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Growth of non-bank financial intermediaries, monetary policy, and financial stability

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EUROSYSTEM

Growth of non-bank financial intermediaries, financial stability, and monetary policy

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Abstract

This paper examines the rise of non-bank financial intermediaries (NBFIs) and its implications for financial stability and monetary policy transmission in the Euro Area and the United States. While the U.S. financial system has long been market-based, the Euro Area has experienced a striking expansion of NBFIs, which now account for a *larger* share of GDP than in the U.S. While the sector has grown significantly, much of its capital is intermediated and allocated outside the EU, reflecting missed opportunities for domestic capital market development. We argue that this pattern is a consequence of limited growth opportunities within Europe, weak financial market infrastructure, and the absence of key institutional enablers such as a sizable capital market and securitization frameworks. We further examine how NBFIs pose supervisory challenges due to geographic concentration, influence money market dynamics, and interact with monetary policy transmission. The paper concludes with policy recommendations to unlock the sector's potential – including reforms to deepen European capital markets, a unified supervisory mechanism and consideration of extending some central bank facilities to NBFIs.

Introduction

Over the past two decades, the global financial system has undergone a profound structural transformation, marked by the rapid growth of non-bank financial intermediaries (NBFIs). In the Euro Area, these institutions – ranging from investment funds and insurance corporations to money market funds and securitization vehicles—now account for a larger share of total financial assets over GDP than in the United States. This expansion poses question on how this evolution has reshaped the architecture of credit intermediation, liquidity provision, and market-based finance in Europe, generating new challenges and opportunities for financial stability and monetary policy.

This paper addresses three fundamental questions raised by this structural shift. First, it investigates the expansion of NBFIs in both the Euro Area and the United

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States, focusing on their size, composition, and systemic importance. While the European NBFI sector now surpasses that of the U.S. in relative terms – amounting to 3.8 times GDP compared to 3.1 times in the U.S. – a substantial share of its capital is invested outside the Euro Area. This outward orientation not only raises questions about the underutilization of domestic financial resources and the persistent shortcomings of European capital markets, but also underscores a deeper structural issue: despite the growing prominence of NBFIs, the European financial system remains predominantly bank-based. The continued reliance on banks for credit provision and liquidity intermediation suggests that market-based finance has not been fully integrated, limiting the domestic anchoring and policy relevance of the NBFI sector in Europe.

Second, we explore the financial stability implications of this structural shift. The expansion of NBFIs introduces new channels of contagion, opacity, and procyclicality – especially through leverage, liquidity mismatches, and interconnectedness. The Euro Area, in particular, faces unique challenges due to the geographic concentration of NBFIs in a handful of jurisdictions and the absence of a unified supervisory framework. These factors complicate macroprudential oversight and risk undermining financial integration across member states.

Third, we examine the changing role of NBFIs in short-term funding markets and their increasing influence on the transmission of monetary policy. As financial intermediation continues to shift globally from bank-based to market-based channels, the effectiveness of central banks in steering short-term interest rates and managing liquidity hinges more critically on the behavior of NBFIs operating in collateralized markets – such as repos, commercial paper, and derivatives funding. In the Euro Area, this dynamic is further complicated by the significant presence of foreign NBFIs in domestic money markets, which can introduce external shocks and reduce the effectiveness of domestic policy measures. We discuss how key players like money market funds and hedge funds shape the pricing and allocation of liquidity, and by replicating and extending dispersion indices across funding rates, we offer empirical evidence of the fragmentation within Euro Area and US money markets. We also explore the institutional factors contributing to this divergence, in contrast to the U.S., where certain NBFIs have direct access to Federal Reserve operations. Finally, we assess whether granting access to central bank facilities to NBFI in Europe could amplify or moderate the transmission of monetary policy in a fragmented market environment and what such measures might imply for broader financial stability.

Taken together, our analysis seeks to illuminate the evolving role of NBFIs in the European financial system, the constraints they impose on monetary policy effectiveness, and the emerging risks they pose to systemic stability. By comparing transatlantic developments, we highlight both the vulnerabilities and untapped potential of the European NBFI sector. We argue that unlocking this potential requires coordinated reforms to deepen capital markets, strengthen supervisory capacity, and reconfigure the central bank toolkit to accommodate the realities of a hybrid financial system.

The paper is organized as follows. Section 1 describes the rise of NBFIs in Europe and in the U.S., the changing architecture of financial Intermediation, the effects to the real economy and the implications for financial stability. Section 2 describes the role of NBFIs in monetary policy, and Section 3 focuses on the role of NBFIs in wholesale funding, monetary policy pass-through, and NBFIs access to CB facilities. Section 4 provides key takeaways, suggestions and concludes.

1 The Rise of NBFIs: Implications for the Real Economy and Systemic Risk

1.1 The Rise of Non-Bank Financial Intermediaries

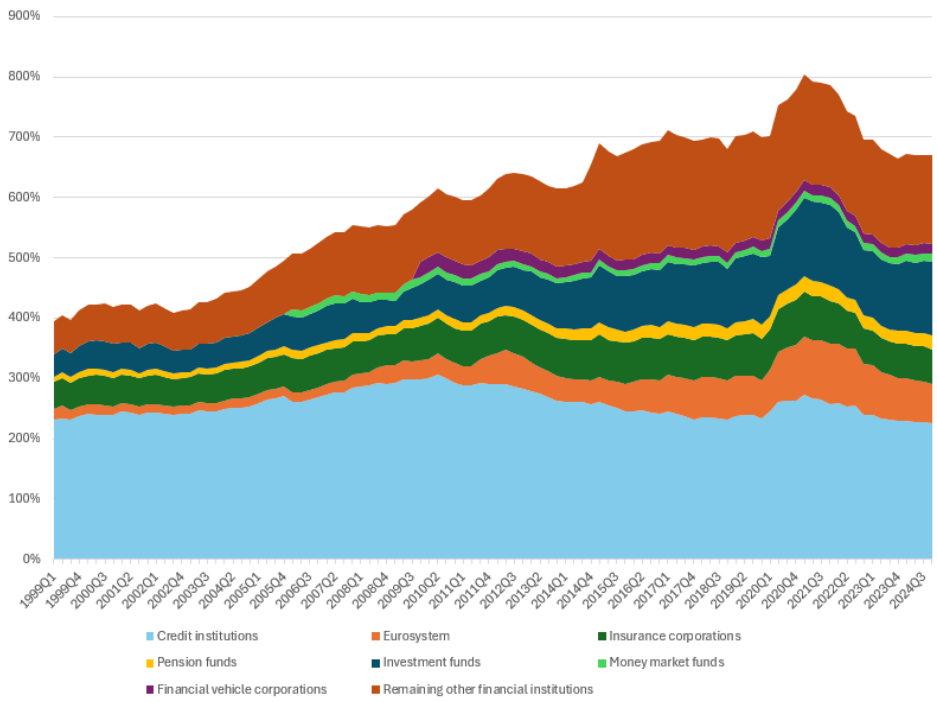
Over the past two decades, a gradual but far-reaching transformation has reshaped the structure of the global financial system. As traditional banks began to deleverage, consolidate, and adjust to increasingly stringent regulatory requirements, a different category of financial actors gained prominence: non-bank financial intermediaries (NBFIs). As of 2023, NBFIs controlled nearly 50% of global financial assets, up from about 40% in 2008, reflecting an increase of over $100 trillion in absolute terms (FSB, 2024).

1.1.1 The Euro Area

A Euro Area perspective shows even more elevated levels. As Chart 1.1 shows, once considered peripheral, NBFIs now account for over 60% of the Euro Area financial sector, rivalling the banking system in both scale and systemic relevance. In 1999, NBFI assets stood at approximately 140% of GDP; today, they are close to 400% of GDP, having almost tripled over this period. At their peak in 2021, NBFI assets temporarily reached 500% of GDP, underscoring their systemic scale and prominence. Banks, by contrast, initially expanded slower but in parallel with NBFIs—reaching almost 300% of GDP before the global financial crisis—but have since retrenched, stabilizing around 200% of GDP, even as NBFIs continued to grow.

Chart 1.1.
Total assets of the Euro Area financial sector as % of nominal GDP. Source: ECB financial integration and structure indicators

(% of GDP)



Sources: ECB financial integration and structure indicators
Notes: The aggregated (non-consolidated) total assets of sub-sectors include financial assets and exclude non-financial assets. Remaining other financial institutions include security and derivative dealers, financial corporations engaged in lending (such as leasing or factoring companies), specialised financial corporations (including venture capital companies, export/import financing companies and some central clearing counterparties), financial auxiliaries (including asset management companies, securities brokers, investment advisers, insurance brokers and exchanges) plus captive financial institutions and money lenders (including financial holding companies, funding vehicles of non-financial corporations – e.g. supporting their debt issuance – and other entities that channel financial flows within non-financial corporations). This Chart is an extension of Chart 1.1. from Financial Integration and Structure in the Euro Area, March 2020.

As Chart 1.1. highlights, this transformation is neither accidental nor uniform across financial institutions. It has been shaped by market forces, regulation, and innovation — and it has brought with it both opportunities and risks as NBFIs play a crucial role in channelling capital, offering liquidity, and supporting financial innovation.

Credit Institutions (Banks)

While non-bank financial institutions have reshaped the financial landscape of the Euro Area, the traditional banking sector — classified as credit institutions (light blue) in Chart 1.1 — obviously continues to play a foundational role. Banks remain the largest single component of the European financial system, holding assets consistently above 200% of GDP throughout the past 25 years. However, despite their absolute growth, their relative share has stagnated since the global financial crisis, while NBFIs have consistently increased their assets with respect to GDP. What was once an unchallenged dominance has gradually given way to a more

balanced and therefore, more complex ecosystem. Banks provide credit lines and funding to investment funds, are exposed to insurers through derivatives and securities holdings, and increasingly rely on MMFs for short-term funding. As such, banks have become both a source of resilience and a potential transmission channel for stress originating in the non-bank space.

Eurosystem

The Eurosystem, the monetary authority of the Euro Area, comprising the European Central Bank (ECB) and the national central banks (NCBs) of the Euro Area member states and therefore neither a bank nor a NBFI, has shaped Euro Area financial assets. Prior to the financial crisis, its balance sheet was modest — below 20% of GDP. By 2021, following successive waves of crisis response (SMP, OMT, PSPP, PEPP, TLTROs), it had increased to nearly 100% of GDP. This unprecedented expansion underpinned market stability but also created a central role for the ECB (and the national central banks (NCBs) of all EU Member States). Since the onset of monetary tightening in 2022, the Eurosystem's footprint has begun to recede, but it remains historically elevated at 65 % of GDP in 2024.

Insurance Corporations and Pension Funds (ICPFs)

A well-known pillar of the non-bank sector is made up of insurance companies and pension funds (ICPFs). These institutions manage long-term liabilities and have traditionally been seen as stable anchors of the financial system by investing in a broad range of assets to match their long-term liabilities. However, persistent low interest rates and the search for yield have pushed many ICPFs toward less liquid and more complex investments. Their growing exposure to real estate, private equity, and alternative assets raises questions about valuation risks and their potential procyclical behaviour during downturns. Their investment decisions influence capital markets and can affect financial stability, particularly if they engage in procyclical investment behaviors or face solvency pressures during economic downturns.

Even though ICPFs face more regulatory constraints than other components of the NBFI sector, they have grown at a moderate but steady pace. From a combined 54% of GDP in 1999, insurance corporations and pension funds have risen to around 80% of GDP in 2024. Unlike the boom in investment funds, this growth has been gradual, reflecting the long-term nature of their liabilities. Interestingly, their relative size has not changed dramatically over 25 years, but their portfolio composition has. Particularly in the post-2014 environment of ultra-low rates, many institutions shifted into riskier or less liquid asset classes – introducing new potential channels of vulnerability (depending on the regulatory framework governing investor redemptions), despite their historically stabilising role (see, e.g., FSR, 2023; Kaufmann et al., 2024).

Investment Funds

At the heart of the NBFI universe in the Euro Area are investment funds, which have expanded rapidly over the past decade. Investment funds are collective investment schemes that pool capital from investors to purchase a diversified portfolio of

financial assets, including equities, bonds, and derivatives (more specific: equity, bond, mixed, real estate, hedge and other funds). In the Euro Area, they play a significant role in channelling savings into capital markets, thereby facilitating corporate financing and contributing to market liquidity. Their activities span across various asset classes and sectors, making them integral to the financial ecosystem. Households, insurance corporations and pension funds are the main Euro Area investors in investment fund shares, gaining indirect exposure to financial instruments such as government bonds or equities.

This centrality is reflected in their remarkable growth: from a modest 37% of GDP in 1999, investment funds have grown to nearly 118% of GDP by 2024 — more than tripling over 25 years. No other NBFI sector has expanded so consistently and rapidly. Around the time of the financial crisis, investment funds held a relatively stable share, but after 2010, their ascent accelerated, marking a decisive shift toward market-based finance in the Euro Area. By 2020, their asset base had already overtaken the entire insurance sector. Today, they represent one of the largest segments of the financial sector in the Euro Area, highlighting both their importance and their potential to act as amplifiers in systemic stress events as well as in their role of transmitting monetary and fiscal policies.

Money Market Funds (MMFs)

Closely related are MMFs – vehicles designed to offer safety and liquidity by investing in short-term, high-quality instruments. While MMFs play an important role in short-term funding markets, they have also proven fragile in times of crisis. Despite their low-risk profile, MMFs can be susceptible to runs during market turmoil due to their promise of near-instant liquidity, which may not align with the liquidity of their underlying assets. In March 2020, a spike in redemptions forced several MMFs into defensive selling, raising concerns about their ability to withstand runs. This experience has prompted global regulatory efforts to enhance MMF resilience, but implementation across jurisdictions remains uneven.

In contrast to the spectacular growth of investment funds, MMFs have remained a consistently small segment in the Euro Area, fluctuating in a narrow range around 10% of GDP over the past two decades. However, their systemic relevance stems not from size, but from function: by providing short-term liquidity to corporates, governments, and the banking sector – primarily through their significant role in the collateralized interbank market (repos) – they are deeply embedded in the Euro Area's financial infrastructure. Their persistent exposure to liquidity mismatches and reliance on investor confidence make them a critical point of vulnerability. During periods of stress, fire-sale dynamics can transmit shocks across markets — as was starkly illustrated during the COVID-19 turmoil in March 2020 (see e.g., IOSCO (2020)).

Financial Vehicle Corporations (FVCs)

Financial vehicle corporations (FVCs) in the past have been considered the more shadowy players. FVCs are the engines behind securitisation, packaging loans and other receivables into tradable securities. They allow the change of the credit

transformation from bank based to market based. While they can support credit supply and risk transfer, they can also obscure exposures and create opacity in the financial system – particularly when risks migrate outside the regulatory perimeter. They are also highly sensitive to market confidence. As the GFC has shown, episodes of dislocation can result in contagion across structured finance markets, particularly when originators retain significant exposure to their own off-balance sheet vehicles.

In terms of size, FVCs remain one of the smallest components of the NBFI landscape. Introduced in the dataset around 2009 (part of Other Financial Institutions (OFIs) before), their asset share has hovered around 16% of GDP since then, with little structural growth. This flat trajectory contrasts sharply with pre-crisis hopes for deep securitisation markets in Europe (see e.g. Draghi, 2024). Despite regulatory efforts like the STS (simple, transparent, standardised) framework, the securitisation market in the Euro Area never recovered its pre-crisis momentum, leaving FVCs as a marginal, though structurally important, element of the financial ecosystem.

Remaining Other Financial Institutions (OFIs)

OFIs, by contrast, are a diverse and often hard-to-define category. They include security and derivative dealers, financial corporations engaged in lending (e.g. engaged in financial leasing, hire purchase, factoring and the provision of personal or commercial finance), specialised financial corporations (e.g. venture and development capital companies, export/import financing companies, financial intermediaries that acquire deposits or loans vis-à-vis MFIs only and central clearing counterparties), financial auxiliaries (security brokers, corporations that manage the issue of securities, corporations providing infrastructure to financial markets, head offices of groups of financial corporations) as well as captive financial institutions and money lenders (e.g. trusts, holding companies, SPEs that qualify as institutional units and raise funds in open markets to be used by their parent corporations, corporations engaged in lending from funds received from a sponsor) (see ECB 2016). Their activities often mirror those of banks – lending, transforming maturities, leveraging – but they do so with different risk appetites and under lighter supervision. In particular, private credit (PC) has emerged as a fast-growing segment at an annualised rate of 13% since 2010 (Cera, 2022), offering tailored financing to mid-sized firms that may no longer be served by traditional banks. Nevertheless, based on Pitchbook Data inc, absolute numbers are still small in comparison to the US. In Q2 2024, PC accounted for €106 billion in the Euro Area while in North America they stood at €1.2 trillion respectively (Cera, 2022). Yet, the opacity of valuations, the use of leverage, and interconnections with institutional investors and especially with banks make this space a potential channel for hidden systemic risk. In conclusion, their activities can enhance financial inclusion and efficiency but may also pose regulatory challenges due to their varied business models and potential for high leverage or liquidity mismatches.

OFIs represent the stealth growth story of the Euro Area's NBFI landscape. Starting from around 50% of GDP in 1999, their asset share almost quadrupled, reaching a

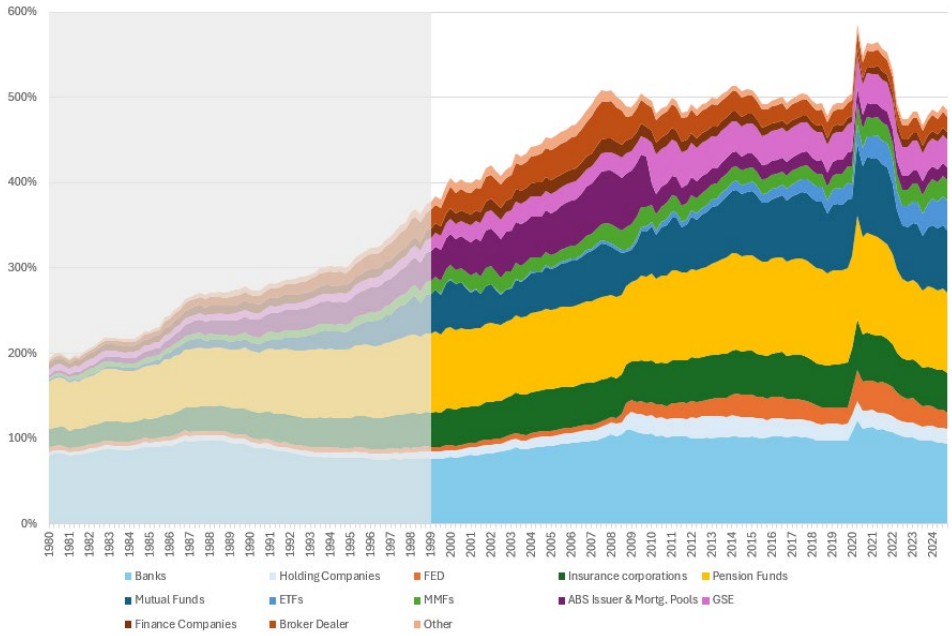
size of almost 200% of GDP. In doing so, they have reached a similar size than banks.[4]

1.1.2 Transatlantic Divergence: Comparing the Euro Area and the United States

While the expansion of NBFIs is a global phenomenon, its trajectory and implications differ markedly between the Euro Area and the United States, reflecting variations in financial structures, regulatory frameworks, and inter-institutional dynamics.

Chart 1.2.
Total assets of the U.S financial sector as % of nominal GDP

(in % of GDP)



Sources: FED from Z1
Notes: The U.S. data is more granular than the Euro Area data presented in Chart 1.1. Holding companies and banks represent credit institutions, Mutual Funds and ETFs present Investment funds. Finance companies, Broker Dealer, and other present OFIs and GSEs do not exist in the Euro Area. The shaded area reflects the period not covered in Chart 1.1.

In the United States, the financial system has long been dominated by capital markets rather than banks. This has provided fertile ground for the early and rapid growth of non-bank institutions such as independent asset managers, hedge funds, private equity firms, and a highly developed securitisation market. The U.S. NBFI ecosystem is also marked by a high degree of functional specialisation and independence. Most large asset management companies – such as BlackRock, Vanguard, or Fidelity – operate independently of banking groups.

By contrast, in the Euro Area, the financial system remains more bank-centric. Even after a decade of capital markets development and the expansion of non-bank

[4] Note that remaining OFIs are a residual category and therefore contain intra-positions that means double counting but also a proxy for interconnectedness.

intermediation, banks still play a dominant role in credit provision.[5] Many European investment funds and asset managers are closely tied to banking groups – often acting as subsidiaries of major banks. This means that prudential oversight of banks indirectly has more relevance for a large share of the NBFI landscape. As a result of these structural differences, bank assets in the United States amount to less than 100% of GDP, whereas in the Euro Area, they consistently exceed 200%.

The Euro Area applies an entity-based regulatory approach, where rules are tied to the type of institution rather than the financial activity itself. This often results in longer intermediation chains and limits the use of regulatory shortcuts, shaping both the structure of the financial system and access to central bank facilities.

Surprisingly, NBFIs' assets amount to 380% of GDP in Europe, larger than the 330% of GDP in the US However, relative to the size of their respective banking sectors. NBFIs are significantly larger in the United States than in the Euro Area. This may not come as a surprise to most readers. What is also surprising, however, is that the total financial assets in the Euro Area are substantially higher than in the U.S., amounting to almost 700% of GDP compared to roughly 500% in the United States. Even more striking: when measured relative to GDP, the size of the NBFI sector is roughly comparable in both jurisdictions. Nevertheless, this has not always been the case. Surprisingly, the U.S. saw all the increase between the 1980 and the financial crisis in 2008 and has despite an increase in FEDs balance sheet completely stagnated since then. The Euro Area financial sector, in contrast, was able to outpace GDP consistently since the inception of the Euro in 1999. First banks and NBFIs in tandem, but since 2010, only NBFIs, while banks even slightly decreased.

There are several reasons for this discrepancy. First, the U.S. has exhibited significantly higher GDP growth rates, which changes the picture in absolute terms. Second, the Euro Area relies more heavily on financial intermediation, with less direct access for ultimate lenders to capital markets. This multilayered structure increases the likelihood of double counting within the Euro Area's financial system. But it also raises a broader question: do longer intermediation chains – by involving more institutional layers, especially with banks at the core – amplify systemic risk? Third, structurally higher household savings rates in the Euro Area contribute to the difference. A substantial portion of these savings is managed by global asset managers, many of which are headquartered in the U.S. Reproducing Chart 1.1 and 1.2 using a headquarter-based classification would likely reverse the impression of parity and instead underscore the strong dominance of the U.S. in NBFI intermediation.[6]

Despite the NBFI sectors being of comparable size relative to GDP in the Euro Area and the U.S. in 2024, there are notable differences in their composition. Pension funds represent the most significant contrast: they account for nearly 100% of GDP

[5] See Heider et al. (2025) for an assessment of the competitiveness of the European banking sector.

