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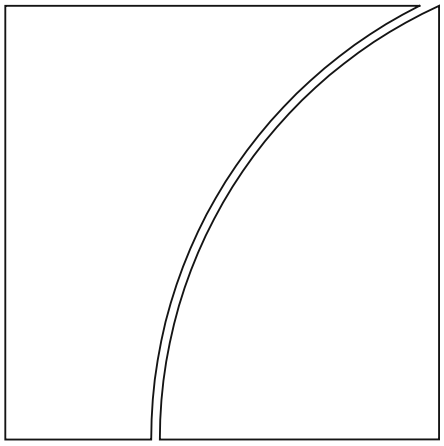

Literature review on non-maturity deposit stability: Established factors and recent developments

by Rashad Ahmed, Fang Du, Li Gu, LaVaughn Henry, Hulusi Inanoglu, Emily Johnston Ross, David Lynch, Don Morgan, Ioana Neamtu, Ajay Palvia, Kamil Pliszka, Greg Sutton, Oana Toader, Dimitris Vagias and Smith Williams

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Contents

Literature review on non-maturity deposit stability: Established factors and recent developments

Rashad Ahmed (Andersen Institute), Fang Du (Board of Governors of the Federal Reserve System), Li Gu (Board of Governors of the Federal Reserve System), LaVaughn Henry (Federal Deposit Insurance Corporation), Hulusi Inanoglu (Board of Governors of the Federal Reserve System), Emily Johnston Ross (Federal Deposit Insurance Corporation), David Lynch (Board of Governors of the Federal Reserve System), Don Morgan (Federal Reserve Bank of New York), Ioana Neamtu (Bank of England), Ajay Palvia (Federal Deposit Insurance Corporation), Kamil Pliszka (Deutsche Bundesbank), Greg Sutton (Financial Stability Institute), Oana Toader (Bank of France and ACPR), Dimitris Vagias (European Central Bank) and Smith Williams (Federal Deposit Insurance Corporation).[1]

1. Executive summary

The banking turmoil of March-May 2023 has led to questions about whether the behaviour of deposits generally, and that of non-maturity deposits (NMDs) specifically, has changed especially with respect to stability.[2] The unusually fast bank depositor outflows amidst depositor panics in 2023 could have been affected by a variety of new developments in the environment in which banks operate over the last several decades. This includes technological innovations, changing funding sources for banks, changes in competition faced by banks, including from non-banks, and the evolution in the legal and regulatory landscape.

This review considers the extent to which these developments have led to NMD behaviour inconsistent with what has been historically established to affect depositor actions. The potential effects of the new developments are assessed against the backdrop of key factors traditionally believed to drive NMD behaviour, including deposit insurance and depositor discipline, the concentration of deposits and the sophistication of depositors, depositor coordination, competition for deposits, bank health fundamentals, and monetary policy.

Both the historical and more recent literature support the idea that many of the central drivers of depositor and NMD stability remain the same. However, the newer evidence indicates that various other factors could have, at least to some extent, influenced NMD behaviour.

On the impact of technology, which has been arguably the most discussed in recent literature, the literature suggests that to the extent there is a difference in behaviour due to technology in recent runs, it is driven more so by technology providing a new means to obtain information rather than simply allowing faster withdrawals for the types of depositors who are most likely to run (corporate deposits).

With respect to institutional landscape this review suggests that the increase in competition in the banking sector and between banks and non-bank financial institutions may have exacerbated the relative instability of NMD in 2023 versus historical experience. To the extent that it is now easier to transfer

[1] The work stream was led by Smith Williams. Comments by other members of the Research Group as well as from other Basel Committee groups are gratefully acknowledged.

[2] NMDs refer to bank deposits without a specific date of repricing or maturity and, as a result, they are known to be more difficult to model. Examples can include demand deposits, savings accounts, money-market deposit accounts, sight deposits, and current accounts. They also make up the dominant or substantial share of bank deposits and behavioural assumptions for NMDs can be a major determinant of interest rate risk in the banking book (IRRBB) exposures. More information on the importance of NMDs in managing IRRBB can be found in the consolidated Basel Framework SRP31 - Interest rate risk in the banking book.

funds out of banks to other investments, such as money market funds (MMFs), the deposits channel of monetary policy may have been strengthened, and depositor stability may have declined.

The research on the effects of regulatory changes indicates some resultant differences in depositor behaviour. However, the literature is sparse and points in both directions; as-of-yet, the literature is inconclusive.

Overall, the review finds some support for the view that the various changes to the banking and financial industry, such as market innovations, regulation, and technological advancements, have affected NMD stability. However, the evidence also suggests changes in NMD stability in recent times have been substantially driven by traditional factors such as deposit insurance coverage and perceptions of bank insolvency. Thus, it would be difficult to conclude whether the net effect of the changes has resulted in more volatile NMD depositor behaviours.

2. Introduction

The banking turmoil of March-May 2023 has led to questions about whether the behaviour of deposits generally, and that of non-maturity deposits (NMDs), specifically, has changed especially with respect to stability. Unusually fast bank depositor outflows amidst depositor panics in 2023 could have been affected by a variety of new developments over the last several decades in the environment in which banks operate. This includes technological innovations allowing for online transactions and faster communication through online and social media platforms in addition to changes in the industrial organisation of banking systems; funding sources for banks, including banks' reliance on uninsured deposits; and the extent of competition faced by banks, in part resulting from the role of non-banks, may have been altered. In addition, since the Great Financial Crisis (GFC) of 2007-2009,[3] the legal and regulatory landscape has evolved in various jurisdictions, and this could have also substantially impacted depositor behaviour and stability.

This review considers the extent to which new developments have led to NMD behaviour inconsistent with what has been established historically. Their potential impacts are assessed against the backdrop of key factors traditionally believed to drive NMD behaviour, including deposit insurance and depositor discipline. The literature, as discussed later, suggests that these are central factors determining the extent of deposit stability. We also review other factors such as concentration of deposits, depositor coordination, and competition for deposits in addition to monetary policy to the extent they impact deposit behaviour.

Next, we consider a large number of factors that could have led to changes in NMD behaviour in recent times as documented by literature to date. As noted previously, these changes include advances in technology. Advances in technology have had substantial impacts on the time it takes to access banking services. For instance, online banking has made it easier for depositors to transfer their deposits to other banks or to shift to non-deposit securities (eg Bindseil and Senner, 2023; Koont et al, 2024). Indeed, depositors in Silicon Valley Bank (SVB) were able to use bank apps and phone calls to make coordinated withdrawals in minutes, and as reported by the Basel Committee on Banking Supervision (2023), SVB lost 85% of its deposits in two days. While this is faster than historical runs generally, it should be noted that major corporations had the ability to withdraw funds in an automated electronic manner already by the late 1970s, at least in the United States, suggesting that the speed of deposit withdrawals from certain depositors may not have increased dramatically (Rose, 2023; Kelly and Rose, 2025).[4]

[3] In the literature, the term GFC may also refer to "Global Financial Crisis". While both "Great Financial Crisis" and "Global Financial Crisis" refer to the same general crisis, the latter is often considered to be more global with a somewhat later onset date. In this review, we refer to GFC as the international financial crisis between 2007 and 2009.

[4] The literature describes sudden deposit withdrawals by deposits as bank runs, deposit runs, or depositor runs; we use these terms interchangeably in the document.

Advances in technology have also increased the amount of information available to depositors and the speed by which this information can spread across depositors, with potential implications for NMD stability. For example, the growing use of online platforms and social media may have provided a new source of information to depositors. The increased speed by which such information, not necessarily correct information, can spread among depositors may also have raised contagion risk. Indeed, Cera et al (2023) note that social media may foster herd behaviour while feeding rumours and disinformation. For instance, some argue that the trigger that ultimately led to Credit Suisse's failure in early 2023 was a single tweet in late 2022 (de Gruyter, 2023). In the case of SVB, Rose (2023) observes that its depositors were connected through common venture capital backers and coordinated their withdrawals through smartphone communications and social media. Several studies look more broadly at the role of social media in increasing information flow to depositors and find evidence that such news can lead to declines in stock values or exacerbate run risk (eg, Cookson et al, 2026; Dosumu et al, 2023; Gam et al, 2025).

The role of deposits and the degree to which they are insured have also notably changed in recent times. For example, there has been strong growth in uninsured deposits in some jurisdictions such as the United States. The sharp rise in uninsured deposits has been partly attributed to monetary quantitative easing (QE) by the Federal Reserve (Acharya et al, 2024; Darst et al, 2025) and may also be partly the result of deposit inflows related to fiscal stimulus during the Covid-19 pandemic (Cole et al, 2024). As reported by the International Association of Deposit Insurers (IADI) (2023), from a global perspective, 59% of eligible deposits were uninsured in 2022 which represents about a 9-percentage point increase since 2015. High levels of uninsured deposits are a central and historical driver of depositor runs and instability; thus, increases in the levels of uninsured deposits could have elevated the risk of deposit flight. In addition, growth in uninsured deposits has coincided with the increased use of online banking which could accentuate the impact of technology more generally.

The degree of competition within the banking industry has also evolved, and this has likely affected bank deposit franchise value and depositor behaviour. For example, there has been a substantial increase in market concentration across many jurisdictions (Baron et al, 2023) which likely reduced competition for deposits. Changes in competition have also resulted from the increasing use of technology by banks and bank customers. As observed by Chasta (2024), the growing use of smartphones worldwide and greater internet penetration have led to a significant increase in the demand for online banking. Banks have responded in turn, undergoing digital transformations enabling them to provide a range of digital banking services that are demanded by their customers. In some markets, this could have also led to increases in competition which could affect banks' deposit franchise values by increasing deposit rate sensitivity to market rates (eg, Erel et al, 2023).

There has been substantial market innovation and changes to the industrial organisation of financial intermediation over the last several decades resulting in a more prominent role played by non-traditional banks and by non-bank financial institutions (NBFIs). These changes have expanded the set of short-term investments that are seen as close substitutes for bank deposits which could impact the supply of deposits to banks. In the United States, for example, the total assets of money market funds (MMFs) have increased from essentially zero in 1980 to $6 trillion in 2023, and the private credit market has reached $2 trillion in 2024, a 50% increase in three years.[5] The mushrooming of securities such as these have likely affected the supply of deposits, particularly those that are relatively more rate sensitive. NBFIs could also indirectly impact deposit markets by reducing bank loan share and, as a result, lead to a reduction in the intensity of bank competition for deposits.[6]

Lastly, there have been notable changes in the regulatory environment across jurisdictions over the past several decades and beyond. The introduction of updated capital rules and revised standards for interest rate risk in the banking book, including the Basel reforms, could have reduced bank risk levels and

[5] US MMF and private credit statistics are from fred.stlouisfed.org/series/MMMFFAQ027S and Muir (2024) respectively.

