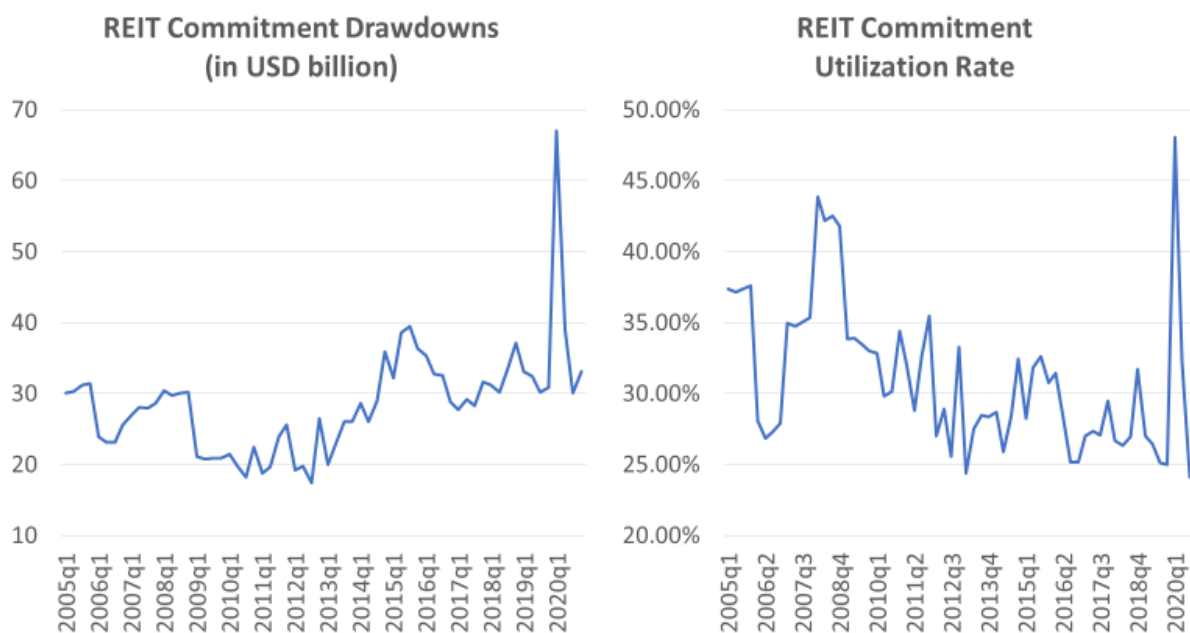
Figure 8a shows that bank credit commitments to REITs have grown by more than 2.5 times from under \$60 billion in 2009q1 to over \$150 billion in 2020q1, and correspondingly their share of bank credit commitments to NBFIs has risen from 26% to over 38%. Figure 8b illustrates that the normal-time drawdown rate (“utilization rate”) of outstanding commitments by REITs is between 25-35%, suggesting that they do use them on an ongoing basis for warehouse financing, but that during the pandemic’s onset, the utilization rate surged above 45%, crossing the level it had reached during the GFC of just below 45%. Acharya, Gopal, Jager and Steffen (2023) point out that this drawdown activity by the REITs is rising steadily post GFC as a share of overall NBFIs and aggregate (NBFIs plus non-financial corporation) drawdowns, rising from (around) 35% and 9% respectively in 2009 to 45% and 11% respectively just before the pandemic, and peaking at 60% and 14% respectively during the pandemic’s onset.

**Figure 8a: Outstanding Bank Credit Commitments to REITs – absolute and as share of commitments to NBFIs (Source: Compustat)**



Source: Acharya, Gopal, Jager and Steffen (2023)

**Figure 8b: Quarterly Drawdowns of Bank Credit Lines to REITs – absolute and as utilization rate (Source: Compustat)**



Source: Acharya, Gopal, Jager and Steffen (2023)

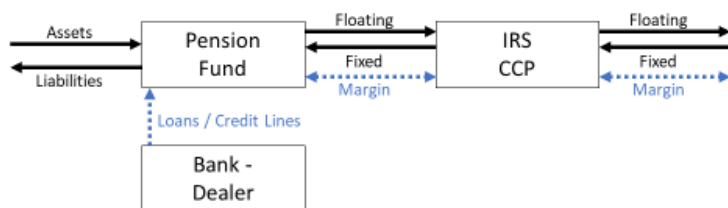
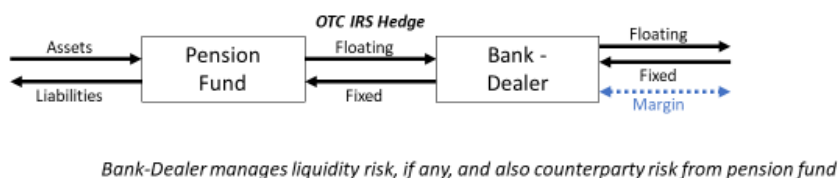
### 3.b.ii. Bank Liquidity Provision for Derivatives Clearing

Consider next the role played by banks in liquidity provision due to derivatives clearing activity. There were extraordinary demands for liquidity in two derivatives markets in the third quarter of 2022: U.K. pension funds faced large margin calls from their interest rate swap (IRS) positions that hedged against falling interest rates, and European electricity producers faced large margin calls from their electricity futures positions that hedged against rising electricity prices. In both cases, banks provided significant amounts of liquidity, but conditions ultimately resulted in central bank and government intervention, respectively.

U.K. pension funds are NBFIs that relied on banks for liquidity through this period of stress. European electricity producers are strictly speaking not NBFIs, but – on account of their cleared derivatives positions – they relied on banks to manage liquidity, in the manner of NBFIs. Furthermore, in the historical context of the shift from bilateral to cleared derivatives contracts, these two episodes of liquidity stress in 2022 show how bank counterparty risk from derivatives positions with clients has transformed into bank provision of loans and credit lines to clients managing their liquidity risk in the form of derivatives margin calls. Figure 9 illustrates how this risk transformation resulted from the shift from bilateral to cleared OTC derivatives.

**Figure 9:**

### Liquidity Risk from Derivatives Clearing: UK Pension Funds



The top schematic shows a bank-dealer with a bilateral IRS facing a pension fund. As typical pre-GFC, the bank-dealer does not collect margin from this pension fund. Hence, the bank bears counterparty risk from the trade and may have to manage its own liquidity risk from margin calls on IRS that it executes with other dealers to hedge its IRS with the pension fund. In contrast to this bilateral trade with the pension fund, the bottom schematic shows a pension fund with a cleared IRS against a central counterparty (CCP), which requires the pension fund to post initial margin and to be prepared to make variation margin calls. Furthermore, to manage these margin requirements, the pension fund engages a bank to make loans to cover initial margin and to provide credit lines to finance variation margin payments. All in all then, Figure 9 illustrates how the massive shift from bilateral to cleared derivatives transformed the role of the banking system from bearing counterparty risk from derivatives trades with clients to providing loans and credit lines to clients managing derivatives margin. Building on this observation, we next consider the two manifestations of financial fragility in 2022 arising from the liquidity risk of derivatives.

#### **Example I: U.K. Pensions in September 2022**

U.K. defined-benefit pension funds hedge the interest rate risk of their long-term liabilities by investing in long-term fixed income assets, like government bonds, or gilts; government-issued inflation-linked bonds, or linkers; and corporate bonds. But – as in other countries – total pension fund liabilities in the U.K. are rather large relative to the supply of



long-term fixed income assets. Hence, to balance the interest rate risk of their assets and liabilities, U.K. pension funds also "receive fixed" and "pay floating" in long-term IRS, which has the same effect on interest-rate exposure as buying long-term government bonds.

Long-term interest rates had been increasing in the U.K. (and globally) since early 2022, but spiked sharply up on September 23 after the unveiling of a government budget proposal that would have increased borrowing without offsetting increases in revenue. Most U.K. pension funds seem to have been relatively well-hedged against increasing interest rates or, if anything, were positioned to benefit slightly from rate increases. Despite that economics, however, rapidly rising rates greatly reduced the value of their IRS positions and generated large margin calls. In response, banks provided liquidity to pension funds through a variety of loans and advances.<sup>24</sup>

Despite the liquidity support from the banking sector just described, many pension funds were forced to sell gilts to raise cash, which pushed prices lower (and rates higher), which in turn led to additional margin calls. There were several institutional and operational factors that added to the liquidity challenges of the funds at this time, but funds that were clearly solvent – with respect to the value of their assets against the value of their liabilities – suffered losses by having to liquidate assets in fire-sales to raise cash to meet margin calls or by being forced out of hedges for failing to meet margin calls, which exposed them to subsequent portfolio losses when rates declined.

In response to the stress on pension funds and the resulting stress in the gilt market, the Bank of England intervened on September 29 and again on October 11 to contain falling gilt prices by committing to purchase and fund large volumes of bonds and by adding linkers and corporate bonds as eligible collateral against loans made to banks to be passed on to pension funds. This intervention was particularly striking in that it ran in the opposite direction as the Bank of England's contractionary monetary policy at the time.