[6] The uncomfortable truth is that a significant share of European savings are intermediated through U.S.-based financial entities – particularly large global players like BlackRock – and ultimately appear as financial assets on the balance sheets of euro area institutions, even though the real financial control and intermediation occur elsewhere. For instance, only 37% of European investment fund assets are allocated to European equities and bonds.

in the U.S., while in the Euro Area, they make up only 25%. OFIs are also distributed unevenly; in the U.S., they account for 34% of GDP, whereas in the Euro Area they represent 155%- five times more. MMFs are about twice as large in the U.S., amounting to 24% of GDP, compared to 12% in the Euro Area. FVCs also show little variation, contributing 15% of GDP in both the Euro Area and the U.S, but Government-Sponsored Enterprises (GSEs), which only exist in the U.S. account for additional 32%. This indicates that it is not only the size that captures the relevance of a sector, but the intermediation activity developed, in the case of FVCs the significant securitization that is then distributed to the rest of the system and the role of private credit. In contrast, Investment Funds are relatively balanced, representing around 100% of GDP in both regions. Insurance corporations are similarly aligned, accounting for approximately 50% in each area.

1.2 The Changing Architecture of financial Intermediation

The times where the modern financial system was a simple web of regulated banks and passive savers is long past. It is a complex, adaptive network where banks and NBFIs collaborate, compete, and co-evolve.

At its core are three economic agents: ultimate creditors (households, non-financial corporations, governments), ultimate borrowers, and a diverse array of financial institutions, both banks and non-banks. This section examines the evolving interlinkages between these actors, focusing on how NBFIs engage in credit and liquidity intermediation—both in tandem with and independently of banks and how they have expanded the wholesale funding functioning of the financial system currently dominated by collateralized funding.

Starting from a bank-centric network without NBFIs and the traditional originate -to-hold (OTH) approach we distinguish between two architectures:

a) A bank-centric network where banks and NBFIs operate in a tightly coupled sequence – most evident during the pre-crisis originate-to-distribute (OTD) era. This model was exemplified by large financial holding companies (FHCs), which integrated commercial banking, broker-dealer, and asset management functions within a single conglomerate.

b) A disintermediated network, where NBFIs connect directly to households, corporations, and states via capital markets and wholesale money markets, reducing the systemic role of traditional banks.

1.2.1 From Bank based to Market based system

In the traditional bank-based system, banks performed the full spectrum of credit, maturity and liquidity transformation within their balance sheets. They originated loans, carried them as long-term assets, and funded them primarily through deposits. The Originate-to-Hold (OTH) model provided natural alignment between asset and

funding duration but imposed strict balance sheet constraints, capital requirements, and exposure to credit, maturity and liquidity risk over time.

However, beginning in the 1980s and accelerating into the 2000s, banks increasingly adopted the Originate-to-Distribute (OTD) model. In this structure, loans are originated but quickly securitized and sold to be held by investors rather than the originating bank. This model allowed banks to (i) Reduce risk-weighted assets, freeing up regulatory capital, (ii) Increase lending capacity without needing more deposits, (iii) Generate fee-based income from structuring and servicing loans and (iy) Achieve higher returns on equity.

The shift to OTD was made possible by the development and institutionalization of NBFIs that took over different stages of the intermediation process (see e.g. Acharya et al., 2024).

A detailed description of this new model has been provided by Poszar et al. (2010) picturing the vast network of non-bank financial intermediaries that conduct credit, maturity, and liquidity transformation without the support of traditional regulatory safety nets such as deposit insurance or central bank liquidity. This network that connects ultimate creditors to ultimate borrowers operates via a multi-step intermediation chain, breaking down traditional banking into distinct components, each performed by specialized entities with Financial Holding companies (FHCs) at the core. FHCs operated as vertically integrated platforms for credit intermediation. By combining commercial banking, investment banking, and asset management under one roof, FHCs controlled multiple stages of the OTD chain—from loan origination and securitization to distribution and short-term funding. Their internal broker-dealers and primary dealer desks facilitated both the creation and placement of structured credit products, while affiliated asset managers and MMFs absorbed the securities.

The regulatory framework implemented after the GFC and the digital revolution that also the financial system is facing after the Covid-19 pandemic have partially re-shaped the financial system network, The key changes are the presence of NBFI that are performing credit, maturity and liquidity transformation not anymore under the roof of FHCs (see Acharya et al. (2024) and Cetorelli and Prazad (2024)), and the development of the collateralized wholesale funding instead of the classical uncollateralized interbank market. These two main changes face spaces on one side to fintech and big tech companies (see ESRB (2022)) as well as their role involvement in the payment system. Regarding the wholesale funding, the role of risk-free assets as collateral is playing a humongous role. At its infancy we observe also the evolution of the stable-coin industry. Appendix A provides a representation and a description of this new system.

The intermediation chain here unfolds differently. MMFs (mostly in the US), for instance, collect savings from households and institutions and use them to provide either funding in the collateralized money markets (repos) intermediated via broker-dealers and cleared by central clearing institutions receiving short-term debt from corporates or sovereigns as collateral or to buy short-term debt from corporates or sovereigns. These MMFs act as liquidity providers to the system, but unlike banks,

they are not backed by deposit insurance or central bank facilities, making them highly susceptible to redemption pressure in times of stress, as the March 2020 market turmoil shows.

Investment funds and ETF are also key actors in this new framework. They lie at the core of the NBFI landscape in the Euro Area, having experienced significant growth over the past decade. Retail and institutional investors use them for diversified exposure to corporate bonds, mortgage-backed securities, or even high-yield credit and to gain exposure to the rest of the world. They are also an important vehicle through which the rest of the world invests in the Euro Area economy. A key difference with respect the Euro investment funds and the US investment funds is that in the Euro Area investment funds, as well as ETFs, are often distributed to retail investors through banks that refer largely to their asset management arms and collect a significant fraction of the fee charged by these investment institutions.

In parallel, pension funds and insurance companies – tasked with managing long-duration liabilities – have grown significantly in size over time and are therefore increasingly allocating capital to government bonds, corporate credit, and structured finance products. This trend creates a stronger direct pipeline from institutional savings pools to credit demand.

A striking feature of this network (mostly in the US) is the growing role of fintech, bigtech, and marketplace lending platforms. These platforms allow NBFI to lend directly to SMEs, or to invest in consumer loans, bypassing the traditional banking infrastructure. Industrial Loan Companies (ILCs), captive finance arms of bigtech firms, and nonbank mortgage originators have all emerged as competitors to banks – not only in the origination of credit, but in holding it and distributing it through digital channels.

Furthermore, the expansion of digital payment systems has complemented this disintermediation by enabling real-time, bank-independent settlement between economic agents. Platforms such as PayPal, Stripe, and Apple Pay, as well as stablecoins[7] and tokenized cash systems, now serve as critical infrastructure for the seamless movement of funds outside the traditional banking rails. This evolution further reduces reliance on deposit-taking banks as intermediaries for payments and liquidity, reinforcing the structural shift toward a decentralized and market-based financial system where banks still play a role but largely as conduits.

This system is also underpinned by collateral markets, especially the centrality of risk-free assets, primarily government bonds, as the foundational layer for wholesale short term funding and a key instrument for inventory management by dealers in the cash bond market. Government securities serve as collateral in repo markets, are used in derivatives margining, dealers' inventory management and are central to the reserve management of NBFIs. The public credit system in particular the safe assets

[7] For an overview of the relationship between Stablecoins and money market funds see Aldasoro et al. (2024) and d'Avernas,et al. (2022).

such as US treasuries and the German Bunds, has effectively become the new pivotal element for market-based finance.

Wholesale short-term funding, i.e. money markets, are one of the neuralgic points of interconnection between banks and NBFIs. These markets not only facilitate liquidity redistribution across the financial system but also serve as an essential transmission channel for monetary policy. Their structural position makes them particularly sensitive to shifts in funding conditions, regulatory frictions, or market stress. As such, disruptions in these markets can generate significant spillover effects, including impaired policy transmission and heightened uncertainty about future monetary outcomes. The following sections examine these dynamics in greater detail, with particular attention to their role in affecting financial stability and monetary policy transmission.

In conclusion, the prevailing trend points toward financial intermediation increasingly being conducted outside the traditional banking system – that is, without insured deposits, access to central bank liquidity, or less prudential oversight. The risks are less about interbank contagion and more about run-like dynamics in wholesale markets, liquidity mismatches in open-ended funds and ETF, and procyclicality in collateral valuation. Acharya et al. (2025), for example, provide evidence that reliance on NBFI financing heightens the vulnerability of NFCs, as banks tend to restrict access to credit lines in response.

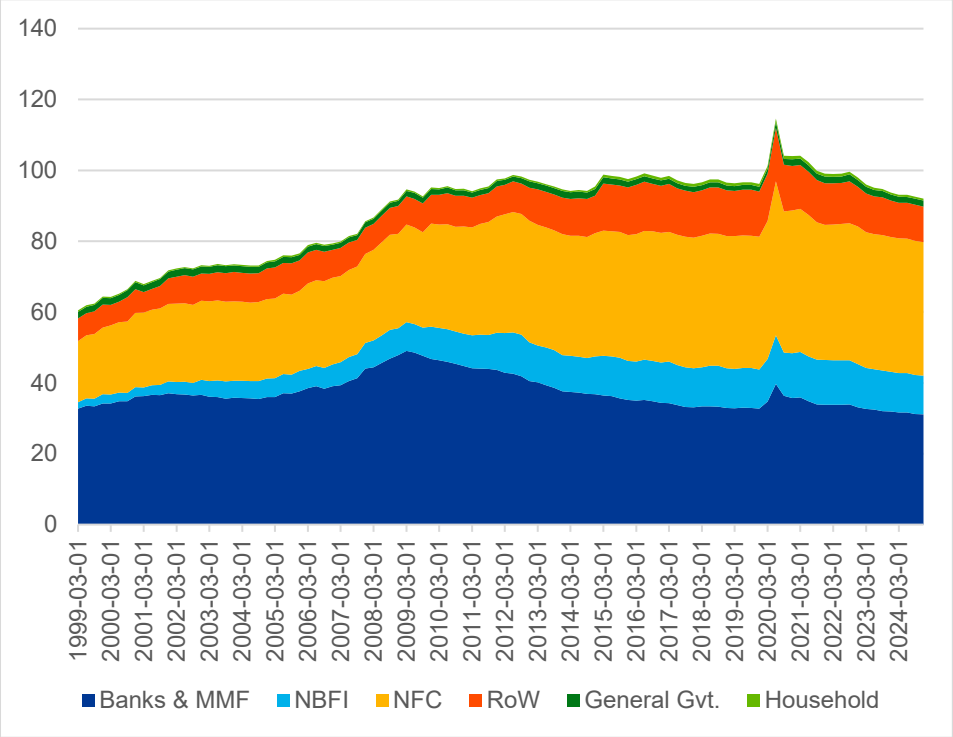
1.3 The Rise of the Disintermediated Financial Network: NBFIs as Direct Channels to the Real Economy

Alongside the interdependent credit chain that links banks and nonbanks through securitization and synthetic risk transfer, a parallel architecture has emerged largely after the GFC as a consequence of the regulatory framework settled in response to that crisis – one that is increasingly characterized by direct connections between NBFIs and the real economy. How is this new system connected to the real economy in EU and in the US? We address this question by looking to the evolution of the providers of NFC loans and debt securities and household loans.

Chart 1.3 illustrates loans to non-financial corporations (NFCs) in the Euro Area, broken down by sector. Overall, we observe that NFC borrowing grew more rapidly than GDP from the introduction of the euro in 1999 until the global financial crisis in 2008. Since then, however, aggregate loan levels have stagnated. Nevertheless, this is not true for its decomposition.

Chart 1.3.
Loans to NFCs of Euro Area by Sector

(in % of GDP)



Sources: ECB, authors' calculations

Chart 1.3. shows a sustained decline in the share of loans provided by banks and MMFs, which fell from 49% of GDP in 2008 to 31% in 2024 (similar to the decline in total assets in Chart 1.1.). In contrast, direct lending from NBFIs – the focus of this subsection – increased steadily, rising from just 2% of GDP in 1999 to 7% in 2008 and reaching 11% in 2024. When comparing only banks (incl. MMFs) and NBFIs, the NBFI share increased from 5% in 1999 to 14% in 2008, and further to 26% in 2024.[8]. This persistent trend strongly suggests that the expansion of the NBFI direct lending channel discussed in this section is not solely a U.S. phenomenon, but also a firmly established feature of the European financial system.

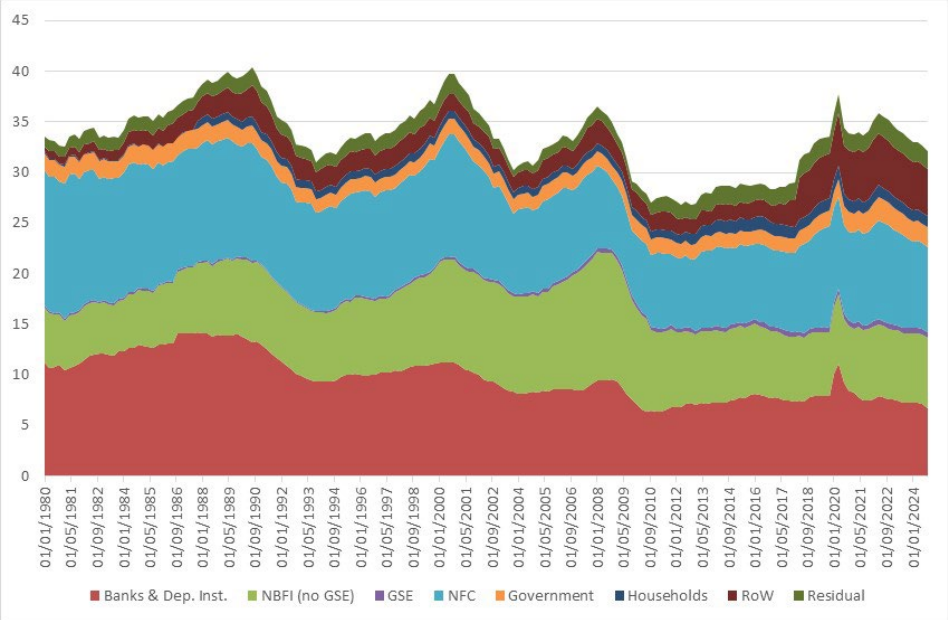
General government and household lending remain marginal in this context. As for the rest of the world (RoW), the available data do not allow us to distinguish whether loans originate from banks or NBFIs. A particularly noteworthy development is the large and growing share of intra-NFC lending, which reached 38% of GDP in 2024, making it the single largest category. This growth has been consistent since 1999 but, according to the ECB (2024), is largely driven by financing conduits located in different Euro Area countries. In such cases, debt issuance is recorded in the conduit's country, while the corresponding loan appears in the balance sheet of the NFC's home country, effectively creating European cross-border flows. It would be

[8] Given that MMFs are included within the banking sector in this dataset, the reported figures may slightly understate the true extent of non-bank lending.

highly relevant to assess whether lending between unrelated NFCs has increased and to what extent. However, due to limitations in the granularity of the available data, this question remains unanswered in Chart 1.3. Nevertheless, according to Andersen and Serrano (2025) a significant fraction of these loans are indeed Trade payables, i.e. represent credit created within the real economy, that are often unsecured, rely heavily on trust, reputation, and existing business relationships, and are particularly important for small and medium-sized enterprises (SMEs), which may have limited access to formal finance. Ignoring intra-NFC holdings can underestimate financial complexity and potential contagion paths within the corporate sector.

Chart 1.4.
Loans to NFCs of US by Sector

(in % of GDP)



Sources: FRED, authors' calculations

Chart 1.4 offers insights into the evolving structure of credit intermediation in the U.S. economy. From the early 1980s through the mid-1990s, banks and depository institutions (in orange) were the dominant source of credit to NFCs, accounting for a large and stable share. However, their role started to decline in relative terms by the late 1990s and particularly during the 2000s, reflecting broader financial disintermediation trends and the growing role of capital markets and non-bank actors. In contrast, NBFIs – shown in green – expanded significantly from the early 2000s onward, particularly leading up to the 2008 financial crisis. This surge highlights the rise of securitization, syndicated loans, private credit funds, and other non-traditional lending platforms. Following the GFC, their share decreased again and stagnated since then. Intra-NFC lending (blue), mainly trade credit, also plays a huge role in the U.S. This finding is also an indication, that high Euro Area intra-NFC lending numbers cannot simply be explained by Euro Area cross-border lending as this explanation does not hold for the U.S.

Although NFCs, GSEs, the government and household show increasing trends, their overall impact on providing loans to the NFC sector is still mitigated. While this was also true for the rest of the world (RoW) until 2014, we see a substantial jump from 1% to 4% of GDP during the last 10 year.

A striking aspect of the chart is the cyclicity of loans to NFCs, while during each cycle, the NBFIs gain more market share. When comparing only banks and NBFIs, the NBFI share increased from 31% in 1980 to 55% in 2008, and has been volatile, but without a trend afterwards (47% in 2024).

The comparison of Chart 1.3 (Euro Area) and 1.4. (U.S.) indicates that in Europe, loans to NFCs are consistently higher. Loans to NFCs are more than double the loans in the U.S. in terms of GDP. Interestingly, the market share shift from banks to NBFIs in the U.S. appeared fully before 2008, while in the Euro Area this shift elevated after 2008. Nevertheless, the NBFIs share of FIs in the Euro Area is currently still well below the share in the U.S. (26% vs. 47% in 2024)

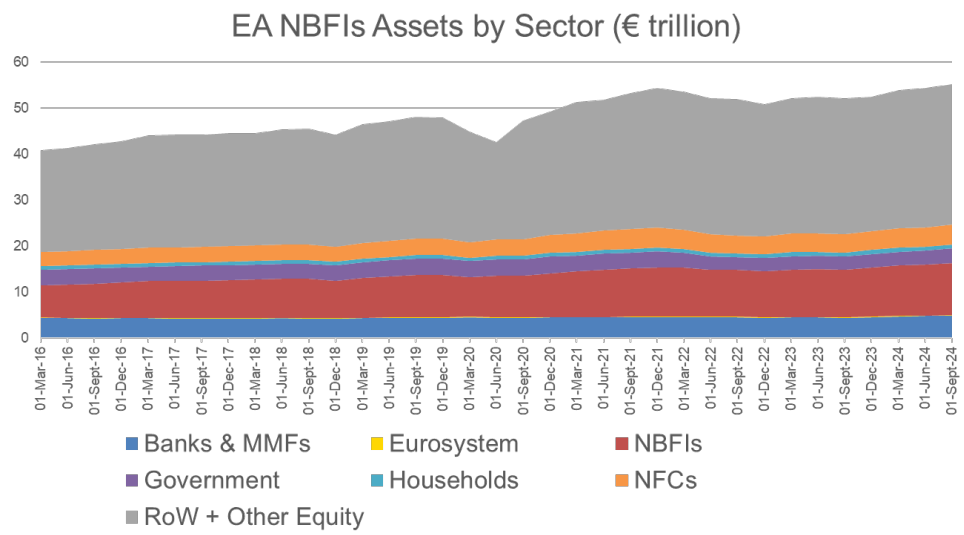
For debt securities to NFCs, the picture is much more tilted towards NBFIs. In the Euro Area, NBFIs market share was 55% in 2015 and is currently at 61%. Banks & MMFs only play a minor role with 12% market share in 2024, even outpaced by the Eurosystem since 2020. In terms of GDP, overall debt securities issued by Euro Area NFCs have been flat during the last 10 years. In the U.S., banks have a market share of only 5% in 2024 and were never above 15% since 1980. Surprisingly, the NBFI market share decreased from above 60% to 46% in 2024. While therefore banks and NBFIs lost market share, the continues and strong increase in RoW more than offset this effect. Finally, households play a much bigger role in the U.S. than in the Euro Area, but their share is decreasing since the GFC.

For households (HHs), the story is easier. In the Euro Area, banks' loans to HHs fluctuate around 85% of total loans without a loss in market share over time as seen for NFCs. Therefore, NBFIs as share of banks and NBFIs remains relatively constant with only 12% in 2024. In the U.S. the absolute share of bank loans to HHs is relatively constant at 25% of GDP (vs. 45% of GDP in the Euro Area) but fluctuates a lot in relatively terms. Overall HHs loans to GDP doubled between 1980 and 2008 and decreased steadily afterwards. This increase was provided by NBFIs and GSEs. At the top in 2007, the NBFI to bank share was 100%, but decreased to 35% in 2024. On the contrary, GSEs have kept their share constant and have an even slightly higher share than banks in 2024.

However, as illustrated in Chart 1.1, the NBFI sector in Europe is sizeable – indeed, even larger relative to GDP than in the United States. This naturally raises the question: beyond their financing of NFCs through loans and debt securities and HHs, where else are these institutions allocating their capital? Chart 1.5 provides the answer to this important question.

Chart 1.5
EA Banks & MMFs and NBFI Assets by sector

(€ trillion)



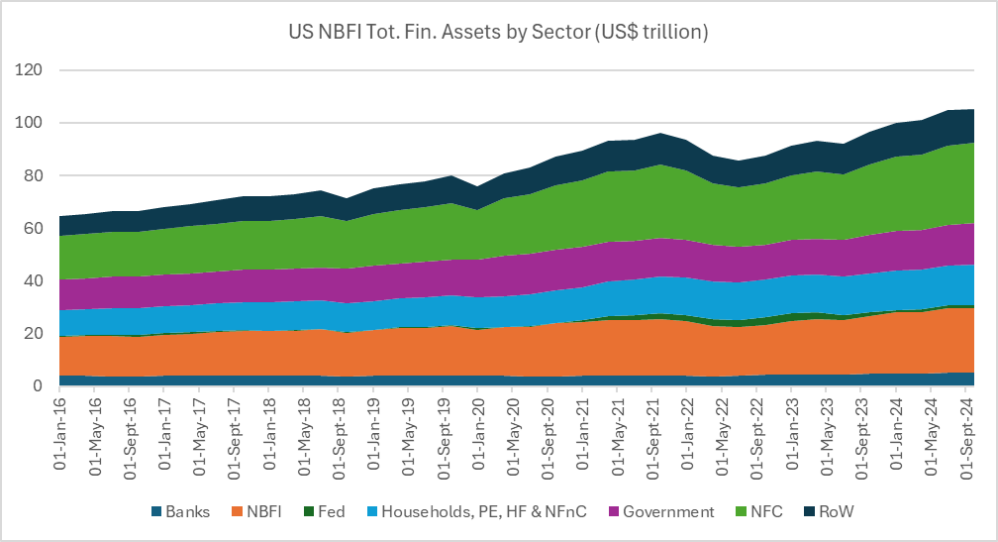
Sources: ECB, authors' calculations

As Chart 1.5 shows, a significant portion of NBFIs in the EU allocate their assets abroad. In the rest of the world category are included about €12 trillion of assets in unlisted shares and other equity for which there is no available information on the domestic share. Therefore, the remaining share of the subcategory represents and underestimation of the RoW exposure of aggregate NBFI assets. This makes Euro Area NBFIs significantly connected with financial institutions in the RoW and heavily influenced by foreign monetary policy and exchange rate dynamics. Additionally, 20% of their investments are directed toward other NBFIs, 9% towards NFCs, 5% to governments and about 10% to banks. This allocation pattern highlights a missed opportunity on several fronts. First, it reflects a lack of progress in developing robust and integrated European capital markets. Second, it reveals an underutilization of NBFIs in contributing to the integration and deepening of the European sovereign bond market, given their tiny investment in European government bonds.