[6] For example, MMFs are an important source of funding for businesses and households (CRS, 2022).

decreased run risk by increasing depositor confidence. In addition, various newer rules could have directly affected bank demand for deposits and therefore depositor behaviour (eg LCR, NSFR). Banking regulators have also introduced additional capital requirements and a variety of other related rules focused on larger banks. The intended net effect of these regulations is to increase bank resiliency; greater depositor confidence and deposit stability could have followed. Additionally, changes in accounting and regulatory rules that allowed banks such as SVB to classify their Treasury holdings as "held to maturity" (HTM) assets could have impacted short-term and long-term depositor behaviour. Lastly, regulatory changes impacting competition for deposits from NBFIs, such as MMF reform, and changes to reciprocal deposits rules, allowing changes to overall deposit insurance coverage, could have impacted deposit markets.

3. NMD stability – established factors

Economic theory suggests that banking systems are inherently unstable with banks being susceptible to runs by depositors (Diamond and Dybvig, 1983). In their seminal analysis, Diamond and Dybvig show that a key factor that could limit such runs is deposit insurance, which assures that covered deposits will be repaid in the event of bank failure and thus reduces the incentive depositors have to run. The explicit coverage of deposit insurance is typically limited, in order to reduce moral hazard. As a result, large depositors may require higher rates to remain in the bank or flee when concerns about bank health arise.[7] Thus, a consequence of less than complete deposit insurance is less than complete mitigation of run-risk.

The evidence suggests that a variety of other factors, beyond deposit insurance and depositor discipline, affect depositor stability. Indeed, evidence from past runs suggests the degree of depositor or uninsured depositor concentration as well as their sophistication impacts depositor behaviour. The likelihood or severity of runs may be higher when a sufficient share of depositors has concerns about other depositors' behaviour or a bank's solvency and is also able to coordinate or communicate in some fashion; there is some support for this view. Other key traditional factors understood to impact depositor behaviour include market competition. The literature suggests most jurisdictions do not have perfectly competitive banking markets and that limited competition leads to lower deposit interest rates and more stable deposits. However, competition has been suggested to be more intense for banks in poor financial condition. Lastly, the literature suggests that depositors behave differently during declining and rising interest rate environments and that restrictive monetary policy can lead to increased deposit and, in particular NMD, instability.

3.1 Inherent deposit instability and deposit insurance

Two primary forces have been proposed as driving bank susceptibility to depositor runs: coordination issues among depositors, leading to panics; and concerns about bank solvency. Seminal, theoretical work by Diamond and Dybvig (1983) posits that the traditional banking business model, funding long-term assets with short-term deposits, is fundamentally unstable and prone to panic-driven runs. This is because if depositors expect other depositors to run, they will likely rush to withdraw deposits immediately, irrespective of whether the underlying bank is fundamentally sound, thereby creating a self-fulfilling run, possibly leading to bank failure. The paper suggests such withdrawals represent a coordination failure in

[7] Moral hazard is a key adverse consequence of deposit insurance whereby depositors may readily provide deposits to risky banks; see FDIC (2023) for a fuller discussion. Less than full insurance coverage is a core principle of IADI in the design of deposit insurance systems to combat moral hazard (eg www.iadi.org/uploads/IADI_Mitigating_Moral_Hazard_Enhanced_Guidance_2013-05.pdf).

the sense that the depositors would be better off had they all chosen to not withdraw.[8] Several studies, such as Bryant (1980), Postlewaite and Vives (1987), Goldstein and Pauzner (2005), Rochet and Vives (2004), and Brown et al (2016), provide similar models or build on Diamond and Dybvig (1983) and likewise suggest runs are driven by depositors' expectations regarding the behaviour of other depositors.

Other studies have suggested bank financial health or economic conditions also matter for depositor behaviour. For example, Chari and Jagannathan (1988), Jacklin and Bhattacharya (1988), Chen (1999), Calomiris and Kahn (1991), and Goldstein and Pauzner (2005) suggest asymmetric information about bank financial condition plays a role. Drechsler et al (2024) similarly suggest that run risk is driven by financial condition but focus on solvency concerns by uninsured depositors following an interest-rate shock that leads to a decline in value of a bank's deposit franchise. Specifically, some of the most attentive and "flighty" deposits withdraw first with slightly less "flighty" deposits also withdrawing as solvency continues to worsen. While the Drechsler et al (2024) model and analysis is motivated by the 2023 regional crises, conceptually deposit franchise-based deposit runs could be relevant to other periods of deposit instability that were characterised by rapidly rising interest rates, such as the S&L crisis of the 1980s. Regardless of whether runs are panic driven, information driven, or the result of both of these features, the resulting deposit instability can lead to severe consequences such as bank failure and financial system-wide stress.

Diamond and Dybvig's framework offers specific insights about regulatory options for controlling runs and thereby mitigating the deposit-driven instability inherent in banking. They suggest deposit insurance as one of the key options available to regulators to prevent runs without reducing the ability of banks to perform their core function: maturity transformation. They argue that other possible solutions, such as suspending deposit convertibility, are less effective as they don't address the root cause of panic-driven runs and leave at least some depositors unable to have access to their funds. Most of the aforementioned theoretical literature considers, or at least mentions, the role that deposit insurance can play in limiting run behaviour (eg, Brown et al, 2016; Drechsler et al, 2023; Goldstein and Pauzner, 2005).

Substantial empirical evidence suggests deposit insurance is effective in reducing runs. Much of this is tested empirically by showing the impact of uninsured deposits on bank distress or failure. Carlson and Rose (2016) find large creditors with substantial uninsured deposits drove the bank run on Continental Illinois in 1984. Both Rose (2015) and Carlson and Rose (2016) suggest deposit insurance and similar guarantees can reduce the possibility of bank runs but not eliminate it, especially if guarantees are uncertain. Boyle et al (2015) utilise a sample of respondents over numerous countries to consider run risk for a set of hypothetical accounts and find that respondents from countries without explicit deposit insurance are more likely to withdraw. A few studies consider more recent evidence but focus on the traditional role of deposit insurance in preventing runs. Rosenberger and Zimmerman (2024), for example, consider the possibility of SVB style runs in credit unions. They find that credit unions, whose deposits had greater insurance coverage during the SVB period, were less likely to flee reinforcing the view that deposit insurance can limit run risk and therefore can improve deposit (and NMD) stability.

Several studies directly consider how changes in the deposit insurance regime or coverage changes can impact deposits or depositor behaviour. Atmaca et al (2023) show that increases in both implicit and explicit deposit insurance limits in Belgium led to reduced deposit instability by slowing withdrawals during the GFC. Martin et al (2018) suggest both regular deposit insurance and temporary deposit insurance result in lower outflows of deposits based on an analysis of account level data of a failed US bank. Similarly, Palvia et al (2024) find opting out of an optional deposit insurance program, the

[8] The literature on bank runs and deposit instability does not always specifically focus on or refer to NMDs or equivalently demand deposits. Nevertheless, Diamond and Dybvig (1983) refer to short term liabilities and NMDs, which have zero maturity; they are among the shortest-term funding sources most heavily used by banks. For example, about 85% of US bank deposits are NMDs (estimated as aggregate ratio of non-time to total deposits) and 79% of bank liabilities are deposits as of 2023 Q4 (FDIC – summary data available at www.fdic.gov/bank-data-guide/data-downloads).

Transaction Account Guarantee (TAG), implemented during the GFC in the United States and focused on NMDs, led to a significant decline in deposits.

The impact of deposit insurance can differ dramatically based on institutional factors such as differing perceptions of implied government support. In particular, creditors such as uninsured depositors of larger or too-big-to-fail (TBTF) institutions may have expectations of being shielded from losses in the event of a failure. At least some evidence supports this view. For example, Oliveira et al (2015) consider an exogenous shock to the Brazilian banking system to show that so-called "TBTF" perceptions for certain banks led to greater deposit inflows for these banks amidst the GFC. Palvia et al (2024) also find larger banks were much more likely to opt-out of the TAG programme consistent with very large banks enjoying either "TBTF" or other benefits of size and not needing deposit insurance as much. A significant literature considers other dimensions of the "TBTF" effect on deposits rates and suggests larger banks have less risk sensitive, and therefore more stable, depositors (eg, Acharya and Mora, 2012; Jacewitz and Pogach, 2016).[9] Caglio et al (2024) similarly provide evidence of a flight to safety by depositors during the recent 2023 regional bank crises, as deposits fled to "TBTF" banks (and depositors were less prone to withdraw funds from such banks). This is consistent with depositors viewing "TBTF" banks as safer.

In sum, the literature suggests that deposit insurance that covers a greater proportion of deposits results in greater deposit stability and that expansions in deposit insurance can increase stability.[10] In particular, theoretical and empirical evidence for deposit insurance being a central factor in improving deposit stability is substantial. Policy discussions also often suggest that the existence of fully credible and full deposit insurance would effectively remove run risk (eg, Beck et al, 2024; FDIC, 2023).[11] An added benefit of deposit insurance covering all or a greater proportion of deposits is that depositors would be less likely to get confused about the deposit insurance limit. Sandri et al (2023) report the results of a survey of US households taken after the March 2023 banking turmoil. One finding of the survey is that only 25% of respondents knew the FDIC insurance limit. Of course, incomplete knowledge, and the implied potential for the spreading of false rumours about the deposit insurance limit, can blur the distinction between insured and uninsured deposits, leading to a decline in depositor confidence and an increased incentive for depositors to run their bank.

3.2 Depositor discipline

A central issue with deposit insurance is that, while it improves deposit stability, it exacerbates moral hazard. Limiting moral hazard is an important consideration in designing deposit insurance systems and one important element typically considered for this task is discipline by deposit market participants, eg depositor discipline (BCBS, 2009).[12] Discipline by uninsured depositors is touted as one of the main solutions to this problem and typically results in depositors withdrawing deposits or requiring higher rates to stay with a bank as its level of risk increases. As a result, depositor discipline is an important factor in deposit stability (FDIC, 2023). Notably, deposit discipline can vary by its timing which may affect the role it plays in stability. In principle, depositor discipline can be both proactive (ex-ante) and punitive (ex-post). To the extent that proactive market discipline forces banks to correct risky behaviour, it can lead to greater

9 Jacewitz and Pogach (2016) also provide a good review of the related empirical literature.

10 The overall impact on the economy is less clear as some studies suggest countries with explicit deposit systems have a greater likelihood of banking crises, especially if interest rates are not regulated and institutions are weaker (Demirguc-Kunt and Detragiache, 2002). In addition, Pancost and Robatto (2023) point out that increases in deposit insurance have negligible impacts on the macroeconomy in situations where the overwhelming majority of deposits are already insured.