In this episode, the liquidity resources of U.K. pension funds were overwhelmed by sudden and large margin calls on their IRS positions. Years ago, bank-dealers might have been exposed to counterparty risk from bilateral derivatives with pension funds. But with the shift to the central clearing of IRS mandated by post-GFC regulation, banks in 2022 instead had exposure from loans and liquidity provision to pension funds that were scrambling to meet margin obligations. In short, the risk linkages between banks and NBFIs have not been eliminated with clearing arrangements for derivatives via CCPs but simply transformed. Furthermore, these transformed risks were substantial enough in September 2022 to lead to

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<sup>24</sup> Banks loaned money to some pension funds on the collateral of their bonds, or loaned money to market participants purchasing bonds from pension funds on a levered basis. Also, banks that are members of IRS clearing houses or CCPs somewhat eased liquidity pressures by settling intraday margin calls from the CCPs on behalf of their pension fund clients while continuing to call those pension funds for margin on an overnight basis.

turmoil in the U.K. government bond market and, ultimately, to the intervention of the Bank of England, with the possibility that banks would have suffered significant losses otherwise.<sup>25</sup>

## **Example II: European Electricity Producers in Q3 2022**

Energy prices began to increase in Europe in 2021 for a variety of reasons, including the emergence of economies from pandemic lockdowns and a Russian supply squeeze. Prices rose higher after Russia's invasion of Ukraine in February 2022 and increased even more steeply from July through August 2022. Electricity producers, who had sold electricity futures contracts to hedge against falling prices, were perfectly solvent, but faced liquidity pressures from variation margin calls and increases in initial margin rates.<sup>26</sup>

As the demand for liquidity to meet margin calls increased, banks increased their exposures to the energy sector by supplying significant amounts of liquidity in several forms.<sup>27</sup> And, in addition to this liquidity provision by banks, support in the form of guarantees was offered or provided to electricity producers by many governments, including Austria, Czech Republic, Germany, Finland, Denmark, Norway, Sweden, United Kingdom, and Switzerland.

In short, while electricity producers are not normally considered NBFIs, derivatives margin requirements mean that they have to manage liquidity like other NBFIs. Furthermore, while banks were not directly exposed to counterparty risk from electricity producers' futures positions, they were exposed to the sector through lending and credit lines and to bilateral derivatives contracts that replaced futures positions. Finally, as bank liquidity support proved insufficient, government authorities felt compelled to intervene with guarantees.<sup>28</sup>

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<sup>25</sup> See Plender (2022), for example, for a news account of this episode. Also, the left graph in Figure A3 shows more generally the significance of the post-GFC clearing mandate in terms of the dramatic increase of funds held in the swaps accounts of customers (as opposed, for example, of dealers) at futures commission merchants (FCMs).

<sup>26</sup> The right graph of Figure A3 shows the significant increase in posted margin for commodity derivatives (along with other types of derivatives) leading up to and through 2022.

<sup>27</sup> These included margin waivers by clearing members based on letters of credit or guarantees from other banks; intraday or overnight advances of margin and other short-term credit lines; credit lines backed by uncollateralized guarantees of other banks; uncollateralized guarantees to clearinghouses (when European regulators temporarily allowed this); committed repurchase agreement facilities (to borrow cash on bond collateral); collateral transformation services (providing cash or highly liquid bonds in exchange for less liquid collateral at a haircut); relatively low-margin bilateral swaps (as a substitute for high-margin futures); and liquidity swaps (in which banks took over high-margin futures positions in exchange for low-margin bilateral swaps). Of course, not all banks were accommodating: some asked clients to reduce risk or to take their business elsewhere. See European Banking Authority (2022) for further details.

<sup>28</sup> See Turnstead (2023), Wilkes and Turnstead (2022), and Wilson and Stafford (2022) for news accounts of this episode.

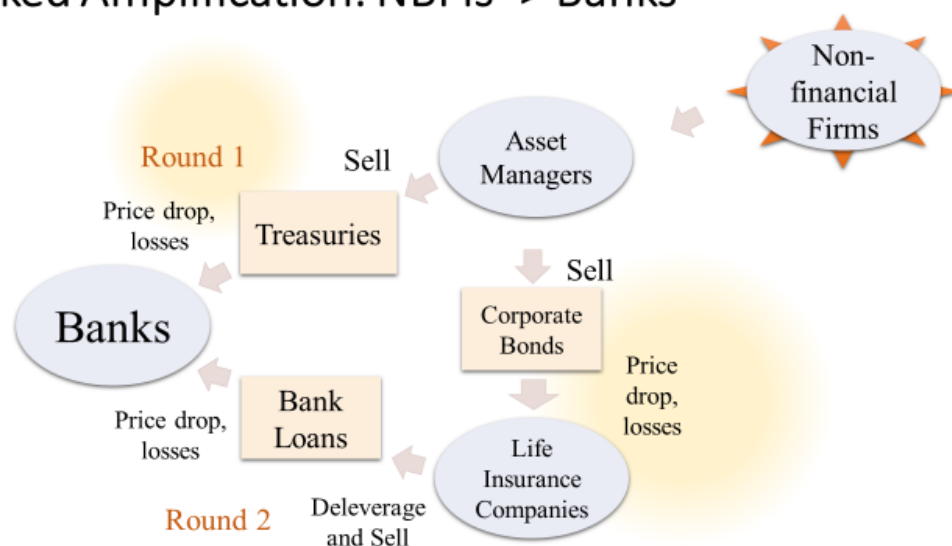
#### 4. Propagation of Risks arising from Bank and NBFI Linkages

The existing literature has recognized that banks and NBFIs are likely to exhibit commonality in asset holdings. Cetorelli, Landoni and Lu (2023), for instance, have quantified the resulting fire-sale externalities in a study of the U.S. financial system. Their study also shows that in states of the world characterized by aggregate or macroeconomic shocks, financial institutions can be exposed to spillovers from fire-sales originated by other financial institutions *even in the absence of commonality in direct asset holdings*. The reason is that vulnerability to an original fire-sale event can propagate and get amplified, indirectly, via additional fire-sales that in turn have their own knock-on effects across sectors. Let us elaborate.

The stylized example in Figure 10a illustrates the potential for such propagation and amplification from original fire-sale events. It is assumed therein that the trigger is a distress event in the real sector of the economy affecting non-financial firms in the aggregate or sectorally (depicted in the upper-right corner). This event could precipitate financial distress among asset managers due to losses on, or repricing of, their portfolio holdings of instruments issued by these non-financial firms. This, in turn, could trigger the forced sales of assets by investment funds in the asset management sector. In this stylized example, funds (for instance, bond funds and hedge funds) sell their holdings of Treasuries and corporate bonds. Now, banks would be exposed to such fire-sales given they hold Treasuries too. For the sake of this example, it is assumed that banks do not hold corporate bonds or that such holdings are negligible. Following Cetorelli, Landoni and Lu (2023), this *direct* effect from a hypothetical fire-sale of bond funds is referred to as the “Round 1” effect.

**Figure 10a:**

#### Asset-linked Amplification: NBFIs -> Banks



Note that even if banks have only a small direct exposure to corporate bond prices, the fire-sales by asset managers could have an impact on other NBFIs such as life insurers that hold corporate bonds in large amounts. If life insurers experience losses or stress as a result of the price impact on their corporate bond holdings, they may be forced to sell their other assets, for instance, sell bank loans in the relatively illiquid secondary market. This could then lead to an *indirect* potential effect on banks from the original fire-sale of asset managers, and is referred to as the “Round 2” effect.

This way, banks may not have significant commonality in asset holdings with an initially-affected NBFI sector – such as the asset management sector in this example – but their effective pairwise exposures could still be substantial. Consequently, the full impact on the financial system from an initial shock may be much larger after taking into account both Round 1 and Round 2 effects. Using the historical Flow of Funds data, Cetorelli, Landoni and Lu (2023) have documented large multiples of an original fire-sale (see Appendix B for details) and that the magnitude of such externalities has been rising over time.

The potential for such risk propagation and amplification in the financial ecosystem is even stronger, once we realize that there can be additional channels due to *liability-side* contractual links across NBFIs and banks (highlighted in Sections 2-3). For example, and still in reference to Figure 10a, banks may be on the receiving end of an initial shock and its propagation through fire-sales originated by bond funds, but in response they could (in addition to initiating *their own* fire-sales) choose to reduce their lending claims to NBFIs, perhaps as a revision to their counterparty risk assessment.