Chart 1.6

US Banks and NBFI Assets by sector

(€ trillion)



Sources: FRED, From Whom To Whom, authors' calculations
Notes: The Flow of Funds define the household category as a residual component. Therefore, it includes Hedge Funds and Private Equity Funds that are impossible to distinguish from households in the data.

In contrast to the pattern observed in the Euro Area, where approximately 50% of NBFI assets are allocated abroad, the U.S. NBFI sector – illustrated in the chart 1.6 – appears to be more domestically anchored, with a smaller relative share of assets invested in the Rest of the World (RoW). While the RoW component in the US has grown over time, it still constitutes a minority share compared to the dominant exposures to domestic sectors such as NFCs, households and private funds.

This divergence reflects important structural differences between the two financial systems. U.S. NBFIs are deeply embedded within well-developed domestic capital markets, enabling them to invest heavily in corporate credit, structured products, and sovereign debt instruments without having to look abroad. By contrast, the Euro Area's NBFI sector shows a marked external orientation, suggesting a lack of deep, integrated internal markets capable of absorbing the scale of domestic intermediation capacity.

The small asset share attributed to the Federal Reserve reflects, in part, the design of U.S. monetary operations, where selected MMFs have direct access to central bank facilities, reinforcing their integration into the domestic financial infrastructure. We will discuss this aspect in detail in Section 3.

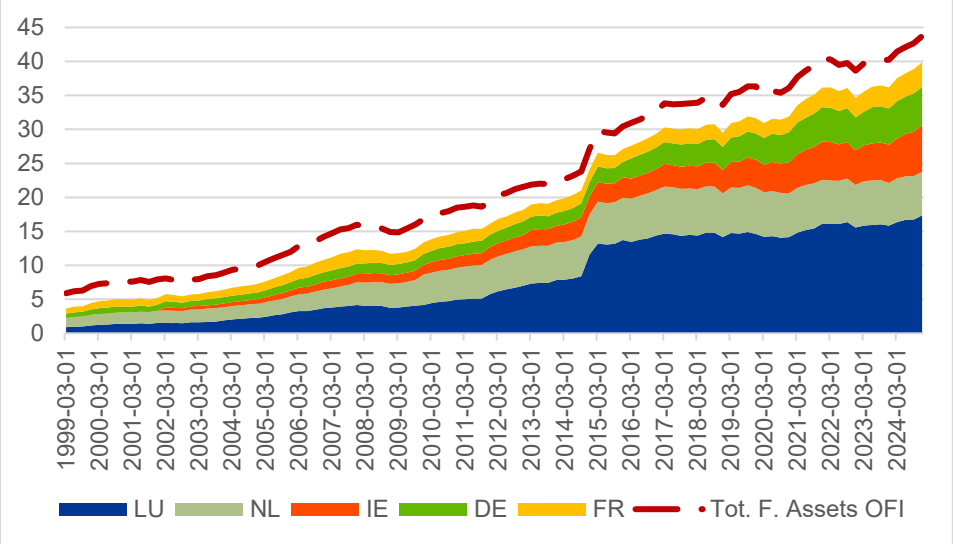
Finally, whereas EU NBFIs allocate only 5% of assets to governments, U.S. NBFIs appear to hold a considerably larger share of domestic public sector assets, either directly or indirectly, especially during and after the pandemic-related expansion of fiscal and monetary support. This highlights another missed opportunity in the Euro Area: NBFIs remain underutilized as buyers of sovereign debt, limiting their contribution to fiscal-monetary coordination and to the stabilization of bond markets.

In summary, the comparison reveals that while U.S. NBFIs act as a core engine of domestic market development and monetary transmission, their European counterparts are still functioning peripherally, constrained by fragmented markets, regulatory silos, and a lack of institutional access.

This paper examines the evolution of the NBFI sector in the Euro Area, without delving into the specific developments within individual member states. However, it is important to assess whether significant asymmetries exist in the geographical distribution of NBFIs and whether, for the share of investments directed toward Europe, notable Euro Area cross-border limitations or home biases can be observed.

Chart 1.7
OFI financial assets by country

(€ trillion)



Sources: ECB, QSA, authors' calculations
Note: OFIs are defined as financial institutions other than MFI, ICPF, and non-MMF Investment Funds.

As chart 1.7 shows, a significant fraction (75%) of NBFI institutions in the EU are concentrated in three main countries: Luxembourg, the Netherlands, and Ireland (see also the FSB 2024 report),

This concentration of NBFI activity presents a complex mix of benefits and risks, and whether this trend is viewed positively or negatively depends on the lens through which it is analyzed.

On the positive side, this concentration can reflect a high degree of specialization and efficiency. These jurisdictions have developed sophisticated financial ecosystems that offer regulatory clarity, experienced legal and tax infrastructures, and well-established fund servicing industries. Such conditions allow for economies of scale and foster cost-effective and innovative financial services. As a result, these countries are well-positioned to act as gateways for pan-European investment, supporting the broader aims of the EU's Capital Markets Union and enhancing Europe's global competitiveness in financial markets. The use of common frameworks like Undertakings for Collective Investments in Transferable Securities

(UCITS) and AIFMD enables fund managers domiciled in these countries to benefit from EU passporting rights, facilitating Euro Area cross-border activity while maintaining a centralized operational base. Moreover, the longstanding regulatory expertise in these hubs contributes to a stable environment for financial market development.

However, this geographic concentration also raises important concerns. One of the most pressing is the potential for systemic concentration risk (see as discussed in Section 1.4. for a detailed discussion)

Table 1

Comparison of Fund Fees: Europe (UCITS) vs United States (Mutual Funds)

(All figures are in %, per annum)

Category	Europe	United States
Equity Funds	1.47	0.40
Bond Funds	0.94	0.38
Mixed/Hybrid Funds	1.48	0.58
ETF	0.23	0.16
Money Market Funds	0.16	0.22

Sources: For EU ESMA (2025) and for MMFs from European Fund and Asset Management Association's Factbook 2024. For US from ICI research perspective report and Morningstar for MMFs.

The comparison of fund fees between Europe (UCITS) and the United States (Mutual Funds) highlights significant structural differences in the cost of retail investment products across the two regions. European equity, bond, and mixed/hybrid funds are consistently more expensive than their U.S. counterparts. For example, the average annual fee for equity UCITS funds in Europe is 1.47%, more than three times higher than the 0.40% charged by U.S. mutual funds. Similar gaps exist in bond funds (0.94% vs. 0.38%) and mixed funds (1.48% vs. 0.58%). These discrepancies largely reflect differences in fund size, distribution models, and competitive dynamics. In Europe, the use of retrocessions (kickbacks to distributors, usually Banks) and fragmented market structures contribute to higher costs, while in the U.S., large-scale platforms and direct-to-investor models help keep fees low.

In the case of ETFs, the gap narrows significantly. European ETFs have an average fee of 0.23%, while U.S. ETFs average 0.16%. This convergence reflects the global

trend toward low-cost passive investing and the relatively uniform competitive pressure on ETF providers across jurisdictions.

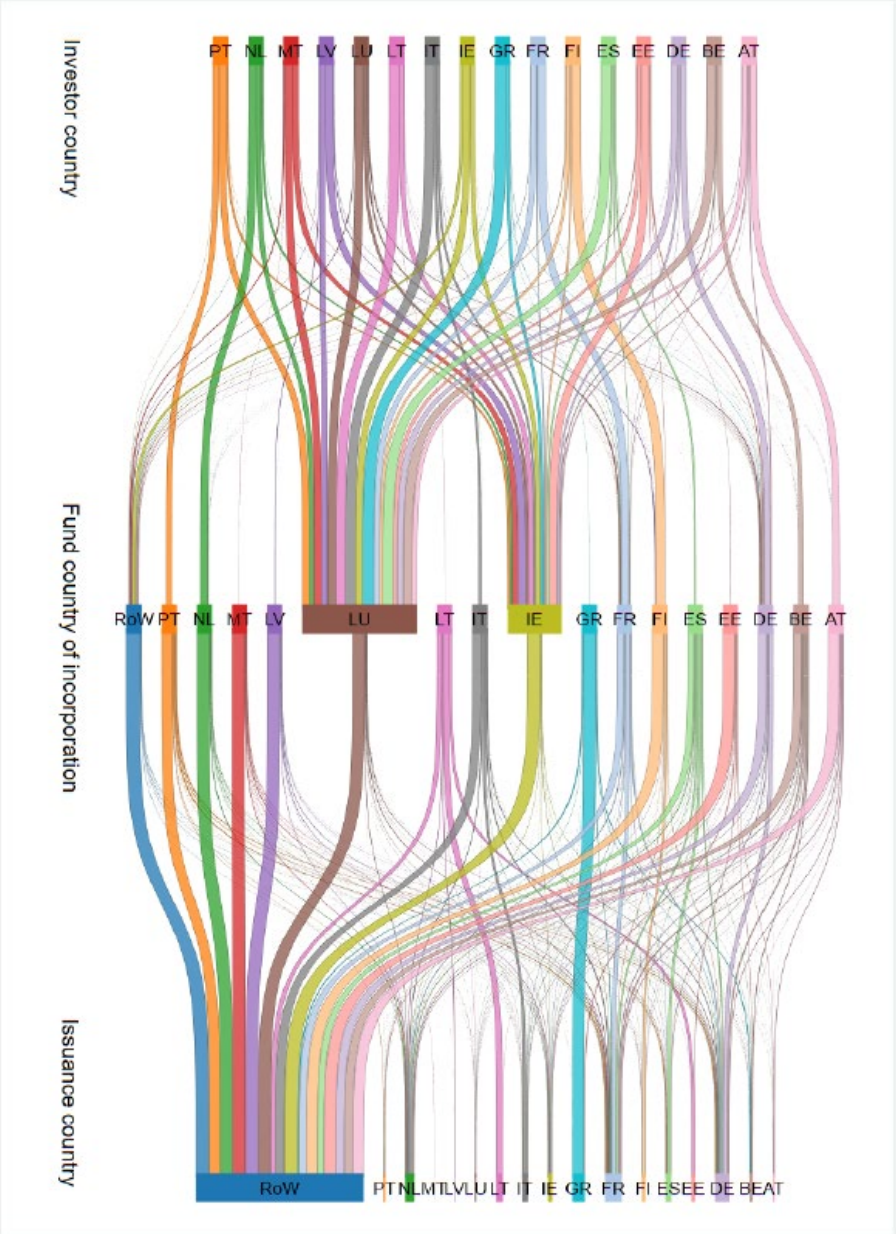
Interestingly, money market funds present a partial reversal of the broader pattern. In Europe, their average fee is 0.16%, slightly lower than the U.S. average of 0.22%. This reflects recent trends in both regions: Both U.S. and EU fund managers have scaled back fee waivers following interest rate normalization, European managers have historically operated with tighter fee margins, especially under the UCITS framework, where capital preservation and low risk are core principles. It is surprizing that even fees in EU are lower, MMFs in Europe are far less growing than in the US.

Overall, the table underscores the higher cost burden for European retail investors, especially for actively managed UCITS products. This cost differential has policy implications, particularly for the EU's Capital Markets Union initiative, which aims to deepen retail investor participation and cross-border competition. Lowering fund costs—through increased transparency, scale efficiencies, and unbundled distribution—remains a key challenge for Europe if it is to match the cost efficiency and investor access seen in the U.S. market.

Furthermore, the concentration of NBFI activity in a handful of countries can entrench unequal development across the EU. Member states with less established financial sectors may struggle to attract investment or build domestic asset management capabilities, potentially exacerbating disparities in capital market access, financial innovation, and labor market specialization. The evidence, at least for investment funds suggest that this is not the case. As Lambert et al. (2024) have shown in Chart 1.8, greater reliance on NBFIs could help mitigate the limitations of cross-border bank lending within the EU – particularly since investment funds in the Euro Area tend to exhibit less home bias than traditional banks. Differently than in the US, where NBFI and in particular investment funds and pension funds are largely characterized by the home bias, i.e. they are largely investing in US assets, the investment funds in Europe are either investing abroad or, differently from European banks, are largely diversified across Europe.

Chart 1.8 from Lambert et al. (2024) shows that in Europe is a significant investment across the different countries into investment funds. Even if there are investment funds located in the different countries (and are largely related to the banking sector), the invested funds flow across all of them with a concentration to Ireland and Luxemburg. These mutual funds, even if located in the different countries, do not face significant home bias, i.e. they invest a significant fraction in the rest of the world but the investment in the European countries is quite well distributed without facing any significant Euro Area cross-country barrier.

Chart 1.8
Investment Allocation of Euro Area Fund Investors



Sources: Lambert, Molestina Vivar and Wedow (2024), Figure 2

Fully leveraging NBFIs could enhance financial integration and improve the transmission of monetary policy across member states. Moreover, if this is accompanied by further progress in developing the Savings and Investments Union, it could boost funding availability in Europe and foster cross-border capital flows – areas where banks face limitations due to the absence of a common deposit insurance scheme and persistent cross-country capital barriers (see e.g. Angeloni et

al., 2024). There is currently also a deep debate about the fact that Europe has a chance to capitalize on missteps in the US in keeping US treasury as the world safe asset. Reduction in sovereign market fragmentation and a larger role of EU NBFI in the sovereign bond market in Europe might help to develop the Euro-wide bonds[9].

Europe has yet to fully harness the potential of NBFIs to enhance financial integration and market efficiency. By increasing the availability of funding within Europe, they could also channel more capital across borders – addressing gaps that banks cannot fill, particularly in the absence of a common deposit insurance scheme. NBFIs are well positioned to help overcome national capital barriers and foster cross-border financial flows, thereby supporting a more unified capital market. However, this potential remains largely untapped for two key reasons. First, Europe offers limited domestic growth opportunities for NBFIs compared to global markets. Second, the region's financial market infrastructure lacks certain enabling features—such as a well-developed securitization framework—that are crucial for facilitating NBFI involvement in areas like mortgage and SME financing. In the US GSEs play a fundamental role on the development of credit securitization. The involvement of public funding in this case is posing fiscal questions that we leave to further research[10]. Nevertheless, without these foundational elements, NBFIs are more inclined to invest abroad, rather than mobilizing capital within the European Union or providing private credit[11].

As mentioned above, the size and structure we are facing of the NBFIs in Europe might pose also financial stability issues, that we are investigating in the next Section under the lens of systemic risk indicators.

1.4 NBFIs and Systemic risk

The evidence provided above is that NBFIs in Europe provide 10% of the credit to NFC (26% of the credit provided by financial institutions) and almost no credit to HHs.

They play an important role in (i) allocating and managing the risk of retail investors' savings, (ii) diversifying and managing risk across financial institutions, and (iii) improving market liquidity and innovation.

However, it is quite difficult to properly assess the trade-off between the benefits coming from investment and risk diversification and the risks that the growing dimension of this financial sector is carrying out if we consider the complexities and opacity they are introducing to the financial system.

Clearly the growth of these NBFIs is the result of the evolution of the financial system versus a more market-based financial system. While individual NBFI entities may not

[9] See Lane (2025) and Lagarde (2025)

[10] Kasinger et al. (2021) discuss the role of government subsidies in NPL securitizations and the potential distortions of market prices.

[11] These evidence points to several questions that we leave to further research: Why is the EU behind on private credit? Is that good or bad?

be of systemic importance, their collective actions may generate systemic risk[12], as the GFC highlighted.

To build a comprehensive framework for assessing systemic risk in NBFIs, it is essential to move beyond the five traditional indicators developed for banks,namely, size, interconnectedness, substitutability, complexity, and cross-jurisdictional activity and include six indicators that better reflect the structural and behavioral characteristics of NBFIs: Leverage, Liquidity Mismatch, Maturity Transformation, Risk Concentration and Correlation, procyclicality of behavior and links to core financial institutions[13].

Together, these eleven indicators capture the multidimensional nature of systemic risk in the non-bank sector. We focus on the four most relevant one: concentration, interconnectedness, leverage and liquidity mismatches (the other 7 can be found in the Appendix B). Furthermore, we identified three additional risks specific for the Euro Area: first, opacity and data gaps, second, inadequate supervisory coordination and third, fragmentation and moral hazard and central bank dependence.

Size and geographical concentration

Size remains relevant, as institutions with large asset volumes may have significant market influence. However, in the context of NBFIs, size alone is not a sufficient indicator of systemic importance. For example, asset managers can control massive portfolios without bearing the same balance sheet risks as banks. Therefore, while size is a useful screening metric, it must be interpreted with caution and in combination with other indicators. However, an important dimension for Europe is the NBFI geographic concentration. One of the most pressing is the potential for systemic concentration risk. When a significant portion of the European NBFI sector is clustered in a few locations, distress in any one of these hubs—whether due to market shocks, policy failures, or operational disruptions—can have disproportionate effects on EU-wide financial stability. This risk is exacerbated when institutions in these centers follow similar investment strategies or hold correlated exposures, as market disruptions can then be amplified through synchronized responses.

Geographical concentration might be related to regulatory arbitrage. Institutions may choose their domicile not because of fundamental economic reasons, but because of comparatively lighter supervision, more favorable tax regimes, or flexible legal arrangements. This behavior can erode the integrity and coherence of EU financial regulation, encouraging a race to the bottom and weakening supervisory effectiveness. Despite the harmonizing influence of European-level legislation, most NBFIs remain under the direct supervision of national competent authorities. This creates a disconnect: while financial institutions operate transnationally, their oversight remains largely domestic. Such fragmentation complicates the task of

[12] Billio et al. (2012) demonstrate that over the past decade, the four key sectors of the financial system—banks, broker-dealers, insurance companies, and hedge funds—have become increasingly interconnected, potentially heightening systemic risk.

[13] See Financial Stability Board (2014) Report developed with IOSCO.

macroprudential authorities like ESMA or the ESRB, which must monitor systemic risk on a cross-border basis without direct supervisory control as stressed below.

In sum, the dominance of a few European countries in the NBFI landscape yields clear structural advantages in terms of efficiency, global standing, and service specialization. Yet it also introduces vulnerabilities that could compromise the stability, fairness, and resilience of the broader European financial system. Addressing these trade-offs requires strengthened coordination among national supervisors, the development of effective EU-level macroprudential tools, and policies that support the diversification and development of capital markets across the entire Union.

Interconnectedness with Banks and the broader financial system

The interconnectedness indicator is particularly significant for NBFIs due to the dense network of financial relationships they form. These relationships can include securities financing transactions, derivative exposures, ownership of common assets or cross ownership[14]. Through these linkages, shocks can propagate rapidly across entities, sectors, or jurisdictions, especially when multiple institutions respond simultaneously to market stress.

Empirical data underscores the depth of these interlinkages: in the European Union as of 2023, approximately 9% of banks' total assets were claims on NBFIs, while NBFIs accounted for around 10-15% of banks' deposits and around 10-12% of securities holdings (e.g. bank bonds). Banks and NBFI are also linked via additional exposure through repos and derivatives, which are harder to quantify precisely but are systemically important[15].

These figures highlight not only the scale of bank – NBFI interaction but also the extent to which traditional banking institutions now rely on nonbank entities for asset generation and balance sheet funding – a structural interdependence with significant implications for financial stability and policy transmission (FSR, 2023). This interwinding is even further present in the US, as Acharya et al. (2024) and Cetorelli and Prazad (2024) have highlighted.

This creates pathways for contagion between the two sectors. Banks finance private credit funds, provide liquidity to asset managers, and may be indirectly exposed to risks building up in affiliated non-bank entities. Regulatory frameworks such as the EU Financial Conglomerates Directive do not fully cover such conglomerates, and binding quantitative limits on bank-NBFI exposures are lacking, which increases systemic vulnerability.

Interconnection could be also indirect. For example, disruption in ETF operations (e.g., inability to roll derivatives or meet collateral calls) can propagate to dealer banks and prime brokers, creating feedback loops in funding and liquidity markets.

[14] As documented in Bagattini,et. al. (2023), that funds run by banks creates substantial dependencies between the banking system and the asset management industry.

[15] For a more detailed analysis of the key linkages between banks and the non-bank financial sector see Franceschi et al. (2023, 2024).

As Chart 1.6 shows, a significant portion of NBFIs in the EU allocate their assets abroad, with approximately 50% invested in the rest of the world. This makes them significantly interconnected with financial institutions in the RoW.

NBFI are not only interconnected with banks but are interconnected among each other. An important channel of interconnection is fund shares held by other mutual funds: Allaire et al. (2023) show that this linkage might create fund fragilities. Another important channel is the portfolio similarity channel highlighted for insurance companies by Girardi et al. 2021.

An important dimension of interconnection for investment funds is the interconnection between mutual funds located in Europe and their main asset managers, such as BlackRock. This interconnection reveals an important dimension of how global financial institutions influence European capital markets through cross-border investment structures and distribution networks.

As Charts 1.6 and 1.7 show, European mutual funds are domiciled predominantly in Luxembourg, and Ireland. These jurisdictions serve as legal and regulatory hubs for thousands of investment vehicles that are passported across the European Economic Area. While these funds are technically European, their management, strategic direction, and underlying ownership are often global in nature. From a financial intermediation perspective, this creates an intricate structure where European-domiciled funds act as "wrappers" for global investment strategies.

This structure has both benefits and risks. On the one hand, European investors gain access to diversified, professionally managed investment strategies. On the other, the concentration of fund management within a handful of global firms (supervised by non-EU supervisors) raises concerns about systemic interconnectedness, herding behavior, and voting power in corporate governance BlackRock, for example, is often among the largest shareholders in many European-listed companies via its UCITS and ETF products, even though the fund vehicles themselves are passively managed. It also highlights the necessity for enhanced international coordination in supervision and improved sharing of supervisory data.

