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Risk Propagation in the European Banking System: Amplification Effect from NBFIs and Market Risks

Laura Valderrama and Richard Varghese

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WORKING PAPER

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**Risk Propagation in the European Banking System:
Amplification Effects from NBFIs and Market Risks**
Prepared by Laura Valderrama and Richard Varghese*

Authorized for distribution by Malhar Nabar
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Laura Valderrama[†]

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February 10, 2026

Abstract

This paper applies network analysis to examine the impact of non-bank financial institutions (NBFIs) and financial market stress on contagion risk within the interbank network. Using network-based simulations on euro area banks' supervisory data, we find that banks' strong capital and liquidity buffers significantly reduce contagion through interbank exposures: baseline scenarios show only modest capital losses and no cascading defaults. In contrast, stress originating from NBFIs under heightened market volatility markedly amplifies systemic risk. These findings highlight NBFIs and market volatility as key amplifiers of financial stress in the euro area. Our findings call for integrating contagion models into system-wide stress testing and designing macroprudential policies that encompass the entire financial ecosystem. Such policies should account for amplification risks from banks' NBFI exposures when calibrating buffers and identifying systemic institutions.

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1 Introduction

The propagation of risk within the financial system has grown increasingly complex as the system evolves beyond traditional banking institutions. The expanding footprint of non-bank financial institutions (NBFIs) over the past decade, coupled with recent episodes of sharp market volatility amid heightened policy and political uncertainty, underscores the need to understand how risks originating outside the banking system may migrate to banks and propagate through the interbank network. We contribute to this discussion by quantifying the propagation of stress in the euro area interbank network when NBFIs exposures and financial market volatility weaken the capacity of banks to absorb shocks.

Non-bank financial intermediation now accounts for nearly half of global financial assets. In the euro area, NBFIs held approximately EUR 42 trillion in Q4 2024, representing more than 50 percent of total financial system assets. Interlinkages between euro area NBFIs and banks are highly concentrated in a small group of systemically important institutions.¹ These linkages are not evenly spread; they are highly concentrated in a few large, complex institutions, adding concerns about systemic impact from NBFIs failures.² [European Central Bank \(2023\)](#) documents that 90 percent of asset exposures and 80 percent of funding linked to NBFIs are concentrated in fewer than 20 banks. Crucially, these banks can act as the nodes connecting to many NBFIs via lending, clearing, derivatives, and repos, making them potential single source of disruption.

Systemic financial stability concerns regarding NBFIs have gained prominence in international policy discussions following recent episodes of financial market stress, including the collapse of Archegos Capital Management in March 2021, the commodities market turmoil in March 2022, and the UK gilt crisis in October 2022. These episodes, combined with lighter regulation of certain NBFIs segments, have heightened concerns about systemic linkages between NBFIs and banks. Furthermore, abrupt market reactions to geopolitical shocks underscore the need for a deeper understanding of how stress migrates across institutional boundaries and amplifies within the financial network through heightened market volatility. For instance, following the

¹Banks and NBFIs are linked through a myriad of channels. On the asset side, banks have direct credit exposures to NBFIs in the form of loans, credit lines, and holdings of securities issued by NBFIs. Banks also take on counterparty exposure via derivatives and repo facilities. On the liability side, NBFIs provide a sizable share of bank funding by depositing cash and engaging in reverse repos with banks. Indirect links between banks and NBFIs, such as those related to common exposures appear to be limited in the euro area. This is partly because banks tend to display a greater domestic bias in their securities portfolio than NBFIs.

²At the same time, the dispersion of derivative exposures across a broad set of small institutions with correlated positions could introduce additional risks, including synchronized defaults, reduced operational efficiency, higher collateral-management costs, and greater operational complexity.

April 2 U.S. tariff announcement, European equity markets experienced a sharp, broad-based sell-off, albeit short-lived. Such shocks could have the potential to trigger severe distress in NBFIs through redemption pressures and spikes in margin and collateral calls, with significant spillovers to core funding markets and banks exposed to NBFIs ([International Monetary Fund 2025c,b,e](#)).

In this context, our paper makes two key contributions to the analysis of systemic risk in the euro area banking system. First, we leverage confidential, non-public supervisory data—specifically, information from the EU’s harmonized reporting COREP and FINREP frameworks, including large exposure reporting which allows for granular analysis—to map risks in the euro area interbank network, including those stemming from NBFIs and financial markets. Second, we extend traditional bank network analysis by integrating two additional channels of risk amplification through stress scenarios that focus on: (i) banks’ significant exposures to NBFIs; and (ii) reduced effectiveness of credit risk mitigation (CRM) techniques under stressed market conditions stemming from heightened financial market volatility.³

We begin by employing a network-based contagion model calibrated to these granular data following the CoMap framework ([Covi et al. 2021](#)) to document risk propagation in the euro area interbank network from simulated bank defaults. Our findings indicate that, under a baseline calibration using regulatory data as of June 2024, contagion risk from direct and indirect interbank exposures remains limited. Strong bank capital and liquidity buffers support overall system resilience.⁴ Nonetheless, our results reveal important heterogeneity in systemic risk profiles across banks based on their business models. Global Systemically Important Banks (G-SIBs) show high contagion potential but remain relatively resilient to inward shocks, making them key transmitters of systemic stress and reinforcing the need for strong oversight and cross-border resolution planning. In contrast, universal and lending-focused banks are more vulnerable.

Next, we refine loss projections under two stylized extreme stress scenarios to capture NBFIs

³The systemic impact of an NBFI default in an interconnected system depends not only on direct exposures but also on the centrality of banks with significant exposures to NBFIs within the interbank network. Also, the size of direct losses depends not only on the size of gross exposures but also on eligible CRM techniques including funded credit protection (e.g., collateral) or unfunded credit protection (e.g., guarantees, and credit derivatives). While CRM plays a key role in mitigating loan losses and counterparty credit risk (CCR) and loan losses, its effectiveness depends on the value of the credit protection, which in turn depends on prevailing market conditions.

⁴The analysis underlying this paper was undertaken in the context of the 2025 Euro Area FSAP and informs the Technical Note on Stress Testing the Banking Sector. See [International Monetary Fund \(2025e\)](#) for details. Please also see assessment of risks associated with investment funds and Central Clearing Counterparties (CCPs) see Technical Note on NBFIs ([International Monetary Fund 2025d](#)).

and market risks. Assuming outright defaults—rather than expected defaults—is aligned with the 2025 CCAR exploratory analysis, the 2025 EU-wide stress test, and the ECB’s 2025 systemic risk network analysis for counterparty risk. In stress testing, treating counterparties as outright defaults is a deliberate way to examine extreme, tail-risk scenarios. This approach assesses whether a financial institution can withstand severe and sudden shocks, rather than average credit losses. In the first stylized scenario, an *NBFI Risk Scenario*, we account for banks’ significant exposures to NBFIs, capturing the potential transmission of credit risk from lightly regulated and highly leveraged non-bank entities through the interbank market. Specifically, the scenario is calibrated to reflect the default of each bank’s top five NBFI counterparties. The calibration aligns with the Federal Reserve exploratory analysis conducted as a companion to the 2025 supervisory stress test ([Federal Reserve Board 2025](#)), which contains a market shock causing the unexpected defaults of each bank’s five largest equity hedge fund counterparties. Our analysis broadens the scope to the top five largest NBFI counterparties including investment funds which are a more pertinent category of NBFIs in the euro area context. Specifically, we include financial service activities, except insurance and pension funding identified by NACE Code K64. To capture large high-risk exposures, we use a broad NBFI category rather than focusing solely on hedge funds—which are often absent or small in banks’ large-exposure reports—recognizing that investment funds carry higher risk-weight densities than insurers or pension funds in COREP data, and thereby aligning our hypothetical-default framework with the 2025 EBA stress test methodology. The most severe bank default simulation, leads to system-wide capital losses of 3.1 percent of total capital and to one additional cascading default, transmitted through the credit channel.⁵