**Figure 10b:**

### Liability-linked Amplification: Banks -> NBFIs

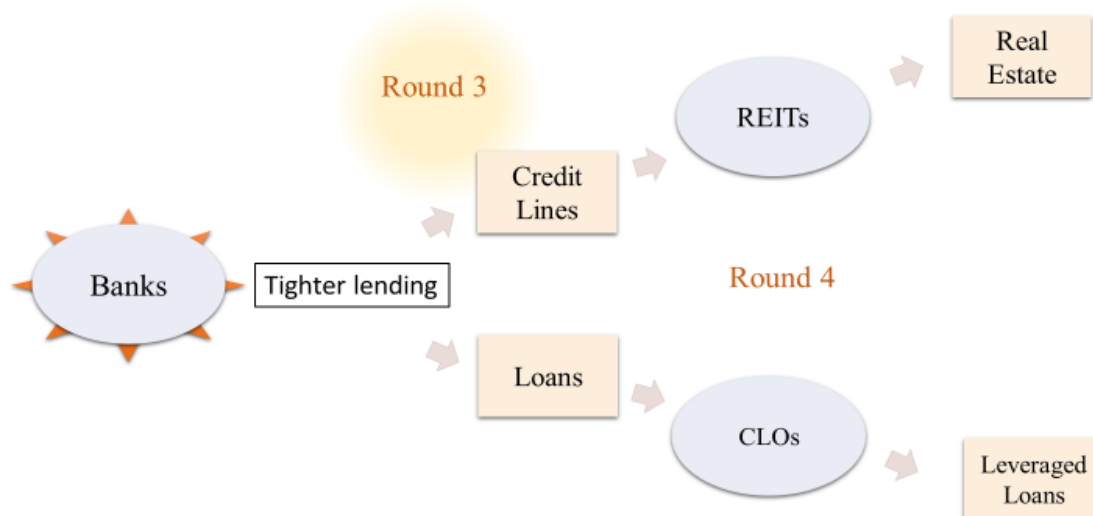


Figure 10b displays how this may play out: banks may reduce both their credit lines to (say) REITs and loans to (say) CLOs. As a result of such response, and given the increasing NBFIs dependence on banks for funding, the original shock can now propagate back to the real sector of the economy, through dislocations in the real estate and leveraged lending markets where REITs and CLOs are respectively significant for credit origination activity. To the best of our knowledge, these Round 3 (banks tightening credit to NBFIs) and Round 4 (NBFIs in turn affecting credit to the real economy) effects are not considered in risk propagation and amplification frameworks that combine banks and NBFIs; doing so seems an important area for future research and policy that seeks to quantify and regulate, respectively, the systemic risk of the entire financial sector.

## 5. Bank-NBFI Co-movement in Market Data

The previous sections have documented the significant instances of transformation of risks and the intimate interconnections between banks and NBFIs. Is there any evidence that as this transformation has taken place over the last two decades, that it has led to enhanced system-wide risk? To answer this question, we explore two lines of inquiry. In the first, we explore how *SRISK*, a measure of market-equity-based capital shortfall under aggregate market stress (Acharya, Engle and Richardson, 2012), has co-moved over time between the banking and the NBFI sectors.<sup>29</sup> Secondly, we examine whether and when equity price movements of the two sectors “Granger-cause” (Granger, 1969) each other.

The *SRISK* measure is calculated for a publicly-traded bank or NBFI as:

$$SRISK = Exp_0 [k(D_t + E_t) - E_t | Crisis] = k.D_0 - (1-k).(1 - LRMES).E_0$$

where *Exp* is the expectations operator (at date 0), *Crisis* is taken to be an aggregate market stress scenario (e.g., a 40% correction to the S&P 500 or MSCI Global index over a six-month period from time 0 to *t*); *D* denotes all non-equity liabilities of the institution assumed to be constant between time 0 and *t* for simplicity; *E* denotes market equity value of the institution; *LRMES* is its long-run marginal expected shortfall, i.e., the percentage loss in market value of its equity in the crisis scenario, which is estimated using dynamic conditional beta econometrics; and *k* is a prudential market-equity-based capital ratio relative to which the capital shortfall *SRISK* is computed, e.g., 8%. *SRISK* is publicly available at [vlab.stern.nyu.edu/srisk](http://vlab.stern.nyu.edu/srisk).

If *SRISK* of an institution is positive, it is deemed to have a capital shortfall on the day of measurement. Aggregate capital shortfall for the financial sector or a sub-sector (banking, NBFI, etc.) is then computed as the sum of the positive *SRISK* values for individual institutions. Note that this assumes a lack of perfect capital mobility between surplus and shortfall institutions, which is a reasonable assumption to make from a financial stability standpoint given the

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<sup>29</sup> Since there are several other econometric alternatives to *SRISK* for measuring systemic risk and to assessing causality, this analysis is meant to be preliminary, i.e., suggestive rather than exhaustive.

uncertainties associated with the resolution of (even mid-sized) financial institutions. Furthermore, given that *SRISK* relies on publicly traded equity, it can only be computed for financial institutions that have a listed stock with daily available prices.<sup>30</sup> Finally, we restrict attention to institutions with at least \$100 million of market capitalization of equity. The result is an aggregate *SRISK* series for banks and NBFIs.

**Figure 11a: Rising Bank and NBFi *SRISK* Co-Movement over Time**

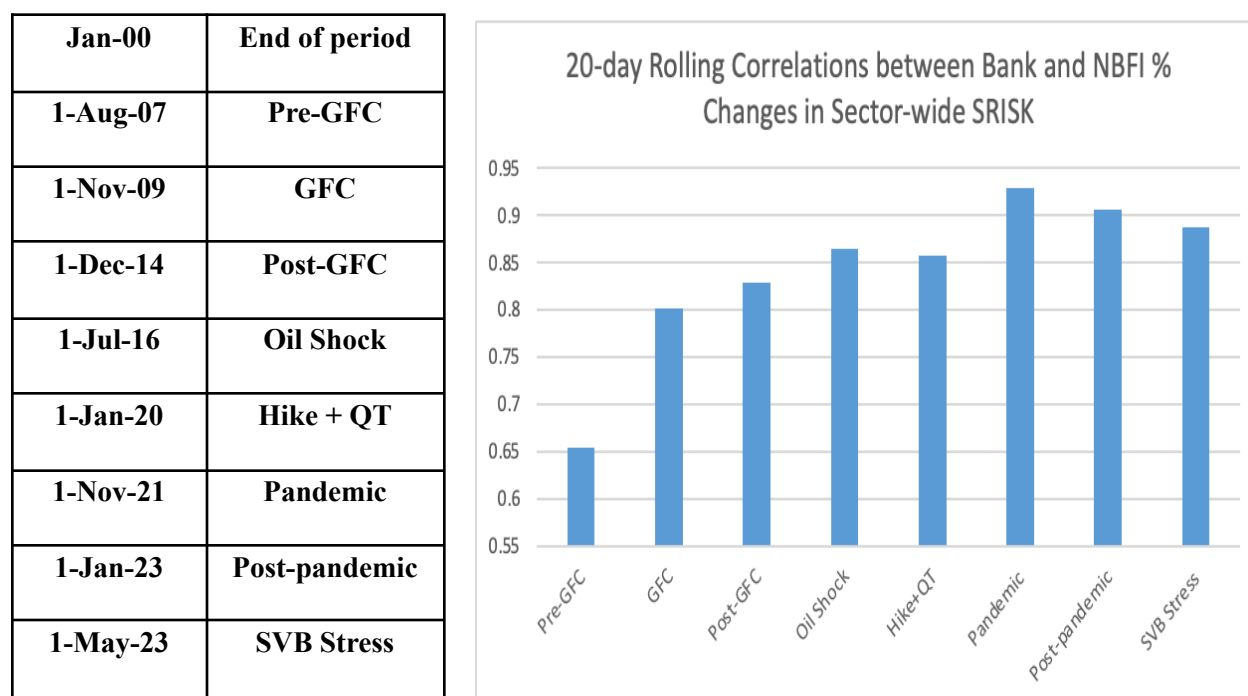


Figure 11a reports the median 20-day rolling correlation of percentage changes in bank and NBFi *SRISK* for several sequentially defined sub-periods of interest during Jan 2000 to end of April 2023: pre-GFC (until 1 Aug 2007), GFC (until 1 Nov 2009), post-GFC (until 1 Dec 2014), downward oil-price shock (until 1 July 2016), pre-pandemic rate hike + Quantitative Tightening (until 1 Jan 2020)<sup>31</sup>, pandemic (until 1 Nov 2021), post-pandemic (until 1 Jan 2023), and Silicon Valley Bank (SVB) – more broadly, regional banking – stress (until end April 2023).

What stands out is that there has been a significant rise in the correlation of bank and NBFi *SRISK* from pre-GFC (0.64) to the period post GFC, rising steadily until the pandemic onset and remaining elevated until the SVB stress. This rise in the joint exposure of bank and NBFi sectors to aggregate risk may seem at odds with the efforts since the collapse of Lehman Brothers to make the banking system safer as well as to separate out its activities into

<sup>30</sup> This implies, for instance, that privately held NBFIs such as CLOs, pension funds, mutual funds, and ETFs, are not covered in our analysis of NBFIs' *SRISK*, but that there is a good coverage of insurance firms, standalone broker-dealers, REITs, and financial services companies, which tend to be publicly listed.