This interconnection reflects the globalization of capital markets, where legal and regulatory boundaries remain national, but investment flows and decision-making are transnational. As a result, European financial stability and investor outcomes are increasingly influenced by the actions and strategies of a small number of globally dominant fund managers. This issue is not just related to systemic risk but to a broad issue related to the political economy of NBFI.

Excessive Leverage

Excessive leverage – both financial and synthetic – can amplify vulnerabilities within the NBFI sector. Synthetic leverage obtained through uncleared derivative contracts lacks transparency and increases counterparty risk. Excessive leverage can lead to rapid asset sell-offs and fire sales, potentially triggering systemic losses and spillovers to banks and the real economy. According to ESMA (2024), Hedge funds are the most predominant example of NBFI exposed to this risk. However, also

leveraged and synthetic ETFs or Leverage UCITS present similar risks. Leverage is built into some ETFs explicitly (e.g., 2x or 3x long/short ETFs) or synthetically via derivatives (e.g., swaps, futures). Daily re-leveraging requirements expose ETFs to procyclical trading: as markets move, leveraged ETFs must buy more in rallies and sell more in downturns to maintain their leverage ratio. This leads to amplified volatility, especially around market close (when rebalancing occurs), and has been linked to sharp end-of-day swings. The use of synthetic leverage also introduces counterparty risk, often through opaque bilateral derivatives, reinforcing the vulnerabilities discussed under this channel. Current regulatory frameworks (e.g., UCITS and AIFMD) contain loopholes, such as flexible VaR-based leverage calculation and limited ex-ante supervisory powers to restrict leverage at the macro-prudential level. Nevertheless, even if the European ETF industry reached a record €2.18 trillion in total Assets under Management (AUM) by the end of 2024, marking a 33% increase from the previous year, leveraged ETFs represent a niche segment within the European ETF landscape.

According to ESMA (2024), as of the end of 2024, the European Alternative Investment industry managed approximately AUM of EUR 5.4 trillion. The vast majority of the reported funds remain not substantially leveraged (91% of NAV) with the median leverage ratio of the substantially leveraged funds equal to 530% and the quartile and decile of those funds with the highest leverage display levels of leverage of 1,018% and 3,633% respectively, a marked increase since end 2022 (841% and 2,344%). Despite its relatively small size compared to the broader European asset management landscape—which boasts total AUM of approximately €32.7 trillion as of December 2024—the hedge fund segment plays a critical role in financial markets due to its complex strategies and substantial leverage.

The fund sector is interconnected with other financial institutions through their investment strategies, recourse to borrowing and investor base. An important source of excessive leverage of NBFI, is that non-EU leveraged NBFI are interconnected with EU NBFI and banks[16].

Structural Liquidity Mismatches

NBFIs such as open-ended funds, ETFs and money market funds often promise daily liquidity to investors while holding fewer liquid assets. This mismatch creates a "first-mover advantage" during market stress, prompting pre-emptive redemptions, asset fire sales, and amplification of shocks. Weak liquidity preparedness for margin and collateral calls, especially in leveraged derivatives positions, can further accelerate these dynamics. The limited use and enforceability of liquidity management tools (LMTs) and inadequate liquidity buffer requirements in EU MMFs aggravate this risk.

Opacity and Data Gaps

The lack of granular, real-time and consolidated data across countries—especially on leverage, exposures in private finance, and cross-border flows—prevents

[16] This linkage has been stressed recently also by Buch (2025).

supervisors from adequately monitoring systemic risk build-up. Bilateral derivatives, private equity leverage, and complex fund structures often fall outside transparent reporting frameworks. Without consistent data exchange and centralised data access, macro-prudential oversight is weakened. A proper data infrastructure would be the basis for the development of a system-wide exploratory scenario (SWES) as the one the BoE is attempting to implement.

Inadequate Supervisory Coordination and Fragmentation

In the EU, macro-prudential supervision of NBFIs remains nationally fragmented. Supervisory inconsistency across borders opens the door to regulatory arbitrage and hampers effective responses to systemic threats. Existing institutions like ESMA lack strong coordination or intervention powers. The absence of a unified supervisory mechanism limits the ability to apply EU-wide macro-prudential tools[17] or conduct meaningful system-wide stress testing (as, for example the BoE system-wide exploratory scenario (SWES)).

Moral Hazard and Central Bank Dependence

Expectations of central bank interventions during crises, such as liquidity backstops or asset purchases, create moral hazard. NBFIs may engage in excessive risk-taking under the assumption of eventual rescue. This undermines market discipline and can lead to misallocation of resources, especially when monetary policy objectives conflict with the provision of emergency liquidity (see Cieslak et al. (2021) and Buiter et al. (2023)). This channel is further discussed in the next Section dedicated to NBFI and Monetary policies.

Key Takeaways

As documented in this section, looking at the trend over time, the Euro Area financial system was basically bank-centric when it entered the global financial crisis. Since then, the importance of investment funds, government debt and central banks in the financial system has increased substantially, while lending links between banks and the real economy have remained fairly stable, with the only exception of an increase of loans provided to NFC by NBFIs. The most relevant aspect is that the significant growth of the NBFI sector in Europe is largely associated with larger investments within NBFI or exposure to the RoW. Moreover, from the financial stability perspective, in Europe, the supervisory framework for NBFIs remains fragmented and underdeveloped, limiting the ability of European authorities to respond effectively to stress episodes originating in the non-bank sector. This poses four main issues: (i) the long chain intermediation that the larger investment NBFI are doing within them, (ii) the missed opportunities to fully harness the potential of NBFIs to enhance financial integration and market efficiency due to the large fractions of funds invested in RoW, (iii) the significant country concentration, interconnection and exposure to the RoW financial shocks and (iv) the fragmented supervisory

[17] These aspects are well known and largely emphasized in Europe. On this regard see Mack (2024) among others.

framework for NBFIs in Europe weakens authorities' capacity to manage systemic stress from the non-bank sector.

2 The Role of NBFIs for Monetary Policy

The growing prominence of NBFIs has not only redefined the structure of financial intermediation but also introduced new complexities into the transmission of monetary policy. Investment funds, insurance corporations, pension funds, hedge funds, and MMFs now play an increasingly central role in allocating credit, managing liquidity, and pricing risk—functions that were traditionally dominated by banks. Whether NBFIs have direct access to central bank facilities, as in the case of certain U.S. MMFs, or operate entirely outside the central banking framework, as in the Euro Area, their footprint makes them inescapable actors in the policy transmission process.

In an ideal world, monetary policy operates through a clean, frictionless mechanism: changes in the policy rate are swiftly and uniformly reflected across short-term interest rates, market expectations adjust accordingly, and the financial system passively accommodates this shift without amplifying or distorting the central bank's intended stance. In such a scenario, the so-called "pass-through" of monetary policy is both complete and neutral in terms of market frictions.

However, the real world is far more fragmented. Structural and institutional frictions—including imperfect competition, regulatory asymmetries, technological infrastructure, and market segmentation—generate dispersion in money market rates and hinder the full transmission of central bank signals. Wholesale funding markets, especially those shaped by collateralized lending and intermediated by NBFIs, are particularly sensitive to these frictions. The result is that marginal rates of substitution between market participants—banks, MMFs, pension funds, hedge funds—diverge, and the uniformity of monetary transmission breaks down.

Moreover, access to central bank operations is uneven across financial institutions. While some NBFIs in the U.S. have been granted access to facilities such as the Federal Reserve's reverse repo operations, NBFIs in the Euro Area operate largely without such support. This raises critical questions: How do these asymmetries influence the transmission of policy rates? What happens when monetary policy is tightened or eased, but a growing share of market intermediation is conducted through agents that are not formal counterparties to the central bank? And how should central banks account for these realities in the design and implementation of policy tools?

These questions are particularly pressing in light of the transformations described in Section 1.2. As intermediation shifts away from traditional banks and toward market-based platforms dominated by NBFIs, the financial accelerator mechanism may be dampened, rerouted, or distorted. Whether NBFIs amplify, absorb, or circumvent the stance of monetary policy depends on the architecture of financial markets, the

institutional frameworks governing central bank access, and the frictions inherent to collateral, funding, and credit markets.

The remainder of this section explores these issues in greater detail. We begin with an overview of how monetary policy is conventionally implemented in the Euro Area and the United States. We then examine the specific transmission channels through which NBFIs interact with and potentially reshape the effects of monetary policy. While this section highlights several implications for central bank strategy, a more detailed analysis of structural challenges and policy trade-offs – especially in the context of short-term rate control – is developed in section 3.

2.1 How Monetary Policy Is Conducted in the Euro Area and the United States

Understanding how monetary policy is formulated and implemented on either side of the Atlantic is not only crucial to appreciating the role of NBFIs in policy transmission, but also to identifying where existing frameworks fall short in accounting for their growing influence. A close examination of current monetary policy mechanisms helps reveal institutional blind spots and gaps that may inhibit the effective transmission of policy through non-bank channels. While both the ECB and the Fed pursue similar macroeconomic goals – price stability and, to a broader extent, financial stability – their operational frameworks differ significantly in scope, design, and institutional architecture. These differences are particularly salient when assessing the potential role of NBFIs in the policy transmission chain.

In the Euro Area, monetary policy is set by the Governing Council of the ECB, which determines the stance through adjustments to three key rates: the deposit facility rate (DFR), the main refinancing operations (MRO) rate, and the marginal lending facility (MLF) rate. These rates guide short-term money market conditions and form the corridor within which interbank rates fluctuate.

Policy execution is handled by the Eurosystem – comprising the ECB and national central banks (NCBs). Monetary operations are open to a broad spectrum of counterparties, notably all financial institutions with a banking license. This institutional design reflects the bank-centric nature of the Euro Area's financial system and relies on refinancing operations against a wide collateral pool, including sovereign bonds, corporate debt, and asset-backed securities.

Operationally, the corridor of ECB policy rates is relatively narrow. As of 2025, the MRO and LTRO rates are typically set 15 basis points above the DFR, while the MLF is priced at 25 basis points above the MRO. The MRO is conducted weekly; the three-month LTRO monthly. The Securities Lending Facility – used for lending securities – has differentiated pricing: borrowing cash against securities is offered at 20 basis points below the DFR or the prevailing market repo rate, whichever is lower, while borrowing securities against other securities incurs a minimum fee of 5 basis points. It is a standing facility available every day.

Despite the apparent openness to a wide range of counterparties, NBFIs in the Euro Area lack direct access to the ECB's liquidity or reserve facilities. This asymmetry limits the ECB's reach and may fragment rate pass-through in non-bank-dominated markets given that NBFIs' share of market intermediation rises.

In contrast, the Federal Reserve System, led by the Federal Open Market Committee (FOMC), operates in a more market-based environment. The FOMC sets a target range for the federal funds rate (FFR) and adjusts two primary instruments to steer this rate: the interest on reserve balances (IORB) and the discount window rate (DWR). Execution is delegated to the Open Market Trading Desk at the New York Fed, which conducts operations in the federal funds and repo markets.

The Fed traditionally relied on a core group of primary dealers, comprising large banks and broker-dealers, for its open market operations. As of early 2025, there are 25 primary dealers, of which approximately 80% are affiliated with banking groups, and 20% are independent NBFIs. Since the global financial crisis, the Fed has expanded access to its facilities, notably via repo and reverse repo operations.

To strengthen its control over short-term interest rates, the Federal Reserve operates several standing facilities through its System Open Market Account (SOMA). The most prominent among these is the Overnight Reverse Repurchase Agreement Facility (ON RRP), where the Fed is receiving cash and is giving treasuries as collateral. The Fed is currently remunerating the cash it received at 15 basis points below IORB (at the inception it was 5 bp below IORB) and is accessible to a broad set of counterparties, including over 100 MMFs (see Ulland, February 13th 2025) . This facility is therefore a deposit facility (liability side access) and does not change the size of the Fed balance sheet because it generates only a substitution on the Fed liabilities either with cash or bank reserves and the treasuries used as collateral still remains in the Fed assets.

The Standing Repurchase Agreement Facility, by contrast, provides liquidity at a minimum bid rate equal to the Discount Window Rate (DWR), currently set 10 basis points above the IORB. The SRF is now available two times per day, in the morning and in the afternoon (see Perli, May 9th 2025).

To support market functioning in the collateral space, the Fed also conducts Securities Lending Operations (SLO), structured as auctions with a minimum bid rate of 5 basis points, where participants borrow securities by offering lending fees. Finally, the FIMA Repo Facility and Reverse Repo Pool support foreign monetary authorities, designed to mitigate dollar funding pressures that could spill over into U.S. financial markets.

Two structural features distinguish the monetary policy frameworks of the Euro Area and the United States. First, access to central bank balance sheets: in the U.S., selected NBFIs – such as MMFs and GSEs – are eligible counterparties in operations like the ON RRP, allowing them to participate directly in liquidity management. In the Euro Area, by contrast, only institutions with a banking license are eligible, excluding most NBFIs from direct interaction with the central bank. Second, collateral frameworks differ: the Fed operates primarily against Treasuries,

while the Eurosystem accepts a broader collateral pool. These differences in institutional access and collateral scope will be explored further in Section 3.

2.2 How NBFIs Reshape Monetary Policy Transmission

The credit, borrowing, and investment activities of NBFIs increasingly affect how monetary policy decisions reach the real economy. As non-bank intermediaries gain prominence, they interact with existing transmission mechanisms in distinct ways, sometimes reinforcing and sometimes bypassing traditional channels. While the economics literature continues to refine and expand the list of transmission pathways, it remains difficult to determine which channels dominate at any given time[18]. The following sections focus on several key transmission channels –credit, deposit, exchange rate, expectations, risk-taking, collateral, and interest rates[19] – and examine the specific role NBFIs play within each.

2.2.1 The Credit and Deposit Channel

The credit channel of monetary policy emphasizes how changes in central bank interest rates influence the supply, pricing, and composition of credit provided by financial intermediaries. Traditionally, this mechanism operated primarily through banks: when policy rates rose, the cost of funding for banks increased, leading to more restrictive lending conditions for households and businesses. Conversely, easing monetary policy lowered funding costs and encouraged credit expansion. In recent decades, however – as outlined in Section 1.2 – NBFIs have become important complementary and, in some cases, substitute providers of credit across a variety of asset classes.

In the United States, NBFIs now play a central role in credit intermediation, particularly through investment funds, ETFs, securitization vehicles, and GSEs. These actors provide financing for corporate bonds, residential and commercial mortgages, auto loans, student debt, and consumer credit more broadly. As illustrated in section 1.3, credit provision by NBFIs takes place both through direct investment in primary markets – such as asset managers purchasing newly issued corporate bonds – and through indirect securitization chains, where loans are pooled and repackaged into asset-backed securities (ABS). The growth of ABS markets in the U.S., particularly post-GFC, was significantly supported by GSEs such as Fannie Mae and Freddie Mac (see Chart 1.2).

When monetary policy tightens, rising interest rates typically raise funding costs for both banks and NBFIs. In the medium-to-long term, investment funds, insurers, and

[18] The ECB (2021) strategy Review paper has examined the growing role of NBFIs in the euro area, highlighting their impact on monetary policy transmission and identifying key vulnerabilities related to liquidity mismatches, leverage, and interconnectedness. The evidence is that the response of NBFIs to monetary policy is heterogeneous and can sometimes amplify procyclical behavior, particularly during low interest rate environments.

[19] These channels are not exhaustive, and we acknowledge that there is no universally agreed-upon definition of monetary policy transmission channels.

private credit funds may scale back credit exposures or become more selective in underwriting, reinforcing the transmission of tighter monetary policy.

However, a crucial point is that not all NBFIs are equally exposed. Entities such as insurance companies and pension funds, which manage long-duration liabilities, are less sensitive to short-term rate changes and may continue to allocate capital to corporate or infrastructure debt. Similarly, private credit funds – which offer long-term, illiquid lending to mid-sized firms – may maintain or even expand their lending activity if investor commitments are locked in and less responsive to rate volatility.

There is a growing literature that recently argued that monetary tightening shifts the supply of credit from banks to nonbanks (see Drechsler et al., 2017; Xiao, 2020; Elliott et al., 2024; Drechsler et al., 2022; Buchak et al., 2022). Fintech, as De Roure et al. (2022) argue, may fill the credit void left by retreating banks, especially in niche markets with regulatory or balance sheet constraints as well as serving risky borrowers not considered by banks[20].

The structure of credit intermediation chains is also relevant. As illustrated in the Appendix A, credit provided via NBFIs often passes through a vertically integrated and collateral-intensive chain: loans are originated, securitized, financed through structured Investment Vehicle (SIV), and distributed across capital markets such as Commercial Paper and Repo markets. This system is efficient but also fragile, particularly when central bank access and liquidity support are not available. Unlike banks, most NBFIs lack access to public liquidity facilities – such as the Standing Repurchase Facility (SRF) in the U.S. or the Main Refinancing Operations (MRO) and LTROs in the Euro Area. They are also excluded from deposit insurance mechanisms, relying instead on indirect liquidity lines from banks. This setup creates a structural interdependence between banks and NBFIs: banks provide liquidity backstops for many NBFIs, while simultaneously relying on them for funding, securities demand, and balance sheet optimization. This private-sector mutual dependence is underpinned by public-sector support—banks benefit from deposit insurance (a credit put) and access to central bank liquidity (a liquidity put), both of which reduce the risk of runs and systemic collapse. The deposit channel of monetary policy is also affected by NBFIs. As documented by Drechsler et al. (2017), increases in the federal funds rate prompt banks to widen deposit spreads, especially on retail accounts, leading sophisticated investors to reallocate funds outside the banking system. These deposit outflows may create financial stability risks, especially during rapid shifts in investor sentiment[21].

Finally, recent work by Elliott et al. (2024) highlights the potential stabilizing role of NBFIs in a global context. When U.S. monetary policy tightens and dollar-denominated credit to non-U.S. borrowers' contracts, non-bank lenders often expand their share of global lending, partially buffering the decline in overall credit supply. This suggests that NBFIs may act not only as amplifiers of monetary transmission

[20] See also, Buchak et al., 2018, Fuster et al., 2019, Murfin and Pratt, 2019, Jiang et al., 2023, Di Maggio and Yao (2021) and Cucic and Gorea (2024)

[21] See also Xiao (2020).

but, under certain conditions, also as shock absorbers, especially in cross-border credit markets.

2.2.2 The Exchange rate channel

The exchange rate channel of monetary policy traditionally functions through changes in the external value of a currency, affecting trade balances and inflation. In modern financial systems, however, where NBFIs hold large and diversified cross-border portfolios, this channel increasingly operates through capital flows, valuation adjustments, and funding market linkages similarly to banks[22].

NBFIs—particularly investment funds, ETFs, and insurance companies—are now central players in international portfolio allocation. Their investment decisions are shaped not only by domestic monetary conditions but also by interest rate differentials and currency expectations across major jurisdictions. A rate hike in the U.S., for example, can trigger rebalancing by Euro Area asset managers out of U.S. Treasuries, corporate bonds, equities or into non-US dollar assets (i.e. securities issued by non-US entities dollar denominated), with implications for both exchange rates and domestic asset markets in Europe.

This dynamic is especially relevant in the Euro Area, where the NBFI sector is large in relative terms and highly outward-oriented. The ESRB NBFI Risk Monitor 2024 (ESRB 2024) estimates that about 60% of NBFI portfolios are invested abroad, with only partial hedging of currency risk. This makes the sector structurally sensitive to foreign monetary policy, particularly that of the Federal Reserve. The implications are not limited to valuation effects: NBFIs' global positioning shapes capital flows, amplifies spillovers, and links Euro Area financial conditions to decisions made outside the Eurosystem.

Another consequence of this exposure is the increasing use of U.S. Treasuries as collateral in the Euro Area repo market (for the in-depth discussion see section 3.3). This practice reflects the credit quality and liquidity of U.S. government debt – but it also ties Euro Area collateral markets to U.S. interest rate and fiscal policy. As yields rise or dollar liquidity tightens, margin calls and collateral shortages can transmit foreign shocks into European short-term funding markets.

Central banks have long relied on swap lines and liquidity facilities to contain such cross-border stress. The ECB and other major central banks can access dollars through standing arrangements with the Fed, while the FIMA Repo Facility and FIMA Reverse Repo Pool allow foreign monetary authorities to temporarily raise dollars using U.S. Treasuries. However, these tools are restricted to official institutions. NBFIs themselves cannot access them directly and rely on domestic redistribution

[22] There is a vast literature regarding this channel, mostly focusing on banks. See in particular the literature studying the international transmission of shocks to financial intermediaries (Peek and Rosengren, 1997, Giannetti and Laeven, 2012, De Haas and Van Horen, 2013, Ongena et al., 2015, Doerr and Schaz, 2021), in particular monetary policy shocks (Cetorelli and Goldberg, 2012, Morais et al., 2019, Avdjiev et al., 2020, Bräuning and Ivashina, 2020)). With a focus on investment funds, Nenova (2025) investigates monetary policy transmission primarily through the portfolio rebalancing channel in international bond markets.

mechanisms, typically mediated through the banking sector. This introduces operational frictions and delays, especially in moments of stress when the speed of liquidity transmission is critical.

2.2.3 The Expectations Channel

The expectations channel of monetary policy works through forward guidance, signalling, and anticipated policy paths. It operates not by changing rates directly, but by shaping beliefs about the future – thereby influencing current financial conditions through yields, valuations, and portfolio positioning.

NBFIs – including hedge funds, investment funds, pension funds, and MMFs – respond rapidly to shifts in expectations about interest rate paths. Changes in forward guidance or macroeconomic signals often trigger large and fast reallocations of capital, whether into duration, out of risk assets, or across jurisdictions. The heavy use of derivatives for hedging, leverage, or arbitrage adds a layer of procyclicality: when expectations shift abruptly, margin calls and collateral demands can intensify selling pressure, amplify volatility, and create spillovers across asset classes and geographies.

This channel becomes particularly relevant in periods of unexpected shocks, where policy communication must contend not only with fundamentals but also with positioning, leverage, and liquidity dynamics. In recent years, several high-profile episodes have demonstrated the outsized role that NBFIs can play in both transmitting and amplifying monetary policy effects through the expectations channel. For an overview of some unexpected shocks[23] (September 2019, March 2020, November 2022 and March 2025) and their implications on monetary policy, Central bank interventions and financial stability see Appendix B

2.2.4 The Risk-Taking, Collateral, and Asset Pricing Channels

The risk-taking channel of monetary policy emphasizes how interest rate levels and expectations influence the risk tolerance, leverage behavior, and portfolio allocation of financial intermediaries. In the case of NBFIs, this channel has become central to understand how monetary policy affects asset prices, credit supply, and systemic risk[24].