11 Fully credible and full deposit insurance may also have large effects on bank risk-taking, the level of deposit insurance assessments on banks, and the broader financial markets (FDIC, 2023).

12 A substantial literature discusses the moral hazard problem resulting from deposit insurance. Anginer and Demirguc-Kunt (2018) provide an excellent review of this literature.

stability, whereas punitive depositor discipline is too late and is likely to instead accelerate run behaviour (FDIC, 2023).

3.2.1 Bank health

The literature suggests that depositor discipline typically results in riskier banks paying higher rates and having more difficulty in securing deposits, especially uninsured deposits. Some studies, such as Brown et al (2020), focus on deposit withdrawals of financially distressed or insolvent banks. They find depositor withdrawal propensity increases as distress increases but is mitigated to some degree by the extent of bank-depositor relationships. Berger and Turk-Ariss (2015) provide evidence of depositor discipline in the form of lower deposit growth rates for financially weaker banks in both the United States and EU prior to the GFC; they suggest such discipline declined in its aftermath perhaps due to government actions during this period.

Other studies, such as Hannan and Hanweck (1988) and Cook and Spellman (1994), also consider or focus on the role of depositor discipline in imposing higher deposit rates in response to a decline in a bank's financial condition. Such studies suggest financially troubled banks pay higher rates as they attempt to incentivise depositors to stay at the bank or to bring in new depositors. Park and Peristiani (1998) and Maechler and McDill (2006) show that depositor discipline leads to both higher uninsured deposit rates and a greater propensity for outflows for at least some banks.

Importantly, while both proactive and punitive depositor discipline can affect deposit levels at banks, either directly or indirectly through forcing banks to pay higher deposit rates, the latter occurs when a financial institution is nearer to failure and therefore is potentially more destabilising (FDIC, 2023). In addition, while in principle depositor discipline would be driven solely by uninsured depositors, in practice this need not be the case. For example, the inconvenience of a bank failure could potentially impact insured depositors as well depending on regulatory resolution policies and expected speed of resolution. For example, Davenport and McDill (2006) show that most withdrawn deposits, in a case study of a 1990s US bank failure, were insured deposits even as uninsured deposits withdrew in higher proportions.

3.2.2 Concentration and sophistication

Prior literature suggests that depositor concentration, whereby a relatively small share of depositors make up a large share of bank deposits, and sophistication can play a significant role in deposit stability. For example, Carslon and Rose (2016) suggest that large, sophisticated depositors, including foreign depositors, other banks and MMFs played an outsized role in the run and subsequent failure of Continental Illinois. The run was fast with about one-third of deposits lost within nine days and was driven substantially by uninsured depositors; they suggest that the concentration of deposit funding is an important factor in the speed and extent of runs – and thus likely NMD stability. Rose (2015) similarly finds that bank runs in the 1920s and 1930s were dominated by large depositors and non-financial corporations. Jones and Oshinsky (2008) suggest deposit concentration at the largest 10 US banking institutions has substantially increased aggregate bank insolvency risk, which as discussed earlier, is a driver of bank runs. Importantly, while sophisticated depositors may be more likely to withdraw in response to perceived bank risk, evidence suggests that unsophisticated depositors can have an impact as well. For example, Hasan et al (2013) suggest that unsophisticated depositors withdrew significant deposits when negative rumours about bank financial health turned out, subsequently, to be valid.

3.2.3 Communication, coordination and deposit insurance

A few pre-2023 studies consider the roles of communication and coordination and deposit insurance in bank depositor actions or run propensity. This limited literature is both empirical and experimental but does to some degree suggest these factors have played a role historically, though the evidence is mixed with respect to directional impact. Iyer and Puri (2012) show that deposit insurance may only partially help in preventing bank runs and being part of a social group can accentuate run risk. Specifically, they find that a depositor is more likely to run if other people in the depositor's network are running. On the other

hand, the ability of depositors to observe the actions of other depositors could reduce run risk. For example, Kiss et al (2012) report lab experimental results using employed students recruited from Universidad de Alicante, that show that when the level of deposit insurance is low, run risk is reduced if depositors see that others are keeping their deposits in the bank. In addition, some results of the experiment support the view that deposit insurance reduces run risk. Shakina and Angerer (2018) also find, in an experimental setting, that the spreading of information across depositors can reduce run risk. In their study, signals about a bank's financial health obtained by way of an anonymous chat window can reduce depositor uncertainty; in this way chatting with other depositors can slow down withdrawal behaviour and reduce run risk. Shakina and Angerer (2018) also conclude from their experiments that deposit insurance lowers run risk.

3.3 Market power and competition

It is often argued that banking systems in most jurisdictions deviate from the perfectly competitive benchmark, with banks exhibiting market power in their lending and borrowing activities. For example, Beck, Demirguc-Kunt and Levine (1999) report that the portion of loans controlled by the largest three banks across 99 countries was over 70% on average during the 1990s. This suggests that banks have market power in the loan market, which may also be reflective of the deposit market. Data and evidence suggest that even after the extensive banking deregulation that occurred in a set of countries towards the end of the last century, and the greater degree of competition between banks that followed, some banking systems remain highly concentrated. Based on an analysis of US commercial banks for the first two decades of this century, Begenau and Stafford (2023) report that 90% of the total bank assets in their study are controlled by the largest 11% of banks. Across all EU27 countries, the European Central Bank (2023a) reports that, at the end of 2022, the average share of assets held by the five largest banks in a country was about 70%.

While banking sector concentration, eg having only a few large banks, results in higher market power of banks, market power also could arise from various frictions emanating from deposit markets, as discussed by Vives (2001). These frictions include imperfect information about the deposit rates paid by other banks and the costs faced by depositors when changing their bank. Of more direct relevance for deposit stability, Drechsler et al (2017) shows substantial market power in the deposits market and suggest that deposits are a uniquely stable funding source for banks. Historical evidence also suggests high levels of deposit market power, as denoted by measures of concentration, have implications for the stability of bank deposits. Most directly, significant research suggests high deposit market concentration leads to lower rates, implying more stable depositors (eg Berger and Hannan, 1989; Hannan and Berger, 1991; Neumark and Sharpe, 1992). Li et al (2023) conjecture that banks with market power in deposit funding perform maturity transformation in part because market power in deposit markets increases deposit funding stability. In a study of the US small business loans market, they show that US banks with more market power in the deposit market make longer maturity loans, with both fixed and floating rates, and charge lower maturity premiums. The ability to exercise market power in the deposit market may be one reason why banks perform maturity transformation in their lending activities. Drechsler et al (2021) argue that the exploitation of this power, displayed when banks do not pass on the complete increase in short-term rates to their customers, creates a large franchise value for their business that makes lending long term at fixed rates a natural activity.[13] The authors further provide empirical evidence for the United States

[13] For example, as discussed in section 3, Drechsler et al (2024) estimate that deposit franchise values can be large, at times more than 10% of bank assets, and they argue that uninsured depositors are concerned with franchise value. If this is the case, then there can be self-fulfilling run equilibria related to franchise value.

indicating that US commercial banks do hedge their interest rate risk this way.[14] Thus, on balance, the evidence suggests banks' market power in deposit markets increases deposit stability.

The extent of competition between banks has been related to bank risk, which can impact deposit stability through both the proactive and punitive channels of depositor discipline discussed previously. For example, if competition between banks raises deposit rates, this lowers bank profitability and increases the probability of bank default. This mechanism is arguably especially important if, as in the model of Egan et al (2017), distressed banks pay higher deposit rates than their competitors in an attempt to keep uninsured deposits. In addition, some studies argue that greater competition, which reduces the market power of banks, decreases their franchise values and leads banks to increase their risk taking. This is the conclusion reached by Keeley (1990) after a study of US data. To the extent greater risk-taking reduces bank health, as noted in the aforementioned literature, competition can be seen as an indirect mechanism through which depositor instability and run risk would increase. On the other hand, it can be argued that bank competition is important for the dynamic efficiency of banks by ensuring a vigorous pace of innovation. However, Vives (2001) concludes that, overall, an increase in competition will typically lead to greater risk taking by banks. This would increase the probability of bank failure and the run risk associated with both proactive and punitive depositor discipline.

Research based on a variety of measures of bank size has considered if size impacts depositor behaviour.[15] Messer and Niepmann (2023) employ a measure which directly considers the impact of larger banks: the share of assets of the largest five banks, based on asset size across 17 jurisdictions in Europe. They find a negative relationship between passthrough and the share of assets of the top five banks but no statistical relationship after conditioning on the level of excess reserves. Other studies use simpler measures which are also found to be informative. For instance, Jacewitz and Pogach (2016) find that US banks with assets greater than 200 billion US dollars paid deposit rates 10 to 50 basis points less than their smaller counterparts for deposits fully covered by deposit insurance. Collectively, these studies suggest higher on average bank size limits competition and improves depositor stability. Another interpretation, suggested by the analysis of d'Avernas et al (2023), is that deposits at large banks provide non-pecuniary benefits to their holders not available from deposits at smaller banks.

3.4 Interest rate environment and monetary policy

Several studies suggest that the interest rate environment and monetary policy can influence depositor behaviour. The historical literature typically suggests greater upward deposit rate rigidity attributable to most depositors being unlikely to flee banks that do not rapidly adjust to rates during tightening monetary policy especially in less competitive markets. For example, Neumark and Sharpe (1992) and Hannan and Berger (1991) find a slower response of deposit rates to rising rate environments for banks in concentrated markets. Presumably this is because banks are exploiting their market power and, consistent with this view, deposit betas are found to systematically vary in rising and declining rate environments. More recently, Drechsler et al (2017) propose a new channel by which monetary policy can affect the macroeconomy that operates through bank deposits when banks have market power and when banks set deposit rates. The proposed channel is called the deposits channel of monetary policy, and has also been considered by others (eg, Wang et al, 2022; Choi and Rocheteau, 2023). The channel operates as follows: when central banks raise policy interest rates, commercial banks usually do not raise deposit rates by an equal amount. Commercial banks with market power in the setting of deposit rates may choose to use that market power

[14] In contrast, Emin et al (2025) argue, for several reasons, including their finding that deposit betas increase when interest rates rise, that long-term lending is not as good a hedge for the deposit franchise as Drechsler et al (2021) claim.