The second scenario, *Market Risk Scenario*, overlays the effects of heightened market volatility on top of the *NBFI Risk Scenario*, reflecting plausible stress conditions amid current elevated asset valuations and uncertain policy environment. Specifically, it introduces fair valuation shocks to high-quality liquid assets and the partial inefficiency of CRMs, increasing bank’s net exposures to vulnerable NBFIs in addition to the the default of each bank’s top five NBFI counterparties laid out in the *NBFI Risk Scenario*. Heightened market volatility often can amplify NBFI vulnerabilities by triggering margin calls, forced deleveraging, and asset fire sales, which increase counterparty risks transmitted to the banking system, thereby motivating the joint consideration of market and NBFI risks in this scenario. In terms of contagion, the most severe

⁵The results remain qualitatively unchanged when the scenario is calibrated to the default of each bank’s top three NBFI counterparties.

event in this set of simulations leads to capital losses equivalent to 4.4 percent of aggregate system capital and triggers three cascading defaults. In terms of vulnerability, the most severe event under the market risk scenario results in a depletion of 3.3 percent of CET1 capital. For context, Credit Suisse incurred CHF 5.5 billion in losses following the March 2021 collapse of Archegos Capital Management—an amount equal to 8.4 percent of its CET1 capital. Thus, we conclude that, when shocks originate from NBFIs or are compounded by market volatility, the potential for amplification of risks in the euro area banking system increases markedly. In both risk scenarios, disaggregated results by bank business model remain broadly consistent with baseline findings.

However, our results likely capture the lower bound of secondary defaults and system-wide capital losses for three reasons. First, our network data does not capture banks' funding exposures to NBFIs. This could be non-trivial as NBFIs could be important lenders to some individual banks. The banking sector in the euro area receives short-term deposits, repo funding and debt securities from NBFIs which may be prone to flight risk and difficult to replace.⁶ Second, our model set up does not account for higher borrowing costs (liquidity costs) that may arise when banks replace lost funding from failing institutions with market borrowing in a stressed environment. This could underestimate losses associated with funding disruptions. In other words, our framework and data does not permit an analysis of liquidity–solvency interactions such as in cases where banks with weaker liquidity positions face higher costs to meet funding needs, thereby eroding solvency. Third, our model takes into account current exposures to NBFIs but does not quantify stressed potential exposures to NBFIs in derivatives and repo operations, which could rise under market shocks. It also does not capture changes in credit valuation adjustment (CVA) in the fair value of derivatives and repos that reflect potential losses from a deterioration in counterparty credit quality. Finally, while the model accounts for the impact of market shocks on the size of the HQLA buffer, it does not incorporate losses arising from asset valuation effects in securities holdings.

One aspect of our results merit further discussion. Notably, in all scenarios, contagion is driven by insolvency rather than illiquidity. Moreover, no cascading defaults in risk scenarios are triggered by liquidity shortfalls. These findings diverge from earlier studies and historical

⁶According to the [European Commission \(2024\)](#), at the end of 2023, data confirm that NBFIs are net lenders to banks. Banks' exposures to NBFIs account for 9.2% of total assets on the asset side (EUR 2.5 trillion) and 10.3% on the liability side (EUR 2.8 trillion), with off-balance sheet exposures—such as undrawn loan commitments, financial guarantees, and other commitments—representing 6.4% of all EU/EEA banks' off-balance-sheet items extended to NBFIs and 9% received from NBFIs.

episodes ([Aikman et al. 2019](#), [Covi et al. 2021](#)) where liquidity stress played a central role in systemic risk propagation. A likely explanation is the ample excess liquidity conditions prevailing in the euro area during the period under study ([Hudepohl et al. 2024](#)). The period is also characterized by low market volatility and smoothly functioning core funding markets (including repo and treasury markets), which support the build-up of liquidity buffers and facilitate the transmission of market liquidity across participants. Moreover, since our network data does not capture banks' funding exposures to NBFIs, our analysis does not incorporate additional liquidity run-off risks arising from NBFIs beyond the run-off rates specified in the LCR. Overall, the results underscore the need for continued vigilance regarding bank–NBFi interlinkages, the functioning of core funding markets, and the structural liquidity position of banks, particularly as central banks transition toward operational frameworks with less abundant reserves ([Buch and Schnabel 2025](#)).

Our findings also carry significant policy implications for safeguarding financial stability. By integrating NBFi exposures and market risk into network analysis, this paper advances the understanding of systemic risk in the European banking system and underscores the importance of enhanced macroprudential surveillance. Monitoring banks' bilateral exposures to NBFIs in isolation is insufficient: amplification effects following an NBFi failure may arise from both the increased size of exposures (as some CRMs may become inefficient under stress) and the centrality of banks subject to NBFi risks (as changes in their default probabilities propagate to their bank counterparties). Using supervisory data and scenario-based simulations, we highlight the importance of macroprudential policies that account for amplification losses stemming from interactions among banks, NBFIs, and market shocks. Quantifying risks from both direct and indirect (hidden) links to NBFIs also helps identify entities that could become systemic through contagion to banks.

Related Literature

While the literature on network analysis has advanced our ability to map and quantify contagion risk ([Espinosa-Vega and Sole 2010](#), [Covi et al. 2021](#), [Barbieri et al. 2025](#)), much of the focus has remained on direct interbank exposures, with less attention paid to the evolving interlinkages between banks and NBFIs, and the role of market risk as a transmission channel. [Espinosa-Vega and Sole \(2010\)](#) illustrate a similar methodology based on [Eisenberg and Noe \(2001\)](#), which has been central to the literature on banking networks. Their approach primarily

uses aggregated country-level data, which offers a broad perspective but does not capture the granularity of individual bank supervisory data. While the framework focuses on credit risk, it does not explicitly model liquidity shocks or incorporate the pool of liquid assets reflected in the LCR framework. As a result, potential interactions between credit and liquidity risks at the bank level are not fully explored. By contrast, (Covi et al. 2021) examine contagion effects from bank defaults using a newly constructed network of euro area banks' large exposures, thereby addressing the limitations of earlier studies that relied either on bank-level data from a single country or on aggregate country-level data.

The recent literature on financial stability risks from NBFIs has focused on NBFIs leverage and its impact on core financial markets. This research shows that NBFIs can both buffer or amplify shocks. Also, it emphasizes how risks can migrate between the regulated banking sector and the less regulated non-bank segment. Many papers highlight how certain NBFIs, especially open-ended funds, can propagate market stress due to liquidity mismatches. Claessens and Lewrick (2022) examine the March 2020 COVID-related turmoil and show that bond mutual funds faced massive investor runs, forcing fire-sales of bonds that deepened the market sell-off. These funds' cash buffers and tools like swing pricing proved inadequate to stem spillovers, and central bank intervention was needed to stabilize markets. Along similar lines, Aramonte et al. (2023) develop a network-based model of leveraged investors and find that when volatility spikes and margins are raised, highly-leveraged NBFIs become forced sellers, which tightens financial conditions system-wide. Their analysis of the “dash for cash” in March 2020 suggests that margin calls on hedge funds and other NBFIs led to collective deleveraging that drained market liquidity.