<sup>31</sup> Note: with some months added at the end of this period for simplicity (QT ended in Sep 2019).

non-banking intermediation. However, the rise is entirely consistent with the perspective offered in this piece that relative to the period since the GFC, banks and NBFIs likely functioned more distinctly pre GFC, or put differently, that the post-GFC reforms of banking sector regulation (Dodd Frank Act, living wills, etc.) have encouraged several banking activities to migrate to the non-bank financial sector without necessarily altering bank exposures to the underlying risk of these activities. As non-banks are now more like banks in their economic function, and the two remain interdependent via funding linkages, their systemic risk co-moves more than in the pre-GFC period.

However, the co-movement of banks' and NBFIs' *SRISK* documented above could simply be a reflection of commonality in their market-wide exposures. In order to establish a notion of interdependence rather than just market-driven co-movement, we document in Figure 11b results from Granger-causality tests of *abnormal* (equal-weighted) daily equity-return indices of banks and NBFIs.

**Figure 11b: Fraction of days in rolling 90-day windows with p-values less than 10% for Granger-causality tests of abnormal (equal-weighted) daily returns for banks and NBFIs<sup>32</sup>**

		Fraction of days with p-value < 10% when	
<b>Jan-00</b>	<b>End of period</b>	<b>Banks cause NBFIs</b>	<b>NBFIs cause Banks</b>
<b>1-Aug-07</b>	<b>Pre-GFC</b>	<b>13%</b>	<b>5%</b>
<b>1-Nov-09</b>	<b>GFC</b>	<b>33%</b>	<b>25%</b>
<b>1-Dec-14</b>	<b>Post-GFC</b>	<b>18%</b>	<b>18%</b>
<b>1-Jul-16</b>	<b>Oil Shock</b>	<b>9%</b>	<b>0%</b>
<b>1-Jan-20</b>	<b>Hike + QT</b>	<b>13%</b>	<b>15%</b>
<b>1-Nov-21</b>	<b>Pandemic</b>	<b>36%</b>	<b>31%</b>
<b>1-Jan-23</b>	<b>Post-pandemic</b>	<b>26%</b>	<b>67%</b>
<b>1-May-23</b>	<b>SVB Stress</b>	<b>24%</b>	<b>62%</b>

<sup>32</sup> All tests are conducted using the optimal number of lags for the Granger-causality test, based on the Akaike Information Criterion (AIC).

To construct abnormal returns, we adjust each daily index return for that day's S&P500 (market) return based on their 90-day rolling historical co-movement (beta). Then, starting on the 91st day of each sub-period (as defined in Figure 11a) until the last day of the sub-period, we conduct daily Granger causality tests for the abnormal bank and NBF equity-return indices over the 90-day historical window. The fraction of days in each sub-period for which the p-value of the Granger-causality test is less than 10% is reported in Table 10b (left column for bank causing NBFIs and the right column for NBFIs causing banks).

Two observations are striking. One, consistently with the *SRISK* co-movement in Figure 11a, bank and NBF sectors' abnormal equity returns "cause" each other more robustly during the GFC and the periods thereafter whereas this was virtually not the case in the pre-GFC period.

Second, during the GFC and the pandemic, there is an especially strong causation link from bank and NBF abnormal equity returns to each other, with NBFIs causing bank returns even more frequently in the post-pandemic and SVB-stress periods. The strong interdependence during the GFC and the pandemic onset periods is consistent with NBF risks spilling over to banks via SPVs and credit line drawdowns, respectively, and in both periods banks being significant providers of liquidity guarantees to NBFIs.<sup>33</sup>

Overall, we conclude that the interdependence between banks and NBFIs warrants taking a unified, rather than an "in-silos", approach to macroprudential regulation, to which we turn next.

## 6. Implications for Macroprudential Regulation

Under the traditional view of financial intermediation, banks engage in "core" intermediation activities, viz., payments-and-settlements, deposit-taking and information-intensive (e.g., small-business), activities that over time have either increasingly required, or certainly in practice are supported by, official backstops. In contrast, NBFIs are considered to engage in "secondary" intermediation activities, e.g., market-making and financial arbitrage that contribute to providing liquidity and price-discovery in the financial system. Under this view, it is often argued that NBFIs should *not* be rescued in the event of distress.<sup>34</sup> This traditional view appears to have shaped at least in part the post-GFC financial regulations: the imposition of rules that restrict activity of banks or encouragement that they do so (e.g., via living will requirements), and a restrictive revision of the interpretation of central banks' authority in times of distress (e.g., modifications of the Section 13(3) of the Federal Reserve

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<sup>33</sup> As such, more empirical analysis is needed to tease out the manifestation of liability-side dependence of banks and NBFIs in their equity change co-movements, and separate such dependence from their asset-side dependence or asset commonality.

<sup>34</sup> See, e.g., "If you fail, you're going to fail, and I am not going to help you and your stockholders are going to be gone, and your creditors will be at risk, and that is the way it should be", in Volcker (2009).



Act), in order to prevent NBFIs from having a *direct* access to backstops while carving out exceptions through the Systemically Important Financial Institution (SIFI) designation process.<sup>35</sup>

However, the perspective we have offered and substantiated in Sections 2-5 with case studies, data and analyses is that this traditional line of thinking is necessarily incomplete and possibly even misplaced. In particular, reiterating from our introductory remarks the application of Goodhart (1975) law to the regulatory perimeter of the financial sector: As the banking perimeter is used for “control” (regulatory) purposes, but activity around the perimeter can be “manipulated” (via regulatory arbitrage) by banks and NBFIs, the regulatory perimeter inexorably ceases to be useful for control purposes. Under the broader interpretation of this principle that we have highlighted, NBFIs are effectively bank SPVs designed for regulatory arbitrage, since they engage in similar intermediation activities as banks and their business model is designed precisely to have funding dependence on banks through stress.

An important corollary then is that a time-inconsistency problem emerges in the provision of official backstops to NBFIs. As stressed NBFIs are bound to impose systemic externalities on the banking system and beyond, limiting the damage to the financial system and the real economy necessitates extending the safety net to the NBFIs, directly or via support of the banks supporting them or of the markets in which they operate. Such support is typically operationalized as some form of the central bank’s lender-of-last-resort (LOLR) function. This problem arises *ex post* regardless of the *ex-ante* regulatory stance towards NBFIs and in spite of inevitably imperfect *ex-ante* rules governing them.

This time-inconsistency problem has materialized multiple times since the GFC, leading gradually to the implicit expectation that NBFIs *are* in fact going to be supported by official backstops as and when the situation demands. For instance, authorities provided *ex-post direct* backstops to derivatives activity in the case of the European electricity producers in 2022 (Section 3). Support has also been provided indirectly via *markets*, as was the case for the UK pension funds in 2022 with Bank of England’s support of the gilts market (Section 3), or for hedge funds with the Federal Reserve purchasing Treasuries in extraordinary amounts in March 2020 (Duffie, 2020, Schrimpf, Shin and Sushko, 2020, among others). Finally, support to NBFIs has also been provided indirectly through the banking system, as done through Fed’s LOLR to JP Morgan Chase for onward lending to Bear Stearns in March 2008, and the many financing facilities instituted by the Federal Reserve, again, in March 2020.

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<sup>35</sup> In the United States, the SIFI designation is the exception that confirms the “separation” rule, exactly because a potentially designated NBF, like banks, would be subject to the Federal Reserve authority, so that entry into the safety net for a designated NBF, such as access to backstops via the FDIC’s Orderly Liquidation Authority, comes automatically with Fed’s supervisory scrutiny.

While such extensions of the central bank’s LOLR function raises difficult democratic governance and political economy issues (Tucker, 2018), presently – for all practical purposes – NBFIs are kept outside of the official safety net *de jure*, but are *de facto* inside, whether explicitly recognized or only tacitly acknowledged. For us, this is an important observation which merits that NBFIs be recognized as an integral part of the financial system with *ex-ante* measures to manage their risks at efficient levels, including monitoring, some amount of regulation, and explicitly articulated *state-contingent* responses.

Next, we provide some possible measures along these lines and briefly discuss their pros and cons from the standpoint of macroprudential regulation. In particular, we do not undertake any discussion of the political economy considerations.

**a. Ex-ante measuring, monitoring, and regulating NBFIs risks:**

An obvious first step in addressing systemic risks arising from NBFIs is to measure those risks. Furthermore, as this paper shows, any measurements of the systemic risks of NBFIs have to account for bank-NBFI funding linkages. Some encouraging progress has been made by the regulatory community along these lines: see, e.g., ECB (2023), FDIC (2019), and FSB (2022).