[15] The literature has relied on several indicators of competition but all of them at least implicitly rely on bank size. For example, Drechsler et al (2017) and Kho (2024) proxy for market power by the Herfindahl index (HHI) which will be highest if the market is comprised of fewer and larger firms. This is based on standard definitions of HHI such as that available at www.justice.gov/atr/herfindahl-hirschman-index#:~:text=The%20HHI%20takes%20into%20account,controlled%20by%20a%20single%20firm.

and not pass on the full amount of the increase in policy rates to deposit rates.[16] Consequently, bank deposits become less attractive than alternative short-term investments that pay more competitive rates, such as MMFs. Some deposits therefore flow out of commercial banks toward MMFs and other investments. An empirical literature has generally concurred that deposits are less sensitive to rates amidst restrictive monetary policy. Kang-Landsberg, Luck, and Plosser (2022), for example, consider the evolution of deposit and market rates in the United States between 1994 and 2022 and document that betas are typically lower when rates are rising as changes to deposit rates lag changes in the Fed funds rate (FFR). Importantly, they note that despite the lag, deposit betas have risen faster (eg have had a higher slope) during the 2022 tightening cycle relative to prior rate cycles which the authors suggest could be due to the more rapid pace of the interest rate hikes. Thus, the literature suggests deposit stability is affected by the intensity or aggressiveness of monetary policy.

D'Amico et al (2024) suggest another reason why high interest rates, caused either by restrictive monetary policy or other factors, leads to some deposit outflows from banks. They argue that high nominal short rates can lead to greater financial market integration, with the result that deposits flow out of regional deposit markets that offer lower rates on deposits towards new national market opportunities that offer higher remuneration. D'Amico et al (2024) argue that this process was especially important in the United States during the years from 1953 to 1983 as high short-term interest rates drew deposits from deposit rich regional markets, where deposits were unremunerated, to a national money market, including MMFs paying higher rates of interest on deposits.

4. Recent changes in NMD behaviour

The banking sector stress in 2023 was characterised by unusually fast US bank runs.[17] This has led national supervisors and academics to evaluate the extent to which the 2023 bank runs or the underlying conditions driving the runs differ from what has been observed historically and to consider reforms to address possibly heightened depositor instability (eg, G30, 2023). One attribute often mentioned as having significant influence on deposit outflows during this period is the role of technology. For example, the G30 report suggests the advent of mobile and online banking has substantially increased the speed of withdrawals. In addition, online platforms and social media have allowed the possibility of information or rumours to be spread much faster, thereby increasing the risk of faster runs or contagion.

The literature also documents a variety of industry and institutional differences over time. For example, the industry has tended to shift more towards deposit funding or uninsured deposit funding at least in some jurisdictions such as the United States (Kupiec, 2023; Hanson et al, 2024); a greater reliance on uninsured deposit funding could have elevated run-risk during the 2023 banking turmoil. In addition, the literature considers whether either the substantial changes in the make-up of the financial sector over time with non-traditional banks and non-bank financial institutions (NBFIs) or the substantial increase in industry or depositor concentration in many jurisdictions has affected depositor stability. Lastly, recent research considers how substantial changes in regulation governing bank capital and liquidity and other regulatory changes have affected the competitive landscape for deposits, which could have implications for depositor behaviour.

[16] For supporting evidence and additional information on deposit rate passthroughs, see Driscoll and Judson (2013), Gerlach et al (2018) and Messer and Niepmann (2023).

[17] For example, Cipriani et al (2024) document 22 bank runs in March of 2023 where net single day liquidity outflows exceeded five standard deviations of historical net outflows. Similarly, FSB (2024) reports that the three fastest deposit runs had outflow speeds up to 300% faster than the highest peak one-day outflow of reported FSB member historical deposit runs.

4.1 Impact of technology

Advancements in technology, such as mobile banking and social media, can impact NMD stability by allowing depositors to act faster (G30, 2023). For example, relative to GFC run speeds there is a notable difference in the speeds of recent runs. Rose (2023) documents that GFC runs of Washington Mutual and Wachovia witnessed deposit outflows of 10% in 16 days and 4.4% in 19 days, respectively. In comparison, and without accounting for a potentially higher concentration, it took only seven days for Silvergate to experience deposit outflow of 52%. The speed of deposit runs for Signature and SVB were even more unprecedented, with two-day deposit outflows of about 87% for SVB and 30% for Signature.

The greater speed of deposit withdrawals, while potentially attributable to advances in technology broadly, in the literature is distinguished by distinct direct and indirect effects of technology that can affect NMD depositor behaviour. For example, technological progress gives depositors the ability to more freely and more immediately act (eg withdrawals initiated online) based on information such as bank financial statements or regulatory announcements which have historically been readily available. Alternatively, technology could affect depositor behaviour indirectly by increasing available information. For example, technology can provide depositors with new sources of information (eg online forums, social media) which allow depositors to more easily and directly communicate with each other or other sources to exchange information about bank financial health.[18] The direct and indirect effects of technology are not necessarily mutually exclusive as both could impact NMD actions. This section reviews the literature exploring both the direct and indirect roles of technology on NMD stability in recent times.

4.1.1 Direct effects

The prevalence of technology in banking has increased in recent times which has been facilitated in part by most banks having introduced a mobile application since the GFC (eg Koont, 2023). This coincides with evolving customer preferences; for example, ABA (2023) shows that online banking has accelerated since the pandemic and a majority of US consumers have conducted banking transactions more via online mobile apps than any other method for the last four years. Defining digital banks as banks which have introduced mobile applications, Koont et al (2024) further find that such banks have greater sensitivity to interest rate hikes and pay higher interest rates. They also show that deposits decline more in response to increases in market rates in the last decade and this increased sensitivity is stronger for deposits of digital banks and deposits of banks with brokerage services. Because depositors of banks with brokerage services can be expected to more easily move money to other non-deposit investments, such as MMFs, the results suggest technology has made it extremely easy for depositors to switch their savings from bank deposits into MMFs. Erel et al (2023) find that banks classified as "online" banks raise deposit rates more relative to brick-and-mortar banks in response to the tightening of monetary policy; the interest rate pass through is 22-35 basis points higher during the 2022-2023 rate hikes relative to traditional banks in response to a 100 basis point increase in the US FFR.[19] Consistent with the differential increase in rates, online banks had inflows during the tightening period of 2022 while traditional banks experienced outflows.[20] A similar result is found in Ciocchetta et al (2025) using data that identifies Italian banks whose customers mainly use online money transfers in their interactions with the bank, termed high digital banks. Their evidence shows that after the monetary tightening in 2022, household term deposits and the related interest rates increase more for the high digital banks than other banks.

[18] Rose (2023) discusses the various direct and indirect ways in which technology could have led to the fast runs of 2022 and 2023.

[19] Narayanan et al (2025) relatedly argue that technological advances have played a central role in the decline of bank branches since 2010 by reducing the value of the deposit franchise which ultimately reduced the ability of banks to retain deposits priced at interest rates below the prevailing markets.

[20] Relatedly, Liang et al (2025) suggest that the adoption of digital payment technology reduces deposit stability during periods of monetary tightening by reducing banks' market power and forcing banks to pay higher rates as policy rates rise.

Additionally, technology can more readily enable depositors to transfer funds outside of the banking system. Bindseil and Senner (2023) propose a variety of different destinations for deposit outflows from banks during a run. These destinations include not only other banks but also non-bank financial institutions such as MMFs, stablecoin, or other securities; they argue that technology has played a role in allowing depositors to more readily shift funds with little cost or risk. Flows out of bank deposits into MMFs may be especially important for digital banks that are part of a financial group that includes an MMF. As noted by Koont et al (2024), in this case, it is extremely easy for depositors to switch their savings from bank deposits into MMFs.[21] They find that when the US FFR increases, deposits flow out faster, and the cost of deposits increases more, in US banks that offer a mobile app and brokerage services.

To the extent these papers suggest the advent of online banking allows bank depositors to more easily and speedily move deposits, such as in response to interest rate shocks, online banking technology likely reduces the value of the deposit franchise and adversely impacts deposit stability. FSB (2024) documents that the speed and scale of the March 2023 depositor run was notably faster – with the speed being two to three times faster – than the highest peak one-day outflow relative to past deposit runs and the scale being higher than the median of past deposit runs. That being said, it is unclear whether the ability to withdraw faster has changed for most types of deposits in recent times. For household and small business depositors, which make up a nontrivial share of deposits, technological advances can explain some of the increases in speed in recent bank runs (Rose, 2023). However, Rose (2023) also notes that corporations make up most of deposit withdrawals in recent failures and these entities have had the ability to make relatively fast electronic withdrawals for decades; as a result, the capacity to withdraw faster is not likely a driver of speedier runs in 2022-2023 for most of the deposits. Carlson and Rose (2016) and Rose (2023) point to several fast historical runs as further evidence of this view.[22]

4.1.2 Indirect effects

Technology-enabled access to more information, relative to historical runs, could also lead to greater deposit instability and faster runs in recent times. One source of such information is from other depositors. For example, Rose (2023) argues that a defining characteristic of the bank runs in 2022-2023 is connectedness and similarity of depositors across failed institutions. He attributes the recent runs to be driven at least in part by a segment of depositors being connected through common venture capital backers and coordinating their withdrawals through smartphone communications and social media.

Several authors consider the impact of social media on bank stock returns, suggesting such communication can aggravate runs or run risk. Cookson et al (2026) find that banks that had greater social media presence prior to the 2023 turmoil had inferior stock returns during the SVB run period. The results suggest social media is utilised by depositors to communicate during runs in real-time and can exacerbate bank runs especially if depositors are concentrated by a common factor; their results suggest social media can result in increased bank run risk and thus negatively impact deposit stability. Dosumu et al (2023) also suggest social media contributed to banking instability during the 2022-2023 period. Using daily stock returns for 94 countries, they found Twitter search volume related to the banking turmoil was negatively linked to country stock returns between February and March 2023; the documented spillover effects between sentiments in US markets and markets in other countries suggest that technology can influence deposit stability beyond domestic financial markets. Alternatively, banks could use social media to promote confidence in times of turmoil. Jiang et al (2025), for example, suggest that banks used "confidence" tweets during the 2023 turmoil to shape investor perceptions. The authors find such tweets lead to more information and fundamentals related social media discussions among bank stakeholders,

[21] Indeed, Koont et al (2024) conclude that deposit franchise values of US digital-broker banks are 14–22% lower than the franchise values of otherwise similar traditional banks.