In most studies, a key insight is that liquidity-risk and leverage in NBFIs can transmit stress to core markets. This is because a rapid unraveling of NBFIs positions can induce fire-sale externalities that hit banks (through losses on assets and tighter funding markets) almost as hard as the NBFIs themselves. Beyond direct bilateral exposures, scholars have looked at network effects arising from overlapping portfolios and common asset holdings. Cettorelli et al. (2023) quantify U.S. banks' vulnerability to fire-sales originating in twelve different NBFIs segments (such as money market funds, hedge funds, and insurers). They find significant “network-like externalities” – because many NBFIs invest in similar assets as banks, distress at an NBFIs can trigger asset price declines that erode bank capital even without direct exposure. For example, a shock causing hedge funds to dump corporate bonds can impair banks holding those

bonds. Their model shows that fire-sale spillovers can be multiplicative when multiple NBFIs segments react to one another’s distress, underscoring the need to treat the non-bank sector “as one organic whole” in risk monitoring. Another study by [Aldasoro et al. \(2020\)](#) used network analytics on BIS data to reveal that the global March 2020 shock saw NBFIs drawing down bank credit lines, highlighting banks’ indirect exposure to NBFIs liquidity needs. These findings reinforce that correlations across bank and NBFIs balance sheets – whether via common assets or interlinked funding paths – can substantially amplify systemic risk.

Our paper is also closely related to [Barbieri et al. \(2025\)](#) who show that loss amplification in the euro area interbank market is linked to the structure of banks’ CCR exposures to NBFIs. In their framework, direct losses stem from the default of the two most vulnerable NBFIs counterparties, while indirect losses arise from credit valuation adjustments (CVA). Their findings indicate that CCR exposures are concentrated among G-SIBs and investment banks, which play a key intermediation role in European financial markets. This interconnectedness can transmit shocks from banks’ CCR exposures to NBFIs across the broader banking system. Our paper takes a similar approach by quantifying amplification channels in the interbank market from banks’ exposures to NBFIs. However, we focus the analysis on identifying cascading defaults through the interbank network, driven by hypothetical bank defaults compounded by losses from banks’ total exposures to NBFIs rather than CCR alone. In addition, we perform a sensitivity analysis to changes in the valuation of CRM to estimate the amplification effects of disorderly market conditions on systemic risk.

The remainder of the paper is organized as follows. Section 2 describes the data and discusses the structure of the interbank market in the euro area. Section 3 presents the model and discusses the channel of risk propagation including the credit risk channel and the funding risk channel. Section 4 shows the calibration of model parameters under baseline conditions as well as under the NBFIs and market risk scenarios. Section 5 discusses the results under each alternative scenario, identifying the amplification of risks posed by NBFIs defaults in the euro area. Section 6 concludes and derives policy implications to address emerging systemic risks arising from banks’ exposures to NBFIs, including new macroprudential tools.

2 Data

We construct the interbank network using supervisory data from the ECB’s COREP and FINREP frameworks, including large exposure reporting. COREP, or Common Reporting, is the standardized framework used by the ECB for banks to report their prudential and financial information, including data on capital, risk exposures, and other metrics required by the Capital Requirements Directive (CRD) whereas FINREP (Financial Reporting) is a standardized reporting system developed by the European Banking Authority (EBA) to standardize financial reporting across the EU. This also includes large exposure database which provides detailed information on Significant Institutions’ (SIs) large exposures (with a value above or equal to EUR 300 million and more than 10% of the institution’s Tier 1 capital before applying credit risk mitigation and exemptions) by country, sector, and counterparty type.

Our dataset covers 72 significant institutions (SIs), out of a total of 109, at the highest level of consolidation across 17 euro area countries. These institutions represent approximately 90 percent of total euro area banking system assets as of June 2024. The mean and standard deviation of total assets are €329 billion and €492 billion, respectively, while those of risk-weighted assets are €110 billion and €151 billion, suggesting a few large institutions dominate the distribution.

This yields a network of 72 banking groups, treated as nodes in the analysis, with the interbank network comprising of 61 lenders and 50 counterparties, with a total of 377 bilateral exposures (edges). While the baseline analysis focuses on exposures among credit institutions—i.e., the interbank network of large exposures—the large exposures dataset also includes information on banks’ exposures to NBFIs. NBFIs exposures data are used to calibrate alternate scenarios which analyze shocks originating from the NBFIs sector and their transmission through the banking system.

Finally, we also classify banks in our sample into four business model categories used throughout the analysis: G-SIB, Lender, Investment, and Universal. This taxonomy is used in all disaggregated results. G-SIBs are global systemically important banks, distinguished by their size, international footprint, and designation under the BCBS/FSB framework. Lenders are institutions predominantly engaged in traditional banking activities, including deposit-taking and loan origination. Investment banks derive a relatively small share of income from net interest and rely more heavily on wholesale activities, including fees, commissions, market-making, and

trading income. Universal banks combine traditional lending with significant non-lending activities, such as insurance, asset management, securities-related services, and trading operations. For the purposes of this analysis, we exclude development, promotional, and custodian banks due to the specialized nature of their business models.

3 Model

We base the contagion model in this paper on the CoMap framework developed by [Covi et al. \(2021\)](#). The CoMap framework employs a simulation-based approach to evaluate and quantify the knock-on effects that arise from the hypothetical default of a euro area bank across its network of exposures. This approach captures how a single bank’s failure can affect the broader banking system by tracing the transmission of losses through two main channels: credit risk and funding disruptions. By simulating the default of each bank in the interbank network, we identify the pathways of contagion and assess the system’s resilience.

The credit risk channel captures how a bank’s hypothetical default affects its obligations to counterparties—specifically, other banks in the network. When a bank defaults, its directly exposed counterparties face potential losses. In response to the default of a subset of banks, denoted by \mathcal{Y} , on their obligations x_{ijk} , bank i incurs credit-related losses, $LOSS_i^{credit}$, which we compute by summing across all defaulting banks $j \in \mathcal{Y}$ and claim types k . We apply exposure-specific loss-given-default rates, λ_{ijk} , to each claim of type k that bank i holds on bank j , multiplied by the defaulted exposure amount:

$$LOSS_i^{credit} = \sum_{j \in \mathcal{Y}} \sum_k \lambda_{ijk} x_{ijk} \quad (1)$$

The funding disruptions channel captures how the hypothetical default of a bank prompts the withdrawal of funding from other banks in the network and triggers their subsequent responses. When a subset of banks, denoted by \mathcal{Y} , defaults and withdraws funding, bank i experiences a funding shortfall, TFS_i , which we calculate by summing across all defaulting banks $j \in \mathcal{Y}$ and claim types k . We apply a bank-specific funding shortfall rate, ρ_{ik} , to the funding x_{jik} that bank i previously received from bank j :

$$TFS_i = \sum_{j \in \mathcal{Y}} \sum_k \rho_{ik} x_{jik} \quad (2)$$

To partially absorb the funding shortfall, bank i can pledge high-quality liquid assets (HQLA) in excess of its net liquidity outflows, denoted by γ_i , to the central bank in exchange for immediate liquidity support. We compute the remaining liquidity shortage as the positive part of the difference between the total funding shortfall and the available HQLA buffer:

$$\max \left\{ 0, \sum_{j \in \mathcal{Y}} \sum_k \rho_{ik} x_{jik} - \gamma_i \right\} \quad (3)$$

If the remaining liquidity shortage is strictly positive, bank i can still meet its liquidity requirement by selling unencumbered, marketable assets that are not eligible for central bank operations. These sales occur at a discount, potentially forcing bank i to deleverage through fire sales to replace the lost funding. Assuming bank i holds a limited pool of such assets, denoted by θ_i , and faces a fire sale discount rate δ_i , we compute its potential fire sale losses, $LOSS_i^{funding}$, as:

$$LOSS_i^{funding} = \delta_i \cdot \min \left\{ \frac{1}{1 - \delta_i} \cdot \max \left(0, \sum_{j \in \mathcal{Y}} \sum_k \rho_{ik} x_{jik} - \gamma_i \right), \theta_i \right\} \quad (4)$$

Armed with the loss estimates derived from the credit and funding channels, we identify two distinct default conditions that determine a bank's vulnerability. The first condition relates to insolvency, where total losses exceed the bank's regulatory capital buffer. The second pertains to illiquidity, where the bank's available liquidity reserves are insufficient to meet its funding needs. We formalize each condition below.

