The evolving nexus: sovereigns, banks and NBFIs

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Preliminary draft. Please do not circulate.

Abstract

The traditional bank-sovereign nexus has been a major financial stability concern, particularly following the eurozone crisis and the post-Covid rise in sovereign debt. However, non-bank financial institutions (NBFIs) have grown significantly to take center stage in international financial markets, particularly as key intermediaries in sovereign bond markets. This paper examines the transmission of risks among banks, sovereigns and NBFIs using bank-level data for European banks and aggregate data worldwide. We find that banks' exposure to their domestic sovereign has recently become less important in explaining the risk co-movement between banks and sovereigns. Instead, banks' exposure to domestic NBFIs has gained importance as an explanatory factor for the same co-movement. This is driven primarily by exposures to riskier sovereigns, either domestic or cross-border. We also find evidence that the importance of NBFI holdings of sovereign debt as drivers of the correlation between NBFI risk with sovereign risk has risen. Together, our results indicate that the traditional sovereign-bank nexus has morphed into a broader sovereign-bank-NBFI nexus.

JEL classification: F34, G01, G21, G23, H63
Keywords: banks, sovereign default, feedback loop, NBFI, nexus, risk

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1 Introduction

During the eurozone crisis, the sovereign–bank nexus – often referred to as the sovereign-bank "doom loop" (Brunnermeier, Garicano, Lane, Pagano, Reis, Santos, Thesmar, Van Nieuwerburgh, and Vayanos, 2016; Gennaioli, Martin, and Rossi, 2014) – emerged as a major vulnerability in the global financial system. Banks' holdings of sovereign debt exposed them to potential losses associated with sovereign distress, weakening their balance sheets and impairing credit provision to the real economy. At the same time, deteriorating bank health increased the contingent liabilities of sovereigns, which were often expected to provide support to struggling banks in order to prevent broader financial instability. This two-way feedback mechanism implied that stress could propagate bidirectionally between sovereigns and banks.

Since then, the structure of the financial system has changed in ways that call for a reassessment of this nexus. In particular, non-bank financial institutions (NBFIs) have grown substantially along several key dimensions – overall size, participation in sovereign debt markets, and interconnectedness with banks (for International Settlements, 2025; Garcia Luna and Hardy, 2019; Aldasoro, Huang, and Kemp, 2020). These developments motivate our central hypothesis: the traditional sovereign–bank nexus has evolved into a broader sovereign–bank–NBFI nexus, in which NBFIs play an increasingly important role in the transmission of sovereign risk to banks. This paper tests this hypothesis by examining how the channels linking sovereigns and banks have changed over time, and by documenting the role of NBFIs in shaping these relationships.

The key mechanism underlying this expanded nexus is the introduction of new frictions and feedback channels involving NBFIs. Many NBFIs, particularly hedge funds, engage in leveraged sovereign bond trading, often funded through short-term (repo) borrowing from banks. This implies that even relatively small shocks to sovereign risk can have a large negative impact on NBFIs' balance sheets. In response, NBFIs may deleverage by engaging in

fire sales of sovereign bonds and by withdrawing deposits from banks. Moreover, there would be an additional negative impact on banks due to a rise in the expected losses associated with their direct exposures to NBFIs. All of these would put pressure on both banks and sovereigns, which would in turn have additional (second round) negative effects on NBFIs. This gives rise to a triangular propagation mechanism, in which shocks to any one of the three sectors – sovereigns, banks, or NBFIs – are transmitted to the other two, resulting in a negative feedback loop passing through all three nodes of the sovereign-NBFI-bank nexus.

We test the empirical implications of this hypothesis using both bank-level and aggregate data. At the bank level, using European Banking Authority (EBA) data, we examine how the correlation between bank and sovereign CDS spreads is affected by banks' exposures to sovereigns and financial institutions. At the aggregate level, using the BIS international banking statistics, we examine the respective relationships at the national banking system level. In both (bank-level and macro) sets of empirical exercises, we assess whether the relative importance of direct sovereign exposures versus financial sector exposures has changed over time.

Our results show that the traditional sovereign–bank nexus has weakened (when considered in isolation). In the earlier part of our sample (prior to 2016), the co-movement between the CDS spreads of banks and sovereigns was higher for banks with greater holdings of risky sovereign debt. In the part of our sample (post-2016), this relationship weakened significantly. However, when we incorporate banks' exposures to the financial sector, particularly to NBFIs, we find a different pattern: in the later period, greater exposure to financial counterparties located in high-risk sovereign jurisdictions is associated with a stronger correlation between bank and sovereign risk. This shift from direct sovereign exposures to indirect exposures via the financial sector is also documented in the results generated using aggregate data.

To further isolate the underlying mechanism, we also examine banks' foreign exposures. This allows us to abstract from the domestic bailout channel that may confound the drivers

of the sovereign–bank CDS spread co-movement. The results from these international regressions confirm our main finding: the importance of direct sovereign exposures has decline over time, while the role of financial sector exposures has increased. Moreover, the evidence suggests that this shift is driven more by the riskiness of the borrowing sovereign than by the nationality of the lending bank. For example, the main determinant of the CDS spread comovement between core European banks and peripheral sovereigns switches from banks' direct sovereign exposures prior to 2016 to banks' exposures to the financial sector. In contrast, the comovement between the CDS spreads of peripheral banks and core sovereigns is driven primarily by banks' exposures to financial institutions throughout the sample.

We also investigate the role of funding and liquidity in amplifying these effects. The expanded (sovereign-bank-NBFI) nexus is more pronounced for banks holding more liquid assets. This is consistent with the hypothesis that banks that tend to fund to certain NBFIs (such as hedge funds) through short-term repo lending tend to be more exposed to sovereign risk through their exposures to NBFIs. In addition, banks' liability-side exposures (through deposits) to NBFIs independently contribute to higher co-movement with sovereign risk, beyond the effects of their asset-side exposures.

Finally, we examine the third side of the (sovereign-bank-NBFI) triangle by analyzing the direct relationship between sovereigns and NBFIs. Using aggregate data on NBFI holdings of sovereign debt, we find patterns consistent with our bank-level results: higher sovereign debt exposure by NBFIs is associated with stronger co-movement between NBFI and sovereign risk, particularly in the later part of the sample.

Taken together, our findings support the hypothesis that the sovereign-risk nexus has expanded from a bilateral sovereign–bank relationship to a triangular sovereign–bank–NBFI nexus. While banks' direct holdings of sovereign debt have become less central in explaining risk transmission between banks and sovereigns, the importance of banks' indirect exposures through NBFIs has grown. This shift is most pronounced for riskier sovereigns and may reflect changes in regulation, market structure and business models. More broadly, our results

highlight the need to incorporate NBFIs into analyses of financial stability and sovereign risk transmission.

Literature Our paper is related to several strands of existing literature. More concretely, we build on existing work that has examined each of the three of edges of the triangle linking sovereigns, banks and NBFI.

The sovereign-bank nexus has been explored both theoretically and empirically in a number of insightful papers. Much of these focus on the Eurozone crisis where both domestic and cross-border aspects of this nexus were on display (Brunnermeier et al., 2016; Fahri and Tirole, 2018; Acharya and Steffen, 2015; Bocola, 2016; Gennaioli et al., 2014; Acharya, Drechsler, and Schnabl, 2014). A few others examine these dynamics in the context of emerging markets, where sovereign risk and banking fragility are often more apparent and crises (sovereign, currency, banking) often come together (Baskaya, Hardy, Şebnem Kalemli-Özcan, and Yue, 2024; Brutti, 2011; Reinhart and Rogoff, 2011). Our paper's key contribution to this discussion is expanding the view of the sovereign bank nexus to account for the growing role of NBFIs, their particular risk sensitivities, and their feedback loops. We also highlight the particular vulnerability of (exposure to) riskier sovereigns for these dynamics.