In a low-interest rate environment, policy-induced declines in returns on low-risk assets push many NBFIs to rebalance toward higher-yielding, riskier securities. This search-for-yield behavior supports risk asset prices and can compress risk premia,

[23] Notable episodes include quarter-end disruptions (Aldasoro, Ehlers, and Eren, 2022; Munyan, 2015); the September 2019 overnight Treasury repo rate surge (Afonso, Cipriani, Copeland, Kovner, La Spada, and Martin, 2020; Avalos, Ehlers, and Eren, 2019; Copeland, Duffie, and Yang, 2021; Correa, Du, and Liao, (2020); the March 2020 Treasury yield increase (He, Nagel, and Song, 2022; Vissing-Jorgensen, 2021); and the September 2022 turmoil in the UK sovereign bond market (Bank of England, 2022).

[24] There is a vast literature regarding this channel, see Hau and Lai (2016), Borio and Zhu (2012), Choi, and Kronlund (2017), Di Maggio and Kacperczyk (2017), Kaufmann (2023), Lian et al. (2019) among others.

reinforcing monetary accommodation. Conversely, as policy rates rise, the appeal of safe assets increases, leading NBFIs to reduce risk exposure—tightening financial conditions further and contributing to asymmetric policy transmission.

A parallel but interlinked dimension is the collateral channel. Monetary policy affects not only NBFI risk appetite, but also the value of their balance sheet assets, many of which are used as collateral for secured funding. A fall in interest rates increases the market value of bonds and credit instruments held by NBFIs, allowing for greater leverage via repo or derivative margin financing. This leverage, in turn, fuels further risk-taking and upward price pressure. A tightening cycle, by contrast, compresses asset values, triggers margin calls, and constrains funding availability, amplifying de-risking and asset sales.

This feedback loop is particularly relevant for hedge funds, which are often highly leveraged and active across both credit and rates markets. According to the ESRB NBFI Risk Monitor (2025), hedge funds – particularly those pursuing relative value strategies – exhibit leverage ratios averaging 30 times their assets under management, far exceeding those of LDI funds or traditional asset managers. Because of their central role in credit intermediation and wholesale funding, hedge fund behavior can strongly influence both policy transmission and market stability, especially during volatile periods.

As discussed at the beginning of this section, a key policy variable in this channel is collateral eligibility. The design of central bank collateral frameworks determines which assets are considered acceptable for refinancing operations and thus influences demand, liquidity, and pricing in affected markets. Here, there is a sharp contrast between the ECB and the Federal Reserve.

In the Euro Area, the Eurosystem's collateral framework is broad and flexible, regularly adjusted to expand or contract access. As shown by Pelizzon et al. (2024), the inclusion of corporate bonds in the eligibility list significantly increases lending activity in the securities lending market, reduces bond yields, and improves market liquidity. By analyzing data on changes to the collateral eligibility list over time, Pelizzon et al. (2024) pinpointed when specific bonds and issuers first became eligible. These eligibility events allow us to show that the resulting increase in both the supply and demand for pledgeable collateral leads to: (a) greater activity in the corporate securities lending market, (b) reduced yields on eligible bonds, and (c) notable impacts on bond liquidity. Overall, corporate bond lending helps to ease the constraint posed by limited collateral availability, thereby enhancing the functioning of financial markets. Finally, Pelizzon et. al. (2024) find that bond eligibility improves firms' access to the capital market and that this has an impact on firms' capital structure, with largely a substitution between bank loans vs. corporate loans and therefore reducing the intermediation channel of banks for large firms. These effects are consistent with findings by Grosse-Rueschkamp et al. (2019) who document a "capital structure channel" of monetary policy, whereby corporate bond issuance rises at the expense of bank credit, ultimately enabling banks to redirect lending toward SMEs.

By contrast, the Federal Reserve's collateral framework has historically been much narrower, focusing almost exclusively on U.S. Treasuries and agency MBS. Only in response to the COVID-19 crisis did the Fed temporarily extend eligibility to corporate bonds under emergency asset purchase programs.

A second key determinant of the collateral channel is the collateral scarcity, shaped by both monetary policy (e.g., QE programs) and fiscal behavior, particularly the issuance decisions of sovereign treasuries. This scarcity – combined with regulatory frictions like leverage capital requirements for securities dealers – can induce rate dispersion in repo and short-term funding markets. As explored in section 3, such fragmentation impairs the smooth transmission of policy rates, particularly where collateral is central to liquidity redistribution.

2.2.5 The Interest Rate Channel

Among the various transmission mechanisms of monetary policy, the interest rate channel remains the most direct and traditionally emphasized. Central banks steer short-term policy rates as a central tool to manage aggregate demand and control inflation. These rates, set by institutions like the ECB's Governing Council or the Federal Open Market Committee (FOMC), are expected to transmit through the financial system to influence broader financial conditions—affecting longer-term interest rates on mortgages, consumer loans, and corporate bonds, and ultimately shaping borrowing, investment, and consumption decisions.

The effectiveness of this channel depends critically on the structure and functioning of wholesale short-term funding markets, particularly money markets. In theory, allocative efficiency in these markets arises when the marginal rates of substitution for lending and borrowing are equalized across all agents. This leads to capital flowing toward its most productive uses – investments with the highest net present value – while funding is sourced from the lowest-cost providers, maximizing the overall surplus from trade. For such efficiency to prevail, central bank policy rate changes must transmit fully and immediately to all money market rates, with deviations explained solely by credit and term risk premiums.

However, this idealized transmission is often disrupted by real-world frictions. Regulation, infrastructure limitations, institutional segmentation, and imperfect competition fragment money markets and distort arbitrage. As a result, the marginal rates of substitution differ across market participants, leading to significant dispersion in wholesale funding rates.

NBFIs have become increasingly central in these fragmented markets. They now play key roles in short-term funding ecosystems – as lenders (e.g., MMFs), intermediaries (broker-dealers), or borrowers (e.g., hedge funds and asset managers relying on repo or commercial paper markets). The degree to which NBFIs respond to changes in policy rates—or are even directly affected by them—depends on a complex interplay of factors, including their access to central bank facilities, the specific instruments they use, and the regulatory environment in which they operate. However, because of regulation, infrastructure, imperfect competition, and other

forms of institutional segmentation, money markets are fragmented, and marginal rates of substitution among money market participants differ in practice. This generates a significant dispersion in wholesale funding rates, both for the long term and the short term, i.e., in money market rates.

These issues are critical for understanding the evolving landscape of monetary transmission. They will be examined in greater detail in the next section, with a focus on the interaction between central bank tools and NBFI behavior in segmented funding markets.

Key Takeaways

As this section has shown, NBFIs play a complex and increasingly central role in the transmission of monetary policy. Their influence extends across all major channels – credit, deposits, expectations, risk-taking, collateral, and interest rates. Depending on their structure, leverage, and access to central bank facilities, NBFIs can transmit, amplify, or at times moderate policy impulses.

They have weakened the traditional credit channel by offering market-based lending alternatives, while amplifying the asset price and collateral channels through their dominant role in bond markets and procyclical investment behavior. Their global exposures and reliance on cross-border collateral have enhanced the international spillovers of domestic policy actions. Meanwhile, their behavior under stress – evident in past crises – has repeatedly forced central banks to intervene beyond conventional liquidity tools, often acting as market-makers of last resort.

As the interest rate channel becomes increasingly interwoven with expectations, asset valuations, and collateral dynamics, central banks face temporary and more and more structurally mounting challenges in maintaining control over short-term rates in money markets – particularly as they seek to scale back their footprint in the market. Against this backdrop, the next section turns to the wholesale funding segment of the financial system, examining how the structure of these markets – and the growing presence of NBFIs within them – shapes the efficiency and reliability of monetary policy transmission.

3 Wholesale funding, NBFI, Monetary policy pass-through, market functioning and financial stability

As described in section 2.2.5., the interest rate channel's effectiveness increasingly hinges on the structure of modern financial markets.

In this section we aim to investigate two main questions. First, does an increasing role played by NBFIs have implications for how effectively central bank liquidity is distributed in money markets? Do NBFIs amplify or dampen money market frictions, including segmentation and collateral scarcity? Under which conditions?

Second, should NBFIs be included as counterparties for central bank operations? Which role should the prudential policy regimes for NBFIs play in this decision?

We are investigating the first question in Section 3.1 under the lens of the current academic literature and the dispersion index proposed by Duffie and Krishnamurthy (2016).

Regarding the second question, given that in Europe NBFIs do not have access to CB balance sheets, in Section 3.2 we are investigating the only empirical evidence of a CB that gave access to their balance sheets to NBFI on the liability side: the Fed's the ON RRP facility. In Section 3.3 we outline the lessons Europe could draw from the introduction of facilities like the Federal Reserve's ON RRP, and explores the potential benefits of either extending the ECB's Securities Lending Facility to selected NBFIs or implementing a mechanism similar to the Bank of England's Contingent Non-Bank Repo Facility (CNRF) – which lends cash against UK sovereign debt (gilts) for short-term durations. This is a contingent facility that the BoE will activate only under special conditions to selected NBFIs. This facility has never been activated so far, so we do not have any empirical evidence, but we could provide some educated guess on how it would work in Europe.

An important caveat is that our analysis is largely confined to examining pass-through and rate dispersion in money markets. It does not constitute a complete assessment of the broader monetary policy stance. However, it is well known that this process, known as interest rate pass-through, determines whether and how monetary policy impulses affect broader credit conditions[25], given the pivotal role that short-term rates have in determining the shape of the term structure of interest rates, pricing of financial instruments, and ultimately real economic activity.

3.1 NBFI and Money Markets: the dispersion index

The growing prominence of NBFIs, coupled with persistent segmentation in wholesale funding markets, complicates the smooth and uniform transmission of policy rate changes. Regulatory barriers and institutional frictions all contribute to heterogeneity in money market rates, challenging the traditional assumptions of allocative efficiency. With broker-dealers retreating from balance sheet-intensive activities due to post-GFC regulations, NBFIs have filled much of the gap in market-based intermediation. However, NBFIs shape money market dynamics through their cyclical liquidity provision, reliance on leverage, and structural liquidity mismatches. Their growing role in market-based finance has made money market rates more sensitive to margin-driven deleveraging and flight-to-safety behavior during stress.

These dynamics raise critical questions about how – and to what extent – changes in central bank policy rates are actually reflected in the interest rates faced by borrowers and lenders across the financial system. This section explores the

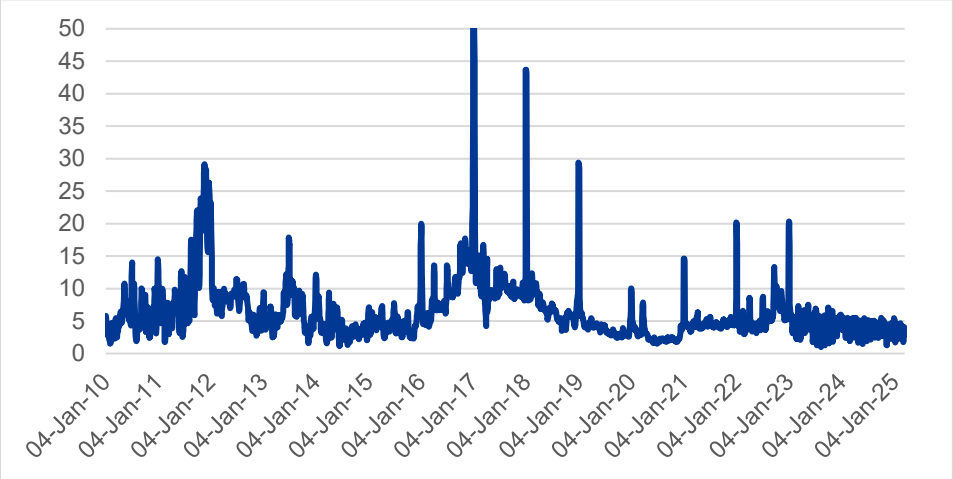
[25] On this regard see Holm-Hadulla and Pool (2025)

mechanics, scope, and limitations of this pass-through, with a particular focus on the role of NBFIs in shaping their effectiveness across different market segments[26].

Empirically the pass-through could be investigated via the dispersion index[27] proposed by Duffie and Krishnamurthy (2016), which we replicated and updated for the EU and the U.S. between 2010 and 2025. This index allows us to quantify the degree of segmentation in money markets by measuring the variation in funding rates across market segments, capturing how far actual market conditions deviate from a fully efficient, unified market. The market segments considered for the EU are the uncollateralized interbank market rate EONIA and its successor, the Euro short-term rate (€STR)[28] and the collateralized interbank market (repo) for general collateral (GC) for Germany (DE), France (FR), Italy (IT) and Spain (ES) and the corresponding special repo rates.

Chart 3.1.
Dispersion index for the Euro Area money market rates

(basis points)



Sources:ECB
Notes: Authors' calculations following Duffie and Krishnamurthy (2016) and Corradin et al. (2020). We have extended the index from 2019 till March 2025 and used a rolling window of one week. The Index constructed using EONIA, €str, DE, FR, IT, ES GC and special repo rates, volume-weighted.[29]

As Chart 3.1 shows, the dispersion index in EU is facing significant quarter end spikes, largely due to regulatory requirements, the monetary tightening after Covid-19 and the consequent monetary easing in the recent years. While these spikes are highly visible in Chart 3.1., the dispersion goes beyond spikes and shows phases of structural deviations from 0, the latest for instance in 2022-2023. This large

[26] There is a vast literature on the role of banks and NBFI in creating money (Gorton and Metrick (2012), Krishnamurthy and Vissing-Jorgensen (2015), Sunderam (2015), Moreira and Savov (2017), Xiao (2020), dAvernas and Vandeweyer (2020), Cipriani and La Spada (2021), Egan, Lewellen and Sunderam (2021),

[27] The index is calculated as: $D_t = \frac{1}{\sum_i v_{i,t}} \sum_i v_{i,t} \left| \hat{y}_{i,t} - \bar{y}_t \right|$, where i indicates different short-term rates, such as EONIA, €str, DE, FR, IT, ES GC and special repo rates, yi is the observed short-term rate i, vi is the outstanding amount of this instrument on day t, and ybar is volume-weighted mean rate of all the short-term rates.

[28] Consider that in Europe, the uncollateralized interbank rate €str is very limited and is based on the borrowing rates of 80 banks; therefore, the index captures only the lending rate of NBFI.

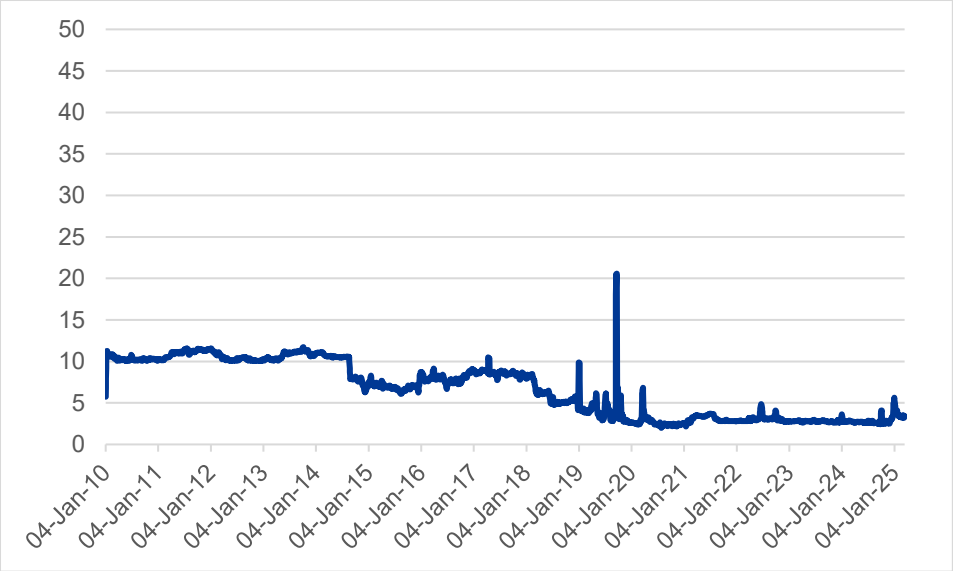
[29] We thank the ECB for providing us the data on the repo rates, EONIA, €STR and the corresponding volumes.

dispersion in short-term repo rates in Europe is largely driven by the difference on repo special rates across sovereign collaterals.

In contrast, the index exhibits a markedly different pattern in the United States. Here, we are considering ON RRPs, EFFR, IORB, IORR, OBFR, SOFR, LIBOR and triparty repo rates.

Chart 3.2.
Dispersion index for the U.S. money market rates

(Basis points)



Sources: FRED, OFR and Bloomberg
Notes: Authors' calculations following Duffie and Krishnamurthy (2016). We consider the following rates: ON RRPs, EFFR, IORB, IORR, OBFR, SOFR, LIBOR and triparty repo rates. and a rolling window of one month for the period 2006-2010 and one week from 2010 till March 2025. We do not consider volumes because of a lack of data.

Chart 3.2 is showing the dispersion index for the U.S. but is calculated with a far lower level of granularity than Chart 3.1 and also underestimates the dispersion when compared to Chart 2 in Duffie and Krishnamurthy (2016).

Exercising the necessary caution, the comparison of chart 3.1. and 3.2. is quite striking and highly informative. It shows that the money market in the US is far less fragmented. The index does not show the quarter end impact and the main spike corresponds to the September 2019 and the March 2020 dash for cash episodes where high demand for cash significantly affected the repo markets (see Appendix C). However, through time the US index has been largely declined. Instead, the Euro Area dispersion index is changing in levels mostly during the initial part of the QE phase, it has been reduced from 2017 and then it has increased again after Covid. Overall, it is showing a volatility that is far larger than in the U.S. This pattern, along with the observed differences, is shaped by a range of underlying factors.

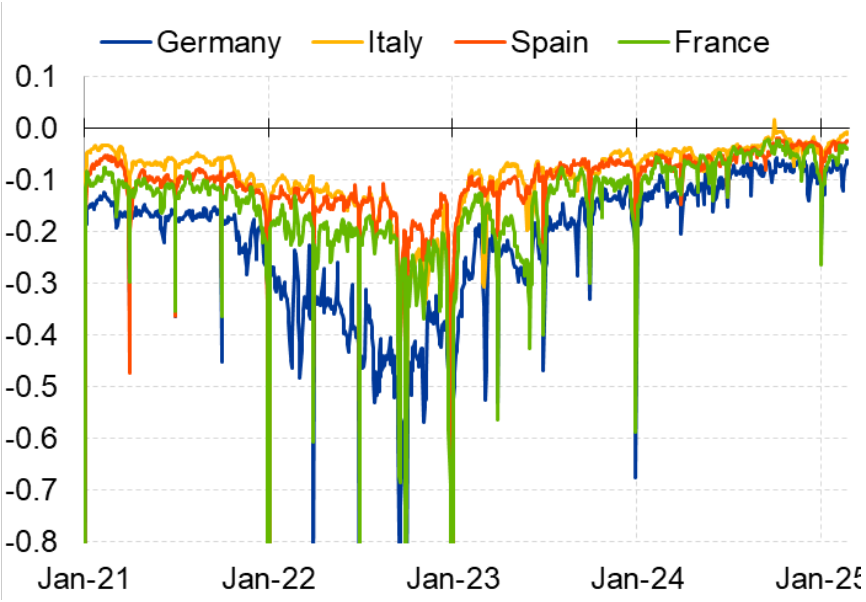
Fragmentation in the money market arises because of regulatory barriers[30], imperfect competitions (see Eisenschmidt et al., 2023), institutional frictions[31], and differential access to central bank facilities. For an overview of all these channels and the role of NBFI see Aramonte et al. (2022).

A simple comparison of these frictions indicates that the regulatory framework contributes to the end-of-quarter volatility, but there are lower institutional frictions in Europe thanks to the well-developed, centrally clear repo market.

Beyond conventional drivers, the dynamics of the European repo market are heavily influenced by differences in sovereign bond convenience yields, often referred to as repo specialness, and by the relative scarcity of specific bonds[32].

Chart 3.3.
Security-specific interest rates on the repo market

(Repo rate-DFR, in %)



Sources: Brokertec and MTS data
Notes: Authors' calculations. The graph reports difference between the daily weighted average repo rates and DFR rate for sovereign bond issued by Germany (DE – blue line), France (FR – green), Italy (IT – yellow) , and Spain (ES - red) from 2021 till March 2025.

[30] One key difference is the different regulations between the EU and the US regarding the application of the Supplementary Leverage Ratio (SLR). In the EU, this ratio is calculated on a quarterly basis using end-of-quarter values, while in the US, it is calculated daily using daily averages for on-balance-sheet exposures and monthly averages for off-balance-sheet exposures. The role played by SLR in generating money market fragmentation has been investigated both in Europe and in the US, see among others, Andreeva, Samarina and Sousa (2025), Huber (2024).

[31] Institutional frictions refer to limited direct trade platforms and limited broader central counterparties (CCPs).

[32] Notice that these differences are not related to market fragmentation but to different levels of scarcity generated by either preferred habitat investors or Central Bank Purchase programs, as shown by Pelizzon et al. (2025). Moreover, consider that the special collateral segment is the largest one in the European repo market (see ECB (2025) and Schnabel (2024 and 2025) and Buch and Schnabel (2025).

Chart 3.3 shows the difference of the repo rates for Germany, France, Italy, and Spain with respect to the DFR in the last few years. We see extreme quarter-end spikes for the four countries, but we also see consistent deviations for all four countries in 2022, which cannot be explained by quarter-end spikes. Furthermore, we see strong deviations between the underlying collaterals signalling not just overall dispersion, but also collateral specific dispersion on top. It is important to note that this additional layer of dispersion is specific to the Euro Area, where multiple sovereign issuers coexist for the same currency.

The dispersion across countries can be largely explained by demand differences among the treasuries used as collateral[33]. Demand differences are driven by different sovereign risks, but also by scarcity induced by the quantitative easing Asset Purchase program implemented by the Eurosystem. This effect is documented by Arrata et al. (2020), who showed that repo specialness is largely caused by the rule adopted by the QE programs implemented by the Eurosystem[34].

Linzert et al. (2025) highlights the role of NBFIs, especially hedge funds, as key contributors to repo specialness. These institutions actively participate in the EU repo market to exploit pricing discrepancies between sovereign bonds and their corresponding futures contracts – a strategy known as the futures – bond basis trade. Their arbitrage activity creates sustained demand for specific sovereign issues, contributing to persistent specialness in repo markets and further reinforcing the impact of collateral scarcity on short-term rates.

In particular, Linzert et al. (2025) show that the ECB's decision to modify the Securities Lending Facility – transitioning from matched repo–reverse-repo transactions to cash-collateralized operations – had a measurable impact on repo market functioning. Introduced in December 2016, this adjustment helped dampen the increase in the dispersion of repo rates by establishing a floor on rates paid when high-quality collateral such as German, French, Italian, or Spanish sovereign bonds are used.