We determine whether a bank becomes insolvent by comparing its total losses—arising from both the credit and funding channels—to its regulatory capital buffer. A bank is considered to be in default due to insolvency if its capital buffer, defined as the difference between its capital position at time t , $c_{i,t}$, and its minimum capital requirement, $c_{i,\min}$, falls short of its total losses:

$$c_{i,t} - c_{i,\min} < LOSS_i^{credit} + LOSS_i^{funding} \quad (5)$$

We assess whether a bank may default due to illiquidity by comparing its funding shortfall to its available liquidity reserves. If the bank's high-quality liquid assets (HQLA) and its pool of unencumbered assets available for fire sale are insufficient to meet its liquidity needs, we classify the bank as being in default due to illiquidity. Specifically, if the available fire-saleable assets, θ_i , fall short of the required liquidity buffer, the condition for illiquidity-driven default

is:

$$\theta_i < \frac{1}{1-\delta_i} \cdot \max \left(0, \sum_{j \in \mathcal{Y}} \sum_k \rho_{ik} x_{jik} - \gamma_i \right) \quad (6)$$

Together, these conditions complete the specification of the model’s default mechanisms.

4 Calibrating Model Parameters

We calibrate the model parameters broadly in line with [Covi et al. \(2021\)](#), particularly for the baseline analysis. Beyond this baseline exercise, we extend the bank network analysis to incorporate additional contagion channels affecting the euro area banks. Specifically, we assess amplification effects from shocks originating outside the banking sector through two complementary exercises: one examining banks’ credit exposures to NBFIs, and another focusing on heightened financial market volatility. To capture how non-linear shocks interact under varying market conditions, we conduct a scenario analysis comprising two alternative scenarios in addition to baseline analysis.

In this section, we summarize the relevant calculations and, where applicable, the assumptions used in the calibration process across three exercises.

4.1 Baseline Analysis

For the baseline analysis, we calibrate the model parameters broadly in line with [Covi et al. \(2021\)](#). Key parameters include the loss-given-default rate, the funding shortfall rate, the net liquidity position, the pool of assets available for fire sales, the fire sale discount rate, and the hurdle rate. Below, we summarize the relevant calculations and assumptions:

- **Loss-given-default rate** (λ_{ijk}): We calibrate loss-given-default rate as the ratio of net exposure to gross exposure. Net exposure refers to the exposure value after exemptions and credit risk mitigation instruments, while gross exposure is defined as the exposure value after exemptions but before applying credit risk mitigation instruments (templates C.27–C.28).
- **Funding shortfall rate** (ρ_{ik}): We assume funding shortfall to be a rate of 100 percent, implying that all interbank funding matures within the 30-day horizon. This assumption

reflects the short-term nature of typical interbank funding arrangements.

- **Net liquidity position** (γ_i): We define net liquidity position as the bank's high-quality liquid assets (HQLA), denoted by $HQLA_i$ (template C.72.00.a.10), in excess of its net liquidity outflows (template C.76.00.a.20).
- **Fire-saleable asset pool** (θ_i): We define this as the total stock of unencumbered, non-central bank eligible marketable assets held by the bank (template F.32.01).
- **Fire sale discount rate** (δ_i): We assume a fire sale discount rate of 50 percent, which corresponds to the highest haircut applied to central bank eligible assets.
- **Capital surplus** ($c_{i,t} - c_{i,\min}$): We define the capital surplus as the excess of Common Equity Tier 1 (CET1) capital over the minimum capital requirement (i.e., the hurdle rate). The minimum capital requirement consists of the 4.5 percent minimum Pillar 1 requirement, plus the bank-specific Pillar 2 Requirement (P2R) set under the Supervisory Review and Evaluation Process (SREP). This is because the trigger for a bank's insolvency in the euro area is the point at which the bank is declared "failing or likely to fail" which corresponds to the bank breaching its overall capital requirements (i.e., 4.5 percent CET1 plus P2R). This is a lower bound, however, as a bank could also be resolved when it is expected to be unable to meet its obligations as they fall due (cash-flow insolvency) or when a sharp decline in market value triggers a confidence shock and large deposit outflows, even if regulatory capital exceeds regulatory requirements.

Table 1 Panel A presents summary statistics for key variables used in the baseline calibration of the interbank network model including measures of exposure, liquidity, unencumbered assets, and capital across euro area banks as of 2024Q2.

Table 1: Summary Statistics of Interbank Network
(Billion euros; 2024Q2)

Variable	Mean	SD	p25	p50	p75
<i>Panel A: Baseline Analysis</i>					
Loss-given-default rate (λ_{ijk})					
Gross Exposure	0.7	0.9	0.1	0.3	0.9
Credit Risk Mitigation	0.1	0.4	0.0	0.0	0.1
Net Exposures	0.5	0.8	0.1	0.2	0.6
Net liquidity position (γ_i)					
High-Quality Liquid Assets	61.6	81.0	10.4	26.3	91.8
Net Liquidity Outflows	38.9	56.8	4.5	11.6	56.6
Fire-saleable asset pool (θ_i)					
Unencumbered non-HQLA assets	215	346	39	66	204
Capital surplus ($c_{i,t} - c_{i,\min}$):					
CET1	16.2	20.6	3.2	7.4	19.0
CET1 Minimum	6.1	8.3	1.1	2.6	7.0
<i>Panel B: NBF1 Risk Scenario</i>					
Adjusted capital surplus ($c_{i,t}^* - c_{i,\min}$)					
Adjusted CET1*	14.4	18.7	3.0	5.9	12.7
Top 5 NBF1 Exposures (cum.)	1.8	2.9	0.4	0.8	2.3
<i>Panel C: Market Risk Scenario</i>					
Adjusted loss-given-default rate (λ_{ijk}^*)					
Adjusted Net Exposures	0.6	0.8	0.1	0.3	0.7
Adjusted Loss Given Default	0.9	0.2	0.9	1.0	1.0
Adjusted net liquidity position (γ_i^*)					
Adjusted High-Quality Liquid Assets	55.5	72.9	9.4	23.6	82.6

Source: ECB and IMF staff calculations. SD denotes the standard deviation; p25, p50, and p75 refer to the 25th, 50th (median), and 75th percentiles, respectively.

4.2 NBF1 Risk Scenario

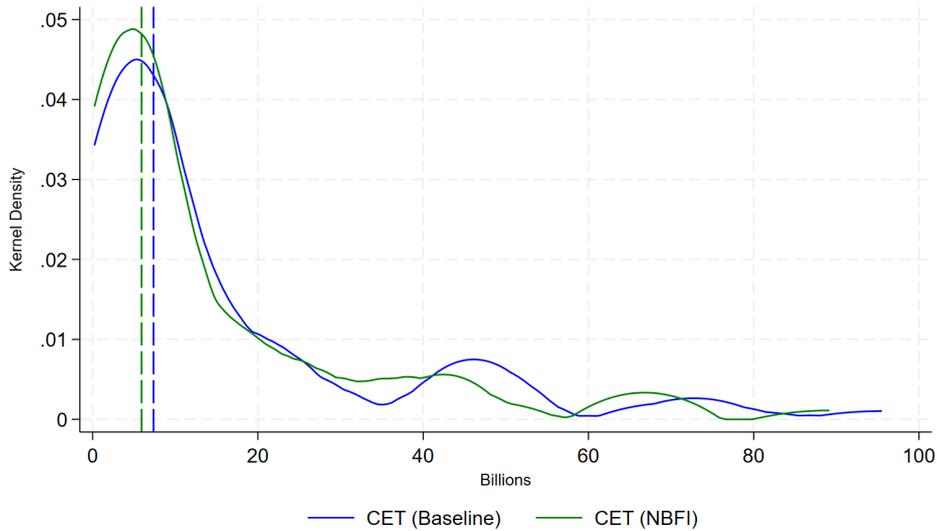
The NBF1 risk scenario examines how vulnerabilities stemming from NBF1s may amplify stress propagation through the interbank network. Concerns about systemic financial stability risks linked to NBF1s have been raised by both the [European Central Bank \(2023, 2024\)](#) and the [International Monetary Fund \(2023, 2024\)](#). In addition to the rapid expansion of the NBF1 sector since the global financial crisis, recent episodes—such as the collapse of Archegos Capital Management, which resulted in estimated losses of about USD 10 billion for major global banks—underscore the importance of monitoring risks in this segment. These events highlight how stress originating in the NBF1 sector can spill over to banks’ balance sheets, particularly through concentrated and opaque credit exposures.