[22] Carlson and Rose (2016) present a detailed analysis of the run by Continental Illinois in 1994 and Rose (2023) documents other relative fast technology driven historical runs (eg First Republic Bank Corporation in 1988, Wachovia in 2008, and Washington Mutual in 2008).

implying a reduction in panic-driven contagion. Similarly, Accornero and Moscatelli (2018) suggest social media can improve the ability to predict deposit flows. Using sentiment and interconnection indicators, derived from Italian Language twitter data, improved the predictive power for short term forecasts of retail deposit growth in a sample of Italian Banks.

Thus, technology such as social media can contribute to information-based runs by adding to depositors' information about bank financial condition and thereby improving the transparency of banks. Alternatively, it can induce panic-based runs by providing depositors information about the views of other depositors. Gam et al (2025) attempt to decipher these possibilities in a study of 861 publicly listed US commercial banks between 2009 and 2022. They find that uninsured deposit flows become more sensitive to bank performance once banks are discussed more on Twitter and that this effect is important for deposit flows during normal as well as crisis times. Importantly, they show that the incremental impact of social media exposure is similar for transparent banks where social media-based information would be less impactful; they interpret these results as being consistent with social media that contribute to panic and do not solely transfer information. FSB (2024) similarly suggests the increased potential for false rumours about banks due to social media as a threat to stability.

4.2 Impact of other industry and depositor changes

Various changes in the financial industry and bank funding, beyond those driven by technology, may have also led to a divergence in depositor behaviour in the 2023 banking turmoil. Consistent with prior banking crises, uninsured deposit levels are thought to have been among the more dominant risk drivers of the 2023 banking turmoil (eg, Metrick, 2024). For example, GAO (2025) documents uninsured deposits at SVB and Signature Bank were much higher, as compared to a sample of similar peer banks.

Banks facing the most trouble amidst the 2023 banking turmoil had unusual concentrations of uninsured deposit clientele from the same industry (Kelly and Rose, 2025) and individual depositors accounting for high shares of the overall deposit base (FSB, 2024). For example, the three failed regional banks, Silvergate, SVB, and Signature, have been commonly characterised as having business models focused on providing services to concentrated client bases in a narrow set of industries. Such banks were "crypto-friendly" with very high concentrations of industry clients specialised in crypto, blockchain, innovated technology, startups, and venture capital (CRS, 2023; Kelly and Rose, 2025). As discussed above in section 3.2, depositor concentration has been historically known to exacerbate run-risk; thus, the relatively greater depositor concentration in certain banks in 2023 with business models focusing on a narrow subset of depositors were likely a key contributor to their run-risk and ultimate failure (Kelly and Rose, 2025).

In addition, the competitive landscape in banking has evolved considerably over time with traditional banks now facing increased competition for depositors from non-traditional banks as well as non-bank financial institutions. Key changes include the degree of asset concentration in various jurisdictions and the increasing role of NBFIs. Potentially, the increasing role of NBFIs could have directly increased the competition for deposits through better technology (Fitch, 2017; Leffert, 2023) or better rates (Xiao, 2020; Alfonso et al, 2023). It could have indirectly impacted deposit markets through greater NBFI roles in the provision of credit (Pires, 2019; Buchak et al, 2018; Slok, 2024; McKinsey, 2024). NBFIs could have impacted deposit markets more directly as a result of investments in deposit markets (Aramonte et al, 2022) or due to integration with traditional banks (Acharya et al, 2024).

Lastly, the substantial differences in monetary policy in 2023 relative to prior bank run episodes could have impacted depositor behaviour or deposit stability, directly or indirectly. For instance, the 2023 banking episode followed interest rate hikes of relatively unprecedented speed across some jurisdictions including the United States (Richter, 2023) and the EU (Lagarde, 2024). Some authors have suggested the unprecedented pace of the rate hikes likely led to a more severe adverse impact on depositor stability than would have otherwise arisen (Blickle, 2025; Ozili, 2024). In addition, NBFIs could have exacerbated the impact of the fast rate hikes (Xiao, 2020).

4.2.1 Share and concentration of uninsured deposits

While deposits, and uninsured deposits in particular, have always been central to bank funding, the dependence on these sources of funding has increased substantially in the last several decades. For example, the share of deposits as a fraction of US bank assets increased from about 66 to about 83% between 2000-Q1 and 2022-Q1 and uninsured deposits to assets increased even more dramatically from about 24% to about 42% over the same period (Kupiec, 2023). In the European Union, the proportion of deposits covered by insurance experienced a notable decline over the period from 2007 to 2022. Specifically, in 2007, 71% of all deposits were insured, whereas by 2022, this figure was only 57% (European Banking Authority, 2023). As documented by the literature reviewed in Section 3, because uninsured deposits are inherently less stable, the increasing share of uninsured deposits could have been a factor in a greater degree of deposit instability in more recent bank failures.

The presence of substantial uninsured deposits is evident and notable in several large-scale failures including those during the GFC (Rose, 2015) and the 2023 banking turmoil (Rose, 2023). For example, prior to their demise, the percentages of uninsured deposits at Wachovia and Washington Mutual were about 39% and 26%, respectively (Rose, 2015). Similarly, although on a different level, the reported shares of uninsured deposits were 89%, 94%, and 90% for Silvergate, SVB, and Signature Bank, respectively, as these three banks approached failure (Rose, 2023).[23] Choi et al (2023) find a negative relationship between banks' uninsured deposits and their stock returns and conclude that banks with higher shares of uninsured deposits experienced stronger outflows during stress than other banks. Bao et al (2025) demonstrate that uninsured deposits are particularly sensitive to changes in interest rates when compared to insured deposits or wholesale funding and conclude that these uninsured deposits serve as a channel for instability during times of stress.

Instability due to high shares of uninsured deposits can be aggravated when such deposits are concentrated among too few depositors or depositors within the same social group or industry. When Wachovia failed in 2008, about a half of its uninsured deposit withdrawals were concentrated in corporate non-time deposits and, as a result, were highly sensitive to the bank's insolvency risk (FDIC, 2008). When Washington Mutual (WaMu) failed, also in 2008, about one third of uninsured withdrawals were concentrated in accounts over $500 million (Rose, 2023). The bank failures of SVB, Signature, and Silvergate in 2023 echo those risk factors of having not only highly concentrated corporate uninsured deposits but also concentrated on a small cohort of corporations with large deposit amounts, a deviation from Wachovia and WaMu's diversified corporate deposit base. To make matters even worse in 2023, the corporate depositors in SVB, Signature, and Silvergate were concentrated in relatively few sectors such as crypto-assets, private equity, and technology related venture capital so that they utilised banks' system/networks to transfer funds with each other in real-time and were aware of some depositors' actions to a degree, an interconnectedness problem that exacerbated the concentration issue. For example, in the last quarter prior to Silvergate's liquidation, its crypto client base accounted for over 90% of its deposits (CRS, 2023). As a result of the significant concentrations of uninsured deposits at Silvergate, SVB, and Signature, deposits at these banks behaved as short-term funding, rather than stable relationship deposits (FDIC, 2023).

Thus, the evidence suggests that uninsured deposits played an outsized role in the 2023 turmoil. At the same time, the evidence documents that this stems from the greater levels of uninsured deposits and their concentrations, not necessarily due to a dramatic underlying shift in uninsured depositor behaviour. Fascione et al (2024) report evidence consistent with this view in a study of 110 significant institutions in Europe between 2016 and 2024, including examination of structural change in deposit flows during the 2023 period. They note that assumed Basel III LCR deposit outflow rates for uninsured deposits were conservative throughout crisis periods and across depositor classes.

[23] The deposit run data is as of Q4 2022 for Silvergate and March 2023 for Silicon Valley Bank and Signature Bank.

4.2.2 Competition for deposits and market innovations

The degree of banking industry concentration has changed substantially in recent decades. To the extent competition and market power can impact deposit markets, recent growth in bank size could have impacted NMD stability. Baron et al (2023) document that the asset size of the top five banks relative to GDP has increased over time and accounts for most of the increase in banking sector size for the 17 advanced economies they examine. In the United States, the number of institutions has been cut almost in half between 2000 and 2020 to only 3985 (Fee and Tiersten-Nyman, 2021). Similarly, the number of credit institutions declined by about half in Europe between 2001 and 2023 to 4,927 (Saravia and Le Grusse, 2024). However, the impact on deposit concentration may not have been uniform across jurisdictions with a substantial increase in the United States and a substantial decline in Europe due to the composition of the share of assets of the largest (top 10) vs other large (top 11 to 100) banks (Fernholz and Koch, 2021). This mixed picture between the two areas may also produce differences in effects on deposit stability.

Beyond changes in competition from the traditional banking sector, a notable change in recent years has been the more prominent role played by both NBFIs and non-traditional banks in providing services performed by traditional banks.[24] Such competition could affect deposit markets in multiple ways. First, NBFIs and non-traditional banks are an alternative avenue for depositor funds. For example, large non-traditional banks, which are funded primarily from internet deposits, appear to be growing deposits faster than traditional banks during recent times but have less stable deposits with higher deposit betas (Fitch, 2017). Similarly, at least some non-banks have obtained bank licences to operate fintech banks and have rapidly grown deposits as a result (Leffert, 2023). A primary feature of NBFIs, such as described above, is that they provide more competitive interest rates than commercial banks. For example, commercial banks on average offer lower deposit rates than the interest rates offered by MMFs: average deposit rates are 1.75% for commercial banks and 2.81% for MMFs in a sample of US commercial banks and MMFs from 1995 to 2012 (Xiao, 2020). NBFIs such as MMFs also hold very short-term assets and issue shares that can be redeemed daily. When the Federal Reserve raises rates, MMFs pass through a greater share of the rate hikes to investors, attracting those who are more yield-sensitive. Similarly, mutual funds offer daily redemptions even when they invest in illiquid assets that take a longer time to sell. High Fed funds rates are associated with high growth rates of NBFI funding as the higher relative MMF betas relative to market rates make them appealing in such environments (Xiao, 2020; Afonso et al, 2023). NBFIs significantly increase depositor surplus by making the deposit market more competitive (Xiao, 2020). Xiao (2020) also finds that wealthy individuals and corporate treasurers are more likely to hold short-term investments at NBFIs. They also show that greater than 30% of US deposits and deposit-like investments are created by NBFIs and that larger NBFI investments offset one-third of the reduction of commercial bank deposits during monetary tightening cycles.