An important observation is that the ECB's Securities Lending Facility functions primarily as a backstop in presence of collateral scarcity, implying that it is not intended to completely neutralize declining repo rates and only eligible Euro Area credit financial institutions could access it. Even it helps to reduce the dispersion index, and it is a reverse repo contract it is quite different than the ON RRP facility of the Fed under three key dimensions.

The Fed's purpose is, indeed, not to resolve the bond scarcity problem but to neutralize declining deposit rates. In an environment with abundant reserves, the ON

[33] While general differences can be explained by regulatory frictions such as the supplementary leverage ratio (SLR) or liquidity coverage ratio (LCR) as suggested by Duffie and Krishnamurthy (2016) and Du et al. (2023), these indicators do not help to explain collateral specific dispersion in the euro area as the ratios are the same for any of these collaterals. They are also not driven by repo market infrastructure, because in the euro area this infrastructure is well developed and the large majority of repo transactions are centrally cleared (see e.g. Mancini et al. (2016)). Partially, it can be explained by imperfect competition at the single transaction level as documented by Ma et al. (2023), but imperfect competition is not able to explain the differences across countries.

[34] These factors are discussed in greater detail in Appendix C of this document.

RRP facility helps reduce rate dispersion by setting an effective floor on the rates that MMFs can earn, thereby enhancing the efficiency of monetary policy pass-through (see also Duffie and Krishnamurthy 2016). For this reason, the bond given as collateral is selected by the Fed from any treasury bond. This facility could not be used, therefore, to short-sell a specific bond as in the case of the Euro Area SECURITIES LENDING FACILITY. Additionally, non-bank financial institutions such as MMFs are eligible to participate directly in the facility. From the perspective of the dispersion index, both facilities help to reduce index dispersion. However, these facilities are very different.

Given that in Europe, the large element of the price dispersion is repo specialness induced by QE and the consequent behavior of arbitrageurs such as hedge funds, does it really matter for the term structure that the short-term rates are not in the corridor? Does it matter for the monetary policy transmission of QE, such as the reduction of the term spread?

The answer to these questions is reported in Jappelli et al. (2025), where we show that average repo specialness is positively correlated with the term spread. Consequently, the extent to which quantitative easing compresses term premia is attenuated by the repo specialness it generates. Jappelli et al. (2025), building on the theoretical framework of Vayanos and Villa (2021), demonstrate that repo specialness raises the cost of carry trades for arbitrageurs and increases the cost of duration extraction for central banks. As a result, the impact of QE on term spreads is weaker than it would be in the absence of repo specialness.

This implies that maintaining repo specialness close to zero is essential, and that the ECB should fully neutralize declining repo rates. One approach is to reduce the spread between the Security Lending Facility rate and the Deposit Facility Rate; another is to extend access to this facility to NBFIs.

This leads us to a broader and more fundamental question: Should NBFIs be granted access to central bank facilities? If so, which specific facilities should they access, and what are the potential trade-offs? In the following section, we examine this issue from a European perspective, relying on the limited empirical evidence currently available on NBFI access to central bank balance sheets.

3.2 NBFI Access to CB balance-sheets, spillovers to the banking sector and monetary and fiscal policies implication

Should NBFIs be included as counterparties for central bank operations? The only facility in place at a central bank that has been used recently and that gives access to CB balance sheet at NBFI is the Fed ON RRP. From a macro perspective, the Overnight Reverse Repo (ON RRP) facility appears as a liability on the Federal Reserve's balance sheet. While investments in the ON RRP facility do not alter the overall size of the Fed's balance sheet – since the underlying securities remain recorded as Fed-held assets – they do affect the composition of its liabilities.

Specifically, ON RRP usage reduces the amount of reserves in the banking system, assuming all other factors remain constant.

Duffie and Krishnamurthy (2016) highlighted the benefits of granting MMFs access to central bank balance sheets through ON RRP facilities. They argue that such access enhances the transmission of monetary policy by improving the pass-through to wholesale market rates. Moreover, RRP operations can help mitigate structural inefficiencies in money markets – such as those arising from imperfect competition, market segmentation, and regulatory frictions. In a more general framework, d'Avernas, and Vandeweyer (2024) demonstrate that ON RRP RRP shifts liquidity from the low marginal value sector (banks) to the high marginal value sector (NBFI), thereby stabilizing short-term rates and alleviating shortages[35].

However, a major concern of FEDs ON RRPs was expressed by some members at the FOMC meeting of June 17-18, 2014. They highlighted the problem that, in times of financial stress, investors would shift cash investments to the RRP facility, thereby disrupting funding to the private sector and exacerbating the financial stress[36].

An investigation of the access of NBFIs and in this specific case, MMFs, to the CB balance sheets is helping us to better assess different predictions. More specifically, we investigate the role CBs played in the March 2023 run to the US banking sector, i.e.: what role does access to central bank balance sheets play in shaping the relationship between interest rates and deposit dynamics? The first important aspect to consider is that standard theories of monetary transmission predict that high interest rates reduce deposit creation (Bernanke and Blinder 1988; Kashyap and Stein 1995; Drechsler et al., 2017). In contrast, as Xiao (2020) shows for the period 1987 till 2013, this relationship for MMFs is reversed: high interest rates expand MMFs shares (i.e. MMFs' deposits).

We have investigated the same relationship for the period from 2014 till 2025. Chart 3.3 reports the evolution of the EFFR rate and the MMFs shares. As Chart 3.3 shows, there is indeed a negative relationship between EFFR and banks' deposit growth and a positive relationship between interest rates and MMFs liabilities growth (i.e. MMFs deposits growth).

The MMFs monetary policy interest rate channel arises from the competition between NBFIs (in particular MMFs) and commercial banks in a deposit market with heterogeneous depositors. Facing a more yield-sensitive clientele, MMFs pass through more rate hikes to depositors, thereby attracting more deposits when the Federal Reserve raises rates. In this way, the pass-through of the deposit channel improves. At the same time, this dynamic underscores the challenges banks face, as deposit outflows toward MMFs can weaken their funding base and potentially undermine financial stability. This potential effect is confirmed if we look again at

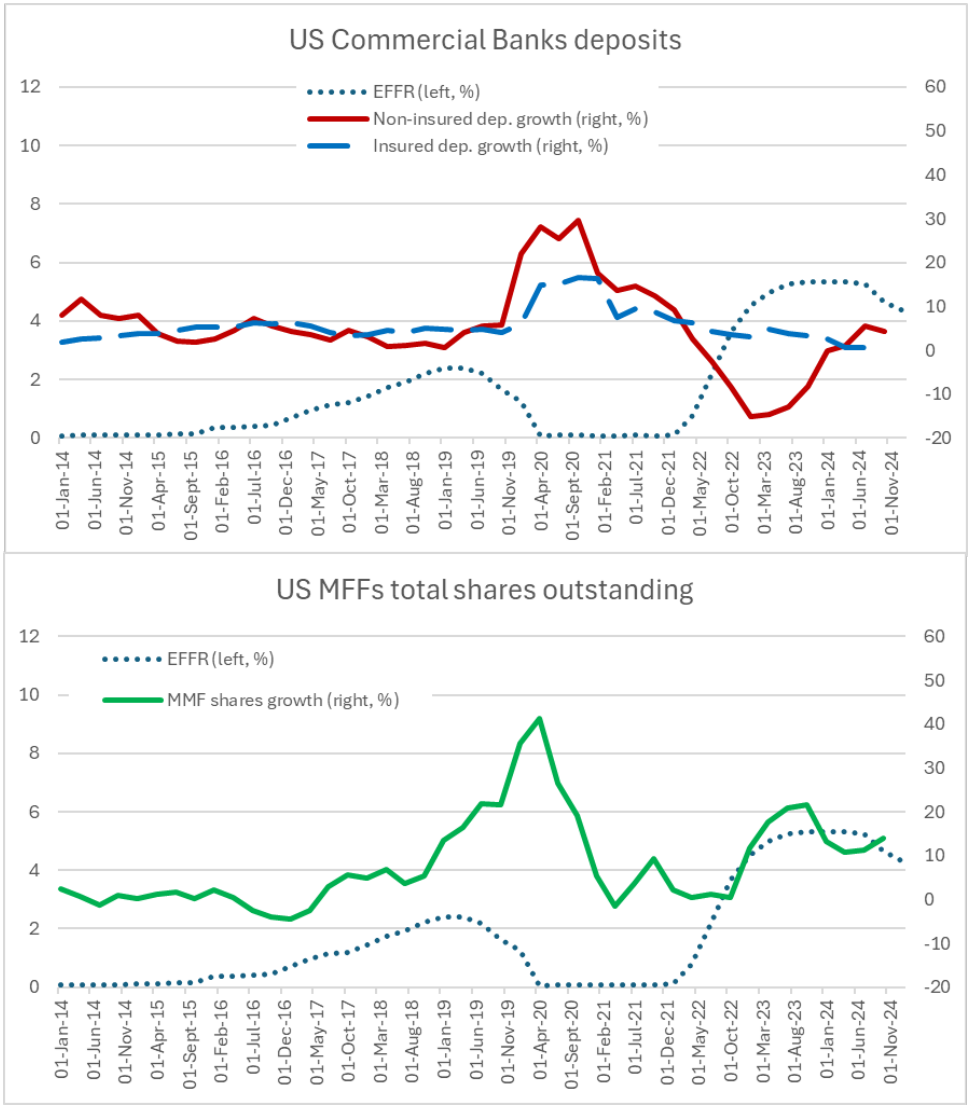
[35] Avenas, (2024) shows that RRP is more than just a price floor—it reallocates balance sheet space and alters incentives across market participants. This dual effect—on liability-side liquidity and intermediation capacity—helps explain observed repo market volatility and the Fed's growing role in managing short-term funding markets. This paper also shows that instead of being a "liquidity absorbing" tool, the RRP is shown to increase net aggregate liquidity by offering assets with higher marginal liquidity value to shadow banks.

[36] See http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20140618.pdf

Chart 3.3, Panel a), which presents a significant reduction of uninsured deposits when the EFFR increases and on the other side a significant increase of MMFs' shares growth at the same time.

Chart 3.3.
US commercial banks and MMFs

(in %, EFFR)



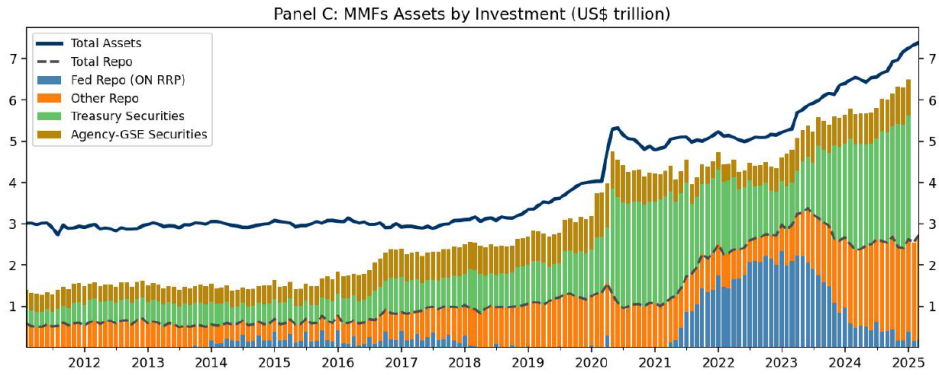
Sources: FRED, FDIC
Notes: EFFR is averaged quarterly; MMF shares include both institutional and retail funds.

On the other side a key question arises: where do MMFs allocate their growing inflows when MMFs shares volumes rise? Chart 3.4 provides insights into this allocation pattern.

Chart 3.4

MMFs Assets y Investment

(in US$ trillion)



Sources: OFR, authors' calculations

As Chart 3.4 shows, MMFs have increased their size constantly since 2016, moving from 1.5T to 6.5 T USDs. MMFs in the US largely invest in the repo market (against treasury collateral) or directly into treasuries. When the Fed started its tightening, they massively used the ONRRP facility, helping the Fed to reduce liquidity in the system by giving to MMFs treasury as collateral rather than doing open market operation. When the Fed started to lower the interest rates, the fraction of liquidity heavily deposited at the Fed moved back to the repo market[37].

In the meanwhile, the MMFs helped significantly the fiscal expansion of the US treasury. With a combination of direct treasury exposure of 3T USDs and indirect via repo of another 3T USDs. If we consider that in 2019 MMFs holding of treasury directly and indirectly was about 3T and now it is 6T and that the US debt has increased by 8T USDs since 2019, MMFs together with the Fed and hedge funds absorbed a significant fraction of the US fiscal expansion.

In an economy where MMFs play a substantial role, the Federal Reserve has been able to benefit from several dynamics. The presence of MMFs helps reduce dispersion between the deposit rate and the EFFR and improves the monetary policy transmission, which would otherwise be weakened – since rate hikes tend to increase MMF deposits and thereby their market influence. Moreover, quantitative tightening (QT) combined with fiscal expansion can be absorbed through MMFs operating in financial and wholesale markets. This setup allows the Fed to manage balance sheet fluctuations effectively, especially within an ample reserve regime, without directly intervening in the Treasury market. Instead of frequent Treasury

[37] We are providing only a correlation evidence. We leave the deep investigation of this issue to further research. On this regard, Afonso et al. (2025) show that increases in banks' balance-sheet costs—especially following the expiration of the Supplementary Leverage Ratio relief—drive money market funds to grow and shift investments toward the Federal Reserve's ON RRP facility, impacting monetary policy implementation and transmission.

transactions, the Fed can rely on repo and reverse repo operations to stabilize liquidity. This approach is particularly pertinent in the current context: although banks hold large reserves, these are not as ample as they seem due to their dependence on reserves enforced by macroprudential regulation (see Copeland et al., (2024) and Duffie 2025). Overall, the structure enables the simultaneous tightening of monetary policy and expansion of fiscal policy. It is an open question whether this combination is feasible in the medium and long term.

Moreover, questions arise regarding the transmission of monetary policy as the banking sector contracts. If MMFs lack access to the central bank – or if the central bank lacks access into MMF balance sheets – this transmission could be weakened (see Xiao, 2020). Conversely, providing MMFs with access to central bank facilities can enhance policy pass-through and restore transmission. Yet this comes with trade-offs, as it may place additional stress on the banking sector.

Despite concerns about a potential credit crunch, there was no strong evidence of one in 2023. Banks were able to withstand deposit withdrawals thanks to the new facility the Fed made in place on March 12, 2023: the Bank Term Funding Program (BTFP) that allows eligible depository institutions to borrow up to the par value of U.S. Treasuries, agency debt, and mortgage-backed securities for a maturity of one year at the 1-year overnight index swap (OIS) rate + 10 basis points. In this way, the Fed prevented panic and avoided further destabilization of the banking system. In this case, the Standing Repurchase Agreement Facility was not sufficient on its own because it imposes that collateral is evaluated at the mark to market plus eventually a "haircut" on the collateral market to market value (i.e., collateral is not valued at par). In the meantime, MMFs continued to provide funding for Treasury securities.

Returning to the central question of this section regarding the benefits and drawbacks of the Fed's ON RRP facility, we can assess that the ON RRP facility helps to reduce the dispersion of short-term interest rates and their volatility and, therefore, the pass-through of monetary policy. It is also helping the CB to implement monetary policy tightening and, at the same time fiscal expansions (and helped to maintain the safe-haven role of Treasuries as a store of value, see Duffie (2025)) but at the same time, it challenges the banks' deposits, creating potential problems to the funding to the private sector and exacerbating the financial stress.

3.2.1 Lessons from ON RRP and the Case for European Adaptation

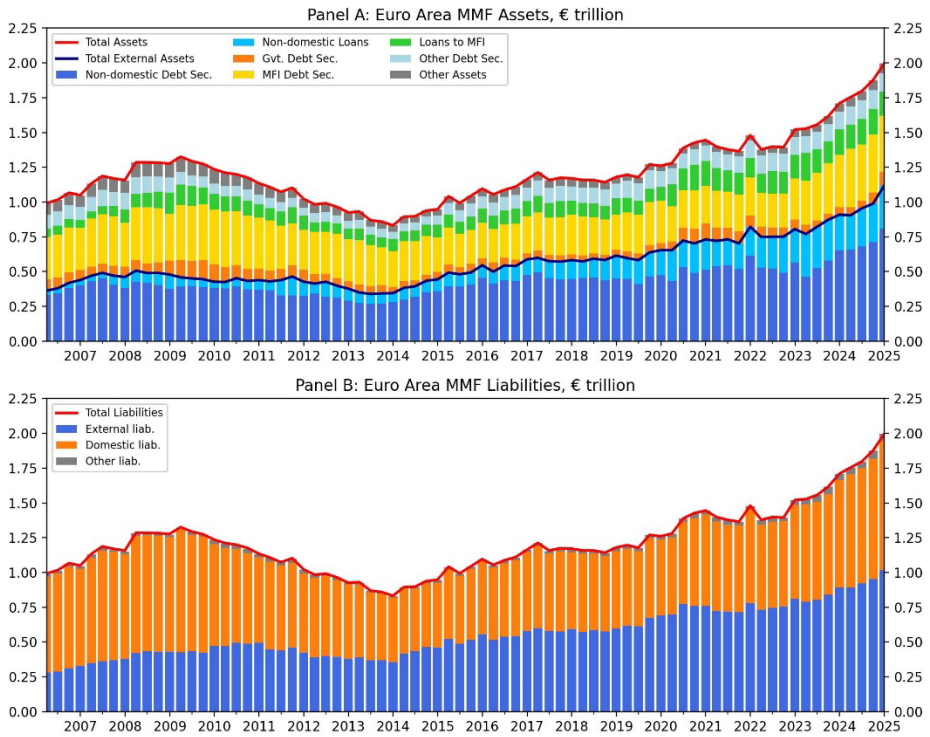
Shall the ECB consider a facility like the ON RRP? As mentioned before, the dispersion index is heavily driven by a repo market largely dominated by scarcity and segmentation that has induced significant repo specialness, in particular in the DE bond collateral segment.

In Europe, MMFs are a small share of the NBFI sector. In 2013, their total assets amounted to €800 billion. As of most recent data, this figure increased to €2 trillion. Chart 3.5 reports their evolution over time.

Chart 3.5

Euro Area MMF balance sheets

(€ trillion)



Sources: ECB, BSI, authors' calculations

Chart 3.5 shows that MMFs in Europe have reduced their size from 2009 till 2014 and then started to grow again, almost doubling their balance sheets. They invest almost 50% of their shares in non-domestic debt securities and loans. Similarly, they collect funds almost equal amounts from domestic and foreigners' investors. Their investments in European government securities are very limited and a significant fraction of their investments are MFI debt securities[38].

What we learned from the US is that MMFs play an important role in monetary and fiscal policies, especially those dedicated to treasuries, but that might pose financial stability issues to the banking sector. For now, this seems an option not relevant in the European landscape, at least for the European MMFs[39]. It would be, instead, more useful to consider the possibility of extending access to selected NBFI at the Security Lending Facility. Being related to specific bonds would help significantly the reduction of repo specialness.

Another possibility is to give access to the CB balance sheets at NBFI as with Contingent Non-Bank Financial Institution Repo Facility (CNRF) settled by the BoE. CNRF will lend cash to NBFIs (specifically insurance companies, pension funds and liability-driven investment funds) against UK sovereign debt for a short lending term.

[38] About the role of ON RRP in Europe see also Schnabel, (2024).

[39] According to Andersen and Serrano (2024) and Linzert et al. (2025) NBFI active in the money market in Europe are largely non-European.

The CNRF is designed to respond to future episodes of significant dysfunction in the UK sovereign bond market that pose risks to UK financial stability—particularly those triggered by shocks that temporarily heighten the liquidity needs of NBFIs across the market. Operating on the opposite side of the corridor with respect to the ON RRP and the Security Lending Facility, the CNRF provides cash to NBFIs in exchange for UK sovereign bond as collateral, thereby helping to prevent disorderly fire sales.

While the CNRF can mitigate acute liquidity stress, it may also introduce leverage dynamics, as highlighted by Breckenfelder and Hoerova (2023). Their empirical findings support the use of central bank asset purchases – similar to market maker of last resort interventions—which stabilize markets without creating additional leverage and are effective in halting fire-sale spirals. Moreover, such purchases have been shown to stave off fund runs by restoring investor confidence.

A key distinction between the two instruments lies in their policy orientation: central bank asset purchases aim to support broad macroeconomic objectives through market-wide accommodation, whereas CNRF-type facilities serve as targeted, tactical liquidity tools designed to address specific market dysfunctions. Because access to the CNRF is limited and conditional, it should not carry the significant leverage-encouraging effects. Nevertheless, its existence may still reinforce risk-taking incentives, as market participants anticipate central bank intervention in times of stress. Given that central banks already serve—implicitly or explicitly—as market makers of last resort, the use of structured, rule-based facilities like the CNRF might be preferable to direct and discretionary intervention in the repo market.

In conclusion, a facility such as the ON RRP would be not relevant for the European money market landscape. The suggestion is that the ECB should start to consider extending the Security Lending Facility to NBFIs and to implement a contingent facility such as the CNRF.

4 Key takeaways, suggestions and conclusions

Key Takeaways

Large but Externally Focused NBFI Sector:

Europe's NBFI sector is large in size, but a significant portion of its funding is intermediated and invested outside the EU. This reflects missed opportunities in fostering domestic financial depth and integration.

Underdeveloped Capital Market:

The persistent investment outflows indicate a lack of progress in building a robust, sizable and integrated European capital market, including a sovereign bond market and Euro-wide bonds.

Untapped Potential of NBFIs:

NBFIs could play a crucial role in reducing rate dispersion, alleviating bond market fragmentation, and fostering cross-border capital flows. However, their

contribution remains limited due to underdeveloped Capital Market and institutional shortcomings.

Challenges to Financial Stability and Supervision:
The concentration of NBFI activity in a few countries raises supervisory challenges, as supervisory data opacity and gap, risks are not evenly distributed and regulatory coordination is still insufficient.

Monetary Policy Transmission and Market Impact:
NBFIs have a dual impact: they provide liquidity and reduce mispricing yet also contribute to segmentation in the EU money market. Their growing presence affects the transmission of monetary policy.

Suggestions

1. *Develop the Savings and Investment Union:*
   Advancing this initiative would help channel more NBFI capital within Europe, boosting domestic funding sources and strengthening integration.

2. *Enhance Capital Market Infrastructure:*
   Establishing a well-functioning securitization system of both covered bonds and Asset-Backed Securities (e.g., for mortgages and SMEs), would unlock NBFI participation in critical credit markets without the border issues present in the banking sector due to the absence of a common deposit insurance scheme and existing cross-border capital barriers. Similar arguments could be extended to sovereign bond market and Euro-wide bonds.

3. *Strengthen Supervisory Frameworks:*
   Addressing country-level concentration in NBFI activity requires enhanced, harmonized supervision at the EU level to mitigate systemic risks.