To address these risks within our framework, we recalibrate model parameters to reflect heightened vulnerability arising from NBF1 linkages. Specifically, banks’ initial capital position, i.e., CET1, is adjusted to absorb full losses from the default of each bank’s top five NBF1 counterparty exposures while accounting for the impact of credit risk mitigation instruments. This approach captures the credit risk from exposures to highly leveraged or lightly regulated entities, excluding insurance undertakings and pension funds, by focusing on the more vulnerable and systemic segments of the NBF1 sector. We use a broader category of NBF1s—not limited to hedge funds—to capture large high-risk exposures, as hedge funds are often absent from many banks’ large exposures or their exposure is relatively small. At the same time, investment funds typically carry higher risk than insurance or pension funds, as reflected in their higher risk-weight densities in regulatory reporting (COREP). This approach, which models the hypothetical default of the most vulnerable counterparties among the largest exposures, is aligned with the 2025 EBA stress test methodology.

As a result, the NBF1 risk scenario begins with a lower initial bank capital position than the baseline, providing a more conservative starting point for the interbank contagion analysis. Table 1 Panel B provides the descriptive statistics for the the adjusted CET1, CET1*, while CET1 minimum is unchanged from the baseline analysis. Figure 1 illustrates the distribution of CET1 capital under both baseline and NBF1 risk scenario calibration , highlighting the reduced buffers that characterize our first risk scenario.

By simulating this recalibrated environment, we assess how diminished capital—reflecting stress originating outside the banking sector—can amplify systemic risk. This stylized config-

Figure 1: Distribution of CET1 Capital: Baseline Analysis and NBF1 Risk Scenario



Notes: Solid blue line shows the distribution of CET1 capital under the baseline scenario, while the solid green line shows the distribution under the NBF1 risk scenario.

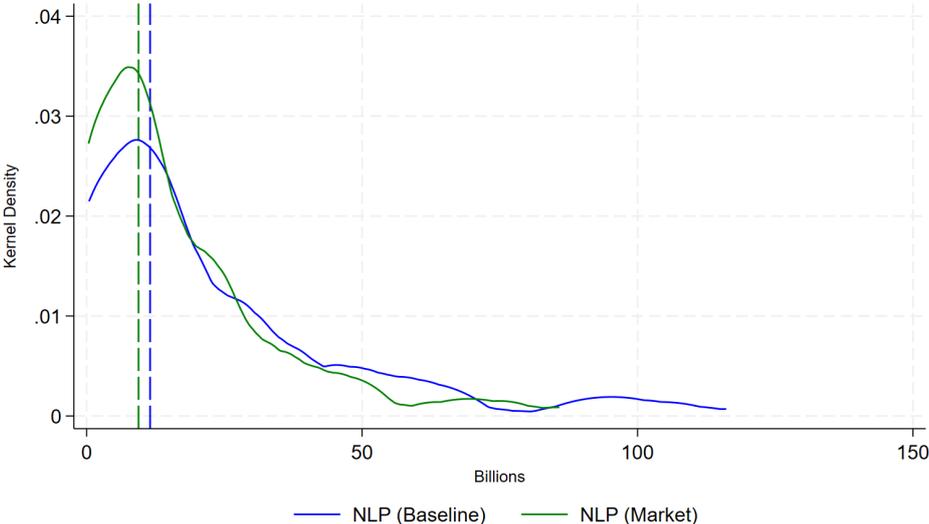
uration offers a useful lens through which to evaluate the resilience of the euro area banking system to shocks transmitted via NBF1 linkages and sets the stage for the subsequent contagion analysis.

4.3 Market Risk Scenario

The market risk scenario explores how extreme financial market volatility—particularly under conditions of heightened geopolitical tensions and elevated asset valuations—propagate stress to the banking sector. Both the [European Central Bank \(2024\)](#) and [International Monetary Fund \(2025f\)](#) have flagged financial market vulnerabilities, including those stemming from stretched valuations and uncertain policy environments, as key risks to financial stability. Recent episodes, such as the financial market response to the April 2 announcement, highlight the need to monitor financial stability risks stemming from abrupt market movements. NBFIs remain particularly exposed to such volatility through their holdings of corporate instruments, sovereign securities and equities, making them susceptible to sudden valuation losses and liquidity pressures as well as margin and collateral calls.

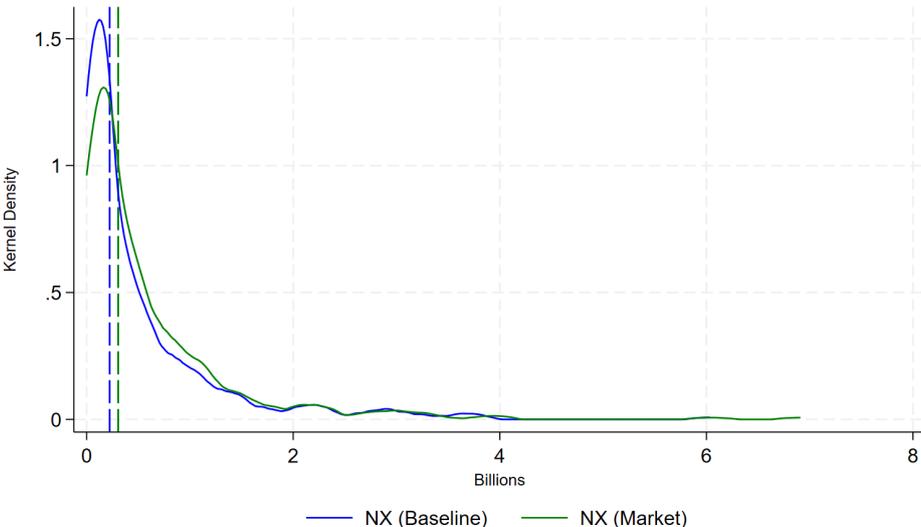
To assess how the interaction between market risks and NBF1 vulnerabilities could transmit through the interbank network, we calibrate a third stylized scenario that builds on the NBF1 risk setup. In addition to the lower initial bank capital levels used in the NBF1 risk scenario, this market risk scenario introduces fair value shocks to HQLA and partial failures of credit risk mitigation instruments. Specifically, we apply a 10 percent haircut to HQLA and assume

Figure 2: Distribution of Net Liquidity Position: Baseline Analysis and Market Risk Scenario



Notes: Solid blue line shows the distribution of Net Liquidity Position under the baseline analysis, while the solid green line shows the distribution under the market risk scenario.