A growing literature has highlighted the growth and financial stability risks of the NBFI sector and their links with banks. Many NBFIs are reliant on banks for their funding, even when they are competing with them in credit markets (Jiang, 2023; Acharya, Gopal, Jager, and Steffen, 2025). The links between banks and NBFIs run even deeper, as NBFIs also often also provide funding to banks. These "interwoven" activities mean banks are exposed to credit and liquidity risks that may appear to have been shifted to the NBFI sector, likely generating the observed correlation in bank and NBFI abnormal equity returns (Acharya, Cetorelli, and Tuckman, 2024).[1] Our paper brings these risk links into the sovereign-bank

[1]Banks also have indirect exposure to NBFIs by investing in the same assets and thus being exposed to NBFI driven fire sales depressing the value of those assets (Cetorelli, Landoni, and Lu, 2023).

nexus and document how sovereign risk propagates through NBFIs to banks.

Lastly, a set of papers have documented the participation of NBFI investors in the sovereign debt market. Fang, Hardy, and Lewis (2025); Arslanalp and Tsuda (2014a,b) show that non-bank investors (mainly NBFIs) are large investors in terms of the share of sovereign debt that they hold. Fang et al. (2025) further highlights how NBFI's holdings of sovereign debt are more price responsive than those of other investors, making their behavior (especially flightiness during stress) particularly important for the price of sovereign debt. As central banks wind down their balance sheets, non-bank investors have been the key players stepping in, thus increasing their market exposure and relevance in recent years (Du, Forbes, and Luzzetti, 2024; Eren, Schrimpf, and Xia, 2025). NBFIs also affect this market by their use of sovereign bonds in leveraged trading activities (eg the cash-futures basis trade (Barth and Kahn, 2025)). We point the implications for these links and vulnerabilities back to the sovereign-bank nexus.

The above literature strands have examined each of the three of edges of the sovereigns-NBFI-banks triangle in isolation (i.e. focusing on only one of the three bilateral links at a time). In contrast, we examine all three edges of the sovereigns-NBFI-banks triangle simultaneously and document how they influence each other in a feedback look that is broader than the traditional sovereign-bank loop. This is our main contribution to the existing literature.

The remainder of this paper is structured as follows: Section 2 describes conceptually how the expanded sovereign-bank-NBFI nexus operates; Section 3 details the data used in our analysis; Section 4 describes the empirical approach and presents the results of our bank-level analysis; Section 5 describes the empirical approach and presents the results of our country-level analysis. Section 6 concludes.

2 The sovereign-bank-NBFI nexus

The sovereign-bank nexus used to have a two-way feedback loop at its core (Figure 1). For banks, this operated through their direct exposures to sovereign debt. A decline in the value of sovereign debt impaired their net worth and led to a cut in credit. For sovereigns, this worked through the risk that a systemic banking crisis would further weaken the economy and impair their creditworthiness, incentivizing them to (at least implicitly) provide support to banks during stress. Thus, both sovereigns and banks are directly impacted by each other's default risk, in addition to the general macroeconomic impacts of the individual failure of each.

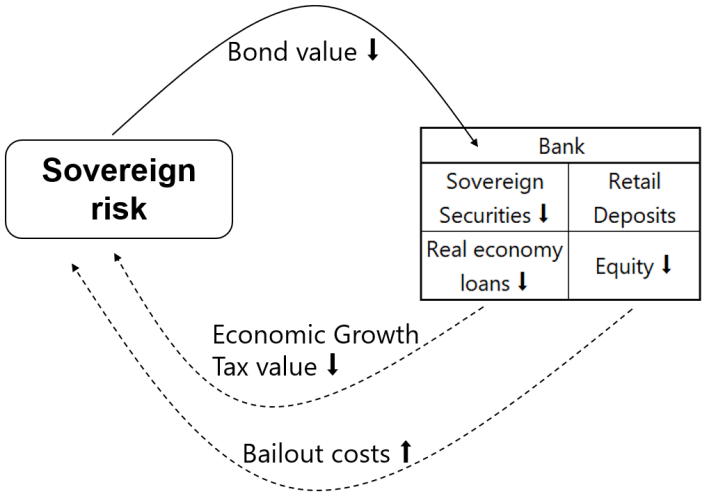


Figure 1: Classic Sovereign-Bank Loop

Notes: Replicated from Brunnermeier et al. (2016).

Adding NBFIs into this nexus changes the dynamics (Figure 2). NBFIs have long been key intermediaries and investors in the sovereign debt market, particularly among advanced economies. But NBFIs' role in the global financial system has grown significantly over the past decade. There has been a substantial increase in both, NBFI's footprint in sovereign debt markets, as well as their linkages with banks. NBFIs directly holding sovereign debt

are exposed to increases in sovereign risks or sovereign defaults. These vulnerabilities can be amplified when these intermediaries take leveraged positions with these investments. Sovereign debt is also increasingly used as collateral in financial transactions. A rise in sovereign risk lowers the value of sovereign bonds as an investment or as collateral, potentially inducing margin calls or fire sales.

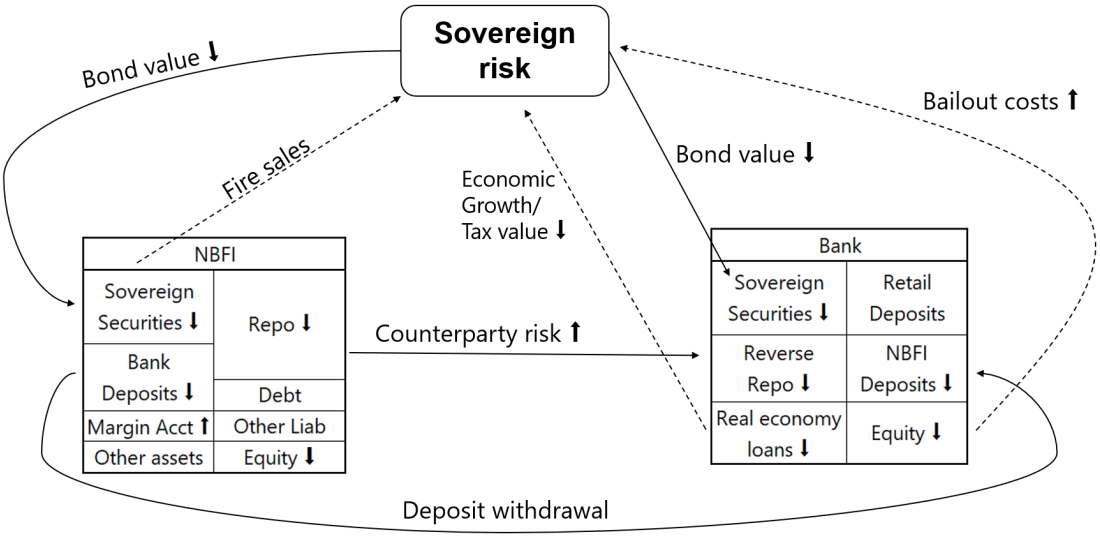


Figure 2: Sovereign-Bank-NBFI Triangle

Notes: Authors' elaboration.

The above shocks can be transmitted back to both sovereigns and banks. In the case of fire sales, this further depresses the value of sovereign debt, increases sovereigns' borrowing costs, reduces their fiscal space and impairs their creditworthiness. When NBFIs face margin calls and incur losses on their sovereign bond holdings, they become riskier counterparties for the banks. Furthermore, as NBFIs become more constrained, this could generate significant liquidity shocks for banks, as NBFIs are also key providers of funding to banks.

To give a more concrete example, the leveraged trading strategies that some NBFIs - and hedge funds in particular - deploy in sovereign bond markets could generate several of the above stress transmission channels (Hernández de Cos, 2025). These leveraged strategies are typically facilitated by NBFI's short-term repo borrowing from banks. As a result, they are

highly vulnerable to adverse shocks in funding markets. Thus, even a mildly negative shock in sovereign bonds markets (triggered either by negative fiscal news or shifts in overall market sentiment) could be significantly amplified by the rapid unraveling of the NBFI's leveraged strategies. In turn, this would (i) transmit to banks via their direct lending exposures to NBFIs and (ii) likely lead to sharp spikes in government bond yields. The latter effect could then trigger further unwinding of NBFI's leveraged positions, thus triggering a new round in the new three-way (sovereign-bank-NBFI risk) feedback loop. As a consequence, the impact of the initial shock in sovereign bond markets would be more negative for banks that are more exposed to NBFIs rather than for banks that are more directly exposed to the sovereign (since, in most cases, the volatility in sovereign bond yields would not translate in a sharp increase in the sovereign's probability of default).