Secondly, increasing competition for loan market share by non-traditional financial institutions could affect bank competition for deposits and the scope of deposit products provided by banks, ultimately impacting deposit stability. There is strong evidence that non-bank loan market share has increased across jurisdictions. For example, the share of loans to non-financial corporations by non-banks in Europe increased roughly four fold, from about 1.5% in 1999 to about 6.2% in 2018 (SUERF, 2019); similarly, in the United States, primary market leveraged loan shares for non-banks roughly doubled to 80% between 2000 and 2020 (Covas and Dionis, 2022). The developments in lending shares suggest possibly less lending by, and therefore fewer deposits at, traditional banks. Buchak et al (2018) document that the "shadow bank" market share in the US residential market roughly doubled between 2007 and 2015. MMFs, private credit markets, and to some extent ETFs, have become important competitors for banks' interest rate sensitive deposits. For example, MMFs have expanded their Treasury bill assets from $4.5 trillion from March 2022 to $6.5 trillion in November 2024 during an aggressive monetary tightening period (Slok, 2024). Private credit has also witnessed rapid growth with total assets of about $2 trillion in

[24] We refer to non-traditional banks as institutions classified as banks but collecting substantial or most deposits through non-traditional channels (eg, online); such institutions are also sometimes referred to as fintech banks.

2023, which is a 10-fold increase since 2009 (McKinsey, 2024). While banks are beginning to face significant competition from private credit in the corporate loan market, the relation between banks and private credit funds is not strictly that of competitors (Aggarwal, 2025); thus, while private credit could adversely affect bank deposit supply, to our knowledge, there is no direct evidence. While not quite as large in terms of scope, cash-like ETFs have also doubled in size to nearly $100 billion from 2019 to 2023. This may reflect both ETF returns being superior to banks' savings deposit rates and the relative convenience of transferring money in and out of the investments (Bloomberg Intelligence, 2023).

Thirdly, NBFIs could affect the deposit market by directly investing in deposits. For example, Aramonte et al (2022) suggest that certain types of NBFIs, namely MMFs, or stablecoins resembling MMFs, often invest in CDs.[25] More generally, Acharya et al (2024) suggest that NBFIs and bank businesses are substantially interwoven and the outflow of business functions from traditional banks to their connected NBFI components over time is driven by a desire to escape regulation.

4.2.3 The effects of unconventional and unprecedented monetary policy

As documented in section 3.4, central bank interest rate policy plays an important role in depositor stability. However, the sheer speed of the 2022 interest rate cycle was unusual. Richter (2023) compares the 2022 US tightening cycle to six prior cycles and shows a substantially greater speed and incline; the 2022 cycle had an incline of 5.25 percentage points in only 16 months whereas the next fastest incline (1998 cycle) increased only 3.25 percentage points in 14 months. The ECB similarly increased its policy rate between July 2022 and September 2023 from 0–0.25% to 4.50–4.75%. Lagard (2024) notes that this increase of 4.5 percentage points was the fastest pace ever and was deemed necessary to respond to the unprecedented increase in inflation.

While rate hikes were initially expected to benefit the banking sector by allowing higher net interest margins for new loans (Drechsler et al, 2017), they also introduced vulnerabilities associated with duration mismatch for existing fixed-rate assets such as Treasury securities, Available-for-Sale (AFS), and Hold-to-Maturity (HTM) securities. As the value reduction of fixed-rate assets exceeds the value increase in deposit franchise under the higher interest rate environment, the run equilibrium arises due to rising insolvency risk, thereby driving deposit runs and causing deposit instability. A bank's solvency ratio affects whether uninsured depositors would run or not (Drechsler et al, 2024). Blickle et al (2025) show that the marginal US depositor had grown increasingly more rate sensitive during the low-for-long QE period as a greater amount of deposits entered the system which resulted in the aggregate deposit base to be flightier.[26] They develop a dynamic model and find that the effect of an increasing share of depositors who are more rate sensitive increases the probability of depositor runs. They also use the model to show that the rate at which interest rates are increased during a tightening cycle affects the likelihood of how a bank will be able to successfully manage the resultant depositor outflows. Unlike the US market, the sensitivity of overnight deposits to market rates in the euro area following the interest rate turnaround in mid-2022 is relatively low compared to other periods of interest rate hikes. This reduced sensitivity has ultimately led to a shift towards term deposits (European Central Bank, 2023b). Ozili (2024) similarly argues that the 2023 turmoil was caused by the speed of the interest rate hikes. Thus, fast moving and unusually tight monetary policy likely played a part in the 2023 banking turmoil.

The impact of monetary policy on deposit stability might be accentuated by the role of NBFIs. Xiao (2020) describes that under the QE environment, during which the US FFR is usually low, both commercial banks and NBFIs offer similar rates on deposits and most depositors choose commercial banks for their convenient transaction services. However, under the quantitative tightening (QT) environment,

[25] The degree of investment in bank deposits by NBFIs could differ due to a variety of factors including regulatory regime; for example, non-systemic stablecoin issuers in Europe must hold at least 30% of their reserve assets in bank deposits (Waller, 2025).

[26] Darst et al (2025) similarly presents evidence that the uninsured deposits of NBFIs increased by around 40% during the QE period that began in 2020.

during which rates increase, NFBIs pass through the higher rates to investors, attracting depositors who are rate sensitive (Xiao, 2020). Meanwhile, some commercial banks are still able to keep paying lower deposit rates because some depositors are dependent on banks' transaction services or because banks are able to exercise market power (Drechsler et al, 2017) which mitigates liquidity risk (Li et al, 2023).

4.3 Impact of regulatory or legal changes

While a large literature, as discussed in section 3, suggests deposit insurance improves deposit stability, deposit insurance frameworks do not typically provide full insurance coverage and the degree of coverage could affect depositor stability. For example, FDIC-insured banks in the United States are covered based on insurance thresholds that have varied historically. To the extent such thresholds are static or do not increase with inflation, the level of de facto insurance could be reduced, which could undermine depositor stability.

In addition, major capital and liquidity reforms have been enacted, particularly as parts of the Basel III reforms introduced in response to the GFC. These reforms, applicable to internationally active banks, include substantial changes to bank capital regulations and the first formal liquidity requirements. The liquidity requirements include the liquidity coverage ratio (LCR) which has come into effect in many jurisdictions and the net stable funding ratio (NSFR) which has also come into effect but with somewhat less prevalence across jurisdictions. A capital surcharge for global systemically important banks (G-SIBs), with a bank's surcharge increasing as its contribution to systemic risk rises, has also been introduced. These additional requirements may have helped make G-SIBs a safe haven for deposit flows during times of stress. Caglio et al (2024) find that during the US regional bank crisis of 2023 deposits flowed into US G-SIBs. They note that this could be because of regulatory changes which have made G-SIBs safer for depositors; they also note that this could reflect the view by depositors that US G-SIBs are too big to fail.

Lastly, various regulatory changes not focused specifically on bank liquidity or capital could have also affected deposit stability. For example, several changes to the regulation of non-banks or accounting treatment of losses including MMF reform and rules impacting the accounting treatment of AFS securities have occurred since the last banking crisis (ie, the GFC). In addition, modifications of brokered deposit regulations in the United States in 2019 allowed for a greater amount of reciprocal deposits to be accepted by banks.[27] To the extent reciprocal deposits, in at least some jurisdictions, allow banks to effectively increase deposit insurance, such regulatory changes could have affected deposit stability.

4.3.1 Deposit insurance coverage levels over time

Guidelines from the International Association of Deposit Insurers (IADI) suggest that jurisdictions consider inflation levels in determining coverage levels; however, only six jurisdictions specifically index coverage levels to inflation (Van Roosebeke and Defina, 2022). For example, on a permanent basis, the US deposit insurance coverage level has increased seven times since 1934 from $2,500 per depositor account in 1934 to $250,000 per depositor account in 2008 (FDIC, 2023). Due to such increases not being continuous, there have been periods where real insurance coverage limits declined substantially. For example, effective insurance coverage (in 2008 dollars) declined notably from 1983 to 2008 and then again from 2008 to 2022 (FDIC, 2023). The history of harmonised deposit insurance across Europe is somewhat shorter but the coverage level has been increased to € 50,000 and again to € 100,000 by 2010 (Laeven, 2013). Though there are recent proposals for an increase, it has not changed since 2010, suggesting substantial declines in effective deposit insurance coverage (EBA, 2023). Van Roosebeke and Defina (2022) also suggest

[27] This involved amending the Federal Deposit Insurance Act to no longer classify certain reciprocal balances as brokered deposits (eg a certain "capped" reciprocal deposits are excluded from being classified as brokered). This effectively allowed for reciprocal deposits to not be included in the brokered deposit ratio as such deposits could be "a more stable source of funding for healthy banks than other types of brokered deposits". See rule preamble for more details at www.fdic.gov/resources/regulations/federal-register-publications/2019-updated-preamble-reciprocal-deposits-3064-ae89.pdf.

inflation adjustments are important especially during periods of high inflation. To the extent declines in deposit insurance coverage increases run-risk, as discussed in section 3, the lack of inflation adjustments in deposit insurance coverage likely increases run-risk by reducing the effective deposit insurance coverage.

4.3.2 Other regulatory/legal changes

Prior to the GFC, formal rule-based bank regulation focused primarily on capital requirements. In response to widespread concerns that formal liquidity regulations were also needed given the liquidity problems witnessed during the GFC, the Basel Committee proposed the two key liquidity rules mentioned previously: the LCR and the NSFR. Sundaresan and Xiao (2024) find that the new liquidity regulations have reduced liquidity risks for banks subject to the rule, though they argue that these bifurcated requirements in part shift liquidity risks to institutions not subject to the rule. Hoerova et al (2018) suggests that LCR and NSFR rules, had they been implemented pre-GFC, would have had a statistically and economically significant negative impact on liquidity take-up during the most recent crisis; however, they would still not have prevented the need for substantial governmental liquidity assistance for European banks. Mashamba and Magweva (2019) consider the impact of the LCR on bank funding structures in emerging markets and suggest it led to banks obtaining more stable deposits. This is consistent with greater demand for retail deposits which are deemed more stable and afforded favourable treatment under the LCR. Roberts et al (2023) suggest that banks subject to the LCR rule are more resilient to liquidity shocks, with the implication that the rule has led to greater overall deposit stability; these studies indicate that the new liquidity rules could have had at least some positive effect on deposit stability.