Another step in the right direction would be for regulators to incorporate in their supervision the view that banks and NBFIs co-evolve, and that bank regulation and supervision themselves can drive the nature of bank and NBFI activities and risks. Some holistic approaches along these lines have appeared with respect to the supervision of CCPs. CFTC (2019) conducted a stress test in which a set of large clearing members and their largest customers simultaneously defaulted to three CCPs. The analysis examined not only the resources on hand at the CCPs to meet the contingency, but also the CCPs' plans for drawing liquidity from the banking system. These plans included lists of individual banks to be tapped, the volumes of liquidity required from each bank, and each source of funds (e.g., bank deposits, maturing overnight reverse repurchase agreements, new repurchase agreements,<sup>36</sup> and lines of credit from banks). Bank of England (2022) conducted a similarly-spirited exercise.

A further step in mitigating systemic risk from NBFIs would be *regulatory reform*. Introducing a full set of laws and rules to govern NBFIs along the lines of banks would represent a vast expansion of financial regulation. Instead, bold but more limited regulation might better contain moral hazard from explicit and implicit safety nets, in particular, by strengthening the incentives for banks and NBFIs to internalize the costs of their linkages. A complete analysis of

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<sup>36</sup> In its reverse repurchase agreements, a CCP lends money on securities collateral. In new repurchase agreements, the CCP would be borrowing money on securities it would have to post as collateral.

reforms along these lines is beyond the scope of this paper, but we mention here three existing proposals:<sup>37</sup>

- (1) *Committed Liquidity Facilities (CLFs)*. Under this proposal, banks would post collateral to CLFs at central banks against which, in the future, they could borrow funds at predetermined haircuts and rates. Furthermore, to incentivize banks to post collateral to these facilities, the amounts that banks could draw down on these facilities would count as high-quality liquid assets in satisfying liquidity coverage ratios (see Nelson, 2023). The existence of CLFs would likely raise the relative costs of the more unusual extensions of bank credit to NBFIs. To explain, say that accounts receivables from a particular corporation were accepted as collateral by the CLF at a certain haircut, while investor commitments to a private equity fund were not accepted at all. Then a bank lending against the accounts receivables would post them to the CLF and gain HQLA equal to their ex-haircut value. By contrast, a bank lending against the investor commitments would have to commit additional funds to claim the same quantity of HQLA.
- (2) *Pawnbroker for All Seasons (PFAS)*. King (2016) proposed that all short-term bank and NBFi claims be fully collateralized at the central bank at appropriate haircuts. PFAS would significantly expand regulation over the NBFi sector. It would also significantly increase equity and long-term debt as a proportion of bank liabilities, because collateral haircuts – which under PFAS have to be funded by equity or long-term debt – are typically large relative to the currently required ratios of equity and long-term debt to assets.<sup>38</sup> However, by requiring that every short-term liability be fully collateralized, the PFAS proposal would discourage bank lending to NBFIs on unusual collateral that would attract relatively high haircuts.
- (3) *Federal Liquidity Options (FLOs)*. Tuckman (2012) proposed that any bank or NBFi be able to purchase options on secured borrowing from the central bank at predetermined haircuts and rates. Furthermore, the central bank would sell a sufficient quantity of FLOs so that it could credibly commit to provide no additional liquidity in a crisis. If this commitment were indeed credible, then *ad hoc* crisis bailouts would no longer be necessary and banks and NBFIs would use FLO prices to internalize the cost of liquidity in stress scenarios.

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<sup>37</sup> It is important to recognize that some attempts have been made in regulation to address the potentially greater fragility of bank liquidity provision to NBFIs but that this remains imperfect and heavily arbitrated. For instance, Yankov (2020) notes that the Liquidity Coverage Ratio penalizes liquidity facilities provided by banks to NBFIs more (outflow rate assumption of 100%) relative to those to non-financials (30%). However, this has simply induced a greater provision of liquidity by banks to NBFIs via credit facilities (outflow rate assumption of 40%).

<sup>38</sup> See Nelson (2023), p. 7, for more details.

A full evaluation and treatment of these proposals is left for future research but we believe it is important that they be carefully considered. The reason is twofold. One, quantifying the liquidity risk implications of bank funding linkages to NBFIs is crucial to effective regulation of the two sectors. Secondly, to the extent that these linkages are the result of purposeful or fortuitous regulatory arbitrage and take advantage of explicit or implicit safety nets, reforms that narrow the scope for such arbitrage can be useful in mitigating systemic risk.

**b. State-contingent measures:**

Finally, how should regulation deal with the inevitable risk that ex-ante measures (such as the ones laid out in Section 6.b above) fail to address all pockets of potential systemic risk in the NBFIs sector, i.e., do not get into “all the cracks” of the complex and ever-evolving financial system?<sup>39</sup> We propose a state-contingent approach which *anticipates* that systemic risk under future stress can arise in such “cracks” and that is *pre-programmed* to put in place regulatory safeguards in parts of the NBFIs sector where systemic risk materializes unexpectedly.

On the first of these aspects, note that even in jurisdictions such as the United States where regulators (specifically, the Financial Stability Oversight Council, under the Dodd Frank Act) have the powers to identify NBFIs as “systemically important financial institutions” (SIFIs), the designation is typically based on static criteria such as the present size, market power or systemic centrality of the institutions. An alternative is to recognize that systemic risk can arise in a prospective manner from NBFIs as they evolve and grow even if they presently might not qualify to meet the SIFI designation. Such prospective assessment requires an ongoing monitoring of NBFIs risks and of bank-NBFIs linkages, as well as their inclusion in assessments of shock amplification mechanisms under stress (as shown, e.g., in Section 4).

Based on their contribution to such amplification, regulators can follow pre-announced but principles-based criteria for (i) designation of NBFIs as SIFIs, (ii) classification of relevant NBFIs types as “systemic as a herd” even if individual NBFIs types do not necessarily meet size or concentration criteria (e.g., in the money-market fund industry), and (iii) based on (i) and (ii), inclusion of SIFI-designated NBFIs in regulatory stress tests for imposition of capital adequacy requirements, leverage restrictions, and/or liquidity coverage ratios. This way, the approach would be forward-looking, time-varying, and state-contingent.

On the second aspect, a key challenge facing the present regulatory discourse on NBFIs is its inability or unwillingness (or both) to acknowledge that directly- or indirectly-rescued NBFIs are *prima facie* SIFIs. Indeed, a key question that the growing extension of LOLR beyond the banking system has raised is whether it is in fact tenable, and indeed desirable, for central

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<sup>39</sup> An alternative approach is simply to recognize that getting in “all the cracks” of the financial system in this manner is rather difficult, and that it is best for macro-prudential policy to be complemented with a monetary policy that leans against the wind, as proposed by Stein (2013). This approach is not necessarily exclusive to the measures we propose in this paper.

banks to undertake such extension without simultaneously expanding regulatory authority over the NBFIs. For instance, the Federal Reserve expanded LOLR to broker-dealers in the form of the Term Securities Lending Facility (TSLF) and Primary Dealer Credit Facility (PDCF) in 2008, without getting in exchange regulatory authority over the recipients (they remained under the regulation of the Securities and Exchange Commission). While the Dodd-Frank Act of 2010 did grant such authority to the Fed over broker-dealers designated as SIFIs, this was only following their failure or near-failure in 2008. In the same vein, while Fed’s 13(3) facilities in March 2020 to deal with the pandemic’s onset benefited an even more expansive set of NBFIs, no regulatory authority to monitor their risks on an ongoing basis has been provided or sought.

It is our submission that, at a minimum, a debate is required as to whether, when, and to what extent, should NBFIs that effectively receive discretionary LOLR support be subject to regulatory authority immediately upon such receipt. Put more strikingly, should access to the Fed LOLR subject the NBFIs to a “Hotel California” principle in terms of being regulated by the Fed thereafter (Acharya, 2022)? Or should they instead be subject to one-off corrective actions (e.g., requirement to de-leverage or to improve liquidity buffers) within a reasonable period of time following their being granted access to the LOLR? The objective in proposing such a debate is not necessarily to expand the central bank regulatory scope; instead, it is to strengthen central bank incentives to regulate the systemic liquidity risk of NBFIs using ex-ante measures proposed in Section 6.a, as doing so would in fact limit the ex-post extension of discretionary LOLR to the NBFIs.

## **7. Conclusion**

Based on a rich variety of data sources and case studies, we have attempted in this paper to establish the limitations of traditional approaches to financial sector regulation which view banks and non-bank financial intermediaries (NBFIs) as *substitutes*, one inside and the other outside the perimeter of banking regulation, with the growth of one implying the shrinking of the other. Invoking Goodhart (1975) law and applying it to financial intermediation, we argued instead that banks and NBFIs are better described as complements. Regulatory arbitrage activity around the perimeter of bank regulation implies that NBFIs are metaphorically special purpose vehicles (SPVs) of banks: banks and NBFIs engage in similar intermediation activities and are intimately interconnected in funding each other, with NBFIs somewhat more dependent on banks given banks’ funding advantages and explicit access to official backstops. This observation necessitates a macro-prudential policy that approaches banks and NBFIs in a unified manner, focusing on both their asset-side and liability-side linkages. By highlighting the important role of these linkages, we believe we have only scratched the surface of research and policy debates that can further our understanding of how these linkages transform over time and affect financial stability.