In addition, the direct exposure channels described above, the three-way feedback loop could also be fueled via the indirect exposures that all three nodes of the bank-NBFI-sovereign nexus have to the real economy. More concretely, the spikes in government bond rates described above would likely translate into sharp increases in interest rates in the real economy (eg mortgages, consumer loans, business loans, corporate bond rates, etc). This would have a negative impact on economic activity, which would in turn be an additional adverse shock for sovereigns (due to lower tax revenues), as well as for banks and NBFIs (due to the deterioration in the creditworthiness of their real-economy borrowers).

Thus, through all of the above channels, sovereign stress can transmit risk to NBFIs, which can propagate that risk on to banks. In turn, stress in the NBFI sector can directly spill over to banks and have direct impact on the pricing of sovereign debt (Fang et al., 2025). This naturally leads us to hypothesize that the classic sovereign-bank nexus has morphed into a broader sovereign-bank-NBFI nexus. In the rest of the paper, we test this hypothesis empirically along multiple dimensions.

3 Data

We examine the relationship between sovereign, bank, and NBFI exposure and risk using bank-level data for European banks as well as aggregate data for a global sample.

The bank-level data stems from the EBA's stress test and transparency exercises. Between 2009 and 2011, spurred by the Great Financial Crisis, the EBA conducted yearly stress tests, the results of which were published. Only in 2011, as an answer to worries about the Sovereign Debt Crisis, the EBA started to also disseminate information about banks' portfolio composition, in particular regarding their sovereign exposures. These disclosures entered an annual schedule starting in 2013 where in roughly every second year, the EBA publishes the data without further analysis ("transparency exercise") while in the other years, the EBA conducts a stress test based on the same data and publishes the results of the test alongside the raw data ("stress test exercise"). In most years, the sample of banks comprises the banks supervised by the ECB but there have been vintages where fewer banks have been in the sample. The data vintages from 2013 to 2019 contain semi-annual data while the data vintages from 2020 to 2024 contain quarterly data. The information we use are the exposures of banks to the sovereign sector and the financial sector of the top 10 counterparty countries. The data set we compile out of all these releases covers exposures from 2011Q4 to 2024Q2 for 213 banks headquartered in 29 countries. When we match these banks to CDS spread data from Markit, we are left with 65 banks from 16 countries. To measure the riskiness of a country's sovereign we also use CDS spreads from Markit.

For our aggregate analyses, we aggregate the CDS spreads using the weighted-average for banks/NBFIs in the country with active CDS and total asset information (weighting factor). For NBFIs, companies with active CDS are mostly (re-)insurance companies, real estate companies or, occasionally, asset management companies.

At the aggregate level, our main dataset is the BIS consolidated banking statistics (CBS). The sample covers quarterly consolidated exposures of banks headquartered in 27 countries

to the sovereign sector in 66 counterparty countries. These exposures include both cross-border lending as well as local claims by the bank's affiliates located in the counterparty country to official sector borrowers and NBFI sector borrowers. When we match this data to countries for which we can produce an estimate of the domestic banking sectors' CDS spreads and have the counterparty countries' sovereign CDS spreads, we obtain a sample of 20 bank nationalities and 42 counterparty countries from 2014Q1 to 2025Q2.

We supplement this with two other aggregated datasets to better capture NBFI positions. To get NBFI investment in the domestic sovereign debt market, we use data from Arslanalp and Tsuda (2014a) and Arslanalp and Tsuda (2014b). These datasets provide quarterly estimates of the holdings of sovereign debt by domestic nonbanks for 24 advanced economies and 22 emerging and developing countries from 2004Q1 to 2025Q2. We use nonbank exposures as a proxy for NBFI exposures, as NBFIs are the dominant investor in that category. We pair this with information on the size of the NBFI sector in each country collected by the Financial Stability Board (FSB). This data set is of annual frequency and covers 28 advanced and emerging countries from 2002 to 2024. When we match this to countries for which we can produce an estimate of the NBFI sectors' CDS spreads and we have counterparty countries' sovereign CDS spreads, we obtain a sample of 11 countries from 2004Q1 to 2024Q3. It is important to stress that, while we can do cross-border analysis for both the EBA and CBS datasets, we cannot do so in the NBFI exposure data as we only observe domestic holdings of the NBFI sector.

4 Bank-level analysis

4.1 Empirical Approach

We focus on how banks' exposure to sovereigns and NBFIs affects the correlation between bank risk and sovereign risk. We run analyses at the bank-day level using daily CDS spreads.

We implement this with the following regression:

$$CDS_{b,t} = \beta_1 * CDS_{j,t} + \beta_2 * Sov.\ Exposure_{b,j,t} + \beta_3 * Fin.\ Exposure_{b,j,t} + \tag{1}$$
$$\beta_4 * Sov.\ Exposure_{b,j,t} \times CDS_{j,t} + \beta_5 * Fin.\ Exposure_{b,j,t} \times CDS_{j,t} + \alpha_{b,q} + \epsilon_{b,t}.$$

In this equation, b denotes a bank, j denotes the country of the exposures, and t denotes time (day) and q indicates quarter. Therefore, $CDS_{b,t}$ is the daily CDS spread for bank b and $CDS_{j,t}$ is the respective daily CDS spread for sovereign j.

The exposure of the bank to either the sovereign ($Sov.Exposure_{b,j,t}$) or the financial sector ($Fin.Exposure_{b,j,t}$) in a given country is measured at the end of a given quarter and linearly interpolated between quarter-ends. This interpolation is implemented to avoid sudden jumps in exposures driving the results. Each bank's sector-specific (sovereign and financial sector) exposures are scaled by total exposures of the bank (reported in the same dataset). Financial sector exposures serve as a proxy for exposure to the NBFI sector, but also include exposures to other banks (which themselves may also have exposure to sovereign debt).[2] These exposures are then interacted with the CDS spread of the corresponding sovereign. Sovereign CDS spreads are demeaned for each country so that the respective coefficients can be interpreted at long-term averages. Both the sovereign and financial exposures are standardized to have mean 0 and a standard deviation of 1, which allows for a one-standard deviation interpretation and better comparability between the different exposure measures. $\alpha_{b,q}$ are bank-quarter fixed effects, controlling for other medium-term factors specific to a given bank (eg their capitalization or profitability in a given quarter).

This regression setup means we are examining the sensitivity of the correlation between bank and sovereign CDS spreads to banks' (sovereign and financial sector) exposures. A positive coefficient on β_4 for instance is consistent with the classical sovereign-bank nexus

[2]In the appendix, we analyse the baseline results using a proxy measure for NBFI exposure constructed based on the ratio of NBFIs' non-performing loans (NPLs) to financial sector's NPLs.

result, indicating that greater bank exposure to sovereign debt is associated with banks' risk co-moving more closely with that of the sovereign.

In our analysis, we split the sample along two key dimensions.

The first split is with respect to the time period. We examine the relationships described above during two time windows: 2011Q4-2015Q4 and 2016Q1-2024Q2. The earlier window includes the eurozone crisis itself as well as a low interest rate environment with easy monetary conditions.The latter window features a larger NBFI sector that is more active in sovereign debt markets, much larger sovereign debt, the Covid-19 pandemic with its associated policy measures (including large fiscal stimulus packages), and subsequent high-rate, high-inflation environment.

The second dimension along which we split our sample is related to the relative riskiness of sovereigns. While all sovereign debt carries risk, some sovereign bonds are perceived to be safe assets and treated by investors in a completely different way from the debt of other sovereigns. For this reason, we split our sample into high risk and low risk sovereigns. In Europe, this translates to a split into periphery (ES, GR, IE, IT, PT) and core (AT, BE, DE, DK, FI, FR, NL, NO, SE, UK). In our baseline analysis, we focus primarily on exposure to the domestic sovereign, so the "periphery" subsample de-facto refers to the country of both the sovereign and the banks' headquarters.