Figure 3: Distribution of Net Exposure: Baseline Analysis and Market Risk Scenario



Notes: Solid blue line shows the distribution of Net Exposure under the baseline analysis, while the solid green line shows the distribution under the market risk scenario.

a 50 percent ineffective rate for credit risk mitigation instruments. These adjustments reflect plausible stress conditions under which banks face both asset valuation losses and reduced protection against counterparty risk.

The combined effect of these shocks results in a lower net liquidity position (through lower HQLA) and higher net exposures (through failure of credit risk mitigation instruments) for banks, thereby increasing the loss-given-default (LGD) relative to the baseline. This setup amplifies the vulnerability of the banking system to contagion, as reduced buffers and elevated exposures heighten the risk of cascading defaults. Table 1 Panel C provides the descriptive statistics for the net liquidity position, net exposures, and loss given default rate. Figures 2 and 3 depict the distribution of net liquidity positions and net exposures under the baseline and market risk scenarios, respectively. Figure 2 highlights the leftward shift in the distribution of banks' liquidity positions, driven by the haircut applied to liquid assets. Figure 3 shows the rightward shift in the distribution of banks' net exposures to NBFIs, reflecting the reduced effectiveness of hedges. Together these charts underscore the fragility introduced by market stress into the interbank network, amplifying both liquidity and credit risks.

5 Results

The bank network analysis facilitates the assessment of each institution's potential to propagate systemic contagion in the event of its failure, as well as its vulnerability to defaults by other banks. The interbank simulation consists of a series of hypothetical defaults, where the default of each entity is triggered iteratively. This iterative exercise yields two key outputs: (i) the number of additional defaults caused by the initial trigger event, and (ii) the losses incurred by each entity in the network during each simulation round.

Following Covi et al. (2021), we use the simulated loss data to construct two indices that rank banks according to their systemic importance and vulnerability. The first, a *Contagion Index* (CI), which measures the system-wide losses induced by the default of bank i as a share of total capital in the system (excluding bank i). The second, a *Vulnerability Index* (VI), which captures the average loss experienced by bank i across all simulations, expressed as a percentage of its own capital. If L_{ji} denote the loss experienced by bank j due to the triggered default of bank i , and k_{ji} denote the capital of bank j , these two measures can be computed as follows:

$$CI_i = 100 \cdot \frac{\sum_{j \neq i} L_{ji}}{\sum_{j \neq i} k_{ji}} \quad (7)$$

$$VI_i = 100 \cdot \frac{\sum_{j \neq i} L_{ij}}{\sum_{j \neq i} k_i} \quad (8)$$

Combining the Contagion and Vulnerability Indices provides a granular mapping of systemic risk within the euro area interbank network. Institutions exhibiting high contagion scores are those whose failure would generate disproportionately large losses across the system, indicating their potential to amplify financial distress through network channels. Conversely, banks with elevated vulnerability scores are more susceptible to shocks originating elsewhere in the system, reflecting structural fragilities or concentrated exposures. The joint distribution of these indices enables the identification of entities that are both systemically important and vulnerable to systemic risk—nodes that may serve as amplifiers of financial instability under stress conditions.

5.1 Baseline Analysis

The baseline simulation results indicate that contagion risk stemming from direct interbank exposures within the euro area remains limited under current conditions. Among the 72 hypothetical default scenarios analyzed, Table 2 presents the ten most impactful events ranked by their Contagion Index. These events generate, on average, capital losses equivalent to 1.3 percent of the aggregate capital in the euro area banking system, with transmission occurring exclusively through credit losses. Importantly, exogenous trigger events do not lead to any cascading defaults, suggesting a high degree of resilience to idiosyncratic shocks under the baseline parametrization.

Relative to the findings of Covi et al. (2021), who report average system-wide losses of 2.5 percent based on 2017Q3 data, the current results point to a more contained risk of contagion. From a financial stability perspective, the absence of cascading defaults underscores the robustness of the interbank system to isolated failures, although it does not preclude the possibility of broader distress under more adverse conditions or in the presence of correlated shocks or shocks originating from outside the banking system.

Despite the overall low level of contagion risk observed in the baseline simulations, the analysis identifies two institutions with characteristics that may amplify systemic spillovers under

Table 2: Contagion and Vulnerability Scores: Baseline Analysis

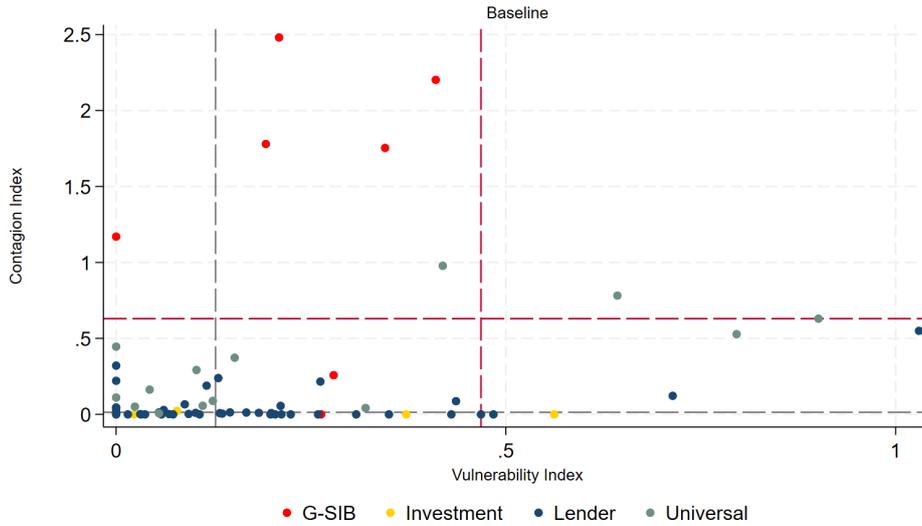
Rank	Business Model	Contagion Index	Vulnerability Index	Total Defaults
1	G-SIB	2.5	0.2	0
2	G-SIB	2.2	0.4	0
3	G-SIB	1.8	0.2	0
4	G-SIB	1.8	0.3	0
5	G-SIB	1.2	0.0	0
6	Universal	1.0	0.4	0
7	Universal	0.8	0.6	0
8	Universal	0.6	0.9	0
9	Lender	0.6	1.0	0
10	Universal	0.5	0.8	0

Source: ECB and IMF staff calculations.

stress. Figure 4 presents a systemic risk map that plots each bank according to its Contagion and Vulnerability Index scores. Each point represents an individual institution, while the dashed grey and red lines denote the median and 75th percentile thresholds of the respective distributions. Banks situated in the upper-right quadrant—above both thresholds—are classified as simultaneously highly systemic and highly vulnerable. These institutions pose a dual risk: they are capable of transmitting significant losses to the rest of the system while also being susceptible to shocks originating from other entities. In addition, six banks exhibit elevated contagion scores, suggesting that their failure could generate outsized system-wide losses, even if they themselves are relatively resilient. Conversely, three institutions rank high on the vulnerability index, indicating that they are particularly exposed to shocks from counterparties, despite having limited outward spillover potential. The analysis could help inform the identification and calibration of the capital buffer for systemically important banks (linked to the contagion index) and the systemic risk buffers (linked to the vulnerability index).