4. *Access to CB's balance sheet only as a backstop in the presence of collateral scarcity and stress episodes*:
   To improve monetary policy effectiveness by eliminating collateral scarcity and ensuring liquidity provision during stress episodes, the EU should consider extending the Securities Lending Facility to key NBFI participants and operationalizing a dedicated Contingent Non-Bank Financial Institution Repo Facility.

Conclusion

The European financial system is vast – its total assets amount to nearly seven times the GDP of the European Union. In comparison, the U.S. financial system, although highly developed and market-driven, is relatively smaller at around five times U.S. GDP. Within this financial architecture, non-bank financial intermediaries (NBFIs) have taken on a growing and increasingly prominent role. In Europe, the

NBFI sector holds assets equivalent to approximately 3.8 times GDP, compared to 3.1 times GDP in the United States.

These figures underscore an important paradox. Despite its sheer scale, the European NBFI sector remains underleveraged in contributing to the continent's financial integration and economic resilience. A significant share of NBFI funding is intermediated across borders and ultimately invested outside the European Union, bypassing opportunities to support domestic capital formation, corporate credit, and market development. While such outward allocation may reflect rational investment behavior in a low-growth, fragmented financial environment, it also exposes structural weaknesses in Europe's financial ecosystem.

Rather than acting as a force for convergence and cohesion, the current pattern of NBFI activity reveals a missed strategic opportunity. It points to the slow progress in building a unified capital market and highlights the persistent absence of key financial infrastructure—such as a deep securitization framework and a sizable capital market. These gaps leave Europe trailing behind the U.S., where NBFIs play a central role.

This paper explores how Europe could reorient the NBFI sector from an external allocator of capital to an internal engine of integration and market depth. We examine the economic and institutional forces behind the current allocation pattern, assess how NBFIs influence short-term markets and monetary policy transmission, and consider the systemic risks stemming from the geographic concentration of NBFI activity in a few EU member states.

We argue that unlocking the potential of NBFIs requires a dual policy agenda. On the structural side, reforms must aim to deepen Europe's financial markets and expand domestic investment opportunities – particularly through the advancement of the Savings and Investment Union and the development of securitization tools. On the monetary and liquidity front, the role of NBFIs in money markets must be recognized through appropriately designed backstops – such as extending the Securities Lending Facility to eligible non-banks or operationalizing a Contingent NBFI Repo Facility.

Only by taking these steps can Europe shift away from a capital-exporting model and begin to fully leverage its financial ecosystem – including the NBFI sector – to foster integration, stability, and growth across the Union.

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Appendix

APPENDIX A

Chart A.1

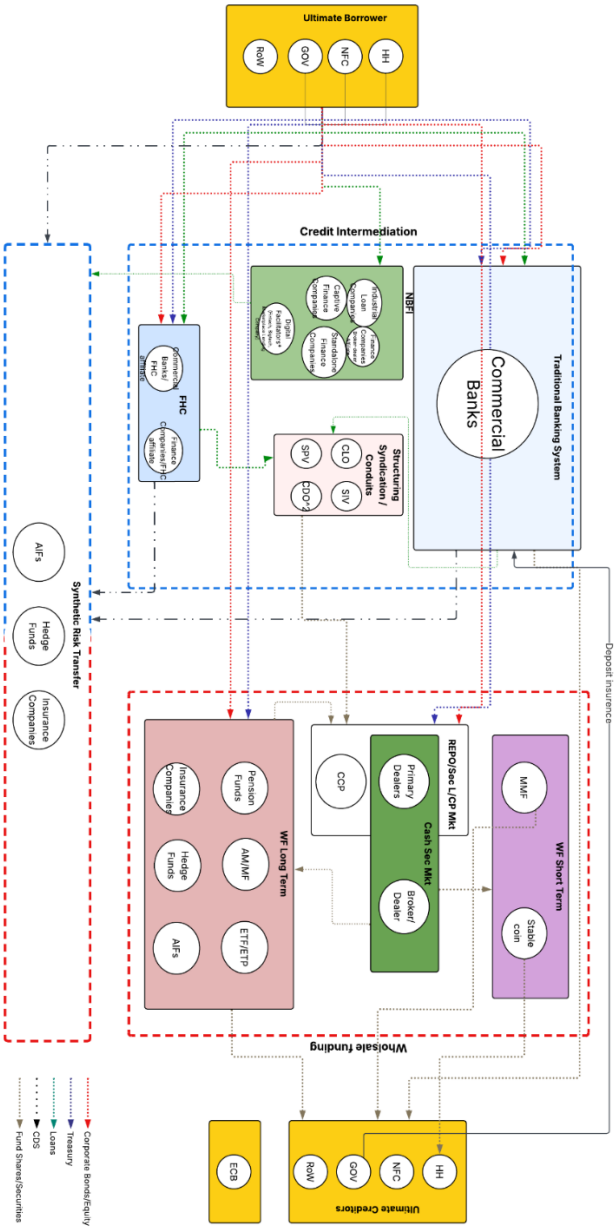


Chart A.1 The Financial system network in 2025

Chart A.1 considers on the right-hand side the ultimate creditors and on the left the ultimate borrowers that borrow either via mortgages or loans or by issuing securities such as equity, corporate bonds and treasuries.

Ultimate borrowers and lenders that are the same entities such as households, non-financial corporations and government interact with commercial banks and NBFI both in the credit intermediation segment and the wholesale funding segment.

The key engine in the credit intermediation segment involves FVCs, including Special Purpose Vehicles (SPVs), Structured Investment Vehicles (SIVs), Collateralized Loan Obligations (CLOs), and Collateralized Debt Obligations (CDOs). These entities, while legally independent and bankruptcy-remote, might be or not closely affiliated with the sponsoring bank, which continues to service the underlying loans and may provide liquidity or credit enhancements. The FVC aggregates the loans and repackages them into structured securities, slicing them into different tranches by credit risk and maturity. These activities are bundling in a vertical chain the credit intermediation activity that transform illiquid loans into marketable securities.

The second step connects the issuance of these securities to the broader funding markets. Here, repo markets, securities lending platforms, and the commercial paper (CP) market come into play. FVCs fund themselves by issuing short-term debt such as asset-backed commercial paper (ABCP) or by pledging collateral into repo agreements. Primary dealers and broker-dealers, often within large financial holding companies, serve as the critical intermediaries. They underwrite and distribute the structured products and engage in maturity transformation by borrowing short term against long-dated securities. Central Counterparties (CCPs) facilitate these repo transactions and securities lending operations, while tri-party clearing banks (such as BNY Mellon) ensure operational and collateral management. Simultaneously, the cash securities market operates as a distribution platform: newly issued MBS or ABS tranches are sold to investors via broker-dealer syndicates or directly through capital markets desks.

The third step involves the holders of risk and providers of capital. MMFs, insurance companies, pension funds, hedge funds absorb the structured securities and provide both short- and long-term financing. MMFs, in particular, play a dual role. On the one side, they absorb commercial paper and repo agreements from FVCs and broker-dealers, recycling short-term cash from households and corporates into the shadow banking system. On the other, they indirectly expose retail investors to credit markets via near-cash instruments. Insurance companies and pension funds, with long-duration liabilities, purchase more senior and stable tranches, seeking yield enhancement over sovereign debt. Hedge funds and credit-focused investment vehicles target the mezzanine and equity tranches, extracting returns through leverage and active credit positioning.

A related layer is the synthetic risk transfer (SRT) mechanism, through which banks retain loans on their balance sheets but transfer credit risk economically - though not legally - via derivative instruments. In these transactions, banks enter into credit default swaps (CDS) or similar contracts with insurance companies, hedge funds, and alternative investment funds (AIFs), shifting the risk of a reference portfolio of loans—often SME, infrastructure, or mortgage exposures—to nonbank investors. This allows banks to achieve capital relief under regulatory frameworks like Basel III,

particularly when the synthetic tranche is rated and structured according to standardized templates.

Ultimate borrowers such as non-financial corporations and government get credits by accessing directly the wholesale markets receiving both short term and long-term financing from MMFs, investment funds, insurance companies, pension funds, hedge funds.

Wholesale markets are also evolving given the role given the role they play played by connecting hedge funds and MMFs in the repo market where hedge funds are able to leverage their positions in treasuries for relative value arbitrage strategies. This strict interaction and the growth we are observing in the wholesale markets point to the fragility that this system is exposed to collateral and margin calls (see FSB report (2024)).

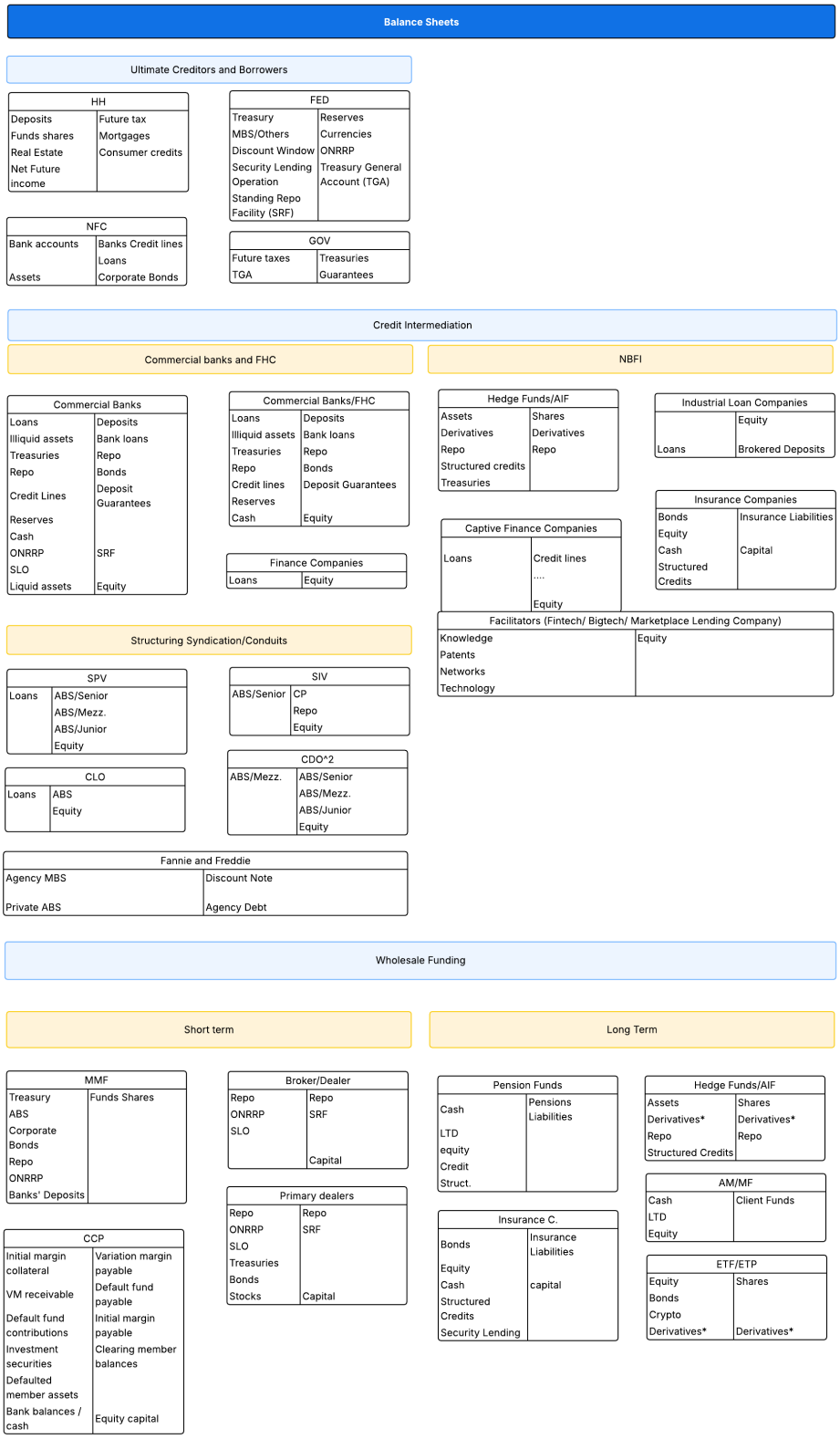
Moreover, with the growth that we are recently observing of crypto assets and stable coins and the issuance of ETF and ETP on these assets we are observing significant wealth transfers among householders. So far regulatory requirements have impeded the diffusion of these instruments in the banking sector, but they are growing among investment and hedge funds entities.

In this model, banks shift from being holders of credit risk to producers of credit instruments. NBFIs, meanwhile, take over the functions of warehousing, financing, distributing, and absorbing risk. This division of labor is not one of independence but of systemic interdependence. The OTD model is only possible because each link in this chain—FVCs for legal transfer, broker-dealers for structuring, primary dealers for market-making, MMFs for liquidity, and institutional investors for absorption—works seamlessly and in sync. As Acharya et al. (2024) show, NBFI loans represents 25% of banks' loans and banks are largely providing credit lines to NBFI. Any disruption in this chain—whether a run on MMFs, a spike in repo haircuts, or a rating downgrade of structured securities—can instantly reverberate through the entire system.

Thus, the evolution from OTH to OTD represents more than a financial innovation. It is a structural reconfiguration of risk, liquidity, and capital. It transforms the role of the bank from a warehouse of credit to a factory of credit products, with NBFIs acting as both the logistical infrastructure and the destination of that credit. As the financial crisis of 2007–2009 revealed, this model enabled explosive credit growth and regulatory arbitrage – but it also concentrated opacity and fragility across multiple institutions and markets outside the reach of conventional regulation. The financial regulation implemented after the GFC aims to prevent this growth, as well as to reduce the opacity and fragility associated with this market-based credit transformation. However, we observe that most of the financial intermediation still relies on the banking sector as a backstop.

For a description of the balance sheets of these institutions see Chart A.2

Chart A.2


Balance Sheets
Ultimate Creditors and Borrowers
HH
Deposits
Future tax
Funds shares
Mortgages
Real Estate
Consumer credits
Net Future income
FED
Treasury
Reserves
MBS/Others
Currencies
Discount Window
ONRRP
Security Lending Operation
Treasury General Account (TGA)
Standing Repo Facility (SRF)
NFC
Bank accounts
Banks Credit lines
Loans
Assets
Corporate Bonds
GOV
Future taxes
Treasuries
TGA
Guarantees
Credit Intermediation
Commercial banks and FHC
NBFI
Commercial Banks
Loans
Deposits
Illiquid assets
Bank loans
Treasuries
Repo
Repo
Bonds
Credit Lines
Deposit Guarantees
Reserves
Cash
ONRRP
SRF
SLO
Liquid assets
Equity
Commercial Banks/FHC
Loans
Deposits
Illiquid assets
Bank loans
Treasuries
Repo
Repo
Bonds
Credit lines
Deposit Guarantees
Reserves
Cash
Equity
Finance Companies
Loans
Equity
Hedge Funds/AIF
Assets
Shares
Derivatives
Derivatives
Repo
Repo
Structured credits
Treasuries
Industrial Loan Companies
Equity
Loans
Brokered Deposits
Insurance Companies
Bonds
Insurance Liabilities
Equity
Cash
Capital
Structured Credits
Captive Finance Companies
Loans
Credit lines
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Equity
Facilitators (Fintech/ Bigtech/ Marketplace Lending Company)
Knowledge
Equity
Patents
Networks
Technology
Structuring Syndication/Conduits
SPV
Loans
ABS/Senior
ABS/Mezz.
ABS/Junior
Equity
SIV
ABS/Senior
CP
Repo
Equity
CLO
Loans
ABS
Equity
CDO^2
ABS/Mezz.
ABS/Senior
ABS/Mezz.
ABS/Junior
Equity
Fannie and Freddie
Agency MBS
Discount Note
Private ABS
Agency Debt
Wholesale Funding
Short term
Long Term
MMF
Treasury
Funds Shares
ABS
Corporate Bonds
Repo
ONRRP
Banks' Deposits
Broker/Dealer
Repo
Repo
ONRRP
SRF
SLO
Capital
Primary dealers
Repo
Repo
ONRRP
SRF
SLO
Treasuries
Bonds
Stocks
Capital
Pension Funds
Cash
Pensions Liabilities
LTD
equity
Credit
Struct.
Insurance C.
Bonds
Insurance Liabilities
Equity
Cash
capital
Structured Credits
Security Lending
Hedge Funds/AIF
Assets
Shares
Derivatives*
Derivatives*
Repo
Repo
Structured Credits
AM/MF
Cash
Client Funds
LTD
Equity
ETF/ETP
Equity
Shares
Bonds
Crypto
Derivatives*
Derivatives*
CCP
Initial margin collateral
Variation margin payable
VM receivable
Default fund payable
Default fund contributions
Initial margin payable
Investment securities
Clearing member balances
Defaulted member assets
Bank balances / cash
Equity capital

Appendix B

Table B.1

Systemic risk indicators for NBFI

Indicator	Applicability to NBFIs	Key Considerations	Examples of Affected Entities
1. Size	✅ Applicable	Size alone doesn't indicate systemic risk; needs context (leverage, liquidity, etc.)	Large asset managers, insurers
2. Interconnectedness	✅✅✅ Highly Relevant	NBFIs interact via funding markets, derivatives, and common holdings	MMFs, hedge funds, insurers
3. Substitutability	⚠️ Conditional	Depends on whether the NBFI plays a critical market infrastructure role	CCPs, rating agencies, large index funds
4. Complexity	✅✅ Important	Complex structures increase opacity and risk propagation	Hedge funds, structured vehicles, synthetic ETFs
5. Cross-Jurisdictional Activity	✅✅ Important	Offshore domiciles and global operations challenge supervision	Global funds, offshore insurers, hedge funds
6. Leverage	✅✅✅ Highly Relevant	Amplifies losses; synthetic leverage often hidden in derivatives	Hedge funds, leveraged funds, PE funds
7. Liquidity Mismatch	✅✅✅ Highly Relevant	Critical in open-ended funds: liquid liabilities vs illiquid assets	Open-ended funds, MMFs

Indicator	Applicability to NBFIs	Key Considerations	Examples of Affected Entities
8. Maturity Transformation	✅✅ Important	Creates rollover risk similar to banks	MMFs, repo market vehicles, ABCP conduits
9. Risk Concentration / Correlation	✅✅ Important	Crowded trades and correlated positions magnify shocks	Passive funds, thematic ETFs, CLO funds
10. Procyclicality of Behavior	✅✅ Important	Common in strategies driven by VaR, risk-parity, or redemptions	Quant funds, risk-parity strategies, high-yield funds
11. Links to Core Institutions	✅✅ Important	Reliance on bank-provided services may transmit shocks into core system	All NBFIs using clearing, derivatives, prime brokerage

Legend:

✅ = Applicable

✅✅ = Important

✅✅✅ = Highly Relevant

⚠️ = Conditionally Relevant (depends on type of NBFI)

size, remains relevant, as institutions with large asset volumes may have significant market influence. However, in the context of NBFIs, size alone is not a sufficient indicator of systemic importance. For example, asset managers can control massive portfolios without bearing the same balance sheet risks as banks. Therefore, while size is a useful screening metric, it must be interpreted with caution and in combination with other indicators.

Substitutability refers to the degree to which a particular institution provides services that are difficult to replace. For some NBFIs—such as central clearing counterparties, large credit rating agencies, or dominant passive fund managers—this can be a crucial source of systemic risk. The inability to easily substitute their services can result in bottlenecks or critical disruptions if they fail or become distressed.

Complexity, captures the operational and structural opacity of certain NBFIs. Complex organizational structures, the use of exotic financial instruments, and opaque balance sheets can obscure risk concentrations and hinder effective oversight. This is especially relevant in hedge funds, structured investment vehicles, or entities operating across multiple jurisdictions under different regulatory regimes.

Cross-jurisdictional activity speaks to the global reach of many NBFIs. Although many are domiciled in specific locations, their operations and asset holdings often span multiple countries. This complicates regulatory coordination and resolution planning, and creates opportunities for regulatory arbitrage, which can heighten systemic vulnerabilities during global stress episodes.

Reliance on Short-Term Funding: Many NBFIs fund longer-dated or illiquid assets with short-term instruments such as repos or commercial paper. In periods of market stress, a sudden loss of access to funding markets can force rapid deleveraging and asset liquidations, contributing to price dislocations and financial instability. This funding fragility was evident during episodes like the March 2020 dash for cash and highlights the fragility of maturity transformation within the sector.

Procyclicality and Herding Behavior: Many NBFIs follow similar risk models and investment strategies, which can create herd behavior. In boom periods, this may fuel asset bubbles, and in downturns, it can intensify market crashes through synchronized selling. Procyclical practices—such as volatility targeting or performance chasing—exacerbate cyclical swings in market conditions and contribute to systemic feedback loops.

Appendix C

Shocks:

- **September 2019 – U.S. Treasury Repo Turmoil**
  A sharp spike in overnight repo rates to nearly 10%, far above the Fed's target range, revealed structural fragilities in short-term dollar funding markets. The stress originated from a confluence of factors: large Treasury settlements, corporate tax payments, and constrained dealer balance sheets. Critically, hedge funds engaged in relative value strategies had built large, leveraged positions in Treasuries financed through repo markets, relying heavily on short-term borrowing from MMFs. When cash demand surged, MMFs and other lenders pulled back, while dealers – many subject to balance sheet constraints – were unable to intermediate. The resulting imbalance forced the Federal Reserve to inject liquidity via overnight operations (see Anbil et al., 2020). The episode underscored how NBFIs' reliance on short-term wholesale funding and leverage can trigger rate instability, even absent a traditional credit shock.

- **March 2020 – COVID-19 Market Crash**
  The onset of the pandemic triggered extreme uncertainty and a collapse in global risk sentiment. Bond funds and MMFs, especially those offering daily liquidity, faced unprecedented investor withdrawals. To meet redemptions, funds engaged in fire sales, amplifying the initial shock and disrupting fixed income markets. Central banks responded forcefully: notably, the Federal Reserve established emergency facilities—including corporate bond purchases—to stabilize expectations and market functioning, while the ECB launched the Pandemic Emergency Purchase Programme (PEPP) and eased collateral rules to support market liquidity and monetary transmission. The episode underscored the liquidity mismatch risk embedded in open-ended fund structures and their impact on the transmission and credibility of monetary policy.

- **September–October 2022 – UK Pension Funds Crisis**
  In the wake of unexpected fiscal announcements by the UK government, yields on gilts surged. Highly leveraged liability-driven investment (LDI) strategies employed by pension funds faced immediate margin calls, leading to widespread asset liquidations and self-reinforcing price declines. The Bank of England intervened by purchasing long-term bonds, not for monetary accommodation but to stabilize market expectations and prevent disorderly unwinding. The case revealed how hidden leverage in seemingly stable institutional portfolios can become a transmission vector for market instability.