4.2 Results

We first examine the classic sovereign-bank nexus in Table 1, focusing on the domestic sovereign and without including the financial sector exposure and its interaction. When we examine this relationship on the full sample (column (1)), we do not see the positive coefficient on the interaction of sovereign exposure with the sovereign's CDS spread, in contrast to the classic sovereign-bank nexus story. This is the case for banks from both core countries (column (2)) periphery countries (column (3)). However, this appears to be

mainly an artifact of the time period. In our pre-2016 sample – which corresponds to the period of analysis for many studies of the sovereign-bank nexus in the eurozone (eg Acharya et al. (2014), which also examines CDS spread correlations) – we see the expected positive coefficient (Columns (4)-(6)). This is especially strong and statistically significant for banks from the periphery, where the eurozone stress was concentrated.

The results for the post-2016 window are quite different. Instead of the usual positive coefficient on the interaction term, we see a negative one (columns (7)-(9)). The estimate is more statistically significant in the periphery, but the magnitude is similar for the core.[3] These results suggest that there was a significant change in the sovereign-bank risk relationship between the earlier sample and the later sample.[4]

We next add in exposures to the financial sector in Table 2, which may help to explain the change in the nature of the sovereign-bank nexus. The financial sector exposure appears to strengthen the sovereign-bank CDS correlation in the full sample (column (1)), especially for periphery countries (column (2)). This appears to be driven mainly by the post-2016 period (columns (7)-(9)), and again especially by the periphery countries (column (8)) where the baseline sovereign risk is higher.

Taken together, the results from Tables 1 and 2 suggest that the classic sovereign-bank nexus has morphed into a sovereign-bank-NBFI nexus. More concretely, there are important differences in the key estimated relationships between the two (pre-2016 to post-2016) subsamples we examine. Sovereign exposure gets replaced by financial sector exposure as the main driver of co-movement between bank and sovereign default risk in the later sample

[3] A potential explanation for a negative coefficient is an implicit bailout guarantee. Banks could hold more government bonds either because of moral suasion (Ongena, Popov, and Van Horen (2019)) or because of activities in the money market – a typical feature of large dealer banks. In both cases, the implicit bailout guarantee by the government might be higher. That is, when sovereign risk rises, the standard transmission channels through the real economy hit both bank types equally but those more exposed can rely on the higher probability of government bailout resulting in a negative correlation between sovereign exposures and risk co-movement.

[4] Related evidence is presented in Hardy and Zhu (2023). Country-quarter level bank-sovereign CDS correlations is lower for advanced economies after Covid, but risk links remain more apparent for EMEs and riskier sovereigns.

Table 1: Domestic sovereign-bank nexus

This table shows results of estimating Specification 1 with only the sovereign exposure terms. Columns (1) to (3) display the results for the full sample, columns (4) to (6) display the results for the sample period until 2015Q4, and columns (7) to (9) display the results for the sample period starting 2016Q1. Periphery refers to banks from Greece, Ireland, Italy, Portugal and Spain. Core refers to banks from Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, or the United Kingdom. Sovereign CDS spreads are de-meaned at the country level. Sovereign exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Full sample			Pre-2016			Post-2016	
	All	Periphery	Core	All	Periphery	Core	All	Periphery	Core
Government CDS Spread (in bps)	1.084***	1.048***	1.675***	0.845***	0.717***	1.614***	1.239***	1.464***	2.989***
	(0.105)	(0.122)	(0.103)	(0.098)	(0.106)	(0.103)	(0.274)	(0.299)	(0.617)
Sov. Exposure	−8.064**	−16.629**	1.660	−6.189	−6.781	−1.374	−14.663***	−41.302***	−0.865
	(3.914)	(7.513)	(3.129)	(8.483)	(14.235)	(6.494)	(4.759)	(11.015)	(3.083)
Sov. Exposure x Gov. CDS Spread	−0.125**	−0.128*	0.041	0.049	0.101**	0.017	−0.229***	−0.323***	−0.248
	(0.058)	(0.067)	(0.057)	(0.046)	(0.051)	(0.071)	(0.087)	(0.095)	(0.204)
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster Bank-Quarter	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	119,250	45,197	74,053	42,969	16,401	26,568	76,281	28,796	47,485
R^2	0.986	0.984	0.974	0.988	0.984	0.965	0.981	0.979	0.973

period. Moreover, the size of the coefficient of the financial sector interaction in the later half of the sample is significantly larger than the coefficient of the sovereign interaction. This suggests that while the key risks associated with the linkages between banks and sovereigns have not disappeared, but have moved to different parts of banks' balance sheets.

Other banks are included in this financial sector exposure variable, which contaminates the interpretation that this is reflective of NBFI exposure. One way to refine this measure is to use information from the EBA about non-performing loans (NPLs), which has NBFIs as a separate category. Assuming that the share of NBFIs within non-performing loans of financial counterparties is representative of the share of NBFIs in the overall exposure, we can use that share to obtain a proxy for true NBFI exposure. Doing this, as shown in

Table A.1 in the appendix, yields similar results.

Table 2: Domestic triangle relationship - sovereign and financial exposure

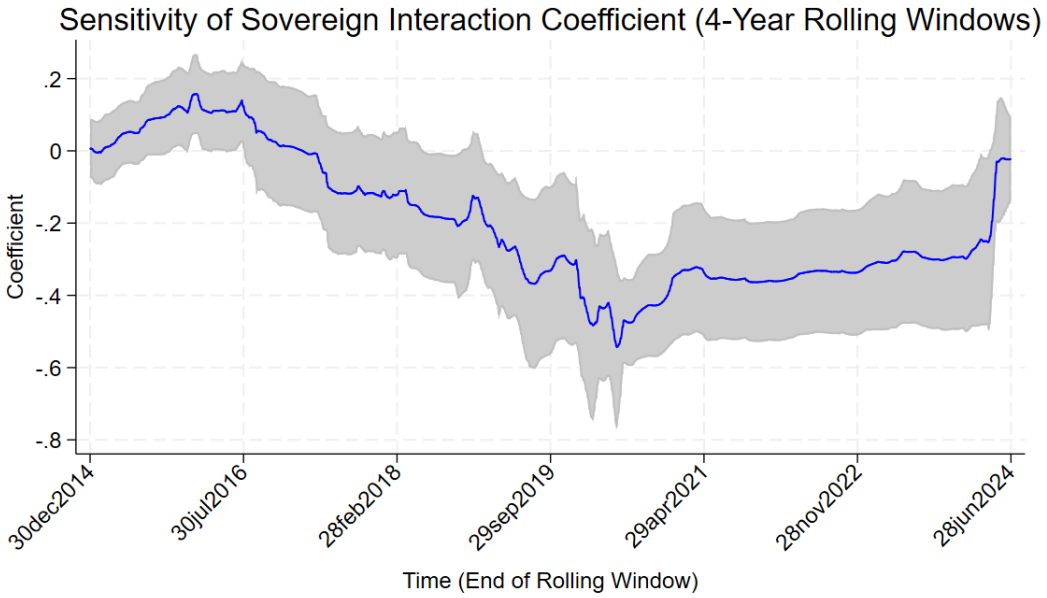
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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample			Pre-2016			Post-2016		
	All	Periphery	Core	All	Periphery	Core	All	Periphery	Core
Government CDS Spread (in bps)	1.000***	0.967***	1.675***	0.843***	0.714***	1.610***	0.978***	1.166***	3.020***
	(0.097)	(0.110)	(0.103)	(0.096)	(0.106)	(0.104)	(0.262)	(0.293)	(0.617)
Fin. Exposure	0.910	3.404	−2.113	−6.034	−9.925	−4.912	8.833***	7.716**	9.669*
	(3.131)	(4.835)	(2.720)	(5.063)	(18.323)	(3.098)	(2.998)	(3.484)	(5.538)
Sov. Exposure	−10.248***	−20.789***	1.944	−5.633	−5.696	0.961	−12.978***	−36.572***	1.551
	(3.826)	(7.114)	(3.212)	(8.829)	(15.118)	(6.333)	(4.590)	(10.680)	(3.196)
Sov. Exposure x Gov. CDS Spread	−0.158***	−0.163***	0.064	0.019	0.087	−0.057	−0.215**	−0.295***	−0.097
	(0.054)	(0.060)	(0.079)	(0.048)	(0.054)	(0.114)	(0.083)	(0.093)	(0.199)
Fin. Exposure x Gov. CDS Spread	0.122***	0.128***	−0.014	0.042*	0.021	0.038	0.214***	0.213***	−0.271***
	(0.028)	(0.030)	(0.038)	(0.025)	(0.027)	(0.051)	(0.044)	(0.043)	(0.073)
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster Bank-Quarter	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	119,250	45,197	74,053	42,969	16,401	26,568	76,281	28,796	47,485
R^2	0.987	0.984	0.974	0.988	0.984	0.966	0.981	0.979	0.973