Indeed, several areas of inquiries that stem from our perspective seem promising to pursue. One, as highlighted in Figures 10a-10b, quantitative exercises to estimate spillover risks between banks and NBFIs can be expanded to cover higher-order transmission mechanisms

wherein banks and NBFIs, hit by initial net-worth shocks via the asset-side fire-sales contagion, subsequently tighten lending to each other. Such calibrations can use the newer From Whom To Whom version of the Flow of Funds data we employed in Section 2.

Second, the systemic-risk comovement and Granger-causality tests between banks and NBFIs that we presented in Section 5 can be undertaken at individual bank and NBF level, teasing out the impact of bilateral liability-side linkages. For example, does a shock to the NBF sector travel to a bank more strongly via those NBFs that have greater outstanding credit lines from the bank; conversely, does a shock to the banking system travel more adversely to a NBF via those banks on whom it is more reliant for financing and contingent liquidity?

Finally, while our analysis focused on the U.S. financial system (with the exception of our derivatives-related case studies for the year 2022 in the U.K. and Europe), it would be worthwhile to ascertain and analyze the full spectrum of bank-NBF liability-side linkages and their evolution in other parts of the world (for European bank exposure to global banks and NBFs, see for example Abad et al., 2022, and ESRB, 2023). Differential patterns across geographies, linked in part to differential business, financial and regulatory environments, may deepen our understanding of how and why bank and NBF interflow of risks gets transformed over time. Clearly, there is ample scope for further research.

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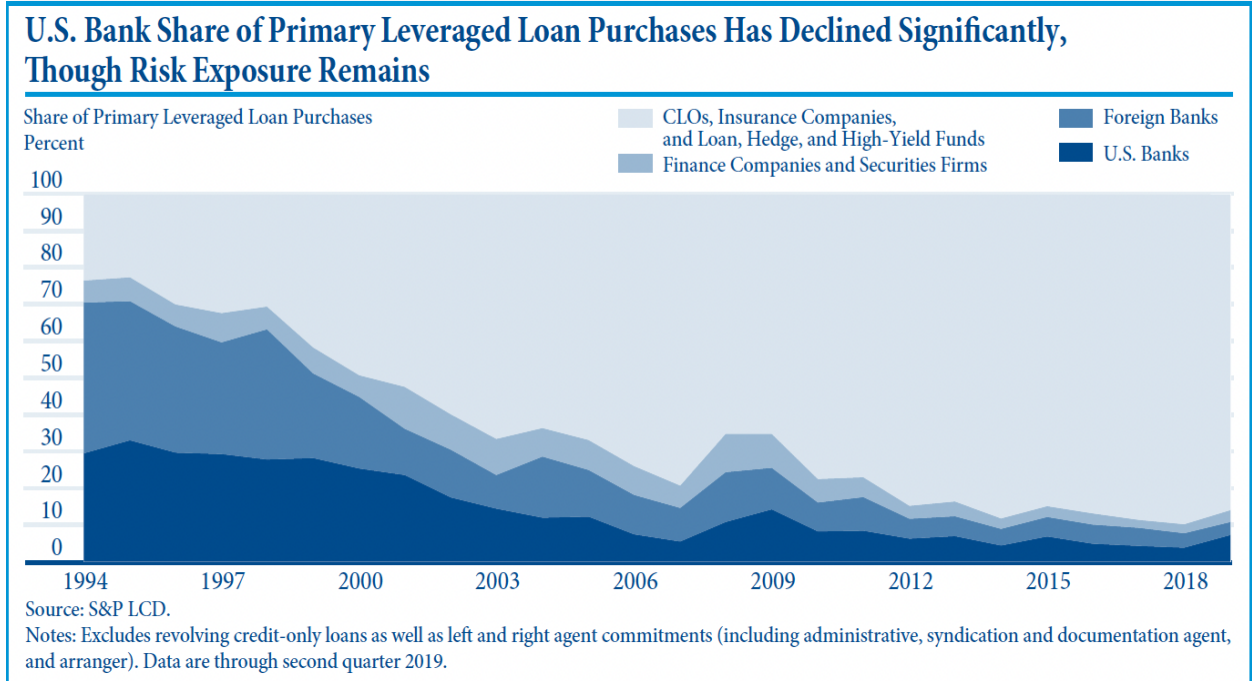
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## Appendix A: Additional Figures

**Figure A1**



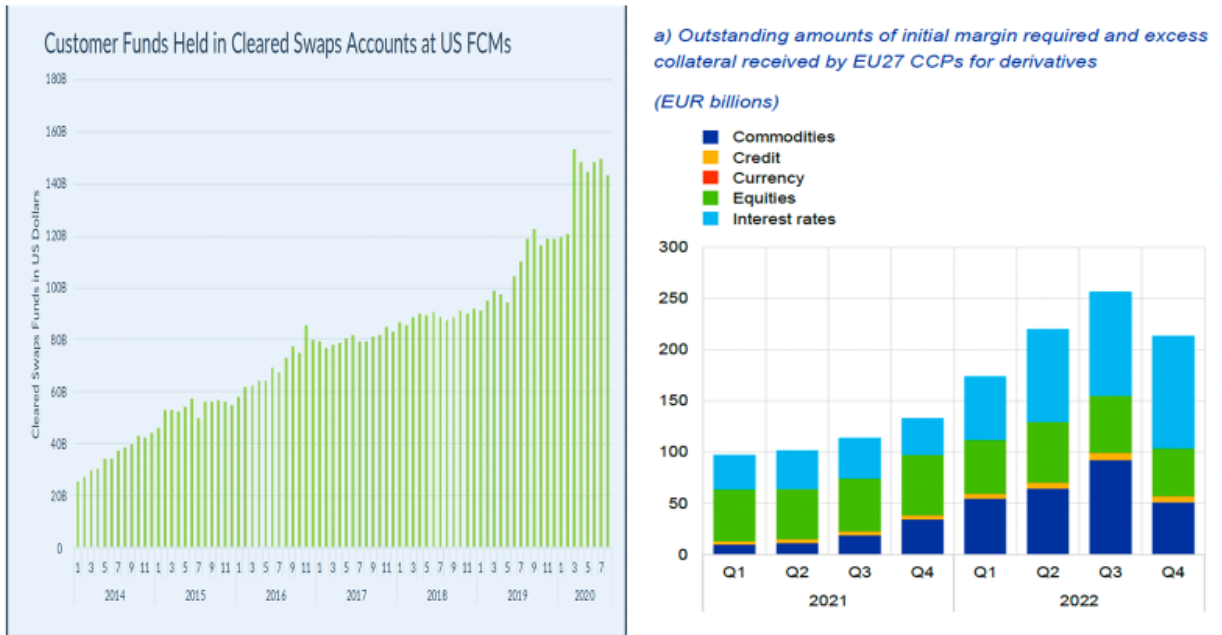
**Figure A2**

### Composition of banks' holdings of NBFIs' liabilities (2023Q1)

Issuer	Instrument	Composition	Issuer	Instrument	Composition
ABS	Corporate and Foreign Bonds	100%	GSE and Agency	Agency- and GSE-Backed Securities	98%
Broker/Dealers	Misc	69%	GSE and Agency	Misc	2%
Broker/Dealers	Federal Funds and Repos	17%	GSE and Agency	Federal Funds and Repos	0%
Broker/Dealers	Depository Institution Loans N.E.C.	13%	Life Ins.	Life Insurance Reserves	87%
Broker/Dealers	Corporate and Foreign Bonds	1%	Life Ins.	Misc	12%
Equity REITs	Mortg_comm	66%	Life Ins.	Federal Funds and Repos	1%
Equity REITs	Depository Institution Loans N.E.C.	15%	Mortgage REITs	Federal Funds and Repos	61%
Equity REITs	Corporate and Foreign Bonds	10%	Mortgage REITs	Corporate and Foreign Bonds	24%
Equity REITs	Misc	6%	Mortgage REITs	Depository Institution Loans N.E.C.	11%
Equity REITs	Mortg_home	3%	Mortgage REITs	Misc	4%
Finance Companies	Depository Institution Loans N.E.C.	70%	Other Fin. Bus.	Misc	63%
Finance Companies	Corporate and Foreign Bonds	19%	Other Fin. Bus.	Other Loans and Advances	37%
Finance Companies	Misc	11%	Other Fin. Bus.	Open Market Paper	0%
Finance Companies	Open Market Paper	0%	PC Ins.	Federal Funds and Repos	100%
Mutual Funds	Mutual Fund Shares	100%	PC Ins.	Misc	15%