Other regulatory changes that may have affected depositor stability include standards for interest rate risk in the banking book and the initial Basel Accord and its subsequent revisions (Basel I, II, III) which strengthened capital requirements and could have had a significant indirect positive effect on deposit stability by increasing bank resiliency.[28] For example, data compiled by the Federal Reserve suggests the aggregate bank common equity tier 1 capital ratio was 12% in 2020 vs 6% during the GFC and 8% pre-GFC in 2006; in addition, less than 0.5% of banks were undercapitalised as of 2019 compared to 2% in 2006 and over 12% at the peak of the GFC.[29] To the extent substantial literature, as discussed in Section 3, suggests information-based runs are driven substantially by solvency concerns, it is likely the evolving capital regulation regime has contributed to greater deposit stability.

Regulatory changes affecting non-banks also could have affected deposit markets. The 2008-2009 crisis witnessed instability in MMFs which could have reduced their attractiveness as alternatives to deposits. However, recent reforms in both the United States and EU, intended to reduce run incentives of MMF investors, have potentially mitigated fears of MMF fragility (IMF, 2018 – Global financial stability report).[30] Consistent with perceived stability and safety, MMF assets growth has been strong at least in some jurisdictions especially for government MMFs. In the United States, for example, the industry's assets were $5.1 trillion in mid-2022, up from under $3 trillion in early 2017 with much of the increase occurring during the pandemic (CRS, 2022). To the extent MMFs are potentially good substitutes for savings accounts from the perspective of depositors, as suggested by Macey (2011), the regulatory driven increase

[28] More details about Basel capital and liquidity standards can be found at www.bis.org/basel_framework/. BCBS (2016) provides more details on updated interest rate risk standards.

[29] See Federal Reserve Supervision and Regulation Report (May 2020).

[30] The US updated MMF rule, which became effective in 2015, involves amendments to the 1940 "Investment Company Act" and was intended to address MMF susceptibility to excessive redemptions during times of stress. A key feature is the requirement that certain MMFs to invest only in government assets (see final rule at www.sec.gov/rules-regulations/2014/07/money-market-fund-reform-amendments-form-pf); in addition, institutional prime funds were required to report their value at floating net asset value. The EU's MMF regulation is similar to the US rule and, among other facets, restricts certain MMFs to investments in government debt (see finance.ec.europa.eu/news/commission-adopts-report-functioning-money-market-funds-regulation-mmf-2023-07-20_en for more details).

in MMF safety could have an impact on the supply of depositors especially during increasing interest rate periods which may impact NMD stability.

A further relevant regulatory change involves the treatment of so-called "reciprocal deposits" in the United States. Conceptually, this arrangement allows a group of banks to place deposit funds at other participating banks to allow for a greater portion of deposits to be covered by deposit insurance. In essence, customers' deposits are spread across banks seamlessly from a customer perspective in exchange for a fee in the form of a somewhat lower deposit rate. To the extent such arrangements effectively expand deposit insurance coverage, they could enhance stability. Prescott and Rosenberger (2024) documents a substantial increase in the use of reciprocal deposits in the United States especially following a regulatory change in 2019. For example, reciprocal deposit usage since 2010 has been strong, especially among medium-sized banks, eg those with assets from $1 billion to $10 billion, where reciprocal deposit share comprised 7% in 2024 relative to less than 2% in 2010 (Prescott and Rosenberger, 2024). Kim et al (2024) show that higher effective deposit insurance, through the use of reciprocal deposits, helped banks in reduce the outflow of deposits during the 2022–2023 banking turmoil.

A new rule, which became effective in 2014, changed the accounting treatment of AFS securities for certain banks by requiring them to realise market value changes in AFS.[31] Fuster and Vickery (2018) document a relative increase in the HTM securities following this change for banks subject to the rule. The purpose of such reclassification from AFS to HTM is to avoid increases in the volatility of regulatory capital due to the rule change. With almost $1 trillion reclassified as HTM during 2022, Granja (2023) suggests that this HTM accounting was used by banks in the runup to the 2023 banking turmoil to reduce adverse regulatory capital impacts. Granja (2023) suggests that banks prone to run-risk, eg those with lower capital and more uninsured depositors, were more likely to do so; SVB likely delayed the runs that ultimately led to its demise by doing so. Thus, the literature supports the view that accounting rules can mask bank fragility and therefore, potentially, limit or at least delay bank runs or failure.

Bank adjustments in response to the 2014 changes to accounting rules could more generally impact depositor instability by limiting market discipline. For example, unlike the accounting treatment for AFS securities, the accounting of HTM securities allows banks to avoid marking-to-market gains and losses.[32] Specifically, the use of amortised cost accounting allows HTM securities to mask the marked-to-market value even as the interest income earned from these securities cannot support the rising deposit liabilities under a higher interest rate environment. The accounting treatment of HTM may not cause deposit runs when the interest rate is very low because the original value of HTM should exceed deposit franchise value as aforementioned. The accounting treatment of HTM deters market discipline by allowing changes in fair value until these securities are forced to sale. This may depress the security price further (a fire sale), to support the interest payments to depositors (Drechsler et al, 2023; Choi et al, 2023; Ewin et al, 2023).

4.4 NMD stability, broader impacts, and mitigating factors

Deposit instability and bank runs are likely to adversely impact not just the affected banks, but also the banking sector more generally and the broader economy. Jamilov et al (2024), for instance, utilise information from bank runs spanning over two hundred years and find that systemic bank runs are typically followed by real GDP being 9% lower relative to pre-run trend and real credit declining around 25% in the ensuing four years. The authors further note that such output impacts occur regardless of whether runs are attributable to fundamentally or non-fundamentally driven factors. Thus, changes in the degree of

[31] The new rule, a result of Basel III implementation, disallows affected banks (eg banks with assets of $250 billion or $10 billion in on-balance sheet foreign exposures) from using an AOCI (accumulated other comprehensive income) filter when measuring regulatory capital (Fuster and Vickery, 2018).

[32] Under accounting treatment in the United States, the unrealised gains and losses are recognised through Accumulated Other Comprehensive Income (AOCI) by reporting fair value, which directly affects the earnings and capital daily.

deposit insurance coverage, changes in technology, and regulatory changes are likely to have impacted, through NMD stability, bank credit growth and ultimately GDP. Credit growth, for example, was notably lower following the heightened regional bank stress during March 2023, especially for banks that had the largest deposit outflows, ie, deposit outflows weakened lending (Caglio et al, 2023). To date, the US economy is not in recession; however, the risk of further economic effects on output stemming from credit crunches have been documented in the past (Bernanke and Lown, 1991).

The various changes in the landscape for banks and depositors has potentially exacerbated deposit instability and therefore also increased the risk of sudden declines in bank lending and ensuing declines in output. The lack of more severe downturns in the United States and elsewhere may be partly attributable to timely regulatory intervention which may have helped alleviate the heightened risk. Evidence suggests the risk of broader contagion due to deposit instability can be in some instances mitigated by swift regulatory actions. For example, GAO (2025) suggests swift moves taken by the US Treasury, Federal Reserve Baord and FDIC following the failures of SVB and Signature Bank played a part in preventing further instability in the US banking sector. Similar actions in other jurisdictions could have played a part in preventing further contagion. The Swiss National Bank, for example, supplied the equivalent of $185 billion in emergency liquidity; these actions along with those of other regulatory bodies helped provide the central bank enough time to more effectively broker a sale of Credit Suisse (Smith, 2023). Thus, the evidence suggests that the possibly more intense deposit instability in 2022-2023 led to at least some broader market impacts with respect to credit in the economy, but emergency regulatory responses likely mitigated the impact to some extent.

Broader impacts to credit supply could also follow the changes in deposits from shifts in monetary policy through the aforementioned deposits channel of monetary policy. To the extent shifts in monetary policy were unusual during the 2023 events, the broader impacts could be more significant relative to historical banking crises; the evidence on the empirical relevance of the deposits channel of monetary policy on lending is mixed, however. In a panel study of a very large number of US banks, Wang et al (2022) report findings supporting the importance of the deposits channel of monetary policy while Barry et al (2023) find mixed results. The latter study finds that small US banks do indeed cut lending in response to unexpected deposit outflows, but this is not the case for large US banks. Barry et al (2023) conjecture that large US banks have easier access to alternative funds to finance their lending. Begenau and Stafford (2023) provide empirical support for this conjecture. They also argue that, given that the largest US banks are responsible for the vast majority of lending in the United States, results for small US banks are not significant from an aggregate macroeconomic perspective.[33] There is also empirical evidence on the importance of the deposits channel of monetary policy for the euro area. Cappelletti et al (2024) report panel regression results for the euro area that show that the large increase in the monetary policy rate from 2021Q1 to 2023Q1 led to deposit outflows from euro area banks, and banks then reduced their lending to euro area firms. However, it is not clear if the estimated effects hold also only for the largest euro area banks; if not then, following the reasoning of Begenau and Stafford (2023), the deposits channel of monetary policy may not be important from the perspective of the euro area macroeconomy.

5. Challenges in assessing NMD behaviour

There are two key challenges in adequately and accurately assessing NMD behaviour and whether such behaviour has changed. The first stems from having readily available data on NMDs at a low enough level of aggregation and at a sufficient reporting frequency to reveal correlations with other factors that have been shown to affect behaviour such as insurance status. A second and related challenge is the difficulty in building tractable models with defensible assumptions that can be estimated with the available data.

[33] In addition, concerning the aggregate macroeconomic effects of bank behaviour, panel regression results that including small banks could be misleading because they will give too much weight to the behaviour of small banks.