APPENDIX D

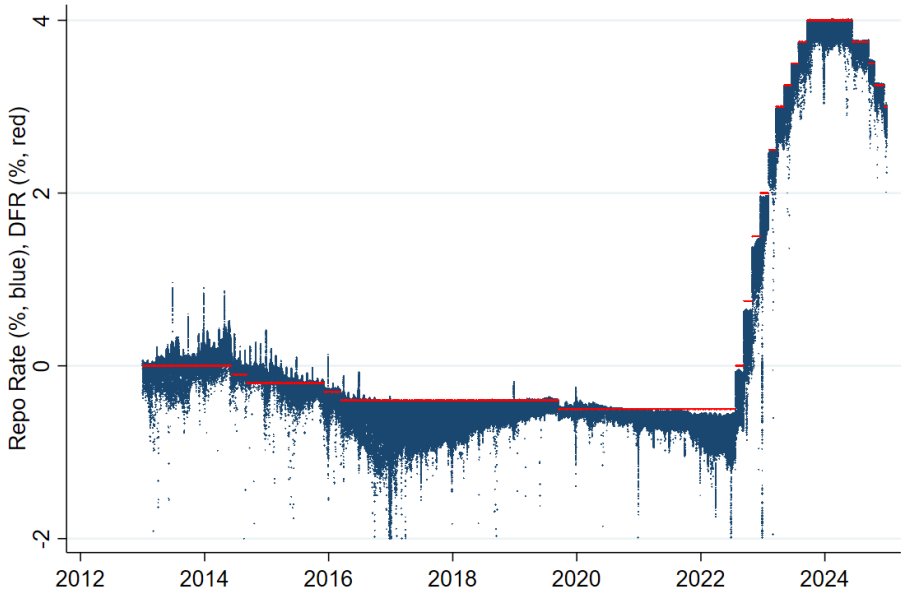
To provide an idea of the potential sources of the EU dispersion index, we show how large the dispersion in the sovereign repo market is.

Chart D.1

Security-specific interest rates on the repo market

Panel A

(Repo rate (%, blue, DFR (%, red))



Sources: Brokertec and MTS data
Notes: Authors' calculations. Panel a is an extension of Figure 3 in Nguyen Tomio and Vari (2023). The Chart shows the rates at which repo transactions took place. Each point represents the weighted-average repo rate for a specific sovereign bond issued by Germany, France, Italy, and Spain, the four largest Euro-Area countries, each day. We focus on spot-next transactions. We report the ECB's main policy rate, the deposit facility rate, in red.

Chart D.1 reports the repo rates of transactions on the sovereign bond issued by Germany, France, Italy, and Spain, the four largest Euro-Area countries, as reported in MTS and Brokertec databases. The Chart shows the large dispersion observed on rates amond and across collaterals. While between 2013 and 2016, dispersion appeared in both directions, fluctuating around the DFR, this pattern has changed since 2017, where repo rates lie consistently below the DFR.

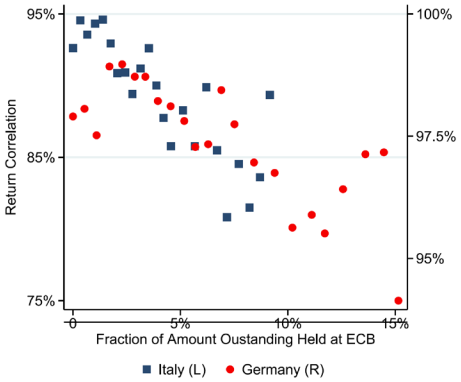
The evidence for the mispricing induced by CBs monetary policy is also provided in Pelizzon et al. (2025), as reported in Chart D.2, which shows that the scarcity induced by the ECB holding of Italian and German sovereign bonds is one of the main driver of the weakening correlation between the future and the cash bund and BTP prices (Chart D.2 panel a), as well as the bond yield mispricing measured by the dispersion of bond yields through the yield curve (using the noise measure of Hu et al. (2013). Chart D.2 panel c shows that the large future bond basis that we observe in the bund (Germany) market after the inception of QE is largely related to

the ECB holding of these bonds. A similar pattern could be observed for the Italian BTP (see Pelizzon et al. 2025).

Chart D.2
Central Bank Driven Mispricing

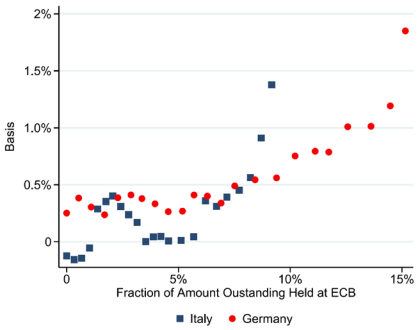
Panel A

(Return correlation)



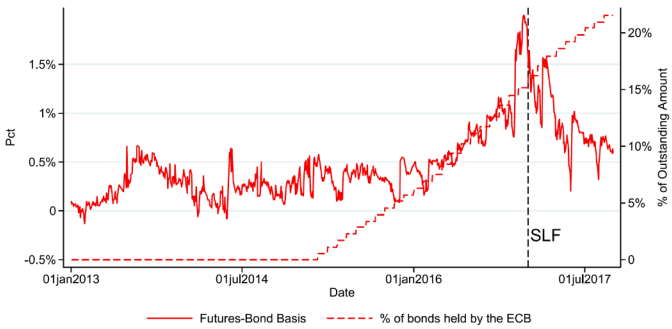
Panel B

(Basis)



Panel C

(in %)



Sources: Data on bond purchases are obtained from the ECB and data on the amount of bond outstanding from national central banks. Data on bond prices and characteristics are from MTS, data on repo transactions are from MTS and BrokerTec, and futures data are for the Eurex market via Thomson Reuters.
Notes: : Authors' calculations. Panel a, b and c are reproduction of Figures 1 and 2 in Pelizzon et al. 2025. Chart in Panel A shows in the X-axes the fraction of sovereign bond outstanding held at the European Central Bank (ECB) and in the Y-axes the monthly average of the 1-minute return correlation calculated at daily frequency between a treasury futures contract and its deliverable bonds. The return correlation for Italy (Germany) is shown on the left (right) y-axis. Panel B shows in the Y axes the basis between the futures contract and the cheapest-to-deliver bond. Panel C shows the Basis, the annualized return from buying a future and shorting the CTD bond, in the absence of trading and funding costs, at a daily frequency. The dashed line represents the amount of bonds held at the ECB as a fraction of the total amount of bonds outstanding (on the right axes). The dashed vertical line marks the implementation of the cash-collateralized securities lending facility.

Chart D.2 above not only shows the role played by CBs to create mispricing in the money markets and the treasury cash and futures markets, but also that there are tools that CBs could adopt to reduce this mispricing, for example, the Security Lending Facility implemented as cash for bonds by the ECB at the end of 2016 (marked with a dotter bar in chart 3.4 panel c). The idea of such a facility is to provide an official backstop, i.e. to cap the level of repo specialness, not to eliminate it, which has been the case for the Security Lending Facility. It has been originally implemented setting a reverse repo rate of 30bp below the DFR rate. Instead, in the US, this facility aims to eliminate the repo specialness and has been settled as a minimum fee of 5bp. As Chart 3.4. panel c and d show, after the introduction of this facility the future bond basis stop to increase even if the purchase of bonds by ECB continues, showing that this facility indeed helps to eliminate market disfunctions and therefore helps the monetary policy pass-through.

Another important consideration is the potential extension of the facility to a broader range of NBFIs, in order to mitigate the frictions created by regulatory constraints such as the SLR for broker-dealers. A relevant precedent is the Bank of England's 2024 initiative, which introduced a contingent repo facility for UK government bonds open to a wider set of non-bank financial institutions. This move aimed to strengthen market resilience and reduce reliance on balance-sheet constrained intermediaries during periods of collateral scarcity. Fragmentation in the short-term repo market has significant repercussions for bond pricing, notably by contributing to yield dispersion along the medium and long ends of the yield curve. This dispersion impedes the pass-through of the monetary policy easing as well as tightening for longer maturities. Nguyen et al. (2023) demonstrate that the limited availability of government bonds –due to their acquisition through quantitative easing and retention by central banks –weakens the transmission of policy rate hikes to the yield curve. For instance, in July 2022, when the ECB raised its policy rates by 50 basis points for the first time in ten years, repo rates backed by the scarcest bonds rose by only 30 basis points. Moreover, they show that bond scarcity not only holds back the increase in repo market interest rates but also weakens the reaction of government bond yields to changes in monetary policy.

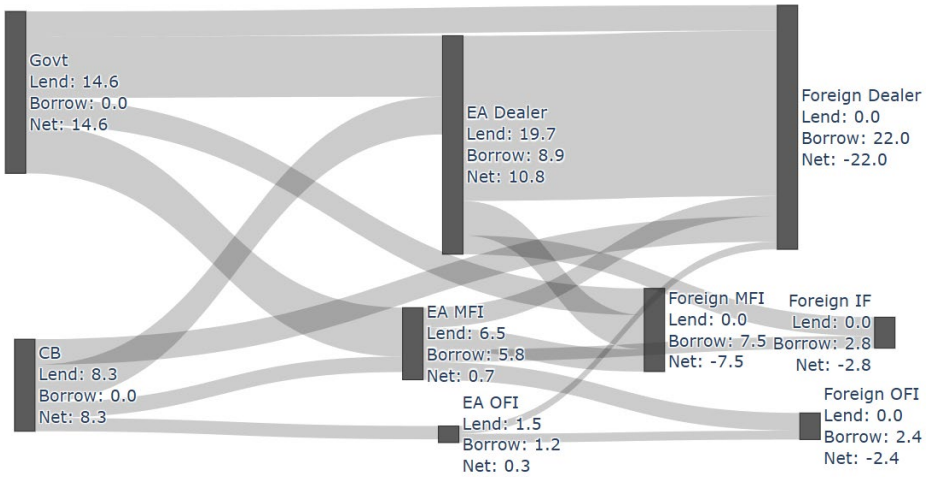
An often-overlooked aspect of bond scarcity and its impact on short-term repo rates is that scarcity is driven not only by demand, but also by the availability (supply) of bonds in the repo market. In this context, the issuance behavior of government treasuries plays a critical role in shaping collateral dynamics. Historically, both central banks and fiscal authorities have addressed sovereign bond market functionality by conducting asset purchases (see Duffie and Keane, 2023). A seldom acknowledged aspect of repo market functioning is the potential role that government treasuries themselves can play in alleviating or exacerbating collateral scarcity. A notable example is the German Treasury Desk (Deutsche Finanzagentur), which – following the Eurosystem's large-scale asset purchases during the COVID-19 crisis that created scarcity in the Bund cash market – began issuing additional government securities, retaining them on its balance sheet, and deploying them in the special repo market segment. This allowed the Finanzagentur to borrow at rates

below the general collateral rate and even below the ECB's deposit facility rate.[40] Such activity is highly relevant, as it effectively mirrors the ECB's own operations in the repo market and illustrates how fiscal authorities can actively shape short-term funding conditions through collateral management strategies. A picture of the interaction in the European bund repo market is reported in Linzert, Nguyen, Pelizzon, Poinelli, and Tomio (2025) and presented here in Chart D.3.

Chart D.3

Bund Repo Market Structure in 2022: Flows between Sectors

(bn EUR)



Sources: SFTDS and MOPDB.
Notes: Authors' calculations. This is a reproduction of Figures 5 in Linzert et al. 2025.Sample of German government bonds for the year 2022.

Chart D.3 shows that a significant fraction of bonds in the bund repo market are provided by the German Finance Agency (GFA) and the Eurosystem, which are heavily intermediated by Dealers and banks with a significant fraction allocated to foreign Dealers and Investment Funds (including hedge funds).

Clearly, the dual role of treasuries and central banks in both ensuring market functioning and conducting fiscal or monetary policy presents a significant institutional challenge. Recent developments in monetary policy tools and treasury liquidity management practices have reshaped the context in which asset purchases aimed at restoring market functioning are evaluated. A key question now is whether such interventions are more appropriately executed on behalf of the fiscal authority—with the central bank acting as its fiscal agent—or independently by the central bank using its own balance sheet. While assigning market-stabilizing purchases to the fiscal authority can offer advantages – such as greater transparency and clearer alignment with fiscal objectives – the overall resilience of the system is enhanced

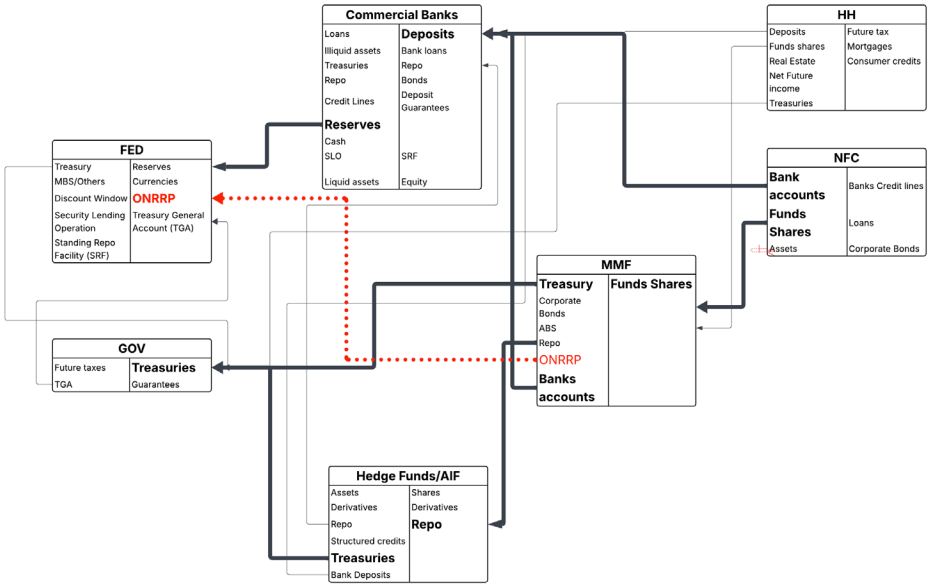
[40] Retention Quote activity by the German Treasury Desk: In the course of an auction, the Finance Agency regularly retains a portion of the respective auction volume as a so called retention quote. This is usually around 20 %. A large part of this retained stock is sold on the secondary market after the auction. The retained securities can be used, among other things, to collateralise repurchase agreements ("repos") or for securities lending.
https://www.deutsche-finanzagentur.de/en/federal-securities/trading/secondary-market/activities

when both institutions are equipped and prepared to act, depending on the nature and origin of the disruption. Crucially, irrespective of the preferred institutional arrangement, it is vital to establish in advance which authority will lead the intervention – or whether a coordinated response will be pursued – to ensure timely and effective action when market functioning is at risk.

Appendix E

The big picture is provided by extracting the crucial interconnections from Chart A.1 and add more details to their balance sheets as reported in Chart A.2. The agents that are of major interest for our analysis are NFCs, HHs, MMFs, Commercial banks, the Fed and the Government. Their interconnections are reported in Figure E.1 where the interconnections that are key for our analysis are reported in bold as well as the balance sheets exposures that creates the linkages.

Chart E.1



Notes: Flow chart of the interactions between NFC (non-financial corporations), HH (householders), MMFs (Money Market Funds), Commercial banks, the Fed and the Government.

When the Fed is increasing interest rates, NFCs have the choice to continue to deposit money at Commercial Banks or at MMFs. The choice is a trade-off between the interest rates offered and the services provided by the two entities. The interest rates MMFs could offer to NFCs depend on the interest rate MMFs could earn from their investments. They have the following choices. First, MMFs could either exploit their market power and obtain a better deposit rate from a commercial bank than a single NFCs, and in this case, they could provide the same services as banks in terms of liquidity provision to NFCs but a better interest remuneration. Second, they could invest in short- term treasuries facing in this case a maturity mismatch that might be problematic in case of crises. Even in this case they could offer a better remuneration to NFCs but they will face a larger liquidity risk and therefore they might be subject to run and fire sales. Third, they could invest in the repo market (e.g. helping mostly hedge funds to leverage their positions in treasuries) and face

maturity mismatch risk and collateral risk. Note that the second and third option is riskier than the first one. All three options are marked in Chart E.1 via the black lines. The new fourth option is using the FED's ON RRP facility. If the rate of this facility is larger than the banks' deposit rates MMFs could get, this option guarantees the same liquidity as the bank account (or even better) and, therefore making MMFs substantially more competitive than they would be without access to such facilities. The larger is the comparative advantage of the ON RRP rate with respect to the banks' deposit rate, the larger is the capacity of MMFs to attract NFCs deposits or more generally sophisticated depositors (that are also usually not insured depositors).

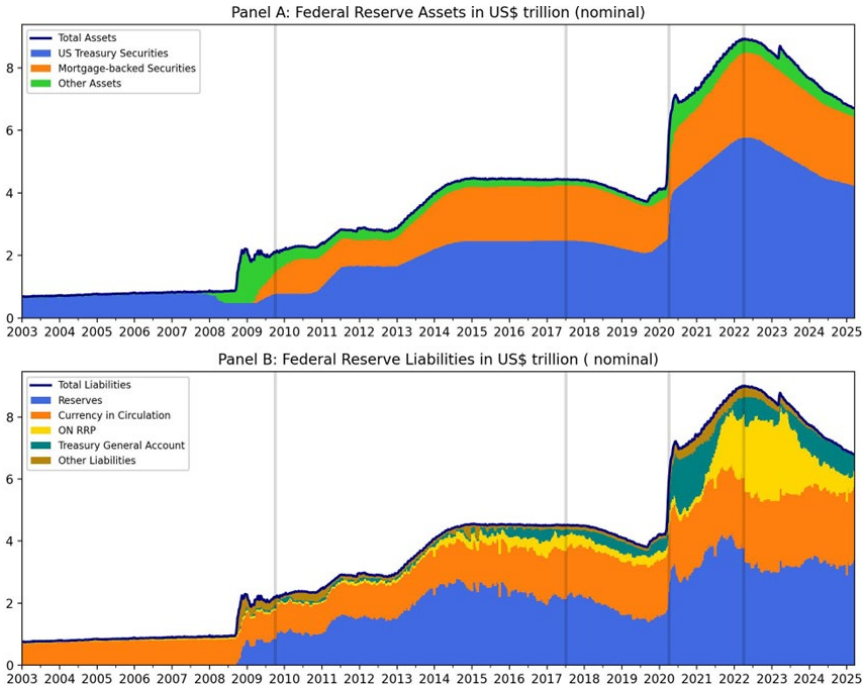
This is indeed what we observed during the monetary policy tightening of 2021-23. The Federal Reserve's ON RRP facility has been used extensively, exerting a significant impact on the size and composition of the Fed's balance sheet. We have instead a completely different picture for the monetary tightening performed by ECB.

Evidence of these key differences could be observed by looking at the evolution of the liability of the Fed and the ECB as highlighted in Chart E.2 and E.3.

Chart E.2

Federal Reserve Balance Sheet

(in US$ trillion)



Sources:FRED

Chart E.2 illustrates the evolution of Federal Reserve assets and liabilities. Chart E.2 panel a) shows the large expansion of the fed assets in particular with treasuries holdings and their consequent reduction in the last few years after the QT implementation. Chart E.2 panel b) shows the evolution of the Fed liabilities, highlighting a sharp increase during the COVID-19 crisis, accompanied by a significant rise in the Treasury General Account (TGA). As the U.S. Treasury began

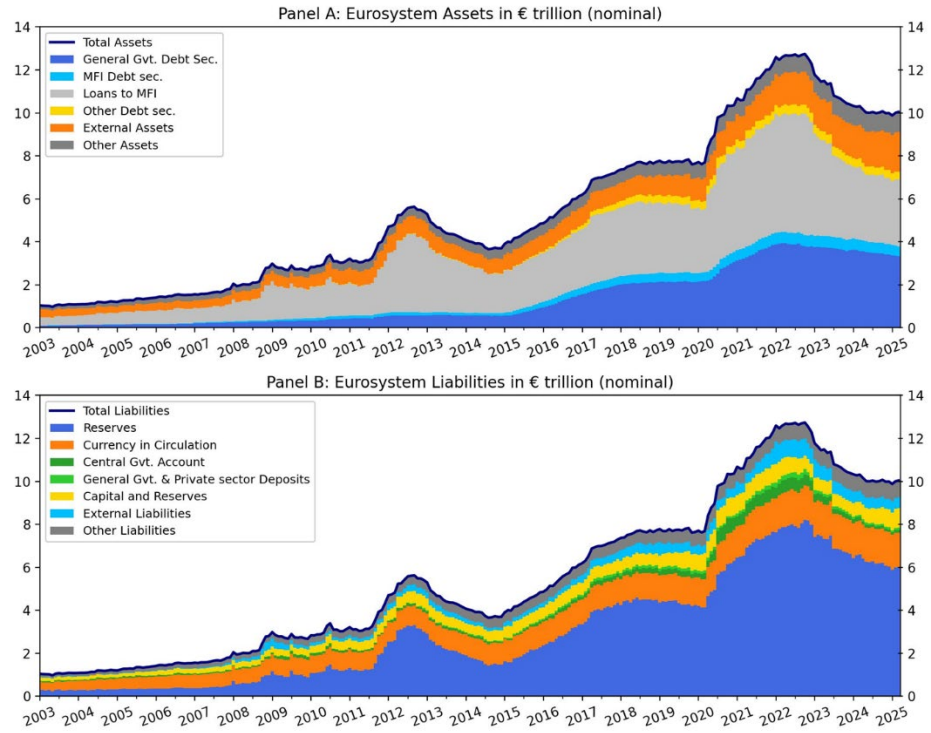
providing fiscal support to households, the TGA gradually declined. Notably, this decline was initially offset by a rise in bank reserves. However, beginning in December 2021, bank reserves also started to fall. From that point onward, the continued expansion of the Federal Reserve's balance sheet was driven primarily by the growth in the ON RRP facility.

The Fed's balance sheet began contracting in May 2022. Over the past few years, this contraction in liabilities has been concentrated almost entirely in reductions in ON RRP balances. Bank reserves declined significantly between September 2021 and March 2023, after which they remained relatively stable.

Chart E.3

Eurosystem Balance sheet

(in € trillion)



Sources: ECB

The evolution of the ECB assets and liabilities is instead quite different (see Chart E.3. Chart E.3 panel a) shows that the evolution of the ECB assets faces a significant contraction in the last few years after the implementation of QT. We could observe a large reduction of loans to MFIs and a slight contraction of government debt securities. This is in line with the evidence of scarcity in the sovereign bond markets, that is still observed in the repo market till a few months ago. In Chart E.3 panel b) one can observe that the ECB liabilities and their evolution are largely dominated by banks' reserves. Given that the ECB does not allow any NBFI to get access to its balance sheet, we do not observe any pattern associated to operations related to e.g. MMFs.