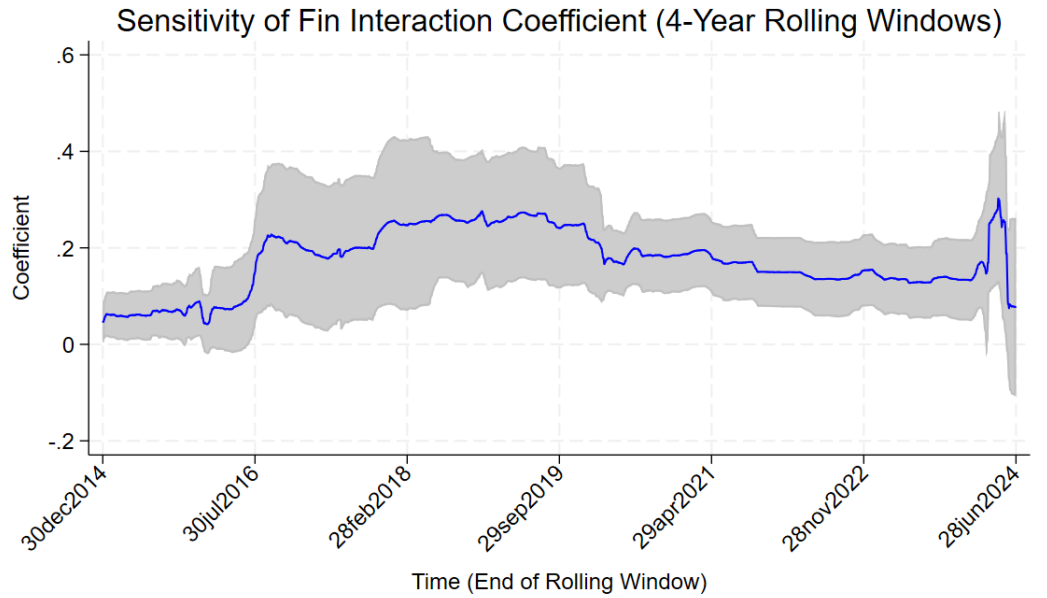
Figure 3: Rolling window coefficients interaction terms

This figure shows the interaction coefficients from estimating 4-year rolling window versions of specification 1. Panel A plots the coefficient of the sovereign exposure interaction, while Panel B plots the coefficient of the financial exposure interaction. The shaded grey areas represent the 90% confidence intervals.

Panel A - Sovereign exposure interaction



Panel B - Financial exposure interaction



To get a better sense of the time series dynamics of the shift that we document, Figure 3 displays the evolution of the interaction terms from Table 2 when running 4-year rolling window regressions. Panel A illustrates that the sovereign exposure sensitivity fades away after the European Sovereign Debt crisis. Around the same time, in 2016, the financial exposures sensitivity picks up and stays at an elevated level until the end of our sample period.

Thus, the results presented thus far suggest that the traditional sovereign-bank nexus was strongest in the earlier period and weakened in the later period, with financial sector exposure now driving the nexus relationship. These links are strongest in periphery countries where sovereign risk is higher. But is this due to the sovereign in these countries or rather the banks?

To check this, we examine the exposure of banks in the core to sovereigns in the periphery, and banks in the periphery to sovereigns in the core (Table 3). Columns (1)-(3) show that for exposure of banks from core countries to sovereigns and financial sector in periphery countries, larger exposure increases the correlation of bank risk with that of the sovereign from that country. While this effect is not statistically significant in the pre-2016 window, it turns statistically significant (while also growing considerably in magnitude) in the post-2016 window. Conversely, direct sovereign exposures directly strengthen the risk correlation pre-2016, but not post-2016. Going in the opposite direction (banks in periphery exposure to sovereigns and financial institutions in the core), we find a very strong link via financial sector exposures for the full sample, as well as for each of the two windows we examine. In contrast, there is no additional effect from direct sovereign exposure. Thus, it seems that the classic sovereign-bank nexus effect was strongest pre-2016 and was primarily driven by exposures to riskier sovereigns, rather than by banks being from countries with riskier sovereigns. In contrast, the link to sovereign risk in cross-country exposures that runs through the financial sector appears to be a more recent (post-2016) phenomenon that is present for all (core and periphery) banks.

Table 3: Cross-border triangle relationship

This table shows results of estimating Specification 1 with cross-border instead of domestic exposures. Columns (1) to (3) display the results for European core banks' exposure to sovereigns from the European periphery, and columns (4) to (6) display the results for European periphery banks' exposure to sovereigns from the European core. Periphery refers to banks from Greece, Ireland, Italy, Portugal and Spain. Core refers to banks from Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, or the United Kingdom. Sovereign CDS spreads are de-meaned at the country level. Sovereign and financial exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)
	Core-to-periphery			Periphery-to-core		
	Full sample	Pre-2016	Post-2016	Full sample	Pre-2016	Post-2016
Government CDS Spread (in bps)	0.188***	0.224***	0.214***	0.076***	0.180***	0.043***
	(0.023)	(0.031)	(0.067)	(0.010)	(0.042)	(0.012)
Fin. Exposure	4.710**	4.385*	24.665**	0.914***	−1.644**	0.890*
	(1.884)	(2.398)	(11.655)	(0.261)	(0.787)	(0.513)
Sov. Exposure	4.219**	−6.567	−0.527	−0.472***	−0.311	−0.299
	(1.856)	(4.469)	(4.091)	(0.157)	(1.135)	(0.210)
Sov. Exposure x Gov. CDS Spread	0.246***	0.322***	0.046	−0.039**	0.078	−0.010
	(0.038)	(0.054)	(0.078)	(0.017)	(0.075)	(0.016)
Fin. Exposure x Gov. CDS Spread	0.027	0.017	0.389*	0.124***	0.211***	0.073**
	(0.030)	(0.034)	(0.210)	(0.018)	(0.031)	(0.034)
Bank-Quarter FE	Y	Y	Y	Y	Y	Y
Cluster Bank-Quarter	Y	Y	Y	Y	Y	Y
Obs.	73,265	33,065	40,200	224,899	71,644	153,255
R^2	0.957	0.938	0.965	0.983	0.978	0.980

As discussed in Section 2, the link via the financial sector could be through a liquidity shock (ie market risk) rather than just credit risk of the NBFI counterparty. NBFIs' dependence on bank funding and their use of leveraged trading strategies can be a driver of risk spillovers from the sovereign sector to the bank sector operating through NBFIs. To explore this possibility, Table 4 does two things.

First, it adds a triple interaction term with the share of liquid assets held by the bank.

Indeed, as reported in column 3, we find that for the sub-sample of periphery countries, the post-2016 link with financial sector exposure is greater for banks that hold more liquid assets (indicative of short-term repo lending to leveraged NBFI, such as hedge funds).