5.1 Measuring NMD and other relevant factors

Measures of NMD at an aggregated, economy-wide level or at the bank-level are collected as part of the usual regulatory filings and are relatively easy to find on the public websites of central banks or regulatory reports of bank supervisors. However, these readily available measures often lack the frequency or detail to explore many of the aspects that, as discussed above, have been shown to affect depositor behaviour. For example, in the United States, the most frequently reported information on deposits used in research is collected on a quarterly basis in what are termed "Call Reports." While the Call Reports provide information that allows a researcher to calculate the amount of total non-term deposits, this total NMD measure cannot be further broken down by factors that have been shown to play a role in depositor stability as discussed above such as insurance status, counterparty type, or account type. Further, the frequency of Call Reports does not allow researchers to identify a depositor run that occurred within one quarter, such as the runs that occurred in March 2023, most of which had a duration of fewer than 20 days (FSB, 2024). The publicly available information covering the euro area is somewhat more comprehensive, providing interested parties with quarterly data on bank-level overnight deposits and deposits redeemable at notice; it is also made available, after an agreed period, in disaggregated form for households and non-financial corporations. Additionally, statistical data for individual jurisdictions of the euro area are provided on a monthly basis, encompassing both deposit volumes and interest rates.[34]

As a result of data limitations, researchers interested in examining depositor behaviour by relying on publicly available data are required, most of the time, to make choices on the measure of deposits that only roughly approximate what they are interested in studying. For example, Acharya et al (2024) compute an estimate of banks' uninsured demand and time deposits using Call Report data, but face some limitations as the data do not contain adequate information to estimate the amount of time deposits that are partially insured. Jiang et al (2024) use Call Report data to explore the relationship of monetary tightening on US bank fragility and use total uninsured deposits as the measure for "run-prone" deposits. Similarly, Bao et al (2025) use total uninsured deposits from Call Report data to explore whether shareholders receive higher returns when a bank has a higher level of uninsured deposits and thus is exposed to a higher probability of experiencing a run. In both cases, the total amount of uninsured deposits is likely a good proxy for the runability of the banks' depositors; however, presumably, uninsured NMDs would be the most run prone.[35]

Some researchers have made use of information collected as part of regulatory or functional processes, but these data are usually confidential and not easily available; they also may not include better measures of NMD. However, they do typically have data that is more finely disaggregated and reported on a more frequent basis than data that is publicly available. For example, Cipriani et al (2024) use transactional-level data from the process of conducting interbank payments and daily data on banks' accounts with the Federal Reserve among other data sources to identify banks that suffered a run in March 2023, a task not possible with only quarterly data. Similarly, Fascione et al (2024) use data collected as part of the monitoring associated with Basel III liquidity standards. These data are reported by large banks at a monthly or daily frequency and allow Fascione et al (2024) to explore whether deposit flows have experienced a structural change in behaviour in recent years. Blickle et al (2024) use similar data collected for large banks in the United States to estimate bank deposit flow sensitivity over time and whether there are differences in flows between counterparties. These authors also employ transaction-level data of bank accounts for a large number of banks from a leading financial data processor to explore flows between banks and outside investment options, a level of data that is particularly unique in the literature.

In short, rarely do researchers have access to data that perfectly measures NMD alone and at a high enough frequency or sufficient granularity. Further, bank failures and bank runs are relatively rare

[34] The ECB data portal can be accessed at data.ecb.europa.eu/.

[35] More broadly, historical deposit or NMD data may not be representative of current deposit behaviour; thus, researchers might also need to consider giving more weight to more relevant data, such as recent observations.

events, which makes some statistical inference more challenging. Additionally, statistical analyses that rely on past predictive risk factors are less capable of capturing new risks in the system, a common shortfall in many research fields. Nevertheless, many have made use of the information that is available to draw important insights on depositor behaviour for policy makers.

5.2 Modelling NMD stability

This review suggests that NMD behaviour is influenced by a variety of factors and that some factors have changed in the intensity of their effects and others have emerged as new elements in NMD behaviour. Regardless of the factor, a key metric to describe deposit behaviour historically has been the deposit beta, a reflection of the rate sensitivity of a bank's depositors. Deposit betas are almost always modelled as not changing over time, assuming symmetry in their response to both rate increases and decreases, although there is an emerging literature suggesting that deposit rate sensitivities can vary with market rates, which would lead to the duration of deposits and the deposit franchise value to also change along with market rates (Greenwald et al, 2023; Veeramani and Lentio, 2024). As such, the tendency to model deposit betas as static could lead to errors in inference. However, dynamic betas present a significant challenge to bank portfolio hedgers by introducing large and dynamic risks that are difficult to model and impractical to replicate on the asset side of the balance sheet. In a reflection of this difficulty, at least one study assumes a higher static beta rather than allowing for dynamic betas (Drechsler et al, 2017).

Many of the reviewed studies suggest uninsured deposits respond differently to a variety of factors relative to insured deposits. Yet not all studies consider them separately. For those that do, betas for insured deposits are typically found to be lower than those for uninsured deposits, suggesting that insured deposits are relatively less rate sensitive (eg, Drechsler et al, 2023; Choi et al, 2023). Bertolotti (2023) provides evidence suggesting the deposit runoff during the recent interest rate hike cycle in 2022 was almost completely driven by uninsured deposits.

Beyond uninsured deposit levels, the aforementioned literature suggests other factors such as customer relationships, monetary policy, and bank financial condition are likely to affect depositor behaviour. For example, Drechsler et al (2024) suggest uninsured deposit outflows depend not only on interest rate increases but also on the bank's solvency, as a large set of studies, discussed in section 3, point to the roles of bank health and other factors affecting NMD behaviour. Ideally, models of NMD behaviour should include all the relevant factors if available. Even if available, however, some of these other factors could be difficult to model, at least collectively, and, as a result, banks' ex ante assumptions on the behaviour of NMDs may be wrong ex post. For example, SVB considered its balance sheet exposure to interest rate risk being hedged despite long duration exposure on the asset side because SVB assumed that its uninsured deposits were long duration liabilities.[36] Similarly, Signature Bank wrongfully assumed its highly concentrated uninsured deposits (82% in 2021[37]) were stable because of existing customer relationships with various digital asset oriented businesses. Significant amounts of uninsured deposits at these banks behaved as short-term funding, rather than stable relationship deposits. The sudden run on SVB showed that these uninsured deposits were not long duration, and highly concentrated uninsured deposits turned out to be unstable and risky. These banks were in effect operating as uninsured institutions (FDIC, 2023).

[36] See www.federalreserve.gov/publications/2023-April-SVB-Executive-Summary.htm.

[37] New York State Department of Financial Services. 2023. "Internal Review of the Supervision and Closure of Signature Bank, 28 April 2023."

6. Takeaways and questions for future research

As reviewed, the pre-2023 literature suggests deposit insurance and depositor discipline remain central factors driving bank-runs and deposit instability. We also document evidence showing that concentration of and coordination among depositors can aggravate depositor instability. Lastly, we discuss the role of market power in limiting depositor instability and the impact of monetary policy in influencing depositor outflows. With respect to what has changed, the evidence is mixed but the literature suggests various changes in technology, institutional frameworks, or other market innovations could have led to a difference in some NMD behaviour in the 2023 runs vs historical runs, although there is sufficient evidence that much has remained unchanged.

A central theme in both the historical literature and the new literature is the role of uninsured deposits and bank solvency. For example, Metrick (2024) notes that though a variety of reasons for the recent US bank failures have been proposed, a common theme is very high levels of uninsured deposits and very substantial unrealised losses on assets. The literature reviewed appears to support this view. Thus, the historical themes of deposit insurance and solvency information-based deposit instability appear to remain central drivers of deposit and NMD instability. However, the evidence does indicate that various other factors could have also, at least to some extent, influenced NMD behaviour. Such factors include technology, which has been arguably the most discussed in recent literature, as well as other factors such as changes in institutional landscape and regulation.

With respect to technology, the evidence suggests there are some notable differences. On the impact of technology on withdrawal speed, the evidence is not overwhelming. Though online banking technologies have had some impact on speed, the differences do not appear to mark a regime shift given relatively fast electronic withdrawals during past bank runs at least for certain types of depositors. Overall, the literature suggests that to the extent there is a difference due to technology in recent runs, it is driven more so by technology providing a new means to obtain information rather than simply allowing faster withdrawals for the types of depositors who are most likely to run (corporate deposits). The information that triggers such runs is related to bank fundamentals or other depositors' views of such fundamentals which could result in both information based or panic-based depositor instability (Chen et al, 2022; Gam et al, 2025). An important implication of potentially greater deposit instability due to technological innovation is the possibility of a reduction in bank franchise values, which could affect banks' ability or willingness to lend long-term at fixed rates, even if their deposit funding remains stable. Thus, one key question for future research is to understand the extent to which banks' desire to hedge their deposit franchise, and their ability to do so, has changed. A further related question is to what extent the growth of online banking has reduced the value of banks to an acquiring party in a takeover.[38] These risks may be mitigated somewhat if banks have adjusted their asset risk or risk management practices to account for any changes in depositor behaviour or composition.

In addition, this review suggests that changes in the institutional landscape for banks and changes in regulation could have exacerbated NMD instability in the 2023 events vs historical bank runs. With respect to institutional landscape, a key change is the extent of competition in the banking sector and between banks and non-bank financial institutions. To the extent that it is now easier to transfer funds out of banks to other investments, such as MMFs, the deposits channel of monetary policy may have been strengthened, and depositor stability may have declined. Nevertheless, it is important to document and better understand the competing options for short-term investments and the factors that influence investors to choose one option over another.

Increased competition for funding between banks may impact deposit stability. Li et al (2023) speculate that greater competition between banks decreases the stability of deposits of a typical bank and thus its willingness to perform maturity transformation by providing long-term loans. One question that

[38] It is an unexplored empirical question if banks may fetch less in an acquisition, including a forced sale by a resolution authority or deposit insurer in the event of bank failure, in current times relative to earlier failures.

naturally arises is whether and to what extent this has occurred. Greater competition may also impact the franchise value of banks. In line with the reasoning of Vives (2001), lower franchise values arising from greater competition could induce banks to increase their risk taking. Thus, another question is whether and how banks have changed the risk profile of their assets as their depositors have gained easier access to other investment options and depositor composition has changed.

Changes in regulation could have also had implications for deposit stability. As the literature discussed in section 5 notes, interest rate and liquidity regulations such as LCR and NSFR likely impacted deposit stability. Similarly, the literature suggests that, by reducing bank solvency risk, such regulations may have also lowered the likelihood of deposit runs by reducing one of the reasons for fundamentals-driven runs. Lastly, other regulations could have affected depositor behaviour more indirectly by affecting the attractiveness of alternative to bank deposits (eg MMFs) or the viability of alternatives to deposit insurance, eg reciprocal deposits. The research on impacts of regulatory changes, as noted in section 5.3, suggests some effects but it is limited and should be extended. For example, to our knowledge, there are few studies considering impacts of regulatory changes on deposit stability outside of the United States and the European Union. There is also no, or at best limited, evidence robustly considering the joint role of recent liquidity and capital regulation on depositor behaviour across multiple jurisdictions which limits the ability to make broader conclusions.

Lastly, while some of the literature seems to favour the view that the various changes to the banking and financial industry have led to reduced NMD stability, the overall evidence is mixed. For example, the literature suggests technology and the reduced deposit insurance coverage has resulted in greater depositor instability, but it also suggests greater market concentration and enhanced capital and liquidity regulation could have resulted in the opposite. Thus, it would be difficult to conclude whether the net effect of the changes has resulted in more volatile NMD depositor behaviours. More research is needed to better understand the net effects of the various changes on depositor and NMD stability.

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