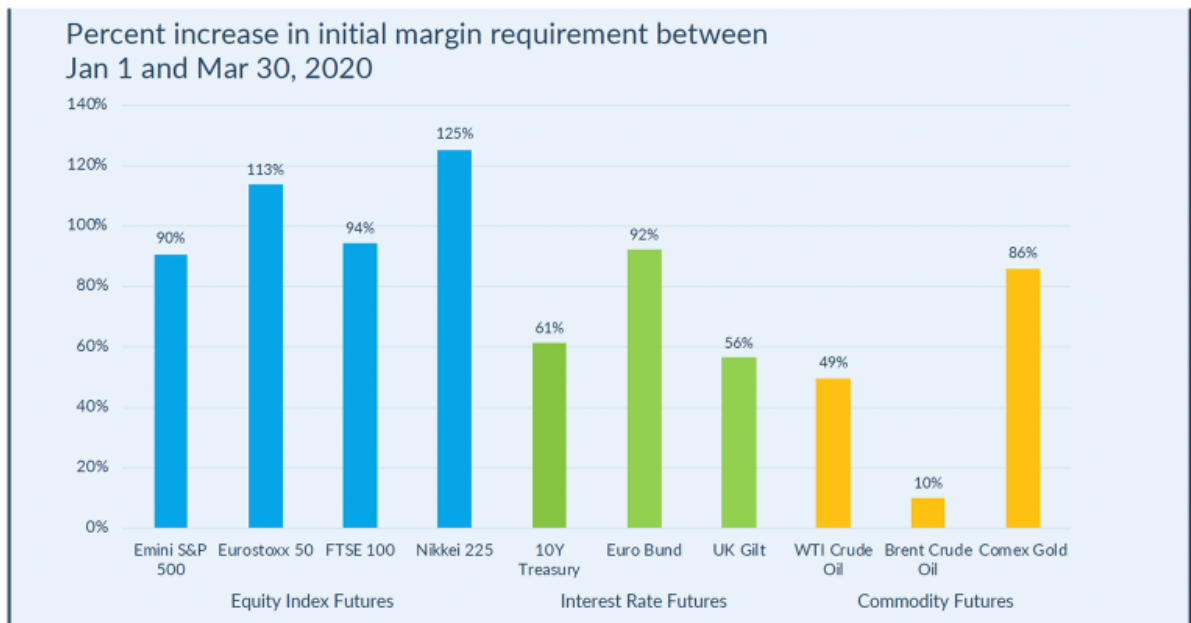
Source: Flow of Funds (From Whom To Whom)

**Figure A3**



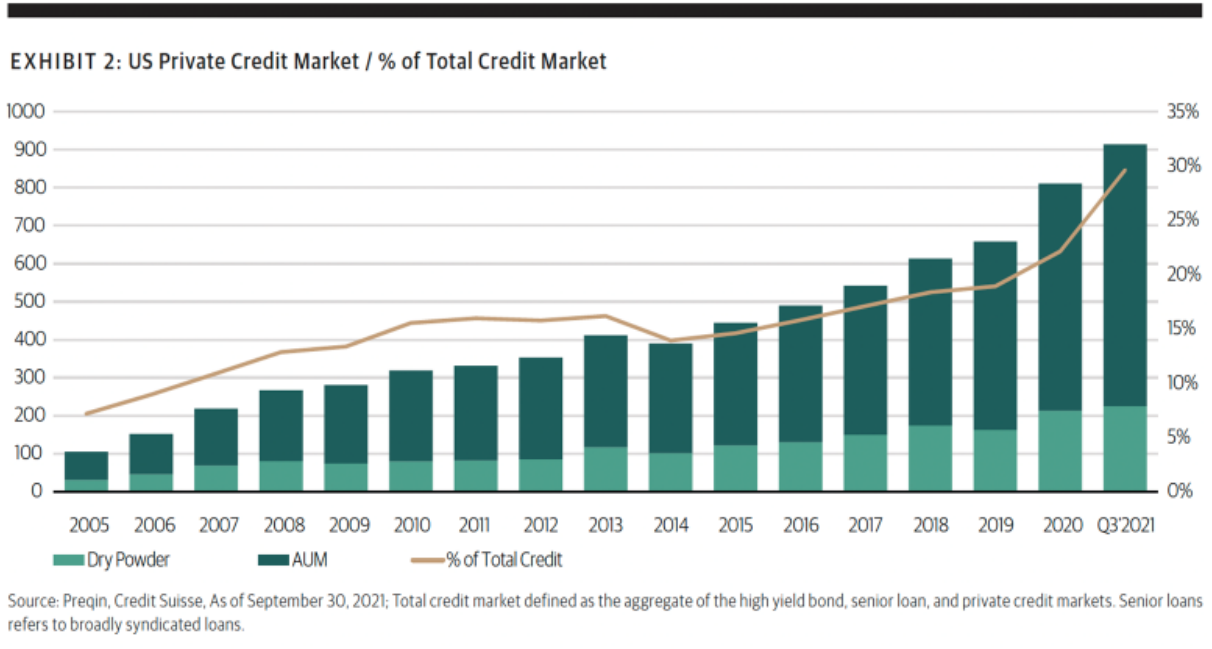
Sources: FIA (2020), p. 13, and European Systemic Risk Board (2023), Chart 23.