Second, the table adds an interaction with exposure to NBFIs on the liability side of the bank's balance sheet. This measure is available from 2019 onward. This tests for the existence of another potentially important mechanism of shock transmission. NBFIs that provide funding to banks may also have exposure to sovereign risk. A rise in sovereign risk could disrupt these intermediaries and lead them to reduce lending to banks (eg withdraw deposits) to meet their immediate liquidity needs. This could potentially put pressure on banks and increase their riskiness. Column (4) shows that this is exactly the case. Accounting also for asset exposure to the sovereign and financial sectors, having more deposits from NBFIs leads to a higher correlation with sovereign CDS spreads, consistent with this hypothesis. This relationship is strongest in periphery countries (column (5)).

Table 4: Domestic triangle relationship - sovereign and financial exposure, only periphery, channels

This table shows results of estimating Specification 1 with additional terms at the bank level. Columns (1) to (3) display the results when adding liquid assets to total assets as an interaction term, and columns (4) to (6) display the results when adding NBFI deposits scaled by total exposure as a further explanatory variable together with its interaction with the sovereign CDS spread. Pre-2016 refers to the sample period until 2015Q4 and Post-2016 refers to the sample period starting 2016Q1. Post-2019 refers to the sample period starting in 2019Q2 due to data availability. Periphery refers to banks from Greece, Ireland, Italy, Portugal and Spain. Core refers to banks from Austria, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, or the United Kingdom. Sovereign CDS spreads are de-meaned at the country level. Sovereign and financial exposure measures as well as NBFI deposits are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)
		Liquidity			NBFI Deposits	
	Periphery, Full sample	Periphery, Pre-2016	Periphery, Post-2016	All, Post-2019	Periphery, Post-2019	Core, Post-2019
Liquid asset-to-total assets	45.412***	47.428***				
	(13.541)	(12.762)				
Government CDS Spread (in bps)	0.822***	0.812***	1.697***	0.935***	1.068**	4.530**
	(0.142)	(0.168)	(0.214)	(0.351)	(0.423)	(1.994)
Liquid asset-to-total assets x Government CDS Spread (in bps)	−0.045**	−0.026	−0.101***			
	(0.021)	(0.026)	(0.036)			
Fin. Exposure	0.631	−2.869	5.076	12.740***	1.750	40.152*
	(3.831)	(17.989)	(3.258)	(3.818)	(4.618)	(20.953)
Sov. Exposure	−3.673	−49.225	−14.630***	−9.491	−33.152**	4.267
	(5.898)	(37.106)	(5.562)	(6.416)	(13.529)	(6.090)
Sov. Exposure x Gov. CDS Spread	0.086	0.155*	−0.207***	−0.196*	−0.288**	−0.044
	(0.063)	(0.078)	(0.070)	(0.107)	(0.117)	(0.476)
Sov. Exposure x Gov. CDS Spread x Liquid asset-to-total assets	−0.008	−0.010	0.018**			
	(0.006)	(0.007)	(0.007)			
Fin. Exposure x Gov. CDS Spread	0.049	−0.020	0.087*	0.102**	0.071*	−0.549
	(0.033)	(0.059)	(0.047)	(0.044)	(0.041)	(0.374)
Fin. Exposure x Gov. CDS Spread x Liquid asset-to-total assets	0.025***	0.018*	0.020***			
	(0.005)	(0.009)	(0.007)			
NBFI Deposits-to-exposure				15.772***	61.712***	−2.646
				(4.066)	(22.418)	(6.281)
NBFI Deposits-to-exposure x Government CDS Spread (in bps)				0.635***	0.952***	−0.672
				(0.203)	(0.339)	(0.523)
Bank-Quarter FE	Y	Y	Y	Y	Y	Y
Cluster Bank-Quarter	Y	Y	Y	Y	Y	Y
Obs.	21,757	6,454	15,303	34,026	14,237	19,789
R^2	0.980	0.976	0.971	0.980	0.982	0.971

5 Macro data analysis

This section explores the sovereign-bank-NBFI relationships at the macro level. Doing so provides several additional benefits. First, it serves as external validity for the results above, which are focused on European banks. Second, it allows us to examine the sovereign debt holdings of the NBFI sector itself to see if its own risk correlates more with sovereign risk when holdings are greater. Third, it presents a more complete view to analyse sovereign risk spillovers through international links. And fourth, it demonstrates these relationships in a system-wide setting, showing that they are relevant in not only micro but also macro contexts.

5.1 NBFI exposure to the sovereign

To analyze the direct relationship of sovereign risk with NBFI risk, we correlate the average CDS of the NBFI sector with the CDS of the sovereign, and examine the sensitivity of this relationship to when sovereign debt makes up a larger share of the NBFI sector's assets. We implement the following regression:

$$\begin{aligned} CDS\ NBFI_{i,t} = \beta_1 * SovCDS_{i,t} + \beta_2 * Sov.\ Exposure_{i,t} + \\ \beta_4 * Sov.\ Exposure_{i,t} \times CDS_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t} \end{aligned} \tag{2}$$

With data at the country-day level, i indexes country and t indexes day. Sov. exposure is again measured at quarter ends and interpolated to daily to avoid large jumps. This metric is obtained by computing the ratio of private non-bank holdings of domestic sovereign debt to the total assets of the NBFI sector. Our sample extends back to 2004Q1 and through 2024Q3, and we continue to consider analyses splitting the period into pre- and post-2016.

Table 5 shows results consistent with our previous results. Specifically, we see that NBFI holdings of government debt do not seem to have much bearing on the risk correlation before

2016, but afterwards there is a strong relationship. Thus, at the same time banks' direct holdings of sovereign debt becomes less impactful on the correlation with sovereign risk, that of NBFIs becomes more impactful. As NBFIs are unlikely to receive a government bailout, this provides potentially cleaner evidence of the change in this risk relationship over time.

Table 5: NBFI exposures to domestic sovereign

This table shows results of estimating Specification 2. Pre-2016 refers to the sample period until 2015Q4, and Post-2016 refers to the sample period starting 2016Q1. Sovereign CDS spreads are de-meaned at the country level. Sovereign exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	Full Sample	Pre-2016	Post-2016
	(1)	(2)	(3)
	NBFI Sector CDS Spread	NBFI Sector CDS Spread	NBFI Sector CDS Spread
Government CDS Spread (in bps)	0.686***	0.723***	−0.288
	(0.054)	(0.057)	(0.181)
Sov. Exposure	19.728***	36.962***	56.664***
	(5.214)	(9.235)	(15.358)
Sov. Exposure x Gov. CDS Spread	0.025	0.036	1.103***
	(0.028)	(0.028)	(0.219)
Day FE	Y	Y	Y
Country FE	Y	Y	Y
Cluster Country-Quarter	Y	Y	Y
Obs.	46,389	28,125	18,264
R^2	0.804	0.813	0.676

5.2 Bank exposure to sovereigns and NBFIs

5.2.1 Empirical Approach

Turning to the aggregate banking sector exposures, we run a similar regression as with the bank-level data, but this time at the country-level:

$$CDS_{i,t} = \beta_1 * CDS_{j,t} + \beta_2 * Sov.\ Exposure_{i,j,t} + \beta_3 * NBFI\ Exposure_{i,j,t} + \quad (3)$$
$$\beta_4 * Sov.\ Exposure_{i,j,t} \times CDS_{j,t} + \beta_5 * NBFI\ Exposure_{i,j,t} \times CDS_{j,t} + \alpha_t + \alpha_i + \epsilon_{i,t}$$

Time t is daily, i again denotes country of headquarters for the bank, and j indicates the country of the exposures. As before, when $j = i$, we are considering domestic exposures. Our exposure measures are consolidated to the parent bank country, captured at the end of the quarter, and interpolated between quarters to get a daily time series without jumps. The analysis runs from 2014Q1-2025Q2.

5.2.2 Results

Table 6 illustrates the triangular nexus relationships through the lens of banks' exposures and bank-sovereign CDS correlations. To mirror our distinction into periphery (high risk) and core (low risk) countries in the European data, we define an indicator variable for high risk countries that takes the value 1 if the country's long-term average CDS spread is above the median of all counterparty countries in our sample, and 0 otherwise. Over the full period (columns (1)-(3)), we once again see a key distinction between countries with higher vs lower sovereign risk. High risk countries show a stronger sovereign-bank CDS correlation when banks have larger exposures to NBFIs, whereas this correlation is stronger in low risk countries when banks have larger direct exposure to the sovereign. The relationship for high-risk countries switches from pre-2016 (column (5)) to post-2016 (column (8)), with pre-2016 showing direct sovereign exposures playing a larger role. Low risk countries do not show

as much of a change over the sample period, with the direct sovereign exposure playing a stronger role recently (columns (6) and (9)).