The results reveal important heterogeneity in systemic risk profiles across bank types and jurisdictions. Global systemically important banks (G-SIBs) exhibit a pronounced capacity to generate system-wide losses in the event of default, as reflected in their elevated Contagion Index scores. However, these institutions appear relatively resilient to shocks originating within the euro area banking system, suggesting robust capital buffers and diversified exposures that mitigate inward vulnerability. This asymmetry underscores their role as potential transmitters rather than receivers of systemic stress, reinforcing the need for continued scrutiny under the G-SIB framework and cross-border resolution planning. In contrast, banks classified as universal or lenders tend to display higher vulnerability scores, indicating greater susceptibility to shocks from counterparties. These results also reveal jurisdictional patterns that further underscore

Figure 4: Systemic Risk Map: Baseline Analysis



Notes: Contagion and vulnerability indices are not normalized as in Covi, Gorpe, and Kok (2021). Grey and red dashed lines correspond to the median and 75th percentile of their respective distribution.

structural heterogeneity across the banking union. Jurisdictions with a larger concentration of G-SIBs tend to be have institutions classified as highly contagious, whereas those where universal or lender-type banks are more prevalent account for a greater share of institutions identified as highly vulnerable. Together, these patterns indicate that systemic risk is unevenly distributed across the euro area and that national banking systems may face distinct challenges in the amplification and absorption of shocks.

5.2 NBFIs Risk Scenario

Bank–NBFIs interlinkages, particularly through banks’ credit exposures to non-bank financial institutions, represent a potential channel for amplifying stress within the interbank network. To assess this risk, we conduct an exploratory scenario that assumes the outright default of the five largest NBFIs. This stylized shock introduces an extreme but plausible event designed to test the resilience of the banking system under conditions of concentrated stress. By embedding this scenario into the network analysis framework, we incorporate uncertainty surrounding the potential vulnerability of market participants and examine how stress originating in the NBFIs sector could propagate through bank balance sheets and interbank exposures. The approach allows for the identification of institutions that are disproportionately exposed to NBFIs credit risk and evaluates the extent to which such exposures could trigger broader contagion effects.

Unlike the baseline analysis, as shown in Table 3, three simulated trigger events—ranked 1, 2, and 6—result in one additional cascading default each within the interbank network. The

Table 3: Contagion and Vulnerability Scores: NBF1 Risk Scenario

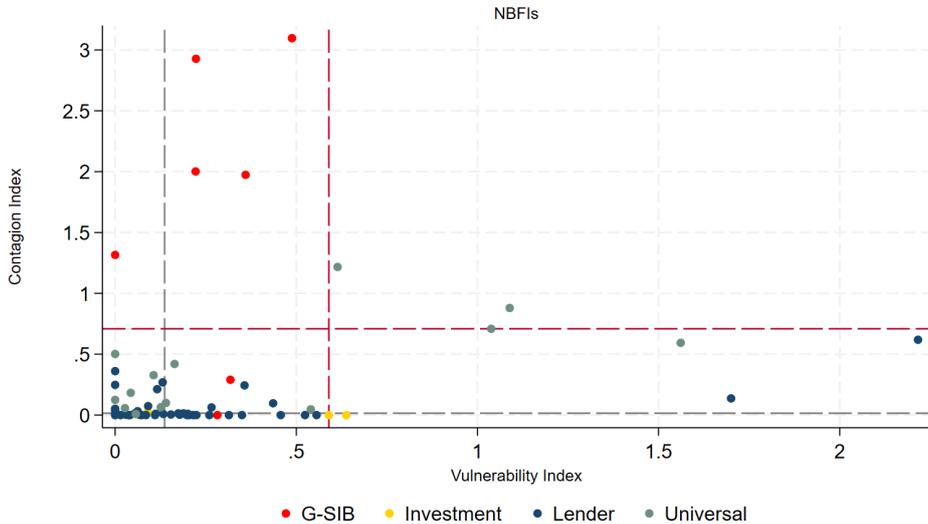
Rank	Business Model	Contagion Index	Vulnerability Index	Total Defaults
1	G-SIB	3.1	0.5	1
2	G-SIB	2.9	0.2	1
3	G-SIB	2.0	0.2	0
4	G-SIB	2.0	0.4	0
5	G-SIB	1.3	0.0	0
6	Universal	1.2	0.6	1
7	Universal	0.9	1.1	0
8	Universal	0.7	1.0	0
9	Lender	0.6	2.2	0
10	Universal	0.6	1.6	0

Source: ECB and IMF staff calculations.

most severe event under the NBF1 scenario triggers a secondary default and generates system-wide capital losses amounting to 3.1 percent, transmitted entirely through the credit channel. These outcomes suggest that stress originating from large NBF1 defaults can materially increase contagion risk, even in a system that appears resilient under baseline parametrization.

It is important to note that these estimates likely understate the true extent of potential losses. The initial calibration assumes relatively modest capital surpluses, thereby limiting the system’s aggregate loss-absorbing capacity. Under more adverse conditions—such as deteriorating asset quality or liquidity constraints—the amplification effects could be significantly larger. On average, the top ten exogenous default events in the NBF1 scenario result in capital losses of 1.5 percent, broadly comparable to the baseline, but with a higher incidence of cascading defaults.

Figure 5: Systemic Risk Map: NBF1 Risk Scenario



Notes: Contagion and vulnerability indices are not normalized as in Covi, Gorge, and Kok (2021). Grey and red dashed lines correspond to the median and 75th percentile of their respective distribution.

Disaggregated results by bank business model and country of domicile remain broadly consistent with baseline findings, reinforcing the robustness of the systemic risk map across scenarios. Figure 5 illustrates that the distributions of contagion and vulnerability indexes have shifted to the right, indicating higher outward and inward systemic spillovers within the banking sector under the NBFIs scenario. These findings highlight the need for enhanced supervisory attention to bank–NBFIs exposures and support the development of integrated risk monitoring tools that capture the evolving interdependencies between banks and NBFIs.

5.3 Market Risk Scenario

When risks associated with NBFIs are compounded by heightened financial market volatility, the potential for contagion through interbank exposures becomes materially more significant. Under a combined market risk and NBFIs stress scenario, seven exogenous bank default events—specifically those ranked 1 through 8, excluding event 4—lead to a total of eleven cascading defaults within the network. As reported in Table 4, these events generate average system-wide capital losses of 1.9 percent, exceeding the baseline and NBFIs-only scenarios. The most severe event under this combined shock results in three additional defaults and capital losses amounting to 4.4 percent of the euro area banking system’s aggregate capital. Consistent with previous scenarios, contagion is transmitted exclusively through the credit channel, with losses arising solely from materialization of credit risk, an interesting finding given the liquidity risks associated with NBFIs and financial market volatility. While NBFIs-related stress alone already elevates systemic risk, the additional market-risk layer yields marginally larger system-wide losses (i.e., an additional 1.3 percentage points), but it increases the likelihood and frequency of cascading defaults (i.e. two additional cascading defaults), underscoring the incremental amplification from combining both shocks.

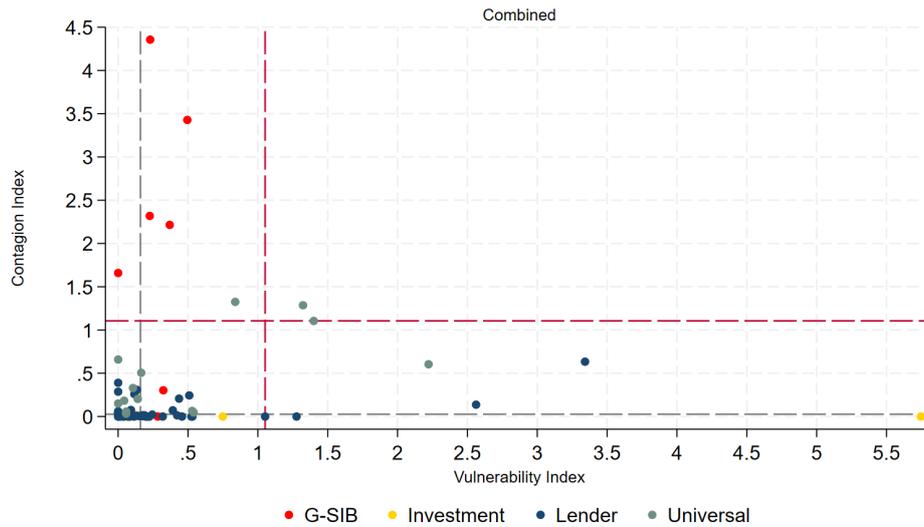
As in the NBFIs risk scenario, disaggregated results by bank business model (Figure 6) remain broadly consistent with baseline findings, reinforcing the robustness of the systemic risk map across stress scenarios. At the same time, Figure 6 indicates that the distribution of contagion and vulnerability losses across simulations has shifted markedly to the right—more so than in the NBFIs scenario—highlighting the amplification effects stemming from significant exposures to NBFIs and the market shock. Also, the increase in cascading defaults under the combined NBFIs and market shock underscores the importance of incorporating multi-dimensional stress scenarios into macroprudential surveillance. These results highlight the need for enhanced