**Figure A4**

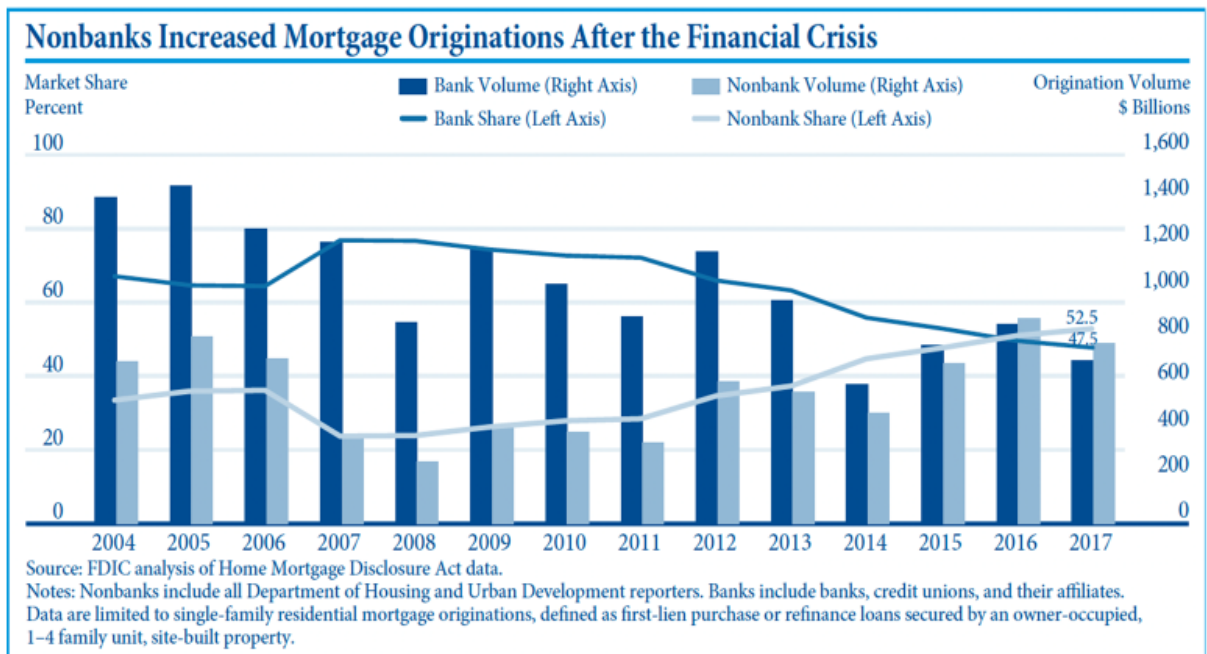


Source: FIA(2020), p. 8

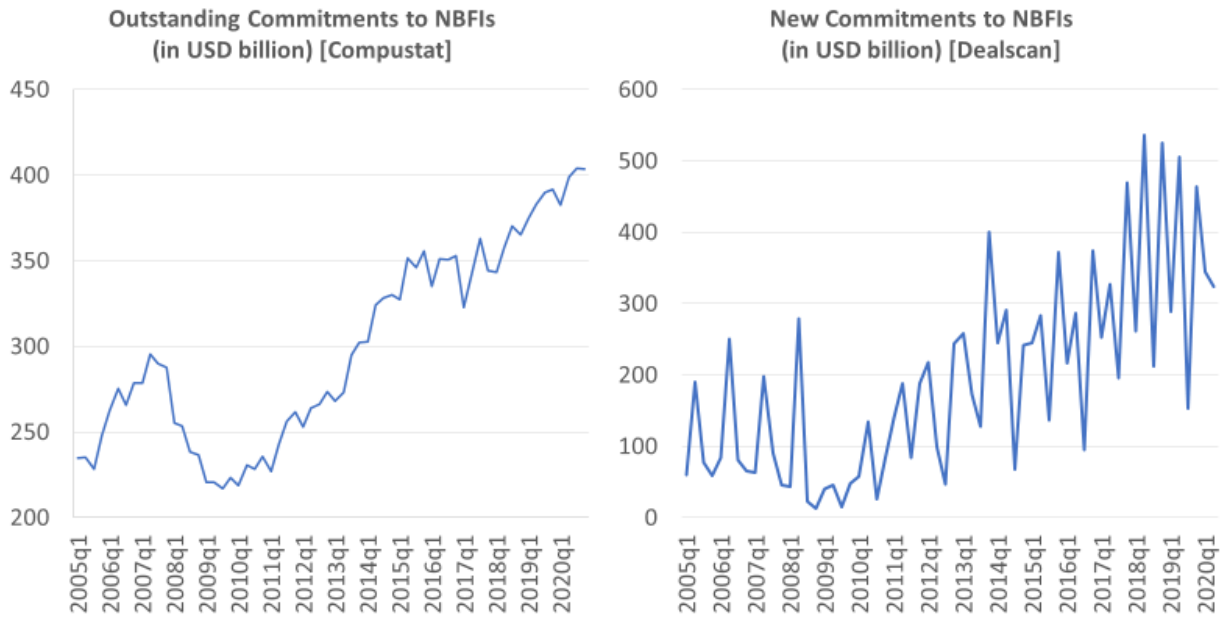
**Figure A5**



**Figure A6**

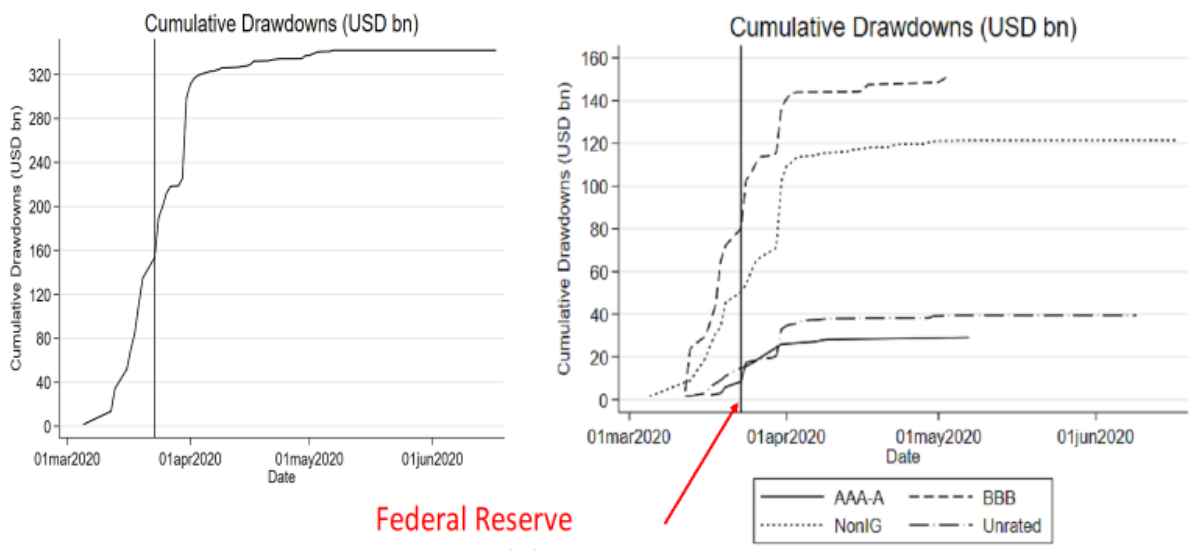


**Figure A7: Bank Commitments to NBFIs (Source: Compustat, Dealscan)**



Source: Acharya, Gopal, Jager and Steffen (2023)

**Figure A8: Aggregate and Rating-specific Cumulative Drawdowns of Bank Credit Lines by Non-bank Corporations during the COVID-19 Shock**



Federal Reserve announced the corporate bond buying program

Source: Acharya, Engle, Jager and Steffen (2021)

## Appendix B: Cetorelli, Landoni and Lu (2023) –

### Asset-linked Amplification of Risks between Banks and NBFIs

Using the historical Flow of Funds data, Cetorelli, Landoni and Lu (2023) have documented large multiples of an original fire-sale and that the magnitude of such externalities has been rising over time. Figure B1 displays asset holdings for banks and twelve distinct NBFi sub-sectors, using the Flow of Funds. As the figure shows, there is a significant overlap in asset classes across sectors, suggesting the potential importance of such network effects. For instance, equity holdings are certainly dominant for equity mutual funds, but they constitute significant shares of total holdings for P&C Insurers, Exchange Traded Funds, Hedge Funds and Pension Funds. Likewise, Agency MBS are held proportionally in meaningful amounts by Banks, Bond Funds, Mortgage REITs. And even more so, Corporate Bonds, Government Bonds and Municipal Bonds are diffused across many of the sectors.

**Figure B1:**

## Who holds what? 2022Q3 Flow of Funds

US \$ Billion	Equity	Agency MBS	Bank Loans	Open Market Paper	Corporate Bonds	Government Bonds	Muni Bonds	Cash
Banks	41	3,272	13,693	0	945	1,606	591	3,470
P&C Insurers	505	126	31	4	593	175	246	110
Life Insurers	117	194	850	21	2,701	141	189	130
Money Market Funds	0	492	0	245	6	1,256	113	2,955
Mutual Funds (Equity)	10,548	0	0	23	0	0	0	189
Mutual Funds (Bonds)	0	433	116	9	1,763	1,107	640	73
Mutual Funds (Hybrid)	530	91	24	3	371	233	135	25
Exchange-Traded Funds	4,554	0	0	0	708	381	87	33
Mortgage REITs	0	156	0	0	10	0	0	17
Broker-Dealers	192	68	0	23	13	127	15	1,484
Finance Companies	0	0	1,040	0	84	0	0	32
Hedge Funds	905	11	207	0	459	192	13	225
Pension Funds	3,786	275	22	46	1,116	537	0	580

Figure B2 below is from Cetorelli, Landoni and Lu (2023), Table 7 (p. 23). The numbers in the figure show the relative importance of the network of asset holding interconnections as a vector of shock amplification. Namely, the figure shows the estimated “network multipliers,” resulting from fire-sales originated from any individual sectors (NBFIs or banks). This network multiplier is defined – in relation to the example in Figure 9 – as the ratio of the Round 2 effect to the total of the Round 1 and Round 2 effects. For example, and still in reference to the stylized example of Figure 9a, take banks and bond mutual funds. How important, in 2023q1, would have

been the Round 2 propagation and amplification between banks and bond mutual funds in transmitting a fire-sale event originated by either side, relative to the total (sum of Round 1 and Round 2) effect, and conversely, how important is the transmission (and amplification) through the entire network?

According to Cetorelli, Landoni and Lu (2023)'s estimates, 89% of the cross-exposure between these two sectors comes from the Round 2 effect. Hence, in the context of Figure 9a, banks and bond mutual funds are still highly exposed to one another, even if banking institutions and bond funds may not necessarily hold large proportions of their assets in common. As Figure B2 indicates, this is true for most pairwise relationships (the majority of the estimated Round 2 effect to total effect ratios are well above 50%).<sup>40</sup>

**Figure B2: Share of pairwise fire-sale exposures driven by network spillovers (Source: Cetorelli, Landoni and Lau, 2023)**

Values in Percent		Final shock received by...													
		Banks	P&C	Life	MMF	MFE	MFB	MFH	ETFs	REIT	B&D	FinCo	HF	PF	
Shock originates from...	Banks		89	68	53	98	89	93	96	57	86	32	84	94	
	P&C Insurers			54	66	36	74	50	44	80	45	97	61	53	
	Life Insurers				92	94	66	84	85	87	90	93	83	81	
	Money Market Funds					100	60	82	89	62	55	100	88	81	
	Mutual Funds (Equity)						100	55	51	100	53	100	55	55	
	Mutual Funds (Bonds)							89	93	83	88	97	89	90	
	Mutual Funds (Hybrid)								57	91	58	98	63	61	
	Exchange-Traded Funds									96	55	98	59	58	
	Mortgage REITs										73	100	95	87	
	Broker-Dealers											100	61	59	
	Finance Companies												94	98	
	Hedge Funds													63	
	Pension Funds														

In other words, NBFIs can be legitimately seen as a set of separate segments in normal times, but they should be considered as parts of an organic whole in analyzing and understanding the propagation and the amplification of stress scenarios in the financial ecosystem.

<sup>40</sup> To reinforce this point, it is instructive to see the banks and finance companies. As indicated in the figure, the network multiplier between banks and finance companies is only 32%. This is mainly due to the fact that finance companies have an asset holding profile with a relatively small overlap with most of the other NBFIs sectors, while having most of their assets (loans) in common with banks. Hence, in the financial ecosystem, finance companies are somewhat of the exception to the rule that sees tight interconnections across sectors. However, even finance companies can be important originators of risk propagation, because a fire-sale starting from them can still amplify through their knock-on effects on banks.