Table 6: Aggregate Domestic triangle relationship - sovereign and NBFI exposure

This table shows results of estimating Specification 3. Columns (1) to (3) display the results for the full sample, columns (4) to (6) display the results for the sample period until 2015Q4, and columns (7) to (9) display the results for the sample period starting 2016Q1. High (low) risk refers to banks from countries whose long-term average CDS spread is above (below) the median of all the counterparty countries in our sample. Sovereign CDS spreads are demeaned at the country level. Sovereign and NBFI exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Full sample			Pre-2016			Post-2016	
	All	High risk	Low risk	All	High risk	Low risk	All	High risk	Low risk
Government CDS Spread (in bps)	0.676***	1.167***	−0.565*	−0.028	0.594	0.843	0.749***	1.252***	−0.692**
	(0.118)	(0.121)	(0.318)	(0.426)	(0.690)	(0.634)	(0.115)	(0.118)	(0.343)
NBFI Exposure	−0.446	6.158	−2.468**	−12.718**	−52.822**	0.121	0.566	7.304	−3.132*
	(1.397)	(5.074)	(1.000)	(5.380)	(19.339)	(2.570)	(1.914)	(5.013)	(1.604)
Sov. Exposure	−1.777	−10.595***	−0.276	9.929**	−134.185***	6.626*	−1.814	−9.403***	−2.237
	(1.143)	(3.624)	(1.145)	(4.422)	(47.048)	(3.745)	(1.207)	(3.610)	(1.383)
Sov. Exposure x Gov. CDS Spread	−0.018	−0.130***	0.241***	0.356**	0.378**	0.042	−0.035	−0.145***	0.128***
	(0.025)	(0.030)	(0.043)	(0.168)	(0.172)	(0.134)	(0.024)	(0.029)	(0.047)
NBFI Exposure x Gov. CDS Spread	0.050*	0.263***	−0.116***	−0.339**	−0.443*	−0.128*	0.053**	0.269***	−0.041*
	(0.026)	(0.050)	(0.019)	(0.133)	(0.241)	(0.075)	(0.025)	(0.048)	(0.024)
Day FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster Country-Quarter	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	40,701	12,970	27,731	6,332	1,566	4,766	34,369	11,404	22,965
R^2	0.959	0.978	0.750	0.949	0.968	0.817	0.964	0.981	0.761

Similar to the exercise conducted in Section 4, we also investigate the temporal dynamics of the shift through the lens of rolling window regressions. In our global sample, Panel A shows that even though the importance of sovereign exposures had diminished in the mid 2010s, there was a second structural shift around the Covid-period, when sovereign exposures lost further importance and turned negative, probably reflecting the massive fiscal spending to boost the economy and the implicit bailout expectations tied to that. In Panel B, we

see the mirror image of the Covid shift for the NBFI sector. While the relevance of NBFI exposures did pick up in the post-2016 period already, it only reached its current level in 2020. Interestingly, both figures indicate an uptick in the relevance of the exposures (sovereign and NBFI) in the year 2025 (not contained in the EBA sample). This seems to indicate that the interconnectedness of all three edges of the triangle has only risen in recent time and that investors are wary of the systemic risk build-up.

Thus far, due to data constraints, we have not distinguished between general exposure to the NBFI sector and indirect exposure to the sovereign via exposures to NBFIs that hold sovereign debt. At the country level, however, we can use the NBFI exposures to sovereigns explored in Table 5 above to adjust the bank exposures to NBFIs in order to get a measure of indirect sovereign exposure via NBFI holdings. We do this by scaling the existent NBFI exposure of the banking sector by the share of sovereign debt in the NBFI sector's portfolio. The results are shown in Table 7. We see that the broad patterns continue to hold, and even the risk correlation for high-risk countries pre-2016 turns positive also (column (5)), though the magnitude of the post-2016 relationship is smaller (column (8)). This suggests that at least part of the link with sovereign risk is driven by NBFI's direct holdings of sovereign debt.

Most of our results have focused on banks relations to their domestic sovereign. However, banks hold the debt of foreign sovereigns as well as lend to foreign NBFI sectors. This link is notable to study since it does not imply a bailout connection per se, and so is more likely to reflect a transmission of risk from the sovereign to the lending bank, rather than the other way around.

In the cross-border context, Table 8 shows fairly consistent results. Direct holdings of foreign sovereign debt drive greater CDS correlations for those banks with that sovereign, but this effect gets weaker over time. In its place, exposure to the NBFI sector in that sovereign's country drives a tighter correlation.

Table 7: Aggregate Domestic triangle relationship - adjusted NBFI exposure

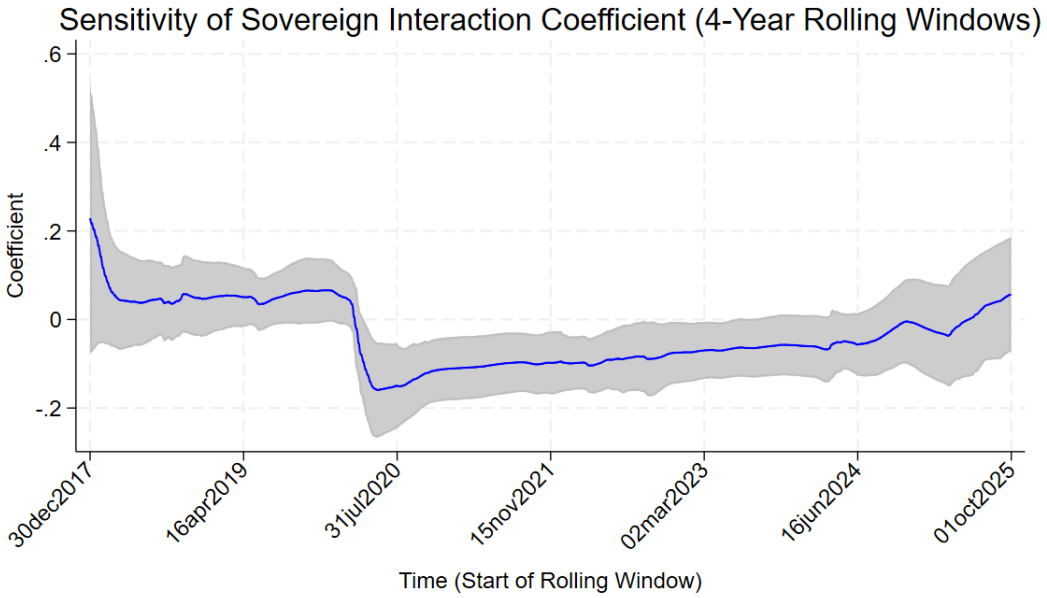
This table shows results of estimating Specification 3 supplemented by NBFI sectors' sovereign exposure as an interaction term. Columns (1) to (3) display the results for the full sample, columns (4) to (6) display the results for the sample period until 2015Q4, and columns (7) to (9) display the results for the sample period starting 2016Q1. High (low) risk refers to banks from countries whose long-term average CDS spread is above (below) the median of all the counterparty countries in our sample. Sovereign CDS spreads are demeaned at the country level. Sovereign and NBFI exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample			Pre-2016			Post-2016		
	All	High risk	Low risk	All	High risk	Low risk	All	High risk	Low risk
Government CDS Spread (in bps)	0.686***	0.673***	−0.831**	0.406	1.344***	0.615	0.702***	0.707***	−0.449
	(0.100)	(0.113)	(0.352)	(0.386)	(0.452)	(0.685)	(0.107)	(0.116)	(0.379)
NBFI Exposure x Sov. Exposure of NBFIs	2.647*	3.988*	−0.311	14.276*	22.821**	−0.695	2.422	1.521	2.458*
	(1.367)	(2.377)	(0.897)	(7.229)	(10.542)	(3.085)	(1.586)	(2.803)	(1.474)
Sov. Exposure	−1.280	3.769	1.882	8.707**	−78.695*	6.351	−0.822	3.241	−2.310
	(1.283)	(3.053)	(1.608)	(3.725)	(38.710)	(3.895)	(1.348)	(3.168)	(2.184)
Sov. Exposure x Gov. CDS Spread	−0.041**	−0.043**	0.294***	0.003	−0.201	0.064	−0.046***	−0.048**	0.097
	(0.017)	(0.018)	(0.054)	(0.118)	(0.131)	(0.153)	(0.017)	(0.018)	(0.062)
NBFI Exposure x Sov. Exposure of NBFIs. x Gov. CDS Spread	0.096***	0.104***	−0.185***	0.171**	0.293**	−0.208	0.091***	0.103***	−0.066*
	(0.023)	(0.024)	(0.028)	(0.086)	(0.117)	(0.138)	(0.022)	(0.026)	(0.036)
Day FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster Country-Quarter	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	31,865	12,146	19,719	5,745	1,566	4,179	26,120	10,580	15,540
R^2	0.968	0.981	0.755	0.946	0.965	0.795	0.974	0.983	0.773