Table 4: Contagion and Vulnerability Scores: Market Risk Scenario

Rank	Business Model	Contagion Index	Vulnerability Index	Total Defaults
1	G-SIB	4.4	0.2	3
2	G-SIB	3.4	0.5	2
3	G-SIB	2.3	0.2	1
4	G-SIB	2.2	0.4	0
5	G-SIB	1.7	0.0	1
6	Universal	1.3	0.8	1
7	Universal	1.3	1.3	1
8	Universal	1.1	1.4	2
9	Universal	0.7	0.0	0
10	Lender	0.6	3.3	0

Source: ECB and IMF staff calculations.

Figure 6: Systemic Risk Map: Market Risk Scenario



Notes: Contagion and vulnerability indices are not normalized as in Covi, Gorge, and Kok (2021). Grey and red dashed lines correspond to the median and 75th percentile of their respective distribution.

monitoring of bank–NBFIs exposures, improved integration of market risk into systemic risk frameworks, and continued vigilance regarding the structural liquidity position of euro area banks.

6 Conclusion

Our analysis of the euro area banking system’s interconnectedness with NBFIs and the impact of market volatility reveals significant insights into systemic risk dynamics. While the banking system currently benefits from robust capital and liquidity buffers that limit direct contagion via interbank exposures, vulnerabilities arising from large NBFIs exposures and volatile market conditions can substantially amplify systemic risk. Baseline simulations show that the failure of a bank does not trigger cascading defaults. The average capital loss associated with the top ten simulated default events is modest, at approximately 1.3 percent of system-wide capital.

However, when stress from NBFIs is combined with heightened market volatility, the amplification potential increases markedly. In the combined scenario, seven hypothetical bank defaults induce eleven cascading defaults, with the most severe event resulting in 4.4 percent of capital losses. These findings underscore the role of NBFIs and market volatility as significant amplifiers of systemic stress. Also, the predominance of insolvency over illiquidity as a contagion channel in the interbank market underlines the importance of monitoring counterparty credit risk and the concentration of exposures, especially as direct and indirect exposures through NBFIs grow, and become more concentrated in G-SIBs as shown by [Barbieri et al. \(2025\)](#).

Two important caveats warrant attention. First, the analysis likely understates contagion risk by omitting additional transmission channels—such as banks’ funding exposures to NBFIs, liquidity-related borrowing costs, and asset valuation effects from market volatility. Second, the conclusion that contagion stems solely from insolvency rather than illiquidity should be interpreted with caution. Notably, no defaults are triggered by liquidity shortfalls across baseline and risk scenarios, marking a departure from the findings of [Covi et al. \(2021\)](#) and historical episodes documented by [Aikman et al. \(2019\)](#), where liquidity stress played a central role in systemic propagation. This divergence likely reflects the euro area’s current ample excess liquidity, largely attributable to the Eurosystem’s accommodative policy measures implemented during and after the COVID-19 pandemic. While liquidity remains abundant, ongoing balance sheet normalization will erode this buffer, heightening the need to monitor vulnerability to liquidity

shocks ([Buch and Schnabel 2025](#)).

Our findings have important policy implications. First, they suggest that monitoring banks' bilateral exposures to NBFIs in isolation is insufficient to mitigate systemic risk. The magnitude of amplification effects following an NBFIs failure is driven by the non-linear interaction between the size of direct bilateral exposures and the centrality of banks exposed to NBFIs defaults within the interbank network. This suggests that microprudential policies focused solely on individual institutions' resilience may underestimate their contribution to systemic risk, which concerns the stability of the financial system as a whole. Second, the results underscore the need for proactive macroprudential policies that encompass not only banks but also the entire financial ecosystem, including NBFIs and market vulnerabilities. They also have implications for identifying systemically important institutions whose failure could trigger broader financial instability. For instance, the EBA Guidelines for identifying other systemically important institutions (O-SIIs) set out a two-step approach. The first step relies on a predefined set of indicators grounded in the Basel Committee's principles—including size, interconnectedness, complexity, substitutability, and cross-border activity—to assess an institution's systemic relevance. In the second step, authorities further evaluate institutions that may not have been identified as O-SIIs in the first stage but could nonetheless be significant within the financial system based on additional quantitative factors. One such factor could be the contagion index utilized in the paper.⁷ Similarly, our analysis helps identify institutions that may need to hold a systemic risk buffer to mitigate macroprudential risks arising from their exposures to systemic entities—both banks and NBFIs—supported by the vulnerability index presented in the paper. Finally, our analysis contributes to the ongoing policy debate on measures to address emerging systemic risks from banks' exposures to NBFIs as we quantify amplification risks arising from both direct and indirect (hidden) links to NBFIs ([European Commission 2024](#)). This approach can help identify NBFIs that could become systemic due to their potential contagion effects on the banking system.⁸

Overall, the paper underscores the critical need to monitor system-wide risk by leveraging

⁷This is in line with the IMF policy recommendations set out in the 2025 Euro Area FSAP. The FSAP recommended that linkages between banks and non-banks be adequately reflected in the calibration of the O-SII buffer. Specifically, if the EBA reviews its O-SII designation guidelines, it should assess whether the designation adequately reflects banks' links with non-banks and whether it would be useful to include such links as a factor in calculating banks' O-SII buffers. See [International Monetary Fund \(2025a\)](#) for details.

⁸The 2025 GFSR argues that increased interconnectedness between banks and NBFIs implies that stress at weaker, lightly regulated institutions can have material consequences for banks and the broader financial system. Policymakers should therefore closely monitor banks' exposures to NBFIs and consider implementing macroprudential buffers to enhance resilience to shocks arising from bank–nonbank interconnections. See [International Monetary Fund \(2025g\)](#) for details.

detailed supervisory data to assess the systemic implications of growing interconnectedness between banks and NBFIs. Integrating granular bilateral exposures and contagion models into stress testing frameworks will enable authorities to anticipate and mitigate risks stemming from complex interactions among banks, NBFIs, and market shocks. Achieving this requires fostering cross-sectoral cooperation and data sharing arrangements among banking, securities, and NBFi regulators to ensure the comprehensive oversight of financial stability risks.

Several extensions of this work merit further exploration. Future analysis could incorporate additional channels of risk transmission, particularly counterparty credit risk arising from derivatives and securities financing transactions. A sharp deterioration in a bank's credit rating could lead to losses for its counterparties through changes in credit valuation adjustments, even if the bank remains solvent. The quantification of this impact would involve leveraging granular data and network-based simulations, as illustrated by [Barbieri et al. \(2025\)](#). Moreover, the euro area bank network could be expanded to include banks domiciled in foreign jurisdictions, as well as NBFIs. Achieving this would require cross-jurisdictional and cross-sectoral cooperation on data sharing and joint risk assessments.

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**Risk Propagation in the European Banking System:
Amplification Effect from NBIs and Market Risks**
Working Paper No. [WP/2026/033]