Figure 4: Rolling window coefficients interaction terms

This figure shows the interaction coefficients from estimating 4-year rolling window versions of specification 3. Panel A plots the coefficient of the sovereign exposure interaction, while Panel B plots the coefficient of the NBFI exposure interaction. The shaded grey areas represent the 90% confidence intervals.

Panel A - Sovereign exposure interaction



Panel B - Financial exposure interaction

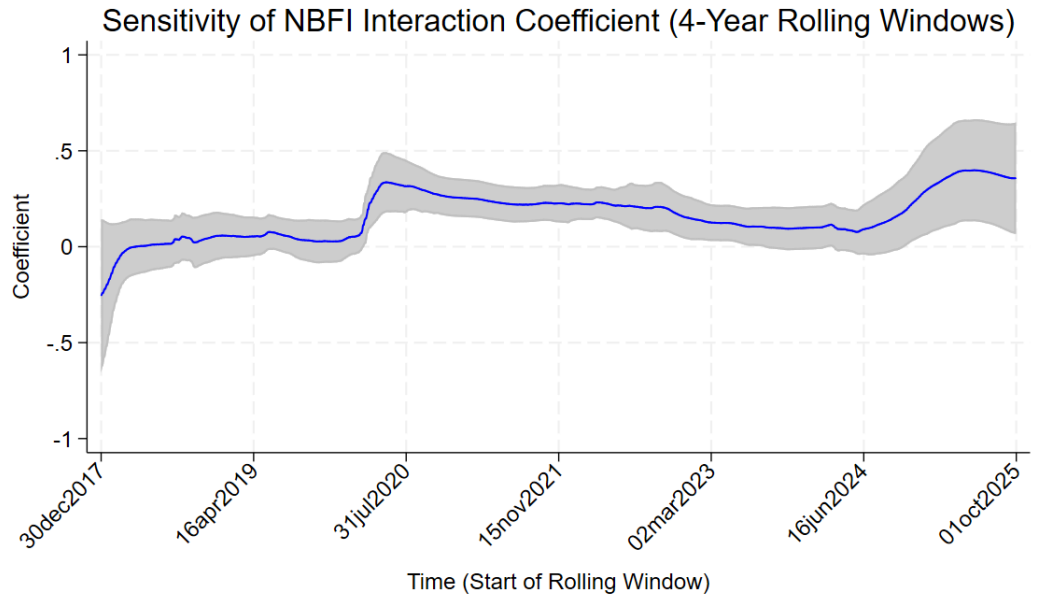


Table 8: Cross-border triangle relationship - sovereign and NBFI exposure, weighted

This table shows results of estimating Specification 3 with cross-border instead of domestic exposures. Pre-2016 refers to the sample period until 2015Q4, and Post-2016 refers to the sample period starting 2016Q1. Sovereign CDS spreads are de-meaned at the country level. Sovereign and NBFI exposure measures are standardized to have mean of 0 and standard deviation of 1. All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1) Full sample	(2) Pre-2016	(3) Post-2016
Government CDS Spread (in bps)	−0.054	0.181***	−0.037
	(0.040)	(0.059)	(0.046)
NBFI Exposure	1.149*	−3.927***	2.350***
	(0.644)	(1.405)	(0.716)
Sov. Exposure	−23.096***	−29.081***	−22.480***
	(2.826)	(4.623)	(3.086)
Sov. Exposure x Gov. CDS Spread	0.224**	1.515***	0.218**
	(0.099)	(0.435)	(0.099)
NBFI Exposure x Gov. CDS Spread	0.172***	−0.428**	0.147***
	(0.055)	(0.181)	(0.054)
Day FE	Y	Y	Y
CPC Country FE	Y	Y	Y
Cluster CPC-Quarter	Y	Y	Y
Obs.	1,204,962	184,232	1,020,730
R^2	0.432	0.260	0.467

6 Conclusion

As the financial landscape evolves, so does the nature of risk transmission in the system. The expansion of NBFIs and the deepening of their links with banks and sovereigns prompts a

reevaluation of the bank-sovereign nexus. Our analysis suggests a key shift in this nexus, with NBFIs now playing an important role in the risk transmission. This shift appears to have two key dimensions. First, a change in financial sector composition and interconnectedness that has created new (systemic) risk spillovers. Second, importantly, investors only seem to price these changes to the financial market environment for countries with high sovereign risk. A possible prediction is that investors will adjust their pricing also for "safe" sovereigns when they begin to perceive them as more risky, for example due to rising government debt level.

There is much more to uncover in this changing nexus. New theoretical models will help to draw out the dynamics and quantify the strength and relevance of different feedback mechanisms. Analysis of fund-level data, especially those with levered trading strategies linked to sovereign bonds, could yield new insights into how and when stress amplification might arise. This paper provides the initial structure and evidence to develop these points further in future research.

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A Appendix tables

Table A.1: Domestic sovereign-bank nexus

This table shows results of ... All variables are winsorized at the 1% and 99% level. Clustered standard errors in parentheses. Significance levels: *(p<0.10), **(p<0.05), ***(p<0.01).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full sample			Pre-2016			Post-2016		
	All	Periphery	Core	All	Periphery	Core	All	Periphery	Core
Government CDS Spread (in bps)	1.003***	0.973***	1.663***	0.846***	0.722***	1.569***	1.031***	1.220***	2.991***
	(0.097)	(0.110)	(0.108)	(0.096)	(0.105)	(0.110)	(0.266)	(0.296)	(0.615)
NBFI Exposure	2.310	3.739	−2.509	−5.997	−5.632	−7.531*	5.294***	5.528***	1.641
	(2.359)	(2.617)	(3.697)	(6.712)	(11.893)	(4.005)	(1.949)	(2.065)	(6.600)
Sov. Exposure	−10.401***	−21.296***	1.418	−6.166	−8.307	2.446	−13.314***	−37.022***	1.584
	(3.798)	(7.016)	(3.269)	(9.109)	(14.894)	(6.736)	(4.628)	(10.815)	(3.338)
Sov. Exposure x Gov. CDS Spread	−0.165***	−0.172***	0.020	0.006	0.067	−0.091	−0.222***	−0.304***	−0.076
	(0.053)	(0.060)	(0.072)	(0.050)	(0.056)	(0.082)	(0.085)	(0.095)	(0.195)
NBFI Exposure x Gov. CDS Spread	0.097***	0.099***	0.022	0.041**	0.031	0.096*	0.130***	0.128***	−0.242*
	(0.019)	(0.019)	(0.054)	(0.020)	(0.020)	(0.050)	(0.029)	(0.028)	(0.126)
Bank-Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster Bank-Quarter	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	119,250	45,197	74,053	42,969	16,401	26,568	76,281	28,796	47,485
R^2	0.987	0.985	0.974	0.988	0.984	0.966	0.981	0.979